

RN SHETTY TRUST ®



ESTD.: 2001  
An Institute with a Difference

# RNS INSTITUTE OF TECHNOLOGY

Autonomous Institution affiliated to Visvesvaraya Technological University, Belagavi

Approved By AICTE, New Delhi. Accredited by NAAC 'A+' Grade

RR Nagar, Dr. Vishnuvardhan Road, Bengaluru - 560 098

Ph: (080) 28611880, 28611881 URL: [www.rnsit.ac.in](http://www.rnsit.ac.in)



Dr. R N Shetty  
Founder



DEPARTMENT OF CIVIL ENGINEERING

## BACHELOR OF ENGINEERING

Scheme and Syllabus of V - VIII Semesters

# 2024 SCHEME



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## VISION

Building RNSIT into a World Class Institution.



## MISSION

To impart high quality education in Engineering, Technology and Management with a difference, enabling students to excel in their career by

- Attracting quality students and preparing them with a strong foundation in fundamentals so as to achieve distinctions in various walks of life leading to outstanding contributions.
- Imparting value based, need based, choice based and skill based professional education to the aspiring youth and carving them into disciplined, World class professionals with social responsibility.
- Promoting excellence in Teaching, Research and Consultancy that galvanizes academic consciousness among Faculty and Students.
- Exposing Students to emerging frontiers of knowledge in various domains and make them suitable for Industry, Entrepreneurship, Higher studies, and Research & Development.
- Providing freedom of action and choice for all the Stakeholders with better visibility.

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# Scheme and Syllabus Batch 2024 – 2028

## 5<sup>th</sup> & 6<sup>th</sup> Semesters

(As per NEP – 2020)

(Effective from the Academic year 2024 – 25)

ESTD:2001

*An Institute with a Difference*

## About RNSIT

RNS Institute of Technology, familiar as RNSIT was established in the year 2001. It is the brainchild of Dr. R. N. Shetty, well known industrialist, and a great philanthropist. The institution was established with a sole purpose of imparting quality education in Engineering, Technology and Management. Being one of the premier engineering colleges in the country RNSIT is marching towards placing itself in the global map by excelling in academics and placements.

Lush green campus, state of the art infrastructure, well equipped laboratories, hundreds of activities, numerous new initiatives, consistent VTU ranks, path breaking placements, cultural extravaganza, Sports events, 4000 + students and 300 + faculty – with all these RNSIT has become dream destination for engineering aspirants across the country.

Founded by a great visionary Dr. R N Shetty, a renowned name in the industries viz construction, manufacturing, hotel, automobile, power & IT services, and education, RNSIT has been scripting history in the field of technical education. Right from its inception in the year 2001, the institution is showing exemplary growth with respect to academics, placements, sports and cultural activities. With 9 UG engineering branches, 4 PG courses and 9 R&D centres. RNSIT is aiming towards becoming the premier engineering institutes in the world.

## Vision

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To impart high quality education in Engineering, Technology and Management with a difference, enabling students to excel in their career by

- Attracting quality Students and preparing them with a strong foundation in fundamentals so as to achieve distinctions in various walks of life leading to outstanding contributions.
- Imparting value based, need based, choice based and skill based professional education to the aspiring youth and carving them into disciplined, World class Professionals with social responsibility.

- Promoting excellence in Teaching, Research and Consultancy that galvanizes academic consciousness among Faculty and Students.
- Exposing Students to emerging frontiers of knowledge in various domains and make them suitable for Industry, Entrepreneurship, Higher studies, and Research & Development.
- Providing freedom of action and choice for all the Stakeholders with better visibility.



## About the Department of Civil Engineering

The Department of Civil Engineering at RNS Institute of Technology (RNSIT), Bengaluru, was established in 2014–15 under Visvesvaraya Technological University (VTU) with an initial intake of 60 students. The department is committed to developing competent Civil Engineers through quality education, practical learning, and industry-oriented training.

The department provides a strong foundation across various Civil Engineering disciplines, supported by experienced faculty members and well-equipped laboratories. Students gain hands-on experience with modern surveying equipment, industry-relevant engineering software, and emerging technologies, enabling them to bridge the gap between theoretical knowledge and practical applications.

To enhance technical competency and professional skills, the department conducts skill development programmes, workshops, internships, industrial interactions, and field-based projects. These activities provide students with practical exposure and prepare them to meet the evolving requirements of the construction and infrastructure industry.

The academic performance of the department is reflected in its student achievements, with two VTU ranks secured by undergraduate students in VTU examinations to date.

The department also places strong emphasis on the continuous professional development of faculty members. Two faculty members have successfully completed the AICTE QIP Post Graduate Certificate Programme in Artificial Intelligence and Machine Learning at IIIT Nagpur. In addition, two faculty members have completed the Lean Manufacturing Practices programme at the Indian Institute of Management Bangalore (IIMB) and received Lean Expert certification. These initiatives strengthen the department's capabilities in Artificial Intelligence, Machine Learning, Lean Practices, and emerging technologies, further supporting innovation and technology-driven education in Civil Engineering.

## Vision

Shaping Excellent Civil Engineering Professionals with Societal Focus

## Mission

- To emphasize understanding of basic Engineering Concepts
- To develop creative ability to analyze and manage industry challenges
- To establish synergy between teaching and research

## Programme Educational Objectives (PEO)

1. **PEO1: Professional Practice:** Graduates will establish themselves as competent civil engineering professionals in industry, government organizations, or as entrepreneurs.
2. **PEO2: Leadership and Ethical Responsibility:** Graduates will demonstrate leadership, teamwork, communication skills, and professional ethics while contributing effectively to societal and environmental development.
3. **PEO3: Higher Studies and Lifelong Learning:** Graduates will pursue higher education, research, or continuous professional development to adapt to emerging technologies and sustainable engineering practices.

## Program Outcomes (PO)

1. **PO1: Engineering Knowledge:** Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.
2. **PO2: Problem Analysis:** Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)
3. **PO3: Design/Development of Solutions:** Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5).
4. **PO4: Conduct Investigations of Complex Problems:** Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

5. **PO5: Engineering Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)
6. **PO6: The Engineer and The World:** Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).
7. **PO7: Ethics:** Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)
8. **PO8: Individual and Collaborative Teamwork:** Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.
9. **PO9: Communication:** Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences
10. **PO10: Project Management and Finance:** Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
11. **PO11: Life-Long Learning:** Recognize the need for and have the preparation and ability for
  - i) independent and life-long learning
  - ii) adaptability to new and emerging technologies and
  - iii) critical thinking in the broadest context of technological change. (WK8)

## **Programme Specific Outcomes (PSOs)**

*The Civil Engineering graduates will have*

1. **PSO1:** Apply Civil **engineering knowledge** and modern engineering tools to analyze, design, and execute safe and sustainable infrastructure systems.

2. **PSO2:** Solve complex civil engineering problems by **developing innovative, cost-effective,** and environmentally responsible solutions.
3. **PSO3:** Plan and manage civil engineering projects by integrating **research-based knowledge,** project management principles, and professional ethics.



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B.E in Civil Engineering  
Scheme of Teaching and Examinations  
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)  
(Effective from the Academic Year 2024-25)

| 5 <sup>th</sup> Semester |        |                     |                                                             |                       |                         |              |               |                                                        |                   |           |           |             |         |    |
|--------------------------|--------|---------------------|-------------------------------------------------------------|-----------------------|-------------------------|--------------|---------------|--------------------------------------------------------|-------------------|-----------|-----------|-------------|---------|----|
| Sl. No.                  | Course | Course Code         | Course Title                                                | TD/PSB                | Teaching Hours Per Week |              |               | Term Work (TW) + Self Learning (SL) Hours Per Semester | Examination       |           |           |             | Credits |    |
|                          |        |                     |                                                             |                       | Theory Lecture (L)      | Tutorial (T) | Practical (P) |                                                        | Duration in Hours | CIE Marks | SEE Marks | Total Marks |         |    |
| 1                        | HSMS   | BCV501              | Construction Management and Entrepreneurship                | Civil                 | 3                       | 2            | 0             | 45                                                     | 3                 | 50        | 50        | 100         | 4       |    |
| 2                        | IPCC   | BCV502              | Irrigation Engineering and Hydraulic Structures             | Civil                 | 3                       | 0            | 2             | 45                                                     | 3                 | 50        | 50        | 100         | 4       |    |
| 3                        | IPCC   | BCV503              | Highway and Airport Engineering                             | Civil                 | 3                       | 0            | 2             | 45                                                     | 3                 | 50        | 50        | 100         | 4       |    |
| 4                        | PCCL   | BCVL504             | Building Information Modelling In Civil Engineering (Basic) | Civil                 | 0                       | 0            | 2             | 0                                                      | 3                 | 50        | 50        | 100         | 1       |    |
| 5                        | PEC    | BCV515X             | Professional Elective (Provide Bucket List)                 | Civil                 | 3                       | 0            | 0             | 45                                                     | 3                 | 50        | 50        | 100         | 3       |    |
| 6                        | PROJ   | BCV586              | Mini Project                                                | Civil                 | 0                       | 0            | 2             | 30                                                     | 3                 | 100       | 0         | 100         | 2       |    |
| 7                        | BSC    | BENS507/<br>BBOE507 | Environmental Studies / Biology for Engineers               | CV/Biotech /Chemistry | 2                       | 0            | 0             | 30                                                     | 2                 | 50        | 50        | 100         | 2       |    |
| 8                        | AEC    | BRMK557             | Research Methodology and IPR                                | Civil                 | 2                       | 0            | 0             | 30                                                     | 2                 | 50        | 50        | 100         | 2       |    |
| 9                        | MC     | BNSK559             | National Service Scheme(NSS)                                | Any Dept.             | 0                       | 0            | 2             | 0                                                      |                   | 100       | 0         | 100         | 0       |    |
|                          |        | BPEK559             | Physical Education(PE) (Sports and Athletics)               | PED                   |                         |              |               |                                                        |                   |           |           |             |         |    |
|                          |        | BYOK559             | Yoga                                                        | PED                   |                         |              |               |                                                        |                   |           |           |             |         |    |
| TOTAL                    |        |                     |                                                             |                       |                         |              |               |                                                        |                   |           | 550       | 350         | 900     | 22 |

**NOTE:** “BIOLOGY FOR ENGINEERS” in 4<sup>th</sup> semester and "ENVIRONMENTAL STUDIES" in 5<sup>th</sup> semester

**PCC:** Professional Core Course, **PCCL:** Professional Core Course laboratory, **UHV:** Universal Human Value Course, **MC:** Mandatory Course (Non-credit), **AEC:** Ability Enhancement Course, **SDC:** Skill Development Course, **L:** Lecture, **T:** Tutorial, **P:** Practical **SL:** Self Learning, **CIE:** Continuous Internal Evaluation, **SEE:** Semester End Evaluation. **Professional Core Course (IPCC):** Refers to Professional Core Course Theory Integrated with practical of the same course.

| Provide Bucket List- Professional Elective (PEC) BCV515X |                               |         |                         |
|----------------------------------------------------------|-------------------------------|---------|-------------------------|
| BCV515A                                                  | Masonry Structures            | BCV515C | Traffic Engineering     |
| BCV515B                                                  | Alternative Building Material | BCV515D | Ground Water Hydraulics |



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6<sup>th</sup> Semester

| Sl. No. | Course  | Course Code | Course Title                                                   | TD/PSB    | Teaching Hours Per Week |              |               | Term work (TW) + Self Learning (SL) Hours Per Semester | Examination       |           |           |             | Credits |
|---------|---------|-------------|----------------------------------------------------------------|-----------|-------------------------|--------------|---------------|--------------------------------------------------------|-------------------|-----------|-----------|-------------|---------|
|         |         |             |                                                                |           | Theory Lecture (L)      | Tutorial (T) | Practical (P) |                                                        | Duration in Hours | CIE Marks | SEE Marks | Total Marks |         |
| 1       | IPCC    | BCV601      | Geotechnical Engineering                                       | Civil     | 3                       | 0            | 2             | 45                                                     | 3                 | 50        | 50        | 100         | 4       |
| 2       | IPCC    | BCV602      | Design of RCC Structural Elements                              | Civil     | 3                       | 0            | 2             | 45                                                     | 3                 | 50        | 50        | 100         | 4       |
| 3       | PEC     | BCV613X     | Professional Elective (Provide Bucket List)                    | Civil     | 3                       | 0            | 0             | 45                                                     | 3                 | 50        | 50        | 100         | 3       |
| 4       | OEC     | BCV654X     | Open Elective (Provide Bucket List)                            | Civil     | 3                       | 0            | 0             | 45                                                     | 3                 | 50        | 50        | 100         | 3       |
| 5       | PROJ    | BCV685      | Major Project Phase-1                                          | Civil     | 0                       | 0            | 4             | 0                                                      | 3                 | 100       | 0         | 100         | 2       |
| 6       | PCCL    | BCVL606     | Building Information Modelling in Civil Engineering (Advanced) | Civil     | 0                       | 0            | 2             | 0                                                      | 3                 | 50        | 50        | 100         | 1       |
| 7       | AEC/SEC | BCVL657X    | Ability Enhancement Course/Skill Enhancement Course            | Civil     | 0                       | 0            | 2             | 0                                                      | 3                 | 50        | 50        | 100         | 1       |
| 8       | MC      | BIKS608     | Indian Knowledge System                                        | Any Dept. | 1                       | 0            | 0             | 0                                                      | 2                 | 100       |           | 100         | 0       |
| 9       | MC      | BNSK659     | National Service Scheme(NSS)                                   | Any Dept. | 0                       | 0            | 2             | 0                                                      |                   | 100       |           | 100         | 0       |
|         |         | BPEK659     | Physical Education(PE) (Sports and Athletics)                  | PED       |                         |              |               |                                                        |                   |           |           |             |         |
|         |         | BYOK659     | Yoga                                                           | PED       |                         |              |               |                                                        |                   |           |           |             |         |
| TOTAL   |         |             |                                                                |           |                         |              |               |                                                        |                   | 600       | 300       | 900         | 18      |

**PCC:** Professional Core Course, **PCCL:** Professional Core Course laboratory, **UHV:** Universal Human Value Course, **MC:** Mandatory Course (Non-credit), **AEC:** Ability Enhancement Course, **SDC:** Skill Development Course, **L:** Lecture, **T:** Tutorial, **P:** Practical **SL:** Self Learning, **CIE:** Continuous Internal Evaluation, **SEE:** Semester End Evaluation.  
**Professional Core Course (IPCC):** Refers to Professional Core Course Theory Integrated with practical of the same course.

**Provide Bucket List**

| Professional Elective BCV613X |                                             |         |                               |
|-------------------------------|---------------------------------------------|---------|-------------------------------|
| BCV613A                       | Earthquake Resistant Structures             | BCV613C | Ground Improvement Techniques |
| BCV613B                       | Water Conservation and Rainwater Harvesting | BCV613D | Intelligent Transport System  |

| Open Elective BCV654X |                                                   |         |                                         |
|-----------------------|---------------------------------------------------|---------|-----------------------------------------|
| BCV654A               | Sustainable Design Concepts for Building Services | BCV654C | Remote Sensing and GIS                  |
| BCV654B               | Foundations of Lean Manufacturing                 | BCV654D | Environmental Protection and Management |

| AEC/SEC BCVL657X |                                           |          |                                                      |
|------------------|-------------------------------------------|----------|------------------------------------------------------|
| BCVL657A         | Structural Design Software Lab            | BCVL657C | Quantum GIS Lab                                      |
| BCVL657B         | MATLAB Applications For Civil Engineering | BCVL657D | Water Distribution Network Modelling With EPANET Lab |

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|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-------------|---------------------------------------------|--------|-------------------------|--------------|---------------|--------------------------------------------------------|-------------------|------------|------------|-------------|-----------|
| 7 <sup>th</sup> Semester                                                                                                                                                                                                                                    |        |             |                                             |        |                         |              |               |                                                        |                   |            |            |             |           |
| Sl. No.                                                                                                                                                                                                                                                     | Course | Course Code | Course Title                                | TD/PSB | Teaching Hours Per Week |              |               | Term work (TW) + Self Learning (SL) Hours Per Semester | Examination       |            |            |             | Credits   |
|                                                                                                                                                                                                                                                             |        |             |                                             |        | Theory Lecture (L)      | Tutorial (T) | Practical (P) |                                                        | Duration in Hours | CIE Marks  | SEE Marks  | Total Marks |           |
| 1                                                                                                                                                                                                                                                           | IPCC   | BCV701      | Design of Steel Structures                  | Civil  | 3                       | 0            | 2             | 45                                                     | 3                 | 50         | 50         | 100         | 4         |
| 2                                                                                                                                                                                                                                                           | IPCC   | BCV702      | Estimation and Contract Management          | Civil  | 3                       | 0            | 2             | 45                                                     | 3                 | 50         | 50         | 100         | 4         |
| 3                                                                                                                                                                                                                                                           | PCC    | BCV703      | Design of Prestressed Concrete Structures   | Civil  | 3                       | 2            | 0             | 45                                                     | 3                 | 50         | 50         | 100         | 4         |
| 4                                                                                                                                                                                                                                                           | PEC    | BCV714X     | Professional Elective (Provide Bucket List) | Civil  | 3                       | 0            | 0             | 45                                                     | 3                 | 50         | 50         | 100         | 3         |
| 5                                                                                                                                                                                                                                                           | OEC    | BCV755X     | Open Elective (Provide Bucket List)         | Civil  | 3                       | 0            | 0             | 45                                                     | 3                 | 50         | 50         | 100         | 3         |
| 6                                                                                                                                                                                                                                                           | PROJ   | BCV786      | Major Project Phase-2                       | Civil  | 0                       | 0            | 12            | 0                                                      | 3                 | 100        | 100        | 200         | 6         |
| <b>TOTAL</b>                                                                                                                                                                                                                                                |        |             |                                             |        |                         |              |               |                                                        |                   | <b>350</b> | <b>350</b> | <b>700</b>  | <b>24</b> |

**Provide Bucket List**

**Professional Elective BCV714X**

|         |                                |         |                                  |
|---------|--------------------------------|---------|----------------------------------|
| BCV714A | Railway and Tunnel Engineering | BCV714C | Industrial Waste Water Treatment |
| BCV714B | Design of Bridges              | BCV714D | Foundation Engineering           |

**Open Elective BCV755X**

|         |                                   |         |                                               |
|---------|-----------------------------------|---------|-----------------------------------------------|
| BCV755A | Conservation of Natural Resources | BCV755C | Reliability Engineering                       |
| BCV755B | Road Safety and Traffic Awareness | BCV755D | Disaster Preparedness and Planning Management |



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|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-------------|------------------------------------------------------|--------|-------------------------|--------------|---------------|--------------------------------------------------------|-------------------|------------|------------|-------------|-----------|
| 8 <sup>th</sup> Semester                                                                                                                                                                                                                                    |        |             |                                                      |        |                         |              |               |                                                        |                   |            |            |             |           |
| Sl. No.                                                                                                                                                                                                                                                     | Course | Course Code | Course Title                                         | TD/PSB | Teaching Hours Per Week |              |               | Term work (TW) + Self Learning (SL) Hours Per Semester | Examination       |            |            |             | Credits   |
|                                                                                                                                                                                                                                                             |        |             |                                                      |        | Theory Lecture (L)      | Tutorial (T) | Practical (P) |                                                        | Duration in Hours | CIE Marks  | SEE Marks  | Total Marks |           |
| 1                                                                                                                                                                                                                                                           | PEC    | BCV811X     | Professional Elective (Provide Bucket List) (Online) | Civil  | 3                       | 0            | 0             | 45                                                     | 3                 | 50         | 50         | 100         | 3         |
| 2                                                                                                                                                                                                                                                           | OEC    | BCV852X     | Open Elective (Provide Bucket List) (Online)         | Civil  | 3                       | 0            | 0             | 45                                                     | 3                 | 50         | 50         | 100         | 3         |
| 3                                                                                                                                                                                                                                                           | INT    | BCV803      | Internship (Industry/Research-Minimum 14 Weeks)      | Civil  | 0                       | 0            | 20            | 0                                                      | 3                 | 100        | 100        | 200         | 10        |
| <b>TOTAL</b>                                                                                                                                                                                                                                                |        |             |                                                      |        |                         |              |               |                                                        |                   | <b>200</b> | <b>200</b> | <b>400</b>  | <b>16</b> |

**Provide Bucket List**

**Professional Elective BCV811X**

|         |                                         |         |                                      |
|---------|-----------------------------------------|---------|--------------------------------------|
| BCV811A | Repair and Rehabilitation of Structures | BCV811C | Professional Practice Law and Ethics |
| BCV811B | Urban Transport Planning                | BCV811D | Pre Engineered Building Technology   |

**Open Elective BCV852X**

|         |                              |         |                                                      |
|---------|------------------------------|---------|------------------------------------------------------|
| BCV852A | Integrated Building Services | BCV852C | Resilient Infrastructure Design Under Climate Change |
| BCV852B | Smart Cities Indian Scenario | BCV852D | Precast Members-System and Construction              |



# V SEMESTER SUBJECTS

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| B.E. (Civil Engineering)<br>Outcome Based Education (OBE) and Choice Based Credit System (CBCS)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                            |             |              |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|-------------|--------------|
| Course Title                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Construction Management and Entrepreneurship               |             |              |
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | BCV501                                                     | Scheme      | 2024         |
| Type of Course                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Humanities, Social Sciences, and Management Studies (HSMS) | Semester    | V            |
| Teaching Hours/Week (L:T:P)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | (3:2:0) 75 hrs/sem                                         | CIE Marks   | 50           |
| Total Hours of Pedagogy per semester (L:T:P: TW& SL)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | (45:30:0:45) 120 hrs/sem                                   | SEE Marks   | 50           |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 4                                                          | Total Marks | 100          |
| Examination type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Theory                                                     | Exam Hours  | 3            |
| <b>COURSE LEARNING OBJECTIVES:</b><br><i>The purpose of the course is to enable the learner to:</i> <ol style="list-style-type: none"> <li>Understand the principles of construction planning, scheduling, resource management and procurement in construction projects.</li> <li>Illustrate the fundamentals of entrepreneurship and business opportunities in the construction industry.</li> <li>Apply engineering economic principles and scheduling techniques for construction project analysis and decision-making.</li> <li>Explain business planning, start-up ecosystem and statutory requirements for construction enterprises.</li> </ol> |                                                            |             |              |
| <b>Module-1: Planning and Scheduling</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                            |             | <b>9 hrs</b> |
| <b>Construction Project Formulation</b> – Construction management, project scope and scope management, types of project planning and their management. Statutory and regulatory requirements such as layout and building plan approval, contracts, fire and safety regulations, quality and environmental regulations, commencement certificate, legal and public policies.<br><b>Schedule Management</b> – Work Breakdown Structure (WBS), Bar charts, sequencing and dependency of activities, network diagrams, activity duration estimation, Critical Path Method (CPM), Program Evaluation and Review Technique (PERT), Case studies.            |                                                            |             |              |
| <b>Module-2: Resource Management and Procurement</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                            |             | <b>9 hrs</b> |
| <b>Resource Management</b> – Basic concepts of resource management, classification of labour, wages and statutory requirements, labour productivity and labour production rate, factors affecting labour productivity.<br><b>Material management:</b> Objectives and functions, Inventory management – Objectives, techniques and control methods (ABC analysis, EOQ, Reorder Level).<br><b>Procurement</b> – Types of procurement, procurement planning, stages of procurement process, procurement execution, and sustainable procurement management.                                                                                               |                                                            |             |              |
| <b>Module- 3: Construction Economics</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                            |             | <b>9 hrs</b> |
| <b>Introduction to engineering economy:</b> Principles of engineering economics, concept on Micro and macro analysis, problem solving and decision making.<br><b>Interest and time value of money:</b> concept of simple and compound interest, interest formula for: single payment, equal payment and uniform gradient series. Nominal and effective interest rates, deferred annuities, capitalized cost.                                                                                                                                                                                                                                          |                                                            |             |              |

Comparison of alternatives: Present worth, annual equivalent, capitalized and rate of return methods, Minimum Cost analysis and break even analysis.

**Module-4: Entrepreneurship in Civil Engineering and Construction Industry 9 hrs**

**Introduction to entrepreneurship** – Concept of entrepreneur and entrepreneurship – Characteristics, competencies and qualities of successful entrepreneurs – Types of entrepreneurs – Role and significance of entrepreneurship in the construction industry – Scope of entrepreneurship for Civil Engineers – Entrepreneurial opportunities in construction contracting, project management consultancy, structural and geotechnical consultancy, real estate and infrastructure development, construction material manufacturing, quantity surveying and estimation services, surveying and geospatial services, testing and quality assurance laboratories, facility and asset management services, and sustainable infrastructure development – Case studies of successful entrepreneurs in Civil Engineering and construction sector.

**Module-5: Business Development and Start-up Ecosystem in Construction Management 9 hrs**

Business planning and enterprise development for construction organizations – Preparation of business plans and feasibility studies – Entrepreneurial skills for Civil Engineers: leadership, communication, negotiation, innovation, decision-making, project management, financial management, contract administration, marketing and risk management – Government schemes and institutional support for construction entrepreneurs: Startup India, MSME, PMEGP, Mudra, SIDBI and incubation centres – Registration, licensing and statutory requirements for construction firms and consultancies – Challenges and opportunities in the construction sector.

**PRACTICAL COMPONENT**

| Sl. No. | Practical Components/Activity-Based Learning (30 hrs) |
|---------|-------------------------------------------------------|
| 1       | Construction Project Planning using WBS Objective     |
| 2       | Construction Scheduling using Gantt Chart             |
| 3       | CPM Analysis for Construction Project                 |
| 4       | Resource Allocation and Resource Levelling            |
| 5       | Material Procurement and Inventory Planning           |
| 6       | Project Cost Estimation and Tracking                  |
| 7       | Baseline Comparison and Project Monitoring            |
| 8       | Construction Project Reporting                        |

## COURSE OUTCOMES:

*After successfully completing the course, the student will be able to:*

|            |                                                                                                                               |
|------------|-------------------------------------------------------------------------------------------------------------------------------|
| <b>CO1</b> | Understand the principles of construction planning, scheduling, resource management and procurement in construction projects. |
| <b>CO2</b> | Illustrate the fundamentals of entrepreneurship and business opportunities in the construction industry.                      |
| <b>CO3</b> | Apply engineering economic principles and scheduling techniques for construction project analysis and decision-making.        |
| <b>CO4</b> | Explain business planning, start-up ecosystem and statutory requirements for construction enterprises.                        |

## ASSESSMENT DETAILS (Both CIE and SEE)

| Assessment Type                                                                                                                                                                                                                                                                                         | Maximum Marks | Minimum Passing Marks | Evaluation Details                                                                                                        |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-----------------------|---------------------------------------------------------------------------------------------------------------------------|
| CIE – IA Tests (A)                                                                                                                                                                                                                                                                                      | 30            | -                     | Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 30 marks. |
| Continuous and Comprehensive Evaluation (B)                                                                                                                                                                                                                                                             | 20            | -                     | Any two Assessment methods as per 24RNBE4.2 (*if it is project based, one assignment shall be given), scaled to 20 marks. |
| <b>Total CIE (A+B)</b>                                                                                                                                                                                                                                                                                  | <b>50</b>     | <b>20</b>             | <b>CIE Evaluation is done for a maximum of 50 marks</b>                                                                   |
| SEE (C)                                                                                                                                                                                                                                                                                                 | 50            | 18                    | <b>SEE is a theory exam conducted for 100 marks and scaled down to 50 marks. Exam duration shall be for 3 hours.</b>      |
| <b>CIE + SEE (A+B+C)</b>                                                                                                                                                                                                                                                                                | <b>100</b>    | <b>40</b>             | Final marks shall be the sum of marks scored in Components A, B and C.                                                    |
| <ul style="list-style-type: none"> <li>The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to appear for SEE.</li> <li><b>If any courses of 3 credits are of Integrated Course type, for such courses the method suggested for 4 credits IPCC shall be followed.</b></li> </ul> |               |                       |                                                                                                                           |

## Suggested Learning Resources:

### Textbooks

1. A. N. Prakash, Construction Management for Practising Engineers. Manipal, India: Manipal Universal Press, 2025.
2. K. K. Chitkara, Construction Project Management: Planning, Scheduling and Control. New Delhi, India: Tata McGraw Hill Publishing Company, 2014.
3. P. Sengupta, Engineering Economics and Costing. New Delhi, India: PHI Learning Pvt. Ltd., 2011.

### Reference Books

1. L. Blank and A. Tarquin, Engineering Economy, 9<sup>th</sup> ed. New York, NY, USA: McGraw-Hill Education, 2020.
2. R. L. Peurifoy and G. D. Oberlender, Construction Planning, Equipment and Methods. New York, NY, USA: McGraw-Hill, 2011.
3. S. W. Nunnally, Construction Methods and Management. Upper Saddle River, NJ, USA: Prentice Hall, 2007.



| B.E. (Civil Engineering)<br>Outcome Based Education (OBE) and Choice Based Credit System (CBCS)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                 |             |              |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|-------------|--------------|
| Course Title                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Irrigation Engineering and Hydraulic Structures |             |              |
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | BCV502                                          | Scheme      | 2024         |
| Type of Course                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Integrated Professional Core Courses (IPCC)     | Semester    | V            |
| Teaching Hours/Week (L:T:P)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | (3:0:2) 75 hrs/sem                              | CIE Marks   | 50           |
| Total Hours of Pedagogy per semester (L:T:P: TW& SL)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | (45:0:30:45) 120 hrs/sem                        | SEE Marks   | 50           |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 4                                               | Total Marks | 100          |
| Examination type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Theory- CIE +SEE & Lab- CIE only                | Exam Hours  | 3            |
| <b>COURSE LEARNING OBJECTIVES:</b><br><i>The purpose of the course is to enable the learner to:</i> <ol style="list-style-type: none"> <li>Understand the principles of irrigation engineering, crop water requirements, duty, delta, and various irrigation practices.</li> <li>Apply appropriate engineering methods for the planning and design of canal systems, reservoirs, and diversion headworks.</li> <li>Analyze the stability, seepage, forces, and safety aspects of gravity dams and earthen dams using suitable analytical and computational techniques.</li> <li>Evaluate irrigation systems and hydraulic structures through real-world data, case studies, field observations, and modern software tools, with emphasis on sustainable practices.</li> </ol> |                                                 |             |              |
| <b>Module-1: Irrigation</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                 |             | <b>9 hrs</b> |
| <b>Irrigation:</b> Definition. Benefits and ill effects of irrigation. System of irrigation: surface. Water Requirements of Crops: Duty, delta and base period, relationship between them, factors affecting duty of water crops and crop seasons in India, frequency of irrigation. Introduction to Smart Irrigation Systems. Basic IOT concepts in Irrigation.                                                                                                                                                                                                                                                                                                                                                                                                              |                                                 |             |              |
| <b>Module-2: Canals</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                 |             | <b>9 hrs</b> |
| <b>Canals:</b> Types of canals. Alignment of canals. Definition of gross command area, cultural command area, intensity of irrigation, time factor, crop factor. Unlined and lined canals. Standard sections. Design of canals by Lacey's and Kennedy's method. Reservoirs: Definition, investigation for reservoir site.                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                 |             |              |
| <b>Module-3: Gravity dams</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                 |             | <b>9 hrs</b> |
| <b>Gravity dams:</b> Forces acting on a gravity dam, causes of failure of a gravity dam, practical profile of a gravity dam, limiting height of a low gravity dam, Factors of Safety – Stability Analysis, Foundation for a Gravity Dam, drainage and inspection galleries.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                 |             |              |
| <b>Module-4: Earth dams</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                 |             | <b>9 hrs</b> |
| <b>Earth dams:</b> Types of Earth dams, causes of failure of earth dam, criteria for safe design of earth dam, measures for control of seepage. Spillways: types of spillways, Design principles of Ogee spillways – Spillway gates. Energy Dissipaters and Stilling Basins Significance of Jump Height Curve and Tail Water Rating Curve – USBR and Indian types of Stilling Basins. Sustainable dam practices.                                                                                                                                                                                                                                                                                                                                                              |                                                 |             |              |

|                                                                                                                                                                                                                                                                                                                                                                             |              |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| <b>Module-5: Diversion Head works</b>                                                                                                                                                                                                                                                                                                                                       | <b>9 hrs</b> |
| <b>Types of Diversion head works-</b> weirs and barrages, layout of diversion head work – components. Causes and failure of Weirs and Barrages on permeable foundations, -Silt Ejectors and Silt Excluders, Weirs on Permeable Foundations – Creep Theories – Bligh's, Lane's and Khosla's theories.<br><b>Hydropower:</b> Hydroelectric power plants, layout, and features |              |

### PRACTICAL COMPONENT OF IPCC

| Sl. No. | Experiments                                                                    |
|---------|--------------------------------------------------------------------------------|
| 1       | Calculation of duty, delta using real data                                     |
| 2       | Determination of Storage Capacity of reservoir using Excel (Mass curve Method) |
| 3       | Stability analysis and Force calculations of Gravity Dams                      |
| 4       | Seepage analysis of Earthen Dams Using HEC-RAS                                 |
| 5       | Exit gradient calculation, U/s and D/s Sheet Piles                             |
| 6       | Estimation of launching apron dimensions                                       |
| 7       | Introduction to computer-based stability analysis tools                        |
| 8       | Case study: Irrigation practices in Karnataka                                  |
| 9       | Visit nearby irrigation structure / barrage                                    |

### COURSE OUTCOMES:

*After successfully completing the course, the student will be able to:*

|            |                                                                                                                        |
|------------|------------------------------------------------------------------------------------------------------------------------|
| <b>CO1</b> | Understand irrigation principles, crop water requirements, and modern irrigation practices                             |
| <b>CO2</b> | Apply design concepts to canals and reservoirs using standard methods and computational.                               |
| <b>CO3</b> | Analyze stability and performance of gravity dams and earth dams using engineering principles and practical approaches |
| <b>CO4</b> | Design diversion headworks and evaluate irrigation systems considering sustainability and current technologies.        |

### ASSESSMENT DETAILS (Both CIE and SEE)

| Assessment Type                                                                                                                                                                                                                                                                                                               | Maximum Marks | Minimum Passing Marks | Evaluation Details                                                                                                        |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-----------------------|---------------------------------------------------------------------------------------------------------------------------|
| CIE- IA Tests (A)                                                                                                                                                                                                                                                                                                             | 20            | -                     | Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 20 marks. |
| Continuous and Comprehensive Evaluation (B)                                                                                                                                                                                                                                                                                   | 10            | -                     | Any one Assessment methods as per 24RNBE4.2 scaled to 10 marks.                                                           |
| <b>Total CIE Theory (A+B)</b>                                                                                                                                                                                                                                                                                                 | <b>30</b>     | <b>12</b>             | <b>Marks of Tests and Assignments awarded for a maximum of 30.</b>                                                        |
| CIE Practical                                                                                                                                                                                                                                                                                                                 | 12            | -                     | Marks awarded for Weekly Conduction of Experiments and Submission of Laboratory records, scaled to 12 marks.              |
| CIE Practical Test                                                                                                                                                                                                                                                                                                            | 8             | -                     | Average of marks of Two tests, each conducted for 100 marks covering all experiments, scaled to 8.                        |
| <b>Total CIE Practical (C)</b>                                                                                                                                                                                                                                                                                                | <b>20</b>     | <b>8</b>              | <b>Marks of Experiments, Record and Test awarded for a maximum of 20 marks.</b>                                           |
| <b>CIE: Theory + Practical (A + B + C)</b>                                                                                                                                                                                                                                                                                    | <b>50</b>     | <b>20</b>             | <b>CIE Evaluation is done for a maximum of 50 marks.</b>                                                                  |
| <b>SEE (D)</b>                                                                                                                                                                                                                                                                                                                | <b>50</b>     | <b>18</b>             | <b>SEE is a theory exam, conducted for 100 marks and scaled down to 50 marks. Exam duration shall before 3 hours.</b>     |
| <b>CIE+SEE (A+B+C+D)</b>                                                                                                                                                                                                                                                                                                      | <b>100</b>    | <b>40</b>             | <b>Final marks shall be the sum of marks scored in Components A, B, C and D</b>                                           |
| <ul style="list-style-type: none"> <li>The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to appear for SEE. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included in their respective modules only.</li> </ul> |               |                       |                                                                                                                           |

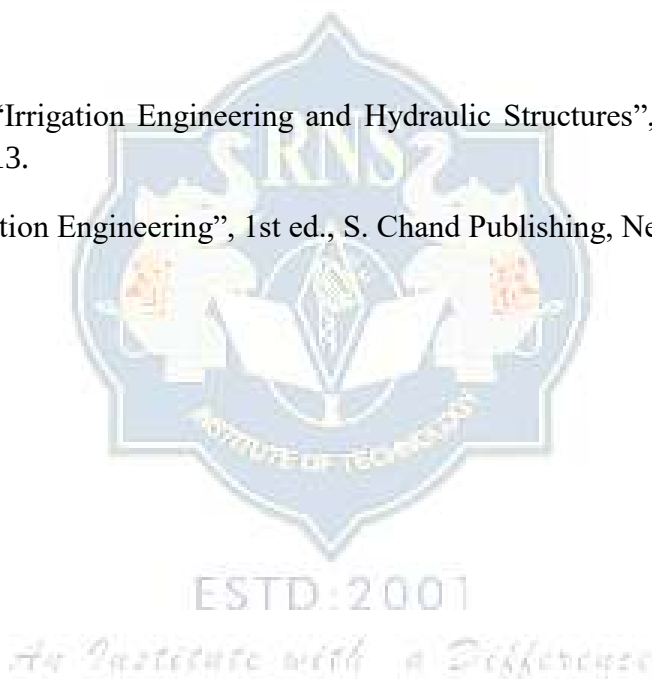
## Suggested Learning Resources:

### Textbooks

1. S. K. Garg, "Irrigation Engineering and Hydraulic Structures", 38<sup>th</sup> ed., Khanna Publishers, New Delhi, 2023.
2. K. R. Arora, "Irrigation Engineering", 3<sup>rd</sup> ed., Standard Publishers Distributors, New Delhi, 2010.
3. B B. C. Punmia and B. B. L. Pande, "Irrigation and Water Power Engineering", 16<sup>th</sup> ed., Laxmi Publications Pvt. Ltd., New Delhi, 2016.
4. R. S. Varshney, S. C. Gupta and R. L. Gupta, "Theory and Design of Hydraulic Structures", 2<sup>nd</sup> ed., Nem Chand & Bros., Roorkee, 1992.

### Reference books

1. K. K. Choudhury, "Irrigation Engineering and Hydraulic Structures", 1<sup>st</sup> ed., Standard Book House, New Delhi, 2013.
2. R. K. Rajput, "Irrigation Engineering", 1st ed., S. Chand Publishing, New Delhi, 2008.



| B.E. (Civil Engineering)<br>Outcome Based Education (OBE) and Choice Based Credit System (CBCS)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                            |             |              |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|-------------|--------------|
| Course Title                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Highway and Airport Engineering            |             |              |
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | BCV503                                     | Scheme      | 2024         |
| Type of Course                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Integrated Professional Core Course (IPCC) | Semester    | V            |
| Teaching Hours/Week (L:T:P)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | (3:0:2) 75 hrs/sem                         | CIE Marks   | 50           |
| Total Hours of Pedagogy per semester (L:T:P: TW& SL)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | (45:0:30:45) 120 hrs/sem                   | SEE Marks   | 50           |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 4                                          | Total Marks | 100          |
| Examination type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Theory- CIE +SEE & Lab- CIE only           | Exam Hours  | 3            |
| <b>COURSE LEARNING OBJECTIVES:</b><br><i>The purpose of the course is to enable the learner to:</i> <ol style="list-style-type: none"> <li>Understand highway planning, alignment principles, and cross-sectional features.</li> <li>Analyze site selection, runway and taxiway characteristics for efficient airport operations.</li> <li>Evaluate Highway geometric elements such as sight distances, curves, gradients and their safety implications.</li> <li>Design flexible, rigid pavements and highway drainage systems.</li> </ol>                                                                                                                                 |                                            |             |              |
| <b>Module-1: Highway Engineering</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                            |             | <b>9 hrs</b> |
| <b>Introduction:</b> Road Classifications and Road Patterns. Highway Alignment: Factors affecting highway alignment, Engineering surveys for alignment conventional and modern method, Role of Highways in the development of nation.<br><b>Highway Geometric Design :</b> Factors affecting geometric design of roads, Cross Sectional Elements, Sight distances, Horizontal alignment- Transition curve, super elevation, Extra widening, Vertical alignment-gradients, summit and valley curves. <b>(No derivations)</b><br><b>Problems on Sight distance, Super elevation, extra widening of curves, Length of transition curve, Length of summit and valley curve.</b> |                                            |             |              |
| <b>Module-2: Highway Materials and Pavements</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                            |             | <b>9 hrs</b> |
| <b>Highway Materials:</b> Highway construction materials, Desirable properties of aggregates, soil subgrade & Bitumen, Application of bituminous emulsion, Desirable properties of Bituminous Mixes.<br><b>Pavement Design:</b> Factors Controlling design of highway pavements, Pavement types, component parts of pavements and their functions; types of joints used in rigid pavement. Critical stresses in flexible and rigid pavement.                                                                                                                                                                                                                                |                                            |             |              |
| <b>Module-3: Highway Construction</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                            |             | <b>9 hrs</b> |
| Construction of non-bituminous pavements: Construction of embankment / subgrade. Granular Subbase. Lime & Cement Stabilized sub base / base. Construction of GSB, WBM and WMM. Construction of bituminous and Rigid pavements.                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                            |             |              |
| <b>Module-4: Highway Drainage &amp; Economics</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                            |             | <b>9 hrs</b> |
| <b>Highway Drainage:</b> Significance and requirements, Surface drainage system and design- Examples, sub surface drainage system, Types of cross drainage structures their choice and location.<br><b>Problems on design of Longitudinal drain.</b><br>Highway Economics: Highway user benefits, VOC using charts only, Economic analysis - annual Cost method-Benefit Cost Ratio method-NPV-IRR methods, Highway financing-BOT-BOOT                                                                                                                                                                                                                                       |                                            |             |              |

concepts.

**Module-5: Airport Engineering**

**9 hrs**

Layout of an airport with component parts and functions, Site selection for airport, Aircraft characteristics affecting the design and planning of airport, Airport classification, Runway orientation using wind rose with examples.

RUNWAY- Basic runway length-Corrections and examples, Runway geometrics, Taxiway-Factors affecting the layout - geometrics of taxiway-Comparison between Runway and Highway, Design of exit taxiway with examples.

**Problems on Runway orientation, Basic Runway length, Exit taxiway design.**

**PRACTICAL COMPONENT OF IPCC**

| Sl. No. | Experiments                                                                                                                                                                                                    |
|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1       | Introduction, Different Modes of Transportation, M R Jayakar Committee recommendations                                                                                                                         |
| 2       | <b>Tests on Aggregates</b><br>a. Crushing Strength Test<br>b. Los Angeles abrasion test<br>c. Impact test d. Shape tests (combined index and angularity number)                                                |
| 3       | <b>Tests on Bituminous Materials</b><br>a. Penetration test<br>b. Ductility test<br>c. Softening point test<br>d. Specific gravity test<br>e. Viscosity test by tar viscometer<br>f. Flash and fire point test |
| 4       | <b>Tests on Soil</b><br>a. Wet sieve analysis<br>b. CBR Test on soil                                                                                                                                           |
| 5       | Design of flexible pavement as per IRC 37-2018                                                                                                                                                                 |
| 6       | Design of Rigid pavement as per IRC 58-2015                                                                                                                                                                    |
| 7       | Bituminous Mix Design by Marshall Method (Demonstration only)                                                                                                                                                  |

**COURSE OUTCOMES:**

*After successfully completing the course, the student will be able to:*

|            |                                                                                  |
|------------|----------------------------------------------------------------------------------|
| <b>CO1</b> | Understand highway classification, alignment, and geometric design principles    |
| <b>CO2</b> | Analyze site selection, runway orientation, taxiway geometry.                    |
| <b>CO3</b> | Evaluate highway economics using standard economic methods and financing models. |
| <b>CO4</b> | Design flexible pavements, rigid pavements, and highway drainage systems.        |

### ASSESSMENT DETAILS (Both CIE and SEE)

| Assessment Type                                                                                                                                                                                                                                                                                                               | Maximum Marks | Minimum Passing Marks | Evaluation Details                                                                                                        |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-----------------------|---------------------------------------------------------------------------------------------------------------------------|
| CIE- IA Tests (A)                                                                                                                                                                                                                                                                                                             | 20            | -                     | Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 20 marks. |
| Continuous and Comprehensive Evaluation (B)                                                                                                                                                                                                                                                                                   | 10            | -                     | Any one Assessment methods as per 24RNBE4.2 scaled to 10 marks.                                                           |
| <b>Total CIE Theory (A+B)</b>                                                                                                                                                                                                                                                                                                 | <b>30</b>     | <b>12</b>             | <b>Marks of Tests and Assignments awarded for a maximum of 30.</b>                                                        |
| CIE Practical                                                                                                                                                                                                                                                                                                                 | 12            | -                     | Marks awarded for Weekly Conduction of Experiments and Submission of Laboratory records, scaled to 12 marks.              |
| CIE Practical Test                                                                                                                                                                                                                                                                                                            | 8             | -                     | Average of marks of Two tests, each conducted for 100 marks covering all experiments, scaled to 8.                        |
| <b>Total CIE Practical (C)</b>                                                                                                                                                                                                                                                                                                | <b>20</b>     | <b>8</b>              | <b>Marks of Experiments, Record and Test awarded for a maximum of 20 marks.</b>                                           |
| <b>CIE: Theory + Practical (A + B + C)</b>                                                                                                                                                                                                                                                                                    | <b>50</b>     | <b>20</b>             | <b>CIE Evaluation is done for a maximum of 50 marks.</b>                                                                  |
| <b>SEE (D)</b>                                                                                                                                                                                                                                                                                                                | <b>50</b>     | <b>18</b>             | <b>SEE is a theory exam, conducted for 100 marks and scaled down to 50 marks. Exam duration shall before 3 hours.</b>     |
| <b>CIE+SEE (A+B+C+D)</b>                                                                                                                                                                                                                                                                                                      | <b>100</b>    | <b>40</b>             | <b>Final marks shall be the sum of marks scored in Components A, B, C and D</b>                                           |
| <ul style="list-style-type: none"> <li>The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to appear for SEE. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included in their respective modules only.</li> </ul> |               |                       |                                                                                                                           |

## Suggested Learning Resources:

### Textbooks

1. S K Khanna and C E G Justo, “Highway Engineering”, Nem Chand Bros, Roorkee.
2. L R Kadiyali, “Highway Engineering”, Khanna Publishers, New Delhi.
3. S C Rangwala “Airport Engineering” 17th Edition, Charotar Publishing House Pvt. Ltd.

### Reference books

1. Airport Planning and Design by Khanna Arora and Jain, Nem Chand Bros, Roorkee.
2. Roads, Railways, Bridges, Tunnels and Harbour Dock Engineering by B L Gupta, Amit Gupta.
3. S K Khanna, C E G Justo and A Veeraragavan, “Highway Materials Testing Laboratory Manual”, Nem Chand Bros, Roorkee.



| B.E. (Civil Engineering)<br>Outcome Based Education (OBE) and Choice Based Credit System (CBCS)                                                                                                                                                                                                                                                                                                                                                                                           |                                                             |             |      |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|-------------|------|
| Course Title                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Building Information Modelling in Civil Engineering (Basic) |             |      |
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | BCVL504                                                     | Scheme      | 2024 |
| Type of Course                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Professional Core Course Laboratory (PCCL)                  | Semester    | V    |
| Teaching Hours/Week (L:T:P)                                                                                                                                                                                                                                                                                                                                                                                                                                                               | (0:0:2) 30 hrs/sem                                          | CIE Marks   | 50   |
| Total Hours of Pedagogy per semester (L:T:P: TW& SL)                                                                                                                                                                                                                                                                                                                                                                                                                                      | (0:0:30:0) 30 hrs/sem                                       | SEE Marks   | 50   |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 1                                                           | Total Marks | 100  |
| Examination type                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Practical                                                   | Exam Hours  | 3    |
| <b>COURSE LEARNING OBJECTIVES:</b><br><i>The purpose of the course is to facilitate the learner to:</i> <ol style="list-style-type: none"> <li>Understand the fundamentals of building design using Building Information Modelling (BIM) and Autodesk Revit Architecture.</li> <li>Prepare components of architectural drawing using BIM techniques.</li> <li>Generate project documentation, schedules, material take-offs, and 3D views using BIM and Autodesk Revit models.</li> </ol> |                                                             |             |      |

| Sl. No. | Experiments                                                                                                                                                                                                                |
|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1       | <b>Introduction to Building Information Modelling.</b>                                                                                                                                                                     |
| 2       | <b>Revit Projects:</b> Project Templates, Revit File Types Working with Revit Elements and Families Exploring the User Interface and Starting a Project.                                                                   |
| 3       | <b>Levels and Grids (Datum Planes):</b> Setting up Levels & Modifying, Creating Grids.                                                                                                                                     |
| 4       | <b>Modelling Walls:</b> Creating Walls and Modify wall types.                                                                                                                                                              |
| 5       | <b>Working with Doors and Windows:</b> Loading Door and Window Types from the Library, Creating Additional Door and Window Sizes.                                                                                          |
| 6       | <b>Using Editing Tools &amp; Working with Views:</b> Using Editing Commands, Setting the view, display Visibility Graphics, Duplicate Views, Elevations & Sections, Adding Callout Views, Creating and Modifying 3D Views. |
| 7       | <b>Modelling Floors:</b> Creating and Modifying Floors.                                                                                                                                                                    |
| 8       | <b>Modelling Stairs, Railings, and Ramps:</b> Creating & Modifying Stairs, Working with Railings, Sketching Custom Stairs, Creating Ramps.                                                                                 |
| 9       | <b>Modelling Roofs:</b> Creating Roofs by Footprint Using Join & unjoin roof.                                                                                                                                              |
| 10      | <b>Material Take-Off and Quantity Schedules:</b> Creating schedules for walls, doors, windows, and floors to extract quantities and material information from the BIM model.                                               |

## COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

|            |                                                                                                                                                   |
|------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>CO1</b> | Explain the concepts of Building Information Modelling (BIM), Autodesk Revit Architecture based project workflows.                                |
| <b>CO2</b> | Create BIM projects by developing levels, grids, and architectural building elements using Autodesk Revit.                                        |
| <b>CO3</b> | Model architectural components including walls, doors, windows, floors, stairs, railings, ramps, and roofs using Autodesk Revit.                  |
| <b>CO4</b> | Generate architectural documentation including plans, elevations, sections, 3D views, material take-offs, and quantity schedules from BIM models. |

## ASSESSMENT DETAILS (Both CIE and SEE)

| <b>1-Credit Lab Course</b>                                                                                                                       |                      |                              |                                                                                                                |
|--------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|------------------------------|----------------------------------------------------------------------------------------------------------------|
| <b>Assessment Type</b>                                                                                                                           | <b>Maximum Marks</b> | <b>Minimum Passing Marks</b> | <b>Evaluation Details</b>                                                                                      |
| CIE Practical (A)                                                                                                                                | 30                   | -                            | Marks awarded for Weekly Conduction of Experiments and Submission of Laboratory records, scaled to 30 marks.   |
| CIE Practical Test (B)                                                                                                                           | 20                   | -                            | Average of marks of Two tests, each conducted for 100 marks covering all experiments, scaled to 20.            |
| <b>Total CIE Practical (A+B)</b>                                                                                                                 | <b>50</b>            | <b>20</b>                    | <b>Sum of Marks of Experiments, Record and Test shall be CIE marks awarded for a maximum of 50.</b>            |
| <b>SEE (C)</b>                                                                                                                                   | <b>50</b>            | <b>20</b>                    | <b>SEE is a lab exam, conducted for 100 marks and scaled down to 50 marks. Exam duration shall be 3 hours.</b> |
| <b>CIE + SEE (A+B+C)</b>                                                                                                                         | <b>100</b>           | <b>40</b>                    | Final marks shall be the sum of marks scored in Components <b>A, B and C.</b>                                  |
| <ul style="list-style-type: none"> <li>The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to appear for SEE.</li> </ul> |                      |                              |                                                                                                                |

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## Suggested Learning Resources:

### Textbooks

1. R. Sacks, C. Eastman, G. Lee, P. Teicholz and K. Liston, "BIM Handbook: A Guide to Building Information Modeling for Owners, Designers, Engineers, Contractors, and Facility Managers," 4<sup>th</sup> ed., John Wiley & Sons, 2024.
2. W. Kymmell, "Building Information Modeling: Planning and Managing Construction Projects with 4D CAD and Simulations," McGraw-Hill Education, 2008.

### Reference books

1. J. Ingram, "Understanding BIM: The Past, Present and Future of Building Information Modelling," Routledge, 2023.
2. M. González García, F. Rodrigues and J. S. Baptista, "New Advances in Building Information Modeling and Engineering Management," Springer, 2023.
3. "ISO 19650 Series: Organization and Digitization of Information About Buildings and Civil Engineering Works, Including Building Information Modelling (BIM)," International Organization for Standardization (ISO), 2018–2025.

| B.E. (Civil Engineering)<br>Outcome Based Education (OBE) and Choice Based Credit System (CBCS)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                     |             |              |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|-------------|--------------|
| Course Title                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Masonry Structures                  |             |              |
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | BCV515A                             | Scheme      | 2024         |
| Type of Course                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Professional Elective Courses (PEC) | Semester    | V            |
| Teaching Hours/Week (L:T:P)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | (3:0:0) 45 hrs/sem                  | CIE Marks   | 50           |
| Total Hours of Pedagogy per semester (L:T:P: TW& SL)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | (45:0:0:45) 90 hrs/sem              | SEE Marks   | 50           |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 3                                   | Total Marks | 100          |
| Examination type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Theory                              | Exam Hours  | 3            |
| <b>COURSE LEARNING OBJECTIVES:</b><br><i>The purpose of the course is to enable the learner to:</i> <ol style="list-style-type: none"> <li>1. Understand the fundamentals of masonry materials, masonry units, mortars, and construction practices.</li> <li>2. Apply masonry construction principles in engineering practice.</li> <li>3. Analyze the behaviour of masonry structures under strength and stability requirements.</li> <li>4. Design masonry structural elements subjected to axial and eccentric loads.</li> </ol>                                                                                                                                                        |                                     |             |              |
| <b>Module–1: Introduction to Masonry Structures</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                     |             | <b>9 hrs</b> |
| Introduction: History of masonry, types of masonry (brick, stone, concrete block), uses of units, mortar, bonds, grout, and reinforcement.<br>Structural applications of load bearing, non-load bearing, shear, and partition walls, advantages and disadvantages (durability, fire resistance, thermal performance, seismic limitations).                                                                                                                                                                                                                                                                                                                                                 |                                     |             |              |
| <b>Module–2: Masonry Materials and Properties</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                     |             | <b>9 hrs</b> |
| <b>Masonry Materials:</b> Types of units like clay bricks, fly ash bricks, concrete blocks, stone, and hollow blocks, types of mortar like cement and lime, classification, properties, and selection of mortars.<br><b>Properties:</b> Material properties of units including compressive strength, modulus of elasticity, water absorption, and thermal expansion, rules for good bonding, types of bonds (English, Flemish, Stretcher, Rat-trap).                                                                                                                                                                                                                                       |                                     |             |              |
| <b>Module– 3: Strength of Masonry and Construction Techniques</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                     |             | <b>9 hrs</b> |
| <b>Strength and Stability:</b> Strength and stability of axially loaded masonry walls, effect of unit strength, mortar strength, joint thickness, rate of absorption, effect of curing, effect of ageing, workmanship. Compressive strength formulae based on elastic theory and empirical formulae.<br><b>Construction Techniques:</b> Construction details and structural behaviour of cavity walls, partition walls, piers, and buttresses, common defects and cracks in masonry, reasons for failure and remedial methods, non-destructive testing (NDT) on masonry walls, site execution practices including safety, scaffolding, and quality control such as plumbing and levelling. |                                     |             |              |

**Module-4: Permissible Stresses and Design Considerations** **9 hrs**

**Permissible stresses:** Types of walls, permissible compressive stress, stress reduction and shape modification factors, increase in permissible stresses for eccentric vertical and lateral load, permissible tensile stress and shear stresses.

**Design Considerations:** Effective height of walls and columns, openings in walls, effective length, effective thickness, slenderness ratio, eccentricity, load dispersion, arching action in lintels. Problems on design considerations for solid walls, cavity walls, wall with pillars

**Module-5: Design of Masonry for Axial and Eccentric Loads** **9 hrs**

**Design of Masonry subjected to axial loads:** Design criteria, design examples of walls under UDL, solid walls, cavity walls, solid wall supported at the ends by cross wall, walls with piers.

**Design of walls subjected to eccentric loads:** Design criteria, stress distribution under eccentric loads, problems on eccentrically loaded solid walls, cavity walls, and walls with piers

**COURSE OUTCOMES:**

*After successfully completing the course, the student will be able to:*

|            |                                                                                              |
|------------|----------------------------------------------------------------------------------------------|
| <b>CO1</b> | Understand the basic concepts of masonry structures and different masonry materials          |
| <b>CO2</b> | Apply engineering principles and non-destructive testing methods to masonry structures.      |
| <b>CO3</b> | Analyze masonry structures with respect to permissible stresses, slenderness, and stability. |
| <b>CO4</b> | Design masonry walls, columns, and piers subjected to axial and eccentric loads.             |

**ASSESSMENT DETAILS (Both CIE and SEE)**

| Assessment Type                             | Maximum Marks | Minimum Passing Marks | Evaluation Details                                                                                                        |
|---------------------------------------------|---------------|-----------------------|---------------------------------------------------------------------------------------------------------------------------|
| CIE – IA Tests (A)                          | 30            | -                     | Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 30 marks. |
| Continuous and Comprehensive Evaluation (B) | 20            | -                     | Any two Assessment methods as per 24RNBE4.2 (*if it is project based, one assignment shall be given), scaled to 20 marks. |
| <b>Total CIE (A+B)</b>                      | <b>50</b>     | <b>20</b>             | <b>CIE Evaluation is done for a maximum of 50 marks</b>                                                                   |

|                                                                                                |     |    |                                                                                                           |
|------------------------------------------------------------------------------------------------|-----|----|-----------------------------------------------------------------------------------------------------------|
| SEE (C)                                                                                        | 50  | 18 | SEE is a theory exam conducted for 100 marks and scaled down to 50 marks. Exam duration shall be 3 hours. |
| CIE + SEE<br>(A+B+C)                                                                           | 100 | 40 | Final marks shall be the sum of marks scored in Components A, B and C.                                    |
| The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to appear for SEE. |     |    |                                                                                                           |

### Suggested Learning Resources:

#### Textbooks:

1. Dayaratnam, P., *Brick and Reinforced Brick Structures*, Oxford & IBH Publishing, 1987.
2. M. L. Gambhir, *Building and Construction Materials*, McGraw Hill education Pvt. Ltd., 2013.

#### Code Books:

1. IS 1905: 1987 (Reaffirmed 2022), Code of Practice for Structural Use of Unreinforced Masonry, Third revision, BIS, New Delhi.
2. SP 20 (S&T) – 1991, “Handbook on masonry design and construction (1st revision) BIS, New Delhi.

#### Reference Books:

1. Sinha, B.P. & Cook, R., *Design of Masonry Structures*, E & FN Spon., 1991
2. Henry, A.W., *Structural Masonry*, Macmillan Education Ltd., UK, 1990.

| <b>B.E. (Civil Engineering)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                            |                    |              |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|--------------------|--------------|
| <b>Outcome Based Education (OBE) and Choice Based Credit System (CBCS)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                            |                    |              |
| <b>Course Title</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>Alternative Building Material</b>       |                    |              |
| <b>Course Code</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>BCV515B</b>                             | <b>Scheme</b>      | <b>2024</b>  |
| <b>Type of Course</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>Professional Elective Courses (PEC)</b> | <b>Semester</b>    | <b>V</b>     |
| <b>Teaching Hours/Week (L:T:P)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>(3:0:0) 45 hrs/sem</b>                  | <b>CIE Marks</b>   | <b>50</b>    |
| <b>Total Hours of Pedagogy per semester (L:T:P: TW&amp; SL)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>(45:0:0:45) 90 hrs/sem</b>              | <b>SEE Marks</b>   | <b>50</b>    |
| <b>Credits</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>3</b>                                   | <b>Total Marks</b> | <b>100</b>   |
| <b>Examination type</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>Theory</b>                              | <b>Exam Hours</b>  | <b>3</b>     |
| <b>COURSE LEARNING OBJECTIVES:</b><br><i>The purpose of the course is to enable the learner to:</i> <ol style="list-style-type: none"> <li>1. Understand the fundamentals, classification and properties of alternative building materials.</li> <li>2. Identify the manufacturing processes and applications of waste-based materials and alternative building technologies.</li> <li>3. Describe the production methods and engineering applications of alternative cementitious and composite materials.</li> <li>4. Explain the cost, sustainability and environmental aspects of alternative building materials.</li> </ol>    |                                            |                    |              |
| <b>Module-1: Introduction to Alternative Building Materials</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                            |                    | <b>9 hrs</b> |
| Introduction to Alternative Building Materials: Need and scope – Classification of alternative building materials – Selection criteria – Physical, mechanical, thermal and durability properties – Comparison with conventional building materials – Lime – Pozzolana cements – Raw materials – Manufacturing process – Properties and uses – Fibres: Metallic and synthetic fibres – Fibre Reinforced Plastics (FRP): Matrix materials, organic and synthetic fibres – Properties and applications.                                                                                                                                |                                            |                    |              |
| <b>Module-2: Building Materials from Waste and Alternative Masonry Technologies</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                            |                    | <b>9 hrs</b> |
| Building materials from agro and industrial wastes – Types of agro wastes – Types of industrial and mine wastes – Properties and applications – Masonry blocks using industrial wastes – Construction and demolition wastes – Alternative building technologies: Use of arches in foundation – Alternatives for wall constructions – Composite masonry – Confined masonry – Cavity walls – Rammed earth construction – Materials, specifications, properties and applications.                                                                                                                                                      |                                            |                    |              |
| <b>Module-3: Alternative Cementitious and Composite Materials</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                            |                    | <b>9 hrs</b> |
| <b>Alternative Roofing Systems:</b> Concepts – Filler slab roofs – Composite beam-panel roofs – Masonry vaults and domes – Design concepts, materials, construction techniques, advantages, limitations and applications<br><b>Alternative Cementitious Materials:</b> Supplementary Cementitious Materials (SCMs) – Fly ash – Ground Granulated Blast Furnace Slag (GGBS) – Silica fume – Rice Husk Ash (RHA) – Metakaolin – Sources and classification, Properties, production methods and engineering applications– Standards and specifications – Environmental benefits – Applications in building materials and construction. |                                            |                    |              |
| <b>Module-4: Alternative Composite Materials and Production Technologies</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                            |                    | <b>9 hrs</b> |
| Geopolymer concrete – Ferrocement – Properties, production methods and engineering applications – Equipment for production of alternative materials: Equipment for production of                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                            |                    |              |

stabilized soil blocks – Fly ash brick manufacturing equipment – Hollow concrete block making machines – Moulds and production methods for precast building components – Equipment for prefabricated building elements – Material handling and quality control equipment – Safety practices in the production of alternative building materials.

**Module-5: Cost Analysis and Sustainable Use of Alternative Materials** **9 hrs**

Cost concepts in buildings – Cost saving techniques in planning, design and construction – Cost analysis: Case studies using alternative building materials – Selection of alternative building materials for sustainable construction – Environmental and economic benefits of alternative building materials – Applications and case studies.

**COURSE OUTCOMES:**

*After successfully completing the course, the student will be able to:*

|            |                                                                                                                                                                       |
|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>CO1</b> | Understand the fundamentals, classification and selection criteria of alternative building materials.                                                                 |
| <b>CO2</b> | Identify the manufacturing processes, properties and applications of waste-based building materials and alternative building technologies.                            |
| <b>CO3</b> | Describe the characteristics, production methods and engineering applications of alternative cementitious materials, composite materials and production technologies. |
| <b>CO4</b> | Explain the cost concepts, sustainability aspects and environmental benefits of alternative building materials.                                                       |

**ASSESSMENT DETAILS (Both CIE and SEE)**

| Assessment Type                             | Maximum Marks | Minimum Passing Marks | Evaluation Details                                                                                                        |
|---------------------------------------------|---------------|-----------------------|---------------------------------------------------------------------------------------------------------------------------|
| CIE – IA Tests (A)                          | 30            | -                     | Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 30 marks. |
| Continuous and Comprehensive Evaluation (B) | 20            | -                     | Any two Assessment methods as per 24RNBE4.2 (*if it is project based, one assignment shall be given), scaled to 20 marks. |
| <b>Total CIE (A+B)</b>                      | <b>50</b>     | <b>20</b>             | <b>CIE Evaluation is done for a maximum of 50 marks</b>                                                                   |
| <b>SEE (C)</b>                              | <b>50</b>     | <b>18</b>             | <b>SEE is a theory exam conducted for 100 marks and scaled down to 50 marks. Exam duration shall be 3 hours.</b>          |

|                                                                                                                                                                                                                                                                                                         |            |           |                                                                                |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-----------|--------------------------------------------------------------------------------|
| <b>CIE + SEE<br/>(A+B+C)</b>                                                                                                                                                                                                                                                                            | <b>100</b> | <b>40</b> | Final marks shall be the sum of marks scored in Components <b>A, B and C</b> . |
| <ul style="list-style-type: none"> <li>The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to appear for SEE.</li> <li><b>If any courses of 3 credits are of Integrated Course type, for such courses the method suggested for 4 credits IPCC shall be followed.</b></li> </ul> |            |           |                                                                                |

### Suggested Learning Resources:

#### Textbooks

- K. S. Jagadish, B. V. Venkatarama Reddy, and K. S. Nanjunda Rao, *Alternative Building Materials and Technologies*, New Delhi, India: New Age International Publishers, Latest Edition, 2018.
- B. V. Venkatarama Reddy, *Sustainable Building Technologies*, New Delhi, India: TERI Press, Latest Edition, 2019

#### Reference Books

- S. K. Duggal, *Building Materials*, 5<sup>th</sup> ed. New Delhi, India: New Age International (P) Ltd., 2020.
- P. C. Varghese, *Building Materials*, 2<sup>nd</sup> ed. New Delhi, India: PHI Learning Pvt. Ltd., 2015.

| B.E. (Civil Engineering)<br>Outcome-Based Education (OBE) and Choice-Based Credit System (CBCS)                                                                                                                                                                                                                                                                                                                                                                                                                         |                                     |             |              |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|-------------|--------------|
| Course Title                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Traffic Engineering                 |             |              |
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | BCV515C                             | Scheme      | 2024         |
| Type of Course                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Professional Elective Courses (PEC) | Semester    | V            |
| Teaching Hours/Week (L: T:P)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | (3:0:0) 45 hrs/sem                  | CIE Marks   | 50           |
| Total Hours of Pedagogy per semester (L:T:P: TW& SL)                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | (45:0:0:45) 90 hrs/sem              | SEE Marks   | 50           |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 3                                   | Total Marks | 100          |
| Examination type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Theory                              | Exam Hours  | 3            |
| <b>COURSE LEARNING OBJECTIVES:</b><br><i>The purpose of the course is to enable the learner to:</i> <ol style="list-style-type: none"> <li>1. Understand the fundamentals of traffic engineering and traffic management principles.</li> <li>2. Apply modern traffic monitoring technologies for traffic management.</li> <li>3. Analyze traffic data using traffic control strategies in real-time traffic management.</li> <li>4. Design solutions for urban traffic problems using emerging technologies.</li> </ol> |                                     |             |              |
| <b>Module-1: Traffic Planning and Characteristics</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                     |             | <b>9 hrs</b> |
| Road Characteristics-Road user characteristics, PIEV theory, Vehicle Performance characteristics, Fundamentals of Traffic Flow theory, Capacity and Level of service LOS: Definitions, highway capacity, factors affecting LOS, HCM methods. Concepts of Microscopic and Macroscopic traffic flow modelling: Urban Traffic problems in India, Integrated planning of town, country, regional, and all urban infrastructures, Sustainable approach- land use & transport and modal integration                           |                                     |             |              |
| <b>Module-2: Traffic Surveys</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                     |             | <b>9 hrs</b> |
| Traffic Surveys- Speed, journey time and delay surveys, Vehicle Volume Survey including non-motorized transports, Methods and interpretation, Origin Destination Survey, Methods and presentation, Parking Survey, Accident analyses-Methods, interpretation and presentation, Statistical applications in traffic studies and traffic forecasting, Level of service- Concept, applications and significance.                                                                                                           |                                     |             |              |
| <b>Module- 3: Traffic Design and Visual Aids</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                     |             | <b>9 hrs</b> |
| Intersection Design- channelization, Rotary intersection design, Signal design, Coordination of signals, Grade separation, Traffic signs including VMS and road markings, Significant roles of traffic control personnel, Networking pedestrian facilities & cycle tracks. Smart Traffic Control Systems. Adaptive traffic signal systems, Real-time traffic control, Smart parking systems, Vehicle-to-Infrastructure communication, Connected vehicles.                                                               |                                     |             |              |
| <b>Module-4: Traffic Safety and Environment</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                     |             | <b>9 hrs</b> |
| Road accidents, Causes, effects, prevention, and cost, Street lighting, Traffic and environment hazards, Air and Noise Pollution, causes, abatement measures, Promotion and integration of public transportation, Promotion of non-motorized transport                                                                                                                                                                                                                                                                  |                                     |             |              |
| <b>Module-5: Traffic Monitoring and Management</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                     |             | <b>9 hrs</b> |
| Area Traffic Management System, Traffic System Management (TSM) with IRC standards, Traffic Regulatory Measures, Travel Demand Management (TDM), Direct and indirect methods,                                                                                                                                                                                                                                                                                                                                           |                                     |             |              |

Congestion and parking pricing, Intelligent Transport System for traffic management, enforcement, and education. Traffic Monitoring Technologies, CCTV-based traffic monitoring, Automatic Number Plate Recognition, GPS-based vehicle tracking, AI-based traffic analysis, and Drone-based traffic monitoring.

### COURSE OUTCOMES:

*After successfully completing the course, the student will be able to:*

|            |                                                                                   |
|------------|-----------------------------------------------------------------------------------|
| <b>CO1</b> | Understand the human factors and vehicular factors in traffic engineering design. |
| <b>CO2</b> | Apply the basic knowledge of Technologies in Traffic monitoring and management.   |
| <b>CO3</b> | Analyze the traffic data from various traffic surveys using statistical methods.  |
| <b>CO4</b> | Design the traffic intersections to comprehend the capacity & LOS                 |

### ASSESSMENT DETAILS (Both CIE and SEE)

| Assessment Type                             | Maximum Marks | Minimum Passing Marks | Evaluation Details                                                                                                                  |
|---------------------------------------------|---------------|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| CIE – IA Tests (A)                          | 30            | -                     | Two tests, each of 50 marks, shall be conducted. The average of the two internal assessment tests shall be scaled down to 30 marks. |
| Continuous and Comprehensive Evaluation (B) | 20            | -                     | Any two Assessment methods as per 24RNBE4.2 (*if it is project-based, one assignment shall be given), scaled to 20 marks.           |
| <b>Total CIE (A+B)</b>                      | <b>50</b>     | <b>20</b>             | <b>CIE Evaluation is done for a maximum of 50 marks</b>                                                                             |
| SEE (C)                                     | 50            | 18                    | SEE is a theory exam conducted for 100 marks and scaled down to 50 marks. Exam duration shall be 3 hours.                           |
| <b>CIE + SEE (A+B+C)</b>                    | <b>100</b>    | <b>40</b>             | Final marks shall be the sum of marks scored in Components A, B, and C.                                                             |

The minimum marks to be secured in CIE are 20 (40%) out of the allotted 50 marks to appear for SEE.

### **Suggested Learning Resources:**

#### **Textbooks**

1. Kadiyal I. L.R. “Traffic Engineering and Transport Planning”, Khanna Publishers, Delhi, 2013
2. Salter. R.I and Hounsell, N.B., “Highway Traffic Analysis and Design”, Macmillan Press Ltd.1996.
3. Highway Capacity Manual, Transportation Research Board. Washington, D.C., 2000.

#### **Reference books**

1. Traffic Flow Theory and Control by Donald R. Drew, McGraw-Hill
2. Fred L. Mannering, Scott S. Washburn, and Walter P. Kilareski, Principles of Highway Engineering and Traffic Analysis, Wiley India Pvt. Ltd., New Delhi, 2011
3. John E Tyworth, “Traffic Management Planning, Operations and Control”, Addison Wesley Publishing Company, 1996

| B.E. (Civil Engineering)<br>Outcome Based Education (OBE) and Choice Based Credit System (CBCS)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                    |             |              |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|-------------|--------------|
| Course Title                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Ground Water Hydraulics            |             |              |
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | BCV515D                            | Scheme      | 2024         |
| Type of Course                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Professional Elective Course (PEC) | Semester    | V            |
| Teaching Hours/Week (L:T:P)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | (3:0:0) 45 hrs/sem                 | CIE Marks   | 50           |
| Total Hours of Pedagogy per semester (L:T:P: TW& SL)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | (45:0:0:45) 90 hrs/sem             | SEE Marks   | 50           |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 3                                  | Total Marks | 100          |
| Examination type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Theory                             | Exam Hours  | 3            |
| <b>COURSE LEARNING OBJECTIVES:</b><br><i>The purpose of the course is to enable the learner to:</i> <ol style="list-style-type: none"> <li>1. Understand the occurrence, distribution, and characteristics of groundwater.</li> <li>2. Acquire the knowledge of flow characteristics for solving problems on ground water recharge.</li> <li>3. Analyze well hydraulics and groundwater behaviour under steady and unsteady conditions using pumping test data and analytical methods.</li> <li>4. Evaluate groundwater exploration and artificial recharge for sustainable water resource management.</li> </ol> |                                    |             |              |
| <b>Module-1: Aquifer</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                    |             | <b>9 hrs</b> |
| Importance, vertical distribution of subsurface water, occurrence in different types of rocks and soils, definitions-aquifers, aquifuge, aquitard, aquiclude, confined and Unconfined aquifers. Groundwater occurrence in fractured rock aquifers                                                                                                                                                                                                                                                                                                                                                                 |                                    |             |              |
| <b>Module-2: Fundamentals of Ground Water Flow</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                    |             | <b>9 hrs</b> |
| <b>Fundamentals of Ground Water Flow:</b> Aquifer parameters, specific yield and specific retention, porosity, storage coefficient, hydraulic conductivity, steady one-dimensional flow: cases with recharge. Groundwater-Surface Water Interaction (Gaining and Losing Streams, Base Flow, River-Aquifer Interaction)                                                                                                                                                                                                                                                                                            |                                    |             |              |
| <b>Module-3: Well Hydraulics</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                    |             | <b>9 hrs</b> |
| <b>Well Hydraulics:</b> Steady Flow, Radial flow in confined and unconfined aquifers, pumping test Unsteady Flow, General equation, solution of unsteady flow equations, leaky aquifers (only introduction), interference of well, image well theory. Groundwater depletion and sustainable yield estimation                                                                                                                                                                                                                                                                                                      |                                    |             |              |
| <b>Module-4: Ground Water Exploration</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                    |             | <b>9 hrs</b> |
| <b>Ground Water Exploration:</b> Seismic method, electrical resistivity method, Geophysical techniques, Borehole geophysical logging techniques (Electrical, Induction and Sonic logging). Groundwater potential zone mapping                                                                                                                                                                                                                                                                                                                                                                                     |                                    |             |              |
| <b>Module-5: Ground Water Development and Recharge</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                    |             | <b>9 hrs</b> |
| <b>Ground Water Development:</b><br>Types of wells, methods of construction, Dug wells and tube wells Pumps for lifting water and working principles, Conjunctive use of surface water and groundwater: necessity and techniques, Groundwater sustainability and management practices<br><b>Ground Water Recharge:</b><br>Artificial recharge, Rainwater harvesting for ground water recharge. Smart groundwater management systems                                                                                                                                                                               |                                    |             |              |

### COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

|            |                                                                                                                               |
|------------|-------------------------------------------------------------------------------------------------------------------------------|
| <b>CO1</b> | Understand the occurrence, distribution, and properties of groundwater in different geological formations.                    |
| <b>CO2</b> | Apply the principles of flow characteristics for groundwater movement and its interaction with surface water.                 |
| <b>CO3</b> | Analyze well hydraulics and sustainable groundwater yield.                                                                    |
| <b>CO4</b> | Assess the groundwater exploration, development, recharge, and management practices using conventional and modern techniques. |

### ASSESSMENT DETAILS (Both CIE and SEE)

| Assessment Type                                                                                | Maximum Marks | Minimum Passing Marks | Evaluation Details                                                                                                        |
|------------------------------------------------------------------------------------------------|---------------|-----------------------|---------------------------------------------------------------------------------------------------------------------------|
| CIE – IA Tests (A)                                                                             | 30            | -                     | Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 30 marks. |
| Continuous and Comprehensive Evaluation (B)                                                    | 20            | -                     | Any two Assessment methods as per 24RNBE4.2 (*if it is project based, one assignment shall be given), scaled to 20 marks. |
| <b>Total CIE (A+B)</b>                                                                         | <b>50</b>     | <b>20</b>             | <b>CIE Evaluation is done for a maximum of 50 marks</b>                                                                   |
| <b>SEE (C)</b>                                                                                 | <b>50</b>     | <b>18</b>             | <b>SEE is a theory exam conducted for 100 marks and scaled down to 50 marks. Exam duration shall be 3 hours.</b>          |
| <b>CIE + SEE (A+B+C)</b>                                                                       | <b>100</b>    | <b>40</b>             | Final marks shall be the sum of marks scored in Components <b>A, B and C.</b>                                             |
| The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to appear for SEE. |               |                       |                                                                                                                           |

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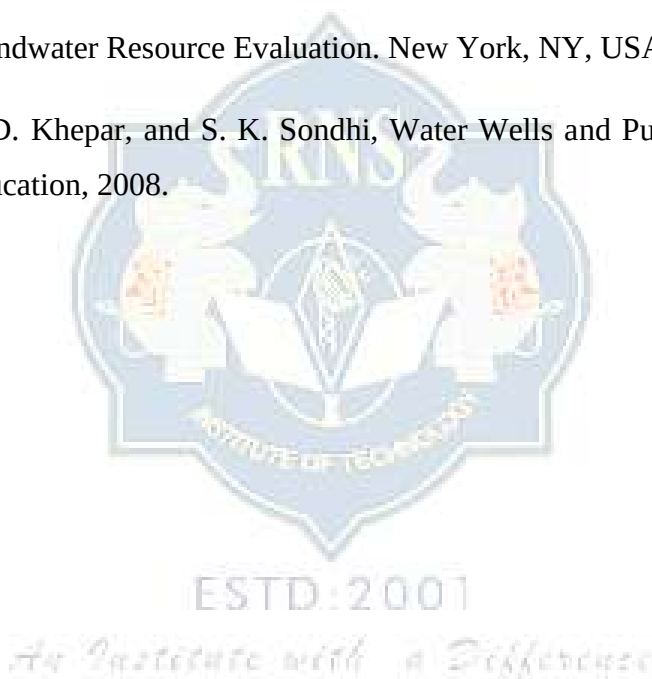
## **Suggested Learning Resources:**

### **Textbooks**

1. H. M. Raghunath, Ground Water, 2nd ed. New Delhi, India: Wiley Eastern Ltd., 1987.
2. D. K. Todd and L. W. Mays, Groundwater Hydrology, 3<sup>rd</sup> ed. New York, NY, USA: John Wiley & Sons, 2005.
3. H. Bouwer, Groundwater Hydrology. New York, NY, USA: McGraw-Hill, 1978.

### **Reference books**

1. S. P. Garg, Ground Water and Tube Wells, 2<sup>nd</sup> ed. New Delhi, India: Oxford & IBH Publishing Co. Pvt. Ltd., 2009.
2. W. C. Walton, Groundwater Resource Evaluation. New York, NY, USA: McGraw-Hill, 1970.
3. D. M. Michael, S. D. Khepar, and S. K. Sondhi, Water Wells and Pumps. New Delhi, India: Tata McGraw-Hill Education, 2008.



| B.E. (Civil Engineering)<br>Outcome Based Education (OBE) and Choice Based Credit System (CBCS)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                        |             |      |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|-------------|------|
| Course Title                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Mini Project           |             |      |
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | BCV586                 | Scheme      | 2024 |
| Type of Course                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Project                | Semester    | V    |
| Teaching Hours/Week (L:T:P)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | (0:0:2) 30 hrs/sem     | CIE Marks   | 100  |
| Total Hours of Pedagogy per semester (L:T:P: TW& SL)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | (0:0:30:30) 60 hrs/sem | SEE Marks   | -    |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 2                      | Total Marks | 100  |
| Examination type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Presentation/Viva Voce | Exam Hours  | 3    |
| <b>COURSE LEARNING OBJECTIVES:</b><br><i>The purpose of the course is to facilitate the learner to:</i> <ol style="list-style-type: none"> <li>1. Explain the planning process and surveying requirements for civil engineering projects using modern survey practices.</li> <li>2. Demonstrate the use of DGPS and Total Station to carry out reconnaissance, control, contour, and alignment surveys.</li> <li>3. Examine and interpret field survey data to develop engineering layouts, contour maps, longitudinal sections, and cross-sections.</li> <li>4. Assess planning, alignment, and design alternatives by applying engineering principles, standards, and project constraints.</li> <li>5. Develop complete engineering designs, drawings, and project reports for civil engineering applications in accordance with standard engineering practices.</li> </ol> |                        |             |      |
| <b>Module-1: Town/Housing/Layout Planning</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                        |             |      |
| <i>The work shall consist of;</i> <ul style="list-style-type: none"> <li>• Reconnaissance survey using <b>Total Station</b> for site selection, project conceptualization, and establishment of control points.</li> <li>• Detailed contour survey of the project area using <b>Total Station</b>.</li> <li>• Preparation of layout plans as per applicable planning regulations.</li> <li>• Centre line marking and transfer of layout from drawing to ground.</li> <li>• Design of roads, drainage, water supply, sewerage, and other infrastructure components.</li> <li>• Preparation of drawings and comprehensive project report.</li> </ul>                                                                                                                                                                                                                            |                        |             |      |
| <b>Module- 2: Water supply and sanitary project</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                        |             |      |
| <i>The work shall consist of;</i> <ul style="list-style-type: none"> <li>• Reconnaissance survey for selection of water source and project conceptualization.</li> <li>• Examination of water sources and estimation of water demand based on present and projected population.</li> <li>• Preparation of village map using <b>DGPS</b>.</li> <li>• Detailed survey for water supply pipeline and underground drainage (UGD) alignment using <b>Total Station</b>.</li> <li>• Selection of suitable location for overhead, ground-level, or underground water tank.</li> <li>• Design of water supply and sanitary components and preparation of drawings and project report.</li> </ul>                                                                                                                                                                                      |                        |             |      |

### Module-3: Highway Project

The work shall consist of;

- Reconnaissance survey for route selection, preliminary alignment, and establishment of control points.
- Preliminary and detailed alignment surveys for a minimum 1–1.5 km stretch between two obligatory points using **Total Station** and **DGPS**.
- Topographic survey for final alignment and preparation of longitudinal section and cross-sections.
- Geometric design of highway including horizontal and vertical alignment, and design of one cross-drainage structure.
- Preparation of detailed project report.

### Module-4: New tank Projects

The work shall consist of;

- Reconnaissance survey for site selection and project conceptualization.
- Alignment of bund centre line and preparation of longitudinal and cross sections using **Total Station**.
- Detailed survey for capacity estimation, contour mapping, waste weir, sluice, and canal alignment using **Total Station**.
- Design of bund, waste weir, sluice, and canal system.
- Preparation of drawings and comprehensive project report.

### COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

|     |                                                                                                                                                                                    |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CO1 | Understand the concepts of planning, surveying, and design involved in Civil Engineering projects such as town/housing layouts, water supply systems, highways, and tank projects. |
| CO2 | Apply modern surveying instruments, including DGPS and Total Station, to perform reconnaissance surveys, establish control points, and collect field data.                         |
| CO3 | Analyze engineering survey data to support contour mapping, alignment studies, layout planning, and infrastructure design.                                                         |
| CO4 | Evaluate suitable planning and design alternatives by considering survey results, engineering standards, and regulatory requirements.                                              |
| CO5 | Create integrated engineering solutions through the preparation of designs, drawings, and technical reports for Civil Engineering projects.                                        |

### ASSESSMENT DETAILS (Both CIE and SEE)

| Assessment Type                                                                                                                                                                                              | Maximum Marks | Minimum Passing Marks | Evaluation Details                                                                                                                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Evaluation based on Reports and Presentation/Viva Voce (A)                                                                                                                                                   | 100           | 40                    | Evaluation based on fieldwork conducted at the site camp, preparation of laboratory reports, and Presentation/Viva Voce covering the respective modules. |
| <b>Total CIE Theory (A)</b>                                                                                                                                                                                  | 100           | 40                    |                                                                                                                                                          |
| <b>SEE (B)</b>                                                                                                                                                                                               | -             | -                     | -                                                                                                                                                        |
| <b>CIE+SEE (A+B)</b>                                                                                                                                                                                         | 100           | 40                    | <b>Final marks shall be the sum of marks scored in Components A, B</b>                                                                                   |
| <ul style="list-style-type: none"> <li>The minimum marks to be secured in CIE is 40 out of allotted 50 marks with minimum 40 % scored in every component of CIE.</li> <li>No SEE for this subject</li> </ul> |               |                       |                                                                                                                                                          |

### Suggested Learning Resources:

#### Textbooks

- [1] Government of India, *Survey of India Manual: GPS Survey Specifications and Standards*, Survey of India, Dehradun, India. (DGPS/GPS control surveys, network design, and survey specifications.)
- [2] K. R. Arora, *Irrigation, Water Resources and Water Power Engineering*, 6<sup>th</sup> ed. New Delhi, India: Standard Publishers Distributors, 2019.
- [3] S. K. Garg, *Water Supply Engineering*, 38<sup>th</sup> ed. New Delhi, India: Khanna Publishers, 2021.
- [4] V. N. S. Murthy, *Land Use Planning and Urban Development*, New Delhi, India: CBS Publishers & Distributors, 2018.
- [5] B. C. Punmia, A. K. Jain, and A. K. Jain, *Surveying, Vol. I*, 17<sup>th</sup> ed. New Delhi, India: Laxmi Publications, 2016.

| B.E. (Civil Engineering)<br>Outcome Based Education (OBE) and Choice Based Credit System (CBCS)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                            |             |              |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|-------------|--------------|
| Course Title:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Environmental Studies      |             |              |
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | BENS407/507                | Scheme      | 2024         |
| Type of Course                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Basic Science Course (BSC) | Semester    | V            |
| Teaching Hours/Week (L:T:P)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | (2:0:0) 30 hrs/sem         | CIE Marks   | 50           |
| Total Hours of Pedagogy per semester (L:T:P: TW& SL)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | (30:0:0:30) 60 hrs/sem     | SEE Marks   | 50           |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 2                          | Total Marks | 100          |
| Examination type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Theory- MCQs               | Exam Hours  | 2            |
| <b>COURSE LEARNING OBJECTIVES:</b><br><i>The purpose of the course is to facilitate the learner to:</i> <ol style="list-style-type: none"> <li>1. Understand the fundamental concepts of ecology, ecosystems, biogeochemical cycles, and sustainability.</li> <li>2. Analyze environmental pollution and degradation with respect to their sources, impacts, and mitigation measures.</li> <li>3. Evaluate the influence of climate change and atmospheric environmental issues on ecosystems and human well-being.</li> <li>4. Explain the role of environmental conservation, legislation, and community-based movements in sustainable environmental management.</li> </ol> |                            |             |              |
| <b>Module-1: Ecology and Sustainability</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                            |             | <b>6 hrs</b> |
| <b>Ecology:</b> Basic concepts of ecosystem. Ecosystems (structure and function) - forest, desert, wetlands, river, oceanic and lake. Biotic and Abiotic components; Food chain; Ecological pyramid.<br><b>Biogeochemical Cycles:</b> carbon cycle, nitrogen cycle, phosphorus cycle, water cycle<br><b>Sustainability:</b> 17 Sustainable Development Goals (SDG) - history, targets, implementation, capacity development.                                                                                                                                                                                                                                                   |                            |             |              |
| <b>Module-2: Environmental Pollution</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                            |             | <b>6 hrs</b> |
| <b>Environmental Pollution:</b> Surface and ground water pollution, noise pollution, soil pollution, air pollution and marine pollution - sources, impacts on living beings, impacts on environment, preventive measures. Case-study on marine pollution.<br><b>Water Chemistry:</b> Significance and effect of pH, total dissolved solids and hardness. Case study on impact of fluoride on human health.                                                                                                                                                                                                                                                                     |                            |             |              |
| <b>Module-3: Environmental Degradation and Conservation</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                            |             | <b>6 hrs</b> |
| <b>Environmental Degradation:</b> Causes and effects of deforestation, desertification, soil erosion and glacier melting.<br><b>Environmental Conservation:</b> Significance and key features of national parks, wildlife sanctuaries, reserved forest and mangrove forest. Importance of western ghats as biodiversity hotspot (flora and fauna)                                                                                                                                                                                                                                                                                                                              |                            |             |              |
| <b>Module-4: Indian Monsoon and Global Warming</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                            |             | <b>6 hrs</b> |
| <b>Climate:</b> Impact on monsoons, significance of El Nino and La Nina on India climate.<br><b>Global warming:</b> causes, greenhouse gases, effects on environment and human health. Causes and effects of acid rain and ozone depletion. Air sampler and its importance in assessing pollutants.                                                                                                                                                                                                                                                                                                                                                                            |                            |             |              |

**Module-5: Environmental Legislation & Movements**

**6 hrs**

**Environmental Legislation:** Environmental Protection Act 1984: Definition, Significance and key features.

**Indian Environmental Movements:** Bishnoi Movement, Chipko & Appiko movement.

**COURSE OUTCOMES:**

*After successfully completing the course, the student will be able to:*

|            |                                                                                                                                                                    |
|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>CO1</b> | Describe the structure and functioning of ecosystems, biogeochemical cycles, and sustainability principles.                                                        |
| <b>CO2</b> | Analyze the causes, impacts, and control measures of environmental pollution and degradation.                                                                      |
| <b>CO3</b> | Assess the effects of climate change, global warming, acid rain, ozone depletion, and climatic phenomena on the environment.                                       |
| <b>CO4</b> | Interpret the significance of environmental conservation practices, environmental legislation, and Indian environmental movements in protecting natural resources. |

**ASSESSMENT DETAILS (Both CIE and SEE)**

| Assessment Type                                                                                                                                  | Maximum Marks | Minimum Passing Marks | Evaluation Details                                                                                                 |
|--------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-----------------------|--------------------------------------------------------------------------------------------------------------------|
| CIE – IA Tests (A)                                                                                                                               | 30            | -                     | Average of Two Internal Assessment Tests (MCQs) each conducted for 30 marks                                        |
| Continuous and Comprehensive Evaluation (B)                                                                                                      | 20            | -                     | Any two Assessment methods as per 24RNBE4.2, scaled to 20 marks.                                                   |
| <b>Total CIE (A+B)</b>                                                                                                                           | <b>50</b>     | <b>20</b>             | <b>CIE Evaluation is done for a maximum of 50 marks.</b>                                                           |
| <b>SEE (C)</b>                                                                                                                                   | <b>50</b>     | <b>18</b>             | <b>Question papers having 50 MCQs with each question carrying 01 mark, and Exam duration shall be for 2 hours.</b> |
| <b>CIE + SEE (A+B+C)</b>                                                                                                                         | <b>100</b>    | <b>40</b>             | Final marks shall be the sum of marks scored in Components A, B and C.                                             |
| <ul style="list-style-type: none"> <li>The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to appear for SEE.</li> </ul> |               |                       |                                                                                                                    |

## Suggested Learning Resources:

### Text Books

1. Benny Joseph, “Environmental studies”, 3<sup>rd</sup> ed., Tata McGraw-Hill, 2017.
2. S M Prakash, “Environmental studies”, 3<sup>rd</sup> ed., Pristine publishing house, 2018.

### Reference Books: -

1. M.Anji Reddy, “Textbook of environmental science and Technology”, revised ed., BS publications, 2014.
2. Dr. B.S Chauhan, “Environmental studies”, 1st ed., University of science press, 2008.



| B.E. (Civil Engineering)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                            |             |              |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|-------------|--------------|
| Outcome Based Education (OBE) and Choice Based Credit System (CBCS)                                                                                                                                                                                                                                                                                                                                                                                                                                               |                            |             |              |
| Course Title                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Biology for Engineers      |             |              |
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | BBOE407/507                | Scheme      | 2024         |
| Type of Course                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Basic Science Course (BSC) | Semester    | V            |
| Teaching Hours/Week (L:T:P)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | (2:0:0) 30 hrs/sem         | CIE Marks   | 50           |
| Total Hours of Pedagogy per semester (L:T:P: TW& SL)                                                                                                                                                                                                                                                                                                                                                                                                                                                              | (30:0:0:30) 60 hrs/sem     | SEE Marks   | 50           |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 2                          | Total Marks | 100          |
| Examination type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Theory- MCQs               | Exam Hours  | 2            |
| <b>COURSE LEARNING OBJECTIVES:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                            |             |              |
| <i>The purpose of the course is to facilitate the learner to:</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                            |             |              |
| <ol style="list-style-type: none"><li>1. Familiarize the students with the basic biological concepts and their engineering applications.</li><li>2. Enable the students with an understanding of bio design principles to create novel devices and structures.</li><li>3. Provide the students an appreciation of how biological systems can be re-designed as substitute products for natural systems.</li><li>4. Motivate the students to develop interdisciplinary vision of biological engineering.</li></ol> |                            |             |              |
| <b>Module-1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                            |             | <b>6 hrs</b> |
| Introduction to fundamentals of life. Structure and functions of a cell. Biomolecules: Properties and functions of Carbohydrates, Nucleic acids, Proteins, Enzymes and Lipids.                                                                                                                                                                                                                                                                                                                                    |                            |             |              |
| <b>Module-2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                            |             | <b>6 hrs</b> |
| Introduction to applications of biomolecules, Carbohydrates in cellulose-based water filters production, PHA and PLA in bioplastics production, Nucleic acids in vaccines and diagnosis, Proteins in food production, Enzymes in biosensors fabrication, food processing, enzymes in bio bleaching, Lipids in biodiesel and detergents production.                                                                                                                                                                |                            |             |              |
| <b>Module-3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                            |             | <b>6 hrs</b> |
| Introduction to adaptations of anatomical principles for bioengineering design, Brain as a CPU system. Eye as a Camera system. Heart as a pump system. Lungs as purification system. Kidney as a filtration system.                                                                                                                                                                                                                                                                                               |                            |             |              |
| <b>Module-4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                            |             | <b>6 hrs</b> |
| Introduction to nature inspired biomaterials and mechanisms, Echolocation, Photosynthesis. Bird flying, Lotus leaf effect, Plant burrs, Shark skin, Kingfisher beak. Artificial blood - hemoglobin-based oxygen carriers (HBOCs) and perfluorocarbons (PFCs).                                                                                                                                                                                                                                                     |                            |             |              |
| <b>Module-5</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                            |             | <b>6 hrs</b> |

Introduction to trends in bioengineering, Tissue engineering, stem cells and their applications, Bio printing techniques and materials. Electrical tongue and electrical nose in food science, DNA origami and Biocomputing, Bio imaging and Artificial Intelligence for disease diagnosis. Bio concrete.

### COURSE OUTCOMES:

*After successfully completing the course, the student will be able to:*

|            |                                                                                                      |
|------------|------------------------------------------------------------------------------------------------------|
| <b>CO1</b> | Corroborate the concepts of biomimetic for specific requirements.                                    |
| <b>CO2</b> | Understand the basic biological concepts for relevant industrial applications adaptation.            |
| <b>CO3</b> | Evaluate the principles of design and development, for exploring engineering knowledge in biological |
| <b>CO4</b> | Think critically towards exploring innovative bio based solutions for socially relevant problems.    |

### ASSESSMENT DETAILS (Both CIE and SEE)

| Assessment Type                                                                                                                                  | Maximum Marks | Minimum Passing Marks | Evaluation Details                                                                                                 |
|--------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-----------------------|--------------------------------------------------------------------------------------------------------------------|
| CIE – IA Tests (A)                                                                                                                               | 30            | -                     | Average of Two Internal Assessment Tests (MCQs) each conducted for 30 marks                                        |
| Continuous and Comprehensive Evaluation (B)                                                                                                      | 20            | -                     | Any two Assessment methods as per 24RNBE4.2, scaled to 20 marks.                                                   |
| <b>Total CIE (A+B)</b>                                                                                                                           | <b>50</b>     | <b>20</b>             | <b>CIE Evaluation is done for a maximum of 50 marks.</b>                                                           |
| <b>SEE (C)</b>                                                                                                                                   | <b>50</b>     | <b>18</b>             | <b>Question papers having 50 MCQs with each question carrying 01 mark, and Exam duration shall be for 2 hours.</b> |
| <b>CIE + SEE (A+B+C)</b>                                                                                                                         | <b>100</b>    | <b>40</b>             | Final marks shall be the sum of marks scored in Components A, B and C.                                             |
| <ul style="list-style-type: none"> <li>The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to appear for SEE.</li> </ul> |               |                       |                                                                                                                    |

### Suggested Learning Resources:

#### Text books

1. Basuchandra's Biology for Engineers, Chandra shekara. B.M, Basavaraju B.C, 2025.

2. Biology for Engineers, Rajendra Singh C and Rathnakar Rao N, Rajendra Singh C and Rathnakar Rao N Publishing, Bengaluru, 2023.

### Reference Books

1. Human Physiology, Stuart Fox, Krista Rompolski, McGraw-Hill eBook. 16<sup>th</sup> Edition, 2022
2. Biology for Engineers, Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W.
3. Barathi S., and Jaganthan M.K., Tata McGraw-Hill, New Delhi, 2012.
4. Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011
5. Biomedical Instrumentation, Leslie Cromwell, Prentice Hall 2011.
6. Biology for Engineers, Sohini Singh and Tanu Allen, Vayu Education of India, New Delhi, 2014.
7. Biomimetics: Nature-Based Innovation, Yoseph Bar-Cohen, 1st edition, 2012, CRC Press.
8. Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies, D. Floreano and C. Mattiussi, MIT Press, 2008.
9. Bioremediation of heavy metals: bacterial participation, by C R Sunilkumar, N Geetha, A C Udayashankar, Lambert Academic Publishing, 2019.

| B.E. (Civil Engineering)<br>Outcome Based Education (OBE) and Choice Based Credit System (CBCS)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                  |             |              |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|-------------|--------------|
| Course Title                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Research Methodology and IPR     |             |              |
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | BRMK557                          | Scheme      | 2024         |
| Type of Course                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Ability Enhancement Course (AEC) | Semester    | V            |
| Teaching Hours/Week (L:T:P)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | (2:0:0) 30 hrs/sem               | CIE Marks   | 50           |
| Total Hours of Pedagogy per semester (L:T:P: TW& SL)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | (30:0:0:30) 60 hrs/sem           | SEE Marks   | 50           |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 2                                | Total Marks | 100          |
| Examination type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Theory- MCQs                     | Exam Hours  | 2            |
| <b>COURSE LEARNING OBJECTIVES:</b> <ol style="list-style-type: none"> <li>Understand the fundamental concepts of research and its various types.</li> <li>Apply the principles of literature review, technical reading, attribution, and citation in academic research.</li> <li>Demonstrate awareness of ethical practices in engineering research.</li> <li>Explain the concepts and significance of Intellectual Property Rights (IPR) in engineering.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                         |                                  |             |              |
| <b>Module-1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                  |             | <b>6 hrs</b> |
| <b>Introduction:</b> Meaning of Research, Objectives of Engineering Research, and Motivation in Engineering Research, Types of Engineering Research, Finding and Solving a Worthwhile Problem. Ethics in Engineering Research, Ethics in Engineering Research Practice, Types of Research Misconduct, Ethical Issues Related to Authorship.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                  |             |              |
| <b>Module-2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                  |             | <b>6 hrs</b> |
| <b>Literature Review and Technical Reading:</b><br>Introduction to literature review and technical reading, understanding new and existing knowledge, and techniques for analysis and synthesis of prior art. Overview of bibliographic databases such as Web of Science, Google, and Google Scholar. Effective search strategies and approaches for technical reading. Conceptualizing research through critical and creative reading practices<br><b>Attributions and Citations:</b> Importance of giving proper credit through attributions and citations. Functions and attributes of citations, and the role of titles and keywords in enhancing citation impact. Understanding knowledge flow through citations and the practice of citing datasets. Overview of citation styles, along with guidelines for acknowledgments and proper attribution in academic writing |                                  |             |              |
| <b>Module-3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                  |             | <b>6 hrs</b> |
| <b>Introduction To Intellectual Property:</b> Role of IP in the Economic and Cultural Development of the Society, IP Governance, IP as a Global Indicator of Innovation, Origin of IP History of IP in India. Major Amendments in IP Laws and Acts in India.<br><b>Patents:</b> Conditions for Obtaining a Patent Protection, To Patent or Not to Patent an Invention. Rights Associated with Patents. Enforcement of Patent Rights. Inventions Eligible for Patenting. Non-Patentable Matters. Patent Infringements. Avoid Public Disclosure of an Invention before Patenting. Process of Patenting                                                                                                                                                                                                                                                                         |                                  |             |              |

| Module-4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 6 hrs |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| <p><b>Process of Patenting:</b> Prior Art Search. Choice of Application to be Filed. Patent Application Forms. Jurisdiction of Filing Patent Application. Publication. Pre-grant Opposition. Examination. Grant of a Patent. Validity of Patent Protection. Post-grant Opposition. Commercialization of a Patent. Need for a Patent Attorney/Agent. Can a Worldwide Patent be Obtained? Do I Need First to File a Patent in India? Patent Related Forms. Fee Structure</p> <p><b>Copyrights and Related Rights:</b> Classes of Copyrights. Criteria for Copyright. Ownership of Copyright. Copyrights of the Author. Copyright Infringements. Copyright Infringement is a Criminal Offence. Copyright Infringement is a Cognizable Offence. Fair Use Doctrine. Copyrights and Internet. Non-Copyright Work. Copyright Registration. Judicial Powers of the Registrar of Copyrights. Fee Structure. Copyright Symbol. Validity of Copyright.</p> |       |
| Module-5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 6 hrs |
| <p><b>Trademarks:</b> Eligibility Criteria. Who Can Apply for a Trademark, Acts and Laws. Designation of Trademark Symbols. Classification of Trademarks. Registration of a Trademark is Not Compulsory. Validity of Trademark. Types of Trademark Registered in India.</p> <p><b>Famous Case Law: Coca-Cola Company vs. Bisleri International Pvt. Ltd.</b></p> <p><b>Industrial Designs:</b> Eligibility Criteria. Acts and Laws to Govern Industrial Designs. Design Rights. Enforcement of Design Rights. Non-Protectable Industrial Designs India. International Treaties.</p> <p><b>Famous Case Law: Apple Inc. vs. Samsung Electronics Co.</b></p> <p><b>Geographical Indications:</b> Acts, Laws and Rules Pertaining to GI. Ownership of GI. Rights Granted to the Holders. Registered GI in India. Identification of Registered GI.</p>                                                                                               |       |

### COURSE OUTCOMES:

*After successfully completing the course, the student will be able to:*

|     |                                                                                                                      |
|-----|----------------------------------------------------------------------------------------------------------------------|
| CO1 | Comprehend the fundamental principles of research and its various classifications                                    |
| CO2 | Analyze and apply concepts of literature review, technical reading, attribution, and citation in research contexts.  |
| CO3 | Demonstrate an understanding of ethical practices in engineering research.                                           |
| CO4 | Interpret and explain the role and significance of Intellectual Property Rights (IPR) in engineering and innovation. |
| CO5 | Understanding the basic principles of design rights                                                                  |

### ASSESSMENT DETAILS (Both CIE and SEE)

| Assessment Type    | Maximum Marks | Minimum Passing Marks | Evaluation Details                                                          |
|--------------------|---------------|-----------------------|-----------------------------------------------------------------------------|
| CIE – IA Tests (A) | 30            | -                     | Average of Two Internal Assessment Tests (MCQs) each conducted for 30 marks |

|                                                                                                                                                  |            |           |                                                                                                                    |
|--------------------------------------------------------------------------------------------------------------------------------------------------|------------|-----------|--------------------------------------------------------------------------------------------------------------------|
| Continuous and Comprehensive Evaluation (B)                                                                                                      | 20         | -         | Any two Assessment methods as per 24RNBE4.2, scaled to 20 marks.                                                   |
| <b>Total CIE (A+B)</b>                                                                                                                           | <b>50</b>  | <b>20</b> | <b>CIE Evaluation is done for a maximum of 50 marks.</b>                                                           |
| <b>SEE (C)</b>                                                                                                                                   | <b>50</b>  | <b>18</b> | <b>Question papers having 50 MCQs with each question carrying 01 mark, and Exam duration shall be for 2 hours.</b> |
| <b>CIE + SEE (A+B+C)</b>                                                                                                                         | <b>100</b> | <b>40</b> | Final marks shall be the sum of marks scored in Components A, B and C.                                             |
| <ul style="list-style-type: none"> <li>The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to appear for SEE.</li> </ul> |            |           |                                                                                                                    |

### Textbook

1. Dr. Santosh M Nejekar, Dr. Harish Bendigeri “Research Methodology and Intellectual Property Rights”, ISBN 978-93-5987-928-4, Edition: 2023-24.

### Reference Book:

1. David V. Thiel “Research Methods for Engineers” Cambridge University Press, 978-1-107-03488-4 2. Intellectual Property Rights by N.K.Acharya Asia Law House 6th Edition. ISBN: 978-93-81849-

### Weblinks and Video Lectures (e-Resources):

Activity-Based Learning (Suggested Activities in Class)/Practical-Based Learning

• Quizzes • Assignments • Seminars

| B.E. (Common to All Branches)<br>Outcome Based Education (OBE) and Choice Based Credit System (CBCS)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                               |             |      |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|-------------|------|
| Course Title                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | National Service Scheme (NSS) |             |      |
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | BNSK559                       | Scheme      | 2024 |
| Type of Course                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Mandatory Course (MC)         | Semester    | V    |
| Teaching Hours/Week (L:T:P)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | (0:0:2) 30 hrs/sem            | CIE Marks   | 100  |
| Total Hours of Pedagogy per semester (L:T:P: TW& SL)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | (0:0:30:0) 30 hrs/sem         | SEE Marks   | -    |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | -                             | Total Marks | 100  |
| Examination type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | -                             | Exam Hours  | -    |
| <b>COURSE LEARNING OBJECTIVES:</b><br><i>The purpose of the course is to facilitate the learner to:</i> <ol style="list-style-type: none"> <li>1. Identify the needs and problems of the community and involve the problem-solving.</li> <li>2. Develop among them a sense of social &amp; civic responsibility &amp; utilize their knowledge in finding practical solutions to individual and community problems.</li> <li>3. Develop competence required for group-living and sharing of responsibilities &amp; gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.</li> </ol> |                               |             |      |
| <b>Module-1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                               |             |      |
| Waste management– Public, Private and Govt organization, 5 R's.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                               |             |      |
| <b>Module-2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                               |             |      |
| Automation of local Activities                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                               |             |      |
| <b>Module-3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                               |             |      |
| Organic farming, Indian Agriculture (Past, Present and Future), Connectivity for marketing.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                               |             |      |
| <b>Module-4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                               |             |      |
| Spreading public awareness under rural outreach Programs.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                               |             |      |
| <b>Module-5</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                               |             |      |
| Food preservation and Packaging                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                               |             |      |

### COURSE OUTCOMES:

*After successfully completing the course, the student will be able to:*

|     |                                                                                                           |
|-----|-----------------------------------------------------------------------------------------------------------|
| CO1 | Understand the motto and concepts of NSS                                                                  |
| CO2 | Develop overall personality of volunteers and make them as leaders and responsible citizens of our nation |
| CO3 | Analyze the environmental and societal problems/issues and will be able to design solutions for the same. |
| CO4 | Communicate effectively with the community and with the officials.                                        |

### ASSESSMENT DETAILS (Both CIE and SEE)

| Assessment Type                                                                                                                                                                                              | Maximum Marks | Minimum Passing Marks | Evaluation Details                                                     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-----------------------|------------------------------------------------------------------------|
| Evaluation based on Reports (A)                                                                                                                                                                              | 100           | -                     | 5 modules Reports, 5 modules X 10 M each = 50 M                        |
| <b>Total CIE Theory (A)</b>                                                                                                                                                                                  | <b>100</b>    | <b>40</b>             |                                                                        |
| <b>SEE (B)</b>                                                                                                                                                                                               | -             | -                     | -                                                                      |
| <b>CIE+SEE (A+B)</b>                                                                                                                                                                                         | <b>100</b>    | <b>40</b>             | <b>Final marks shall be the sum of marks scored in Components A, B</b> |
| <ul style="list-style-type: none"> <li>The minimum marks to be secured in CIE is 40 out of allotted 50 marks with minimum 40 % scored in every component of CIE.</li> <li>No SEE for this subject</li> </ul> |               |                       |                                                                        |

### Suggested Learning Resources:

#### Reference Books:

- 1) NSS Course Manual, Published by NSS Cell, VTU Belagavi.
- 2) Government of Karnataka, NSS cell, activities reports and its manual.
- 3) Government of India, NSS cell, Activities reports and its manual.

#### Web links:

- 1) <https://nss.gov.in/>
- 2) <https://pledge.mygov.in/>

| B.E. (Common to All Branches)<br>Outcome Based Education (OBE) and Choice Based Credit System (CBCS)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                       |             |              |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|-------------|--------------|
| Course Title                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Physical Education    |             |              |
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | BPEK559               | Scheme      | 2024         |
| Type of Course                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Mandatory Course (MC) | Semester    | V            |
| Teaching Hours/Week (L:T:P)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | (0:0:2) 30 hrs/sem    | CIE Marks   | 100          |
| Total Hours of Pedagogy per semester (L:T:P: TW& SL)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | (0:0:30:0) 30 hrs/sem | SEE Marks   | -            |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | -                     | Total Marks | 100          |
| Examination type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | -                     | Exam Hours  | -            |
| <b>COURSE LEARNING OBJECTIVES:</b><br><i>The purpose of the course is to facilitate the learner to:</i> <ol style="list-style-type: none"> <li>1. Understand the fundamental concepts of Physical Education, games and sports skills, Health, Nutrition and Fitness</li> <li>2. Familiarization of health-related Exercises, Sports for overall growth and development</li> <li>3. Participate in the competition at regional/state / national / international levels.</li> <li>4. Create consciousness among the students on Health, Fitness and Wellness in developing and maintaining a healthy lifestyle.</li> </ol> |                       |             |              |
| <b>Module-1: Athletics - Track Events</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                       |             | <b>3 hrs</b> |
| <b>110 Mtrs and 400Mtrs:</b><br>Hurdling Technique: Lead leg Technique, Trail leg Technique<br>Crouch start (its variations) use of Starting Block.                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                       |             |              |
| <b>Module-2: Athletics – Jumps</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                       |             | <b>3 hrs</b> |
| <b>High Jump</b><br>A) Approach Run<br>B) Take-off<br>C) Bar Clearance (Straddle)<br>D) Landing                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                       |             |              |
| <b>Module-3: Title: Athletics – Throws</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                       |             | <b>3 hrs</b> |
| <b>Discuss Throw</b><br>A) Holding the Discus<br>B) Initial Stance Primary Swing<br>C) Rotation<br>D) Release and Recovery (Rotation in the circle)                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                       |             |              |
| <b>Module-4: Football</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                       |             | <b>3 hrs</b> |
| <b>A. Fundamental skills</b> <ol style="list-style-type: none"> <li>1. Kicking: Kicking the ball with inside of the foot, Kicking the ball with Full Instep of the foot, Kicking the ball with Inner Instep of the foot, Kicking the ball with Outer Instep of the foot and Lofted Kick.</li> <li>2. Trapping: Trapping- the Rolling ball, and the Bouncing ball with sole of the foot.</li> <li>3. Dribbling: Dribbling the ball with Instep of the foot, Dribbling the ball with Inner and</li> </ol>                                                                                                                  |                       |             |              |

|                                                                                        |              |
|----------------------------------------------------------------------------------------|--------------|
| Outer Instep of the foot.                                                              |              |
| 4. Heading: In standing, running and jumping condition.                                |              |
| 5. Throw-in: Standing throw-in and Running throw-in.                                   |              |
| 6. Tackling: Simple Tackling, Slide Tackling.                                          |              |
| 7. Goal Keeping: Collection of Ball, Ball clearance- kicking, throwing and deflecting. |              |
| 8. Game practice with application of Rules and Regulations                             |              |
| <b>B. Rules and their interpretation and duties of the officials</b>                   |              |
| <b>Module-5: Hockey</b>                                                                | <b>3 hrs</b> |
| <b>A. Fundamental skills</b>                                                           |              |
| 1. Passing: Short pass, Long pass , push pass, hit                                     |              |
| 2. Trapping.                                                                           |              |
| 3. Dribbling and Dozing.                                                               |              |
| 4. Penalty stroke practice.                                                            |              |
| 5. Penalty corner practice.                                                            |              |
| 6. Tackling: Simple Tackling, Slide Tackling.                                          |              |
| 7. Goal Keeping, Ball clearance- kicking, and deflecting.                              |              |
| 8. Game practice with application of Rules and Regulations                             |              |
| <b>B. Rules and their interpretation and duties of the officials</b>                   |              |

### COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

|     |                                                                                                                                                                         |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CO1 | Understand and demonstrate fundamental techniques of <b>track events</b> including 110m and 400m hurdles, with proper use of starting blocks and hurdling skills.       |
| CO2 | Apply technical knowledge of <b>athletic jumps</b> , particularly high jump, including approach run, take-off, bar clearance, and landing techniques.                   |
| CO3 | Develop skills and perform <b>throwing events</b> , specifically discus throw, with correct techniques such as grip, stance, rotation, release, and recovery.           |
| CO4 | Demonstrate fundamental skills of <b>football</b> such as kicking, trapping, dribbling, heading, throw-in, tackling, and goalkeeping along with understanding rules and |
| CO5 | Exhibit basic skills and techniques in <b>hockey</b> , including passing, trapping, dribbling, tackling, penalty strokes/corners, and understand rules and duties of    |

### ASSESSMENT DETAILS (Both CIE and SEE)

| Assessment Type       | Maximum Marks | Minimum Passing Marks | Evaluation Details                                                       |
|-----------------------|---------------|-----------------------|--------------------------------------------------------------------------|
| CIE – IA Tests<br>(A) | 60            | ---                   | Sum of Two Internal Assessment Tests (MCQs) each conducted for 30 marks. |

|                                                                                                                                         |     |     |                                                   |
|-----------------------------------------------------------------------------------------------------------------------------------------|-----|-----|---------------------------------------------------|
| Project (B)                                                                                                                             | 40  | --- | -----                                             |
| Total CIE<br>(A+B)                                                                                                                      | 100 | 40  | CIE Evaluation is done for a maximum of 100 marks |
| <ul style="list-style-type: none"> <li>The minimum marks to be secured in CIE is 40 (40%) out of 100 marks allotted to Pass.</li> </ul> |     |     |                                                   |

### Suggested Learning Resources:

#### Textbooks

1. Health and Physical Education by V.K. Sharma
2. Introduction to Physical Education, Fitness, and Sport by Daryl Siedentop
3. Physical Education Activities, Sports and Games: The Origin and Background, Rules of Play, Teaching Hints and Fundamentals by Louis E. Means

#### Reference Books

1. Saraswati Health and Physical Education Textbook
2. Foundations of Physical Education, Exercise Science and Sport by Deborah A. Wuest



| B.E. (Common to All Branches)                                                                                                                                                                                                                                                                                                                                                                           |                       |             |              |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|-------------|--------------|
| Outcome Based Education (OBE) and Choice Based Credit System (CBCS)                                                                                                                                                                                                                                                                                                                                     |                       |             |              |
| Course Title                                                                                                                                                                                                                                                                                                                                                                                            | Yoga                  |             |              |
| Course Code                                                                                                                                                                                                                                                                                                                                                                                             | BYOK559               | Scheme      | 2024         |
| Type of Course                                                                                                                                                                                                                                                                                                                                                                                          | Mandatory Course (MC) | Semester    | V            |
| Teaching Hours/Week (L:T:P)                                                                                                                                                                                                                                                                                                                                                                             | (0:0:2) 30 hrs/sem    | CIE Marks   | 100          |
| Total Hours of Pedagogy per semester (L:T:P: TW& SL)                                                                                                                                                                                                                                                                                                                                                    | (0:0:30:0) 30 hrs/sem | SEE Marks   | -            |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                 | -                     | Total Marks | 100          |
| Examination type                                                                                                                                                                                                                                                                                                                                                                                        | -                     | Exam Hours  | -            |
| <b>COURSE LEARNING OBJECTIVES:</b><br><i>The purpose of the course is to facilitate the learner to:</i><br><div><div>1. Physical, Mental &amp; spiritual Objectives of Yoga</div><div>2. Explain the meaning of Yoga.</div><div>3. Discuss the importance of the Yoga and its scope.</div><div>4. Describe the aims and objectives of Yoga.</div><div>5. Clarify the misconceptions on Yoga</div></div> |                       |             |              |
| <b>Module-1: Suryanamaskara</b>                                                                                                                                                                                                                                                                                                                                                                         |                       |             | <b>3 hrs</b> |
| Suryanamaskar 12 count 6 rounds<br><div><div>a) Suryanamaskar prayer.</div><div>b) Meaning, need &amp; Importance</div><div>c) Benefits of Suryanamaskara</div></div>                                                                                                                                                                                                                                   |                       |             |              |
| <b>Module-2: Yoga</b>                                                                                                                                                                                                                                                                                                                                                                                   |                       |             | <b>3 hrs</b> |
| <div><div>a) Meaning and definition.</div><div>b) Brief introduction of yogic practices for the common man</div><div>c) Rules and regulations</div><div>d) Misconceptions of Yoga</div></div>                                                                                                                                                                                                           |                       |             |              |
| <b>Module-3: Asanas - Sitting &amp; Standing:</b>                                                                                                                                                                                                                                                                                                                                                       |                       |             | <b>3 hrs</b> |
| Need & importance of different Asana, Asana its meaning by name, technique, precautionary measures and benefits of each asana.<br><div><div>Sitting</div><div><div>1 . Ardha Ushtrasana</div><div>2. Yogamudra in Padmasana</div></div></div> <div><div>Standing</div><div><div>1 . Hastapadasana</div><div>2. Utkatasana</div></div></div>                                                             |                       |             |              |
| <b>Module-4: Asanas - Supine line</b>                                                                                                                                                                                                                                                                                                                                                                   |                       |             | <b>3 hrs</b> |
| Need & importance of different Asana, Asana its meaning by name, technique, precautionary measures and benefits of each asana.<br><div><div>Supine line</div><div><div>1 . Sarvangasana</div><div>2. Chakraasana</div></div></div>                                                                                                                                                                      |                       |             |              |
| <b>Module-5: Pranayama</b>                                                                                                                                                                                                                                                                                                                                                                              |                       |             | <b>3 hrs</b> |

Kapalabhati - Revision of practice 40 strokes/min - 3 rounds

Pranayama -- 1. Ujjayi  
2. Sheetal

Meaning, Need, importance of Pranayama. Different types. Meaning by name, technique, precautionary measures and benefits of each Pranayama



# VI SEMESTER SUBJECTS



| B.E. (Civil Engineering)<br>Outcome Based Education (OBE) and Choice Based Credit System (CBCS)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                            |             |              |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|-------------|--------------|
| Course Title                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Geotechnical Engineering                   |             |              |
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | BCV601                                     | Scheme      | 2024         |
| Type of Course                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Integrated Professional Core Course (IPCC) | Semester    | VI           |
| Teaching Hours/Week (L: T:P)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | (3:0:2) 75 hrs/sem                         | CIE Marks   | 50           |
| Total Hours of Pedagogy per semester (L: T:P: TW& SL)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | (45:0:30:45) 120 hrs/sem                   | SEE Marks   | 50           |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 4                                          | Total Marks | 100          |
| Examination type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Theory- CIE +SEE & Lab-CIE only            | Exam Hours  | 3            |
| <b>COURSE LEARNING OBJECTIVES:</b><br><i>The purpose of the course is to enable the learner to:</i> <ol style="list-style-type: none"> <li>Understand the fundamental concepts of soil mechanics and the engineering properties of soils.</li> <li>Apply the principles governing soil water, effective stress, compaction, and consolidation in geotechnical engineering.</li> <li>Analyze the shear strength characteristics and factors influencing the bearing capacity and settlement of soils.</li> <li>Evaluate the engineering behaviour of soils using laboratory and field investigations.</li> </ol>    |                                            |             |              |
| <b>Module-1: Index properties and IS Soil classification</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                            |             | <b>9 hrs</b> |
| <b>Phase Diagram:</b> Definitions and Interrelationships among the terms. Numerical problems on inter-relationships, borrow area embankment. Types of soil structures and Clay Minerals.<br><b>Index Properties of Soils:</b> Water content, Specific Gravity, Particle size distribution, Relative Density, Consistency limits and indices, In-situ density. Numerical problems on index properties.<br><b>IS Soil classification:</b> - Types of soil Classification, IS Soil Classification, Plasticity chart and its importance. Numerical problems on soil Classification.                                    |                                            |             |              |
| <b>Module-2: Soil water - Effective stress analysis</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                            |             | <b>9 hrs</b> |
| <b>Soil Water:</b> Permeability, Darcy's law-assumption and validity, coefficient of permeability and its determination (laboratory method and Field methods), permeability of stratified soils. Capillary phenomenon, Flow net characteristics, and applications. Numerical problems on permeability of soils.<br><b>Effective Stress Analysis:</b> Effective stress concept-total stress, effective stress and Neutral stress and Numerical problems on effective stress analysis.                                                                                                                               |                                            |             |              |
| <b>Module-3: Compaction and Consolidation</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                            |             | <b>9 hrs</b> |
| <b>Compaction:</b> Principle of compaction, Standard and Modified proctor's compaction tests, factors affecting compaction, effect of compaction on soil properties, Field compaction methods and control. Numerical problems on compaction of soils.<br><b>Consolidation:</b> Mass-spring analogy, Terzaghi's one dimensional consolidation theory (No derivation). Consolidation characteristics of soil. Laboratory one dimensional consolidation test, Pre-consolidation pressure, and its determination by Casagrande's method. Numerical problems on consolidation of soils with single and double drainage. |                                            |             |              |
| <b>Module-4: Shear Strength</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                            |             | <b>9 hrs</b> |
| Shear strength and concept of shear strength, Mohr-Coulomb Failure Criterion, Modified Mohr-Coulomb Criterion. Total and effective shear strength parameters, Measurement of shear strength parameters – Direct shear test, unconfined compression test, triaxial compression test and field                                                                                                                                                                                                                                                                                                                       |                                            |             |              |

Vane shear test, Factors affecting shear strength of soils.

**Module-5: Bearing capacity and Settlement**

**9 hrs**

**Bearing Capacity:** Types of foundations, Determination of bearing capacity by Terzaghi's and BIS methods (IS: 6403), Modes of shear failure, Factors affecting Bearing capacity of soil. Effect of water table and load eccentricity on bearing capacity of soil, Field methods of determining bearing capacity of soil (SPT and plate load test). Numerical problems on determination of bearing capacity by Terzaghi and BIS methods.

**Settlement:** Types of settlements and importance, Computation of immediate and consolidation settlement, permissible differential, and total settlements (IS 8009 Part 1).

**PRACTICAL COMPONENT OF IPCC**

| Sl. No. | Experiments                                                                              |
|---------|------------------------------------------------------------------------------------------|
| 1       | Water content determination <b>i)</b> oven drying <b>ii)</b> Rapid moisture meter method |
| 2       | Grain size analysis (Sieve analysis of soil)                                             |
| 3       | In-situ density tests <b>i)</b> Core-cutter method <b>ii)</b> Sand replacement method    |
| 4       | Consistency limits<br><b>i)</b> Liquid limit test <b>ii)</b> Plastic limit test          |
| 5       | Permeability test<br><b>i)</b> Constant head test <b>ii)</b> Variable head test          |
| 6       | Standard compaction test                                                                 |
| 7       | Modified compaction test                                                                 |
| 8       | Direct Shear test                                                                        |
| 9       | Unconfined compression test                                                              |
| 10      | Tri-axial Test                                                                           |

**COURSE OUTCOMES:**

*After successfully completing the course, the student will be able to:*

|            |                                                                                                                                               |
|------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| <b>CO1</b> | Identify the engineering properties and classify soils based on phase relationships, index properties, and the IS Soil Classification System. |
| <b>CO2</b> | Explain the principles of permeability, effective stress, compaction, and consolidation of soils                                              |
| <b>CO3</b> | Determine the shear strength, bearing capacity, and settlement characteristics of soils using standard methods.                               |
| <b>CO4</b> | Evaluate the suitability of soils for geotechnical engineering applications using laboratory and field test results.                          |

## ASSESSMENT DETAILS (Both CIE and SEE)

| 4-Credit Lab Integrated Theory Courses (IPCC)                                                                                                                                                                                                                                                                                |               |                       |                                                                                                                           |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-----------------------|---------------------------------------------------------------------------------------------------------------------------|
| Assessment Type                                                                                                                                                                                                                                                                                                              | Maximum Marks | Minimum Passing Marks | Evaluation Details                                                                                                        |
| CIE- IA Tests (A)                                                                                                                                                                                                                                                                                                            | 20            | -                     | Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 20 marks. |
| Continuous and Comprehensive Evaluation (B)                                                                                                                                                                                                                                                                                  | 10            | -                     | Any one Assessment methods as per 24RNBE4.2 scaled to 10 marks.                                                           |
| <b>Total CIE Theory (A+B)</b>                                                                                                                                                                                                                                                                                                | <b>30</b>     | <b>12</b>             | <b>Marks of Tests and Assignments awarded for a maximum of 30.</b>                                                        |
| CIE Practical                                                                                                                                                                                                                                                                                                                | 12            | -                     | Marks awarded for Weekly Conduction of Experiments and Submission of Laboratory records, scaled to 12 marks.              |
| CIE Practical Test                                                                                                                                                                                                                                                                                                           | 8             | -                     | Average of marks of Two tests, each conducted for 100 marks covering all experiments, scaled to 8.                        |
| <b>Total CIE Practical (C)</b>                                                                                                                                                                                                                                                                                               | <b>20</b>     | <b>8</b>              | <b>Marks of Experiments, Record and Test awarded for a maximum of 20 marks.</b>                                           |
| <b>CIE: Theory + Practical (A + B + C)</b>                                                                                                                                                                                                                                                                                   | <b>50</b>     | <b>20</b>             | <b>CIE Evaluation is done for a maximum of 50 marks.</b>                                                                  |
| <b>SEE (D)</b>                                                                                                                                                                                                                                                                                                               | <b>50</b>     | <b>18</b>             | <b>SEE is a theory exam, conducted for 100 marks and scaled down to 50 marks. Exam duration shall be 3 hours.</b>         |
| <b>CIE+SEE (A+B+C+D)</b>                                                                                                                                                                                                                                                                                                     | <b>100</b>    | <b>40</b>             | <b>Final marks shall be the sum of marks scored in Components A, B, C and D</b>                                           |
| <ul style="list-style-type: none"> <li>The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to appear for SEE. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included in their respective modules only</li> </ul> |               |                       |                                                                                                                           |

## Suggested Learning Resources:

### Textbooks

1. B. C. Punmia, *Soil Mechanics and Foundation Engineering*, 17<sup>th</sup> ed. New Delhi, India: Laxmi Publications, 2017.

2. Gopal Ranjan and A. S. R. Rao, *Basic and Applied Soil Mechanics*, 3<sup>rd</sup> ed. New Delhi, India: New Age International (P) Ltd., 2016.
3. S. Mittal and J. P. Shukla, *Soil Testing for Engineers*, 1<sup>st</sup> ed. New Delhi, India: Khanna Publishers, 2020.

### Reference books

1. V. N. S. Murthy, *Principles of Soil Mechanics and Foundation Engineering*, 2<sup>nd</sup> ed. New Delhi, India: CBS Publishers & Distributors Pvt. Ltd., 2018.
2. J. E. Bowles, *Foundation Analysis and Design*, 5th ed. New York, NY, USA: McGraw-Hill, 2001.
3. K. H. Head, *Manual of Soil Laboratory Testing*, Vols. I–III. Dunbeath, Scotland, UK: Whittles Publishing, 2006.



| B.E. (Civil Engineering)<br>Outcome Based Education (OBE) and Choice Based Credit System (CBCS)                                                                                                                                                                                                                                                                                                                                                                                                                         |                                             |             |              |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|-------------|--------------|
| Course Title                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Design of RCC Structural Elements           |             |              |
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | BCV602                                      | Scheme      | 2024         |
| Type of Course                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Integrated Professional Core Courses (IPCC) | Semester    | VI           |
| Teaching Hrs/Week (L: T: P)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | (3:0:2) 75 hrs/sem                          | CIE Marks   | 50           |
| Total Hrs of Pedagogy per semester (L: T:P:TW&SL)                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | (45:0:30:45) 120 hrs/sem                    | SEE Marks   | 50           |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 4                                           | Total Marks | 100          |
| Examination type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Theory- CIE +SEE, and Lab- CIE only         | Exam hrs    | 3            |
| <b>COURSE LEARNING OBJECTIVES:</b><br><i>The purpose of the course is to facilitate the learner to:</i> <ol style="list-style-type: none"> <li>Understand the principles of limit state design and codal provisions for reinforced concrete structures.</li> <li>Analyze the behaviour and design requirements of reinforced concrete structural elements under different loading conditions.</li> <li>Design reinforced concrete beams, slabs, staircases, columns, and footings using limit state methods.</li> </ol> |                                             |             |              |
| <b>Module – 1: Limit State Analysis and Design of Beams</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                             |             | <b>9 hrs</b> |
| Introduction to Design Philosophies, Limit State Method, Analysis and Design of Singly Reinforced Beams, Analysis and Design of Doubly Reinforced Beams, Checks for Shear, Bond and Development Length as per IS 456, design concept of Flanged Sections (T-Beams and L-Beams).                                                                                                                                                                                                                                         |                                             |             |              |
| <b>Module – 2: Limit State Design of Slabs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                             |             | <b>9 hrs</b> |
| Introduction to Slabs, Types of Slabs, Design of One-Way Slabs, Design of Two-Way Slabs under Different Boundary Conditions, Design of Cantilever Slabs.                                                                                                                                                                                                                                                                                                                                                                |                                             |             |              |
| <b>Module– 3: Design of staircase</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                             |             | <b>9 hrs</b> |
| Introduction to Staircases, Classification of Staircases, Load Calculations and Design Considerations, Design of Dog-Legged Staircase, Design of Open-Well Staircase, Design of Cantilever Staircase.                                                                                                                                                                                                                                                                                                                   |                                             |             |              |
| <b>Module–4: Design of Columns</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                             |             | <b>9 hrs</b> |
| Introduction to Columns and Pedestals, Classification of Columns, Analysis and Design of Short Axially Loaded Columns, Design of Columns with Uni-axial Moments, Design of Columns with Bi-axial Moments using SP-16.                                                                                                                                                                                                                                                                                                   |                                             |             |              |
| <b>Module–5: Limit State Design of Footings &amp; Retaining walls</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                             |             | <b>9 hrs</b> |

Introduction to Footings and Types of Footings, Design of Rectangular Footings with Axial Load and Uni-axial Moment, Design of Trapezoidal Footings with Axial Load and Uni-axial Moment, Concept of Scouring Depth, Introduction to Retaining Walls, Types, Design Considerations and Design of Cantilever Retaining Wall.

## PRACTICAL COMPONENT OF IPCC

| Sl. No. | Set of Experiments (30 hrs)                                                                                                                              |
|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1       | Prepare reinforcement detailing and Bar Bending Schedule (BBS) for singly reinforced concrete beams using Auto-CAD.                                      |
| 2       | Prepare reinforcement detailing and BBS for doubly reinforced concrete beams using Auto-CAD.                                                             |
| 3       | Prepare reinforcement detailing of T-beams and L-beams using Auto-CAD.                                                                                   |
| 4       | Prepare reinforcement detailing and BBS for one-way slabs using Auto-CAD.                                                                                |
| 5       | Prepare reinforcement detailing and BBS for two-way and cantilever slabs using Auto-CAD.                                                                 |
| 6       | Prepare reinforcement detailing of dog-legged staircases using Auto-CAD.                                                                                 |
| 7       | Prepare reinforcement detailing of open-well and cantilever staircases using Auto-CAD.                                                                   |
| 8       | Prepare reinforcement detailing of reinforced concrete columns subjected to axial load and bending using Auto-CAD.                                       |
| 9       | Prepare reinforcement detailing and reinforcement schedules for isolated rectangular and trapezoidal footings using Auto-CAD.                            |
| 10      | Conduct a site visit to an RCC construction project and prepare a report on reinforcement detailing, concreting practices, and quality control measures. |

## COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

|     |                                                                                                                                           |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------|
| CO1 | Explain the principles of limit state design and relevant codal provisions for reinforced concrete structures.                            |
| CO2 | Analyze the behavior and design requirements of reinforced concrete beams, slabs, staircases, columns, and footings.                      |
| CO3 | Design reinforced concrete structural elements using limit state methods and relevant codal provisions.                                   |
| CO4 | Prepare reinforcement detailing and bar bending schedules for reinforced concrete members using AutoCAD and standard detailing practices. |

## ASSESSMENT DETAILS (Both CIE and SEE)

| 4-Credit Lab Integrated Theory Courses (IPCC)                                                                                                                                                                                                                               |               |                       |                                                                                                                           |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-----------------------|---------------------------------------------------------------------------------------------------------------------------|
| Assessment Type                                                                                                                                                                                                                                                             | Maximum Marks | Minimum Passing Marks | Evaluation Details                                                                                                        |
| CIE- IA Tests (A)                                                                                                                                                                                                                                                           | 20            | -                     | Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 20 marks. |
| Continuous and Comprehensive Evaluation (B)                                                                                                                                                                                                                                 | 10            | -                     | Any one Assessment method as per 24RNBE4.2 scaled to 10 marks.                                                            |
| <b>Total CIE Theory (A+B)</b>                                                                                                                                                                                                                                               | <b>30</b>     | <b>12</b>             | <b>Marks of Tests and Assignments awarded for a maximum of 30.</b>                                                        |
| CIE Practical                                                                                                                                                                                                                                                               | 12            | -                     | Marks awarded for Weekly Conduction of Experiments and Submission of Laboratory records, scaled to 12 marks.              |
| CIE Practical Test                                                                                                                                                                                                                                                          | 8             | -                     | Average of marks of Two tests, each conducted for 100 marks covering all experiments, scaled to 8.                        |
| <b>Total CIE Practical (C)</b>                                                                                                                                                                                                                                              | <b>20</b>     | <b>8</b>              | <b>Marks of Experiments, Record and Test awarded for a maximum of 20 marks.</b>                                           |
| <b>CIE: Theory + Practical (A + B + C)</b>                                                                                                                                                                                                                                  | <b>50</b>     | <b>20</b>             | <b>CIE Evaluation is done for a maximum of 50 marks.</b>                                                                  |
| <b>SEE (D)</b>                                                                                                                                                                                                                                                              | <b>50</b>     | <b>18</b>             | <b>SEE is a theory exam, conducted for 100 marks and scaled down to 50 marks. Exam duration shall be 3 hrs.</b>           |
| <b>CIE+SEE (A+B+C+D)</b>                                                                                                                                                                                                                                                    | <b>100</b>    | <b>40</b>             | <b>Final marks shall be the sum of marks scored in Components A, B, C and D</b>                                           |
| The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to appear for SEE. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included in their respective modules only. |               |                       |                                                                                                                           |

## Suggested Learning Resources:

### Textbooks

1. U. Pillai and D. Menon, *Reinforced Concrete Design*, 3<sup>rd</sup> ed., Tata McGraw Hill Education, New Delhi, 2017.

2. N. Subramanian, *Design of Reinforced Concrete Structures*, Oxford University Press, New Delhi, 2019.
3. N. Krishna Raju, *Design of Reinforced Concrete Structures (IS 456:2000)*, 3<sup>rd</sup> ed., CBS Publishers & Distributors, New Delhi, 2016.

### Reference Books:

1. W.H. Mosley, R. Hulse and J.H. Bungey, *Reinforced Concrete Design*, 7<sup>th</sup> ed., Palgrave Macmillan, 2012.
2. A.H. Nilson, D. Darwin and C.W. Dolan, *Design of Concrete Structures*, 14<sup>th</sup> ed., McGraw-Hill Education, 2010.
3. R. Park and T. Paulay, *Reinforced Concrete Structures*, John Wiley & Sons, 1975.

### Recommended Codes

1. **IS 456:2000** – Plain and Reinforced Concrete – Code of Practice
2. **SP 16:1980** – Design Aids for Reinforced Concrete to IS 456:2000.
3. **IS 875 (Part 1 & Part 2)** – Dead Loads and Imposed Loads.



| <b>B.E. (Civil Engineering)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                            |                    |              |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|--------------------|--------------|
| <b>Outcome Based Education (OBE) and Choice Based Credit System (CBCS)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                            |                    |              |
| <b>Course Title</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>Earthquake Resistant Structures</b>     |                    |              |
| <b>Course Code</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>BCV613A</b>                             | <b>Scheme</b>      | <b>2024</b>  |
| <b>Type of Course</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>Professional Elective Courses (PEC)</b> | <b>Semester</b>    | <b>VI</b>    |
| <b>Teaching Hours/Week (L: T:P)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>(3:0:0) 45 hrs/sem</b>                  | <b>CIE Marks</b>   | <b>50</b>    |
| <b>Total Hours of Pedagogy per semester (L: T:P: TW&amp; SL)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>(45:0:0:45) 90 hrs/sem</b>              | <b>SEE Marks</b>   | <b>50</b>    |
| <b>Credits</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>3</b>                                   | <b>Total Marks</b> | <b>100</b>   |
| <b>Examination type</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>Theory</b>                              | <b>Exam Hours</b>  | <b>3</b>     |
| <b>COURSE LEARNING OBJECTIVES:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                            |                    |              |
| <i>The purpose of the course is to enable the learner to:</i>                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                            |                    |              |
| <ol style="list-style-type: none"> <li>1. Understand the fundamentals of engineering seismology and structural dynamics.</li> <li>2. Assess Irregularities in building detrimental to its earthquake performance.</li> <li>3. Apply different methods to compute seismic lateral forces on structure as per codal provisions.</li> <li>4. Design earthquake resistant RCC and Masonry structures.</li> </ol>                                                                                                |                                            |                    |              |
| <b>Module-1: Engineering Seismology</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                            |                    | <b>9 hrs</b> |
| Terminologies (Focus, Focal depth, Epicenter, etc.); Causes of Earthquakes; Theory of plate tectonics; Types and characteristics faults; Classification of Earthquakes; Major past earthquakes and their consequences; Types and characteristics of seismic waves; Magnitude and intensity of earthquakes; local site effects; Earthquake ground motion characteristics: Amplitude, frequency and duration; Seismic zoning map of India. Problems on computation of wave velocities. Location of epicenter. |                                            |                    |              |
| <b>Module-2: Introduction to structural dynamics</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                            |                    | <b>9 hrs</b> |
| Basic Definitions, Concept of degrees of freedom, D'Alembert's principle, principle of virtual displacement and energy principles, Types of Vibrations, Damping and its types, Analytical Model of dynamic system, Free vibration of damped and undamped system having single degree of freedom. Concept of equivalent spring, Numerical problems on determining natural period, natural frequency, mass, stiffness, amplitude, and acceleration for undamped free vibration systems.                       |                                            |                    |              |
| <b>Module-3: Seismic Performance of Buildings and Over View of IS-1893 (Part-I)</b>                                                                                                                                                                                                                                                                                                                                                                                                                         |                                            |                    | <b>9 hrs</b> |
| Types of damages to building observed during past earthquakes; Plan irregularities; mass irregularity; stiffness irregularity; Concept of soft and weak storey; Torsional irregularity and its consequences; configuration problems; continuous load path; Architectural aspects of earthquake resistant buildings; Lateral load resistant systems. Seismic design philosophy, Structural modelling, Code based seismic design methods.                                                                     |                                            |                    |              |
| <b>Module-4: Determination of Design lateral forces</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                            |                    | <b>9 hrs</b> |
| Equivalent lateral force procedure and dynamic analysis procedure. Step by step procedures for seismic analysis of RC buildings using Equivalent static lateral force method and response spectrum methods (maximum of 4 stories and without infill walls). Numerical problems.                                                                                                                                                                                                                             |                                            |                    |              |
| <b>Module-5: Earthquake Resistant Analysis and Design of RC Buildings &amp; Masonry Buildings</b>                                                                                                                                                                                                                                                                                                                                                                                                           |                                            |                    | <b>9 hrs</b> |
| <b>Ductility considerations:</b> Factor affecting ductility, ductile detailing of flexural members, columns and frame members as per IS13920. Design of Ductile Reinforced Concrete Beams,                                                                                                                                                                                                                                                                                                                  |                                            |                    |              |

Seismic Design of Ductile Reinforced Concrete column.

**Earthquake Resistant Design of Masonry Buildings:** Performance of Unreinforced, Reinforced, Infill Masonry Walls, Box Action, Lintel and sill Bands, elastic properties of structural masonry, lateral load analysis, Recommendations for Improving performance of Masonry Buildings during earthquakes; Retrofitting of Masonry buildings.

### COURSE OUTCOMES:

*After successfully completing the course, the student will be able to:*

|            |                                                                                                                  |
|------------|------------------------------------------------------------------------------------------------------------------|
| <b>CO1</b> | Identify structural irregularities in buildings influencing earthquake performance.                              |
| <b>CO2</b> | Explain the fundamental concepts of engineering seismology, earthquake characteristics, and structural dynamics. |
| <b>CO3</b> | Analyse seismic lateral forces on framed and masonry structures as per codal provisions.                         |
| <b>CO4</b> | Design earthquake-resistant RCC and masonry structures.                                                          |

### ASSESSMENT DETAILS (Both CIE and SEE)

| Assessment Type                             | Maximum Marks | Minimum Passing Marks | Evaluation Details                                                                                                        |
|---------------------------------------------|---------------|-----------------------|---------------------------------------------------------------------------------------------------------------------------|
| CIE – IA Tests (A)                          | 30            | -                     | Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 30 marks. |
| Continuous and Comprehensive Evaluation (B) | 20            | -                     | Any two Assessment methods as per 24RNBE4.2 (*if it is project based, one assignment shall be given), scaled to 20 marks. |
| <b>Total CIE (A+B)</b>                      | <b>50</b>     | <b>20</b>             | <b>CIE Evaluation is done for a maximum of 50 marks</b>                                                                   |
| <b>SEE (C)</b>                              | <b>50</b>     | <b>18</b>             | <b>SEE is a theory exam conducted for 100 marks and scaled down to 50 marks. Exam duration shall be 3 hours.</b>          |
| <b>CIE + SEE (A+B+C)</b>                    | <b>100</b>    | <b>40</b>             | Final marks shall be the sum of marks scored in Components A, B and C.                                                    |

The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to appear for SEE.

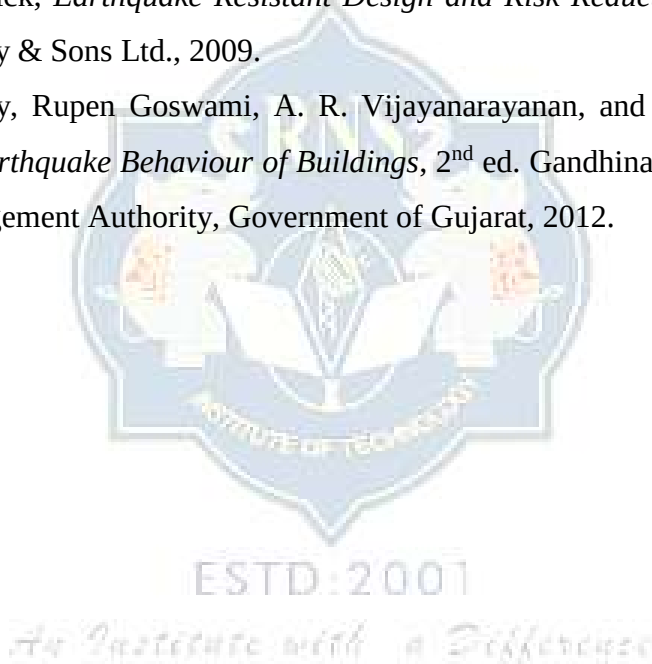
## Suggested Learning Resources:

### Textbooks

1. Pankaj Agarwal and Manish Shrikhande, *Earthquake Resistant Design of Structures*, 2<sup>nd</sup> ed. New Delhi, India: PHI Learning Pvt. Ltd., 2016.
2. S. K. Duggal, *Earthquake Resistant Design of Structures*, 2<sup>nd</sup> ed. New Delhi, India: Oxford University Press, 2013.
3. T. K. Datta, *Seismic Analysis of Structures*, 1st ed. Singapore: John Wiley & Sons (Asia) Pt. Ltd., 2010.

### Reference books

1. David J. Dowrick, *Earthquake Resistant Design and Risk Reduction*, 2<sup>nd</sup> ed. Chichester, UK: John Wiley & Sons Ltd., 2009.
2. C. V. R. Murty, Rupen Goswami, A. R. Vijayanarayanan, and Vipul V. Mehta, *Some Concepts in Earthquake Behaviour of Buildings*, 2<sup>nd</sup> ed. Gandhinagar, India: Gujarat State Disaster Management Authority, Government of Gujarat, 2012.



| B.E. (Civil Engineering)<br>Outcome Based Education (OBE) and Choice Based Credit System (CBCS)                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                             |             |              |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|-------------|--------------|
| Course Title                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Water Conservation and Rainwater Harvesting |             |              |
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | BCV613B                                     | Scheme      | 2024         |
| Type of Course                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Professional Core Course (PCC)              | Semester    | VI           |
| Teaching Hours/Week (L:T:P)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | (3:0:0) 45 hrs/sem                          | CIE Marks   | 50           |
| Total Hours of Pedagogy per semester (L:T:P: TW& SL)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | (45:0:0:45) 90 hrs/sem                      | SEE Marks   | 50           |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 3                                           | Total Marks | 100          |
| Examination type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Theory                                      | Exam Hours  | 3            |
| <b>COURSE LEARNING OBJECTIVES:</b><br><i>The purpose of the course is to enable the learner to:</i> <ol style="list-style-type: none"> <li>Understand the importance of water resources, hydrological processes, and sustainable water management.</li> <li>Analyse the principles of groundwater occurrence, groundwater recharge, and water conservation.</li> <li>Develop rainwater harvesting systems based on engineering principles.</li> <li>Explain the concepts of subsurface investigation, water management, and water footprint for sustainability.</li> </ol> |                                             |             |              |
| <b>Module – 1: Water and its importance</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                             |             | <b>9 hrs</b> |
| Monsoon- types and behaviour in India, Rainfall characteristics and distribution, Onset and withdrawal of effective rains, Dry spells and wet spells, Critical dry spells, Water loss from soil, Rainfall Measurement and factors, Hydrological cycle, Scenario of water in Karnataka: Major rivers, Geographical distribution, river basins, Influence of human activity on water cycle.                                                                                                                                                                                  |                                             |             |              |
| <b>Module – 2: Elementary Knowledge of Ground Water and its recharge</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                             |             | <b>9 hrs</b> |
| General concepts of aquifer, aquiclude and aquifuge. Need and principles of water harvesting, typical Groundwater recharge pit, Factors affecting groundwater recharge. Reviving of existing and dry borewells, Importance of check dams.                                                                                                                                                                                                                                                                                                                                  |                                             |             |              |
| <b>Module – 3: Rainwater harvesting</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                             |             | <b>9 hrs</b> |
| Rainwater harvesting: Methods, Classes, Benefits, Approach, Rooftop rainwater harvesting, Subsurface barriers/dykes, Farm ponds and its applications in rural areas Calculation of available rainwater for harvesting, Preparation of technical drawings, Design of rainwater harvesting structures.                                                                                                                                                                                                                                                                       |                                             |             |              |
| <b>Module – 4: Elementary Conservation of Water</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                             |             | <b>9 hrs</b> |
| Importance of water conservation, Water conservation in daily use, Conservation in agriculture, Conservation in industries, Water conservation strategies: Limiting consumption, Reuse and recycling, Elimination of losses, Pollution prevention                                                                                                                                                                                                                                                                                                                          |                                             |             |              |
| <b>Module – 5: Subsurface Investigation of Ground Water</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                             |             | <b>9 hrs</b> |
| General geophysical methods and importance, Present laws regarding water management, Water footprints: Blue water footprint, Green water footprint, Grey water footprint, Sustainability assessment                                                                                                                                                                                                                                                                                                                                                                        |                                             |             |              |

### COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

|            |                                                                                                                           |
|------------|---------------------------------------------------------------------------------------------------------------------------|
| <b>CO1</b> | Understand the role of water resources and hydrological processes in sustainable water management.                        |
| <b>CO2</b> | Analyze groundwater occurrence, groundwater recharge, and water conservation practices.                                   |
| <b>CO3</b> | Develop rainwater harvesting systems to meet water conservation requirements.                                             |
| <b>CO4</b> | Explain subsurface investigation techniques, water management practices, and water footprint concepts for sustainability. |

### ASSESSMENT DETAILS (Both CIE and SEE)

| Assessment Type                                                                                | Maximum Marks | Minimum Passing Marks | Evaluation Details                                                                                                        |
|------------------------------------------------------------------------------------------------|---------------|-----------------------|---------------------------------------------------------------------------------------------------------------------------|
| CIE – IA Tests (A)                                                                             | 30            | -                     | Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 30 marks. |
| Continuous and Comprehensive Evaluation (B)                                                    | 20            | -                     | Any two Assessment methods as per 24RNBE4.2 (*if it is project based, one assignment shall be given), scaled to 20 marks. |
| <b>Total CIE (A+B)</b>                                                                         | <b>50</b>     | <b>20</b>             | <b>CIE Evaluation is done for a maximum of 50 marks</b>                                                                   |
| SEE (C)                                                                                        | 50            | 18                    | SEE is a theory exam conducted for 100 marks and scaled down to 50 marks. Exam duration shall be 3 hours.                 |
| <b>CIE + SEE (A+B+C)</b>                                                                       | <b>100</b>    | <b>40</b>             | Final marks shall be the sum of marks scored in Components A, B and C.                                                    |
| The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to appear for SEE. |               |                       |                                                                                                                           |

## Suggested Learning Resources:

### Textbooks

1. Hydrology – H.M. Raghunath, 4<sup>th</sup> Edition, New Age Publications.
2. Ground Water Hydrology – David K. Todd & Larry W. Mays, Wiley India.

### Reference books

1. Rain Water Harvesting – P.K. Singh, 2<sup>nd</sup> Edition, Macmillan India Ltd.
2. Groundwater Prospecting & Management – H.P. Patra, 2<sup>nd</sup> Edition, Springer Publication.



| <b>B.E. (Civil Engineering)</b>                                                                                                                                                                                                                                                                                                                                                                                                                       |                                            |                    |              |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|--------------------|--------------|
| <b>Outcome-Based Education (OBE) and Choice-Based Credit System (CBCS)</b>                                                                                                                                                                                                                                                                                                                                                                            |                                            |                    |              |
| <b>Course Title:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>Ground Improvement Techniques</b>       |                    |              |
| <b>Course Code:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>BCV613C</b>                             | <b>Scheme</b>      | <b>2024</b>  |
| <b>Type of Course</b>                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>Professional Elective Courses (PEC)</b> | <b>Semester</b>    | <b>VI</b>    |
| <b>Teaching Hours/Week (L: T:P)</b>                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>(3:0:0) 45 hrs/sem</b>                  | <b>CIE Marks</b>   | <b>50</b>    |
| <b>Total Hours of Pedagogy per semester (L:T:P: TW&amp; SL)</b>                                                                                                                                                                                                                                                                                                                                                                                       | <b>(45:0:0:45) 90 hrs/sem</b>              | <b>SEE Marks</b>   | <b>50</b>    |
| <b>Credits</b>                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>3</b>                                   | <b>Total Marks</b> | <b>100</b>   |
| <b>Examination type</b>                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>Theory</b>                              | <b>Exam Hours</b>  | <b>3</b>     |
| <b>COURSE LEARNING OBJECTIVES:</b><br><i>The purpose of the course is to facilitate the learner to:</i> <ol style="list-style-type: none"> <li>1. Understand the ground conditions, and geotechnical processes involved in ground improvement techniques.</li> <li>2. Describe the principles and techniques involved in soil stabilisation and compaction.</li> <li>3. Utilize in-situ soil treatment techniques in engineering practice.</li> </ol> |                                            |                    |              |
| <b>Module-1: Introduction</b>                                                                                                                                                                                                                                                                                                                                                                                                                         |                                            |                    | <b>9 hrs</b> |
| <b>Introduction</b><br>Need for Ground Improvement, Different types of problematic soils, Alterations of ground after formation, Reclaimed soils, Natural offshore deposits; Ground Improvement Potential – Hazardous ground conditions, poor ground conditions, favorable ground conditions, Alternative Approaches, Geotechnical processes.                                                                                                         |                                            |                    |              |
| <b>Module-2: Mechanical Stabilization</b>                                                                                                                                                                                                                                                                                                                                                                                                             |                                            |                    | <b>9 hrs</b> |
| Shallow and deep compaction, Principles and methods of soil compaction, Shallow compaction and methods. Properties of compacted soil and compaction control, Deep compaction and Vibratory methods, Dynamic compaction.                                                                                                                                                                                                                               |                                            |                    |              |
| <b>Module- 3: Modification by Admixtures</b>                                                                                                                                                                                                                                                                                                                                                                                                          |                                            |                    | <b>9 hrs</b> |
| Introduction to Stabilization, Cement stabilization and cement columns, Lime stabilization and lime columns. Stabilization using bitumen and emulsions, Stabilization using industrial wastes, Construction techniques and applications.                                                                                                                                                                                                              |                                            |                    |              |
| <b>Module-4: Grouting and Injection</b>                                                                                                                                                                                                                                                                                                                                                                                                               |                                            |                    | <b>9 hrs</b> |
| Introduction, Effect of grouting. Chemicals and materials used. Types of grouting. Grouting procedure, Applications of grouting                                                                                                                                                                                                                                                                                                                       |                                            |                    |              |
| <b>Module-5: In Situ Soil Treatment Methods</b>                                                                                                                                                                                                                                                                                                                                                                                                       |                                            |                    | <b>9 hrs</b> |
| Soil nailing and ground anchors, rock anchoring, micro-piles, design methods, construction techniques, Functions and applications of geo synthetics – geotextiles, geo grids, geo membranes; soil reinforcement using strips, bars and geo synthetics.                                                                                                                                                                                                |                                            |                    |              |

## COURSE OUTCOMES:

*After completing the course, the student will be able to:*

|            |                                                                                                                  |
|------------|------------------------------------------------------------------------------------------------------------------|
| <b>CO1</b> | Explain ground conditions, problematic soils, and the need for ground improvement in civil engineering projects. |
| <b>CO2</b> | Describe the principles and techniques involved in the stabilization and compaction of soil.                     |
| <b>CO3</b> | Discuss grouting techniques to enhance soil properties under different field conditions.                         |
| <b>CO4</b> | Utilize in-situ ground improvement methods for treatment of soil                                                 |

## ASSESSMENT DETAILS (Both CIE and SEE)

| 2, 3 and 4-Credit Theory Courses                                                                                                                                                                                                                                                                 |               |                       |                                                                                                                           |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-----------------------|---------------------------------------------------------------------------------------------------------------------------|
| Assessment Type                                                                                                                                                                                                                                                                                  | Maximum Marks | Minimum Passing Marks | Evaluation Details                                                                                                        |
| CIE – IA Tests (A)                                                                                                                                                                                                                                                                               | 30            | -                     | Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 30 marks. |
| Continuous and Comprehensive Evaluation (B)                                                                                                                                                                                                                                                      | 20            | -                     | Any two Assessment methods as per 24RNBE4.2 (*if it is project based, one assignment shall be given), scaled to 20 marks. |
| <b>Total CIE (A+B)</b>                                                                                                                                                                                                                                                                           | <b>50</b>     | <b>20</b>             | <b>CIE Evaluation is done for a maximum of 50 marks</b>                                                                   |
| <b>SEE (C)</b>                                                                                                                                                                                                                                                                                   | <b>50</b>     | <b>18</b>             | <b>SEE is a theory exam conducted for 100 marks and scaled down to 50 marks. Exam duration shall be 3 hours.</b>          |
| <b>CIE + SEE (A+B+C)</b>                                                                                                                                                                                                                                                                         | <b>100</b>    | <b>40</b>             | Final marks shall be the sum of marks scored in Components A, B and C.                                                    |
| <ul style="list-style-type: none"> <li>The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to appear for SEE.</li> <li>If any courses of 3 credits are of Integrated Course type, for such courses the method suggested for 4 credits IPCC shall be followed.</li> </ul> |               |                       |                                                                                                                           |

## Suggested Learning Resources:

### Textbooks

1. S. K. Gulhati and M. Datta, *Geotechnical Engineering*, Tata McGraw Hill.
2. M. R. Hausmann, *Principles of Ground Modification*, McGraw-Hill.
3. Purushothama Raj. P, *Ground Improvement Techniques*, Firewall Media.

### Reference Books

1. P. Nicholson, *Soil Improvement and Ground Modification Methods*, Butterworth-Heinemann.
2. R. M. Koerner, *Designing with Geosynthetics*, Prentice Hall.
3. Moseley, Kirsch & Bell, *Ground Improvement*, CRC Press.
4. Holtz & Kovacs, *An Introduction to Geotechnical Engineering*, Pearson.



| B.E. (Civil Engineering)<br>Outcome Based Education (OBE) and Choice Based Credit System (CBCS)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                     |             |              |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|-------------|--------------|
| Course Title                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Intelligent Transport System        |             |              |
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | BCV613D                             | Scheme      | 2024         |
| Type of Course                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Professional Elective Courses (PEC) | Semester    | VI           |
| Teaching Hours/Week (L:T:P)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | (3:0:0) 45 hrs/sem                  | CIE Marks   | 50           |
| Total Hours of Pedagogy per semester (L:T:P: TW& SL)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | (45:0:0:45) 90 hrs/sem              | SEE Marks   | 50           |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 3                                   | Total Marks | 100          |
| Examination type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Theory                              | Exam Hours  | 3            |
| <b>COURSE LEARNING OBJECTIVES:</b><br><i>The purpose of the course is to enable the learner to:</i> <ol style="list-style-type: none"> <li>1. Understand the basic concepts, applications, security, and safety aspects of Intelligent Transportation Systems (ITS).</li> <li>2. Apply video detection, ANPR, ATMS, ATIS, and dynamic traffic assignment techniques for basic traffic monitoring and management applications.</li> <li>3. Analyze travel information systems and assess the effectiveness of traveller information and route guidance services.</li> <li>4. Evaluate automated highway systems and compare Intelligent Transportation System (ITS) implementations in developed and developing countries.</li> </ol> |                                     |             |              |
| <b>Module-1: Introduction to Intelligent Transport System</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                     |             | <b>9 hrs</b> |
| Introduction to Intelligent Transportation Systems (ITS) -Definition – Role and Responsibilities – Advanced Traveller Information System – Fleet Oriented ITS Services – Electronic Toll Collection – Critical issues – Security – Safety.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                     |             |              |
| <b>Module-2: ITS Architecture and Hardware</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                     |             | <b>9 hrs</b> |
| Architecture – ITS Architecture Framework – Hardware Sensors – Vehicle Detection – Techniques – Dynamic Message Sign – GPRS – GPS – Toll Collection.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                     |             |              |
| <b>Module-3: Advanced Transport Management System</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                     |             | <b>9 hrs</b> |
| Video Detection – Virtual Loop - Cameras - ANPR – IR Lighting – Integrated Traffic Management – Control Centre – Junction Management Strategies- ATMS – Advanced Traveler Information Systems (ATIS)- Route Guidance – Issues - Historical – Current – Predictive Guidance – Data Collection – Analysis – Dynamic Traffic Assignment (DTA) – Components – Algorithm.                                                                                                                                                                                                                                                                                                                                                                 |                                     |             |              |
| <b>Module-4: Advanced Traveller and Information System</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                     |             | <b>9 hrs</b> |
| Travel Information – Pre Trip and Enroute Methods- Basic ATIS Concepts – Smart Route System – Data Collection – Process – Dissemination to Travelers – Evaluation of Information – Value of Information – Business Opportunities.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                     |             |              |
| <b>Module-5: Case Studies</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                     |             | <b>9 hrs</b> |
| Automated Highway Systems - Vehicles in Platoons – Integration of Automated Highway Systems. ITS Programs in the World – Overview of ITS implementations in developed countries, ITS in developing countries.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                     |             |              |

### COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

|            |                                                                                                                                                                        |
|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>CO1</b> | Understand and describe the fundamentals, applications, and key challenges of Intelligent Transportation Systems including safety, security, and operational services. |
| <b>CO2</b> | Apply ITS architecture, sensors, communication technologies, vehicle detection methods, and electronic toll collection systems.                                        |
| <b>CO3</b> | Analyze and apply traffic monitoring, management, and traveler information techniques using vehicle detection, route guidance, and dynamic traffic assignment systems. |
| <b>CO4</b> | Evaluate automated highway systems and compare ITS implementations in developed and developing countries.                                                              |

### ASSESSMENT DETAILS (Both CIE and SEE)

| Assessment Type                             | Maximum Marks | Minimum Passing Marks | Evaluation Details                                                                                                        |
|---------------------------------------------|---------------|-----------------------|---------------------------------------------------------------------------------------------------------------------------|
| CIE – IA Tests (A)                          | 30            | -                     | Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 30 marks. |
| Continuous and Comprehensive Evaluation (B) | 20            | -                     | Any two Assessment methods as per 24RNBE4.2 (*if it is project based, one assignment shall be given), scaled to 20 marks. |
| <b>Total CIE (A+B)</b>                      | <b>50</b>     | <b>20</b>             | <b>CIE Evaluation is done for a maximum of 50 marks</b>                                                                   |
| SEE (C)                                     | 50            | 18                    | SEE is a theory exam conducted for 100 marks and scaled down to 50 marks. Exam duration shall be 3 hours.                 |
| <b>CIE + SEE (A+B+C)</b>                    | <b>100</b>    | <b>40</b>             | Final marks shall be the sum of marks scored in Components A, B and C.                                                    |

The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to appear for SEE.

## Suggested Learning Resources:

### Textbooks

1. Intelligent Transport Systems, Intelligent Transportation Primer, Washington, US, 2001.
2. Henry F.Korth, and Abraham Siberschatz, Data Base System Concepts, McGraw Hill, 1992.
3. Turban E., "Decision Support and Expert Systems Management Support Systems", Maxwell Macmillan, 1998.

### Reference books

1. Sitausu S. Mittra, "Decision Support Systems – Tools and Techniques", John Wiley, New York, 1986.
2. Cycle W.Halsapple and Andrew B.Winston, "Decision Support Systems – Theory and Application", Springer Verlag, New York, 1987
3. ITS Hand Book 2000: Recommendations for World Road Association (PIARC) by Kan Paul Chen, John Miles.

| <b>B.E. (Civil Engineering)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                          |                    |              |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|--------------------|--------------|
| <b>Outcome Based Education (OBE) and Choice Based Credit System (CBCS)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                          |                    |              |
| <b>Course Title</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>Sustainable Design Concepts for Building Services</b> |                    |              |
| <b>Course Code</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>BCV654A</b>                                           | <b>Scheme</b>      | <b>2024</b>  |
| <b>Type of Course</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>Open Elective Courses (OEC)</b>                       | <b>Semester</b>    | <b>VI</b>    |
| <b>Teaching Hours/Week (L:T:P)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>(3:0:0) 45 hrs/sem</b>                                | <b>CIE Marks</b>   | <b>50</b>    |
| <b>Total Hours of Pedagogy per semester (L:T:P: TW&amp; SL)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>(45:0:0:45) 90 hrs/sem</b>                            | <b>SEE Marks</b>   | <b>50</b>    |
| <b>Credits</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>3</b>                                                 | <b>Total Marks</b> | <b>100</b>   |
| <b>Examination type</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>Theory</b>                                            | <b>Exam Hours</b>  | <b>3</b>     |
| <b>COURSE LEARNING OBJECTIVES:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                          |                    |              |
| <i>The purpose of the course is to enable the learner to:</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                          |                    |              |
| <ol style="list-style-type: none"> <li>1. To provide fundamental knowledge of sustainable building concepts, climatology, and heat transfer mechanisms influencing building performance.</li> <li>2. To expose learners to shading systems, thermal comfort, visual comfort, indoor air quality, and acoustics for designing comfortable and energy-efficient buildings.</li> <li>3. To develop an understanding of sustainable building practices, including energy efficiency, water efficiency, and waste management strategies.</li> <li>4. To impart knowledge of life cycle assessment, green project management, and green building rating and certification systems for sustainable construction and operation.</li> </ol> |                                                          |                    |              |
| <b>Module–1: Introduction to Sustainability and Climatology</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                          |                    | <b>9 hrs</b> |
| Overview of Sustainability – Global energy scenario, carbon footprint and climate action, Net zero in carbon offsetting, Water neutral, Sustainable construction and resource management. Green buildings - Selection of site – preservation and planning, Influence of climate on buildings, Basics of climatology, Earth – Sun relationship, Solar angles and sun path diagram, Design of shading systems.                                                                                                                                                                                                                                                                                                                       |                                                          |                    |              |
| <b>Module–2: Comfort in Buildings</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                          |                    | <b>9 hrs</b> |
| Thermal comfort – Basics of Thermodynamics, Convection/radiation heat transfer, Heat gain through various elements of a building, Thermal comfort models and case studies Acoustics – Building acoustics, measures, defects and prevention of sound transmission Indoor Air Quality – Effects, design consideration and integrated approach for IAQ management Visual comfort – Enhancement strategies for Daylighting and Artificial lighting.                                                                                                                                                                                                                                                                                    |                                                          |                    |              |
| <b>Module–3:Energy, water efficiency and waste management in buildings</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                          |                    | <b>9 hrs</b> |
| Energy efficiency – Energy efficiency in building envelope and energy efficient HVAC and Lighting as per Energy conservation building code (ECBC) 2017, Energy simulation, Energy management system – Renewable energy and Energy Audit. Water Efficiency – Planning and design of water management system, Rainwater harvesting, Water efficient design and fixtures, Treatment and reuse and Water efficient landscape system. Waste management – Types of waste and its treatment methods, Construction and demolition waste management, Waste management                                                                                                                                                                       |                                                          |                    |              |

in residential, commercial buildings, healthcare facilities.

**Module-4: Life Cycle Assessment of Buildings and Green project management** **9 hrs**

Materials – Green product certifications, features of sustainable building materials and sustainable alternatives for structural, envelope and finishing materials. Low carbon cement, Zero emission bricks and lean construction practices. Life cycle assessment and its types – Modelling and Analysis, Greenhouse gas emission. Different phases of Green building project management.

**Module-5: Sustainable rating systems** **9 hrs**

Green building rating systems- LEED, BREEAM and others, Indian Green building rating systems – IGBC & GRIHA. IGBC criteria for certification -site selection credits, pre-design credits, detailed design credits, pre-construction credits, construction credits, post construction credits

**COURSE OUTCOMES:**

*After successfully completing the course, the student will be able to:*

|            |                                                                                                                                                                 |
|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>CO1</b> | Explain the principles of sustainable building design, climatology, heat transfer mechanisms, and shading systems for improving building performance.           |
| <b>CO2</b> | Analyze the design parameters influencing thermal comfort, visual comfort, indoor air quality, acoustics, and resource efficiency in buildings.                 |
| <b>CO3</b> | Evaluate sustainable building solutions involving energy efficiency, water conservation, waste management, life cycle assessment, and green project management. |
| <b>CO4</b> | Apply green building practices and assess buildings using green rating and certification systems to support sustainable construction and operation.             |

**ASSESSMENT DETAILS (Both CIE and SEE)**

| Assessment Type                             | Maximum Marks | Minimum Passing Marks | Evaluation Details                                                                                                        |
|---------------------------------------------|---------------|-----------------------|---------------------------------------------------------------------------------------------------------------------------|
| CIE – IA Tests (A)                          | 30            | -                     | Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 30 marks. |
| Continuous and Comprehensive Evaluation (B) | 20            | -                     | Any two Assessment methods as per 24RNBE4.2 (*if it is project based, one assignment shall be given), scaled to 20 marks. |
| <b>Total CIE (A+B)</b>                      | <b>50</b>     | <b>20</b>             | <b>CIE Evaluation is done for a</b>                                                                                       |

|                                                                                                |            |           |                                                                                                                  |
|------------------------------------------------------------------------------------------------|------------|-----------|------------------------------------------------------------------------------------------------------------------|
|                                                                                                |            |           | <b>maximum of 50 marks</b>                                                                                       |
| <b>SEE (C)</b>                                                                                 | <b>50</b>  | <b>18</b> | <b>SEE is a theory exam conducted for 100 marks and scaled down to 50 marks. Exam duration shall be 3 hours.</b> |
| <b>CIE + SEE<br/>(A+B+C)</b>                                                                   | <b>100</b> | <b>40</b> | Final marks shall be the sum of marks scored in Components <b>A, B and C.</b>                                    |
| The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to appear for SEE. |            |           |                                                                                                                  |

### Suggested Learning Resources:

#### Textbooks

1. Bureau of Indian Standards (BIS). (2016). National Building Code of India 2016 (NBC 2016), Vol. 1 and 2. Bureau of Indian Standards, New Delhi, India.
2. Charangith shah, Water supply and sanitary engineering, Galgotia publishers.
3. Kamala & DL Kanth Rao, Environmental Engineering, Tata McGraw Hill publishing co. Ltd. Technical teachers Training Institute (Madras), Environmental Engineering, Tata McGraw Hill publishing Co. Ltd.

#### Reference books

1. M.David Egan, Concepts in Building Fire Safety.
2. O.H.Koenigsberger, "Manual of Tropical Housing and Building", Longman Group United Kingdom
3. V.K.Jain, Fire Safety In Building 2edition, New Age International Publishers
4. E.G.Butcher, Smoke control in Fire-safety Design.

| B.E. (Civil Engineering)<br>Outcome Based Education (OBE) and Choice Based Credit System (CBCS)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                   |             |              |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|-------------|--------------|
| Course Title                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Foundations of Lean Manufacturing |             |              |
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | BCV654B                           | Scheme      | 2024         |
| Type of Course                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Open Elective Courses (OEC)       | Semester    | VI           |
| Teaching Hours/Week (L:T:P)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | (3:0:0) 45 hrs/sem                | CIE Marks   | 50           |
| Total Hours of Pedagogy per semester (L:T:P: TW& SL)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | (45:0:0:45) 90 hrs/sem            | SEE Marks   | 50           |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 3                                 | Total Marks | 100          |
| Examination type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Theory                            | Exam Hours  | 3            |
| <b>COURSE LEARNING OBJECTIVES:</b><br><i>The purpose of the course is to enable the learner to:</i> <ol style="list-style-type: none"> <li>Understand the philosophy, principles, and essential concepts of Lean Manufacturing and Lean Systems.</li> <li>Develop observation, analytical, and problem-solving skills for identifying workplace hazards, wastes, and process inefficiencies.</li> <li>Apply Lean tools and techniques for improving productivity, safety, flow management, and workplace organization.</li> <li>Analyze and evaluate industrial, institutional, and service processes for continuous improvement using Lean principles and visual management tools.</li> </ol> |                                   |             |              |
| <b>Module-1: Introduction to Lean Manufacturing and Observation Skills</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                   |             | <b>9 hrs</b> |
| <b>Introduction to Manufacturing Systems;</b> Evolution of Manufacturing – Craft Production, Mass Manufacturing, and Lean Manufacturing; Rise of Toyota Production System; Lean Principles and Lean Thinking.<br><b>Observation Skills</b> – Seeing versus Observing; Observation Process; Introduction to 4W1H Methodology; Label Writing and Label Grouping; Workplace Safety and Cleanliness; Unsafe Conditions and Unsafe Acts; Hazard and Risk Identification.<br><b>Case Study:</b> Observation and hazard identification in a workplace environment.                                                                                                                                    |                                   |             |              |
| <b>Module-2: Essential Concepts in Lean Systems</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                   |             | <b>9 hrs</b> |
| Business Cycle; Concepts in Procurement, Production, and Delivery; Organization of Men, Material, and Machines; Types of Materials; Self-Discipline; Time Management; Teamwork; Brainstorming Techniques; Conflict Management; Role of Human Factors in Lean Systems; Introduction to Continuous Improvement Culture.<br><b>Case Study:</b> Analysis of procurement, production, and delivery processes in an organization.                                                                                                                                                                                                                                                                    |                                   |             |              |
| <b>Module-3: Lean Operations and Waste Elimination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                   |             | <b>9 hrs</b> |
| Operations and Functional Silos; Drawbacks of Functional Silos; Lean Operations; Concept of Waste (MUDA); Eight Types of Waste; Root Causes of Waste; Waste Elimination Techniques; Process Flow Diagram (PFD); Loops in Lean Operations; Process Analysis and Improvement; Continuous Improvement Practices.<br><b>Case Study:</b> Identification and elimination of waste in an industrial, institutional, or service process.                                                                                                                                                                                                                                                               |                                   |             |              |
| <b>Module-4: Flow Management and Productivity Improvement</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                   |             | <b>9 hrs</b> |
| Concept of Flow; Flow versus Process; Characteristics of Flow; Attributes of Process; Time and Motion Study; Takt Time; Origin of Waste in Processes; Material Flow and Information Flow; Flow in Manufacturing Systems; Flow in Business Processes; Productivity Improvement through                                                                                                                                                                                                                                                                                                                                                                                                          |                                   |             |              |

Flow Management.

**Case Study:** Analysis of flow efficiency and bottleneck identification in a process.

**Module-5: Visual Management and Lean Applications**

**9 hrs**

5S Methodology – Sort, Set in Order, Shine, Standardize, and Sustain; Stages of Flow; Visual Management Concepts; Family of VMaps; Introduction to VMapQ; Benefits of VMapQ; Visualizing Material Flow, Space Allocation, and Safety Issues; Guidelines for Creating VMapQ; Development of Current and Proposed VMapQ; Lean Applications in Manufacturing, Construction, Logistics, Healthcare, and Service Industries.

**Case Study:** Visual mapping of material flow and workplace improvement using VMapQ

### COURSE OUTCOMES:

*After successfully completing the course, the student will be able to:*

|            |                                                                                                                                                                                                |
|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>CO1</b> | Explain the principles of Lean Manufacturing, observation skills, workplace safety, flow management, and visual management concepts.                                                           |
| <b>CO2</b> | Apply Lean tools and techniques to identify workplace hazards, process inefficiencies, and opportunities for operational improvement.                                                          |
| <b>CO3</b> | Analyze operational processes, material flow, information flow, wastes, and productivity issues using Lean principles and flow management techniques.                                          |
| <b>CO4</b> | Evaluate existing systems and develop continuous improvement strategies using Lean Manufacturing principles and visual management tools in industrial, institutional, or service environments. |

### ASSESSMENT DETAILS (Both CIE and SEE)

| Assessment Type                             | Maximum Marks | Minimum Passing Marks | Evaluation Details                                                                                                        |
|---------------------------------------------|---------------|-----------------------|---------------------------------------------------------------------------------------------------------------------------|
| CIE – IA Tests (A)                          | 30            | -                     | Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 30 marks. |
| Continuous and Comprehensive Evaluation (B) | 20            | -                     | Any two Assessment methods as per 24RNBE4.2 (*if it is project based, one assignment shall be given), scaled to 20 marks. |
| <b>Total CIE (A+B)</b>                      | <b>50</b>     | <b>20</b>             | <b>CIE Evaluation is done for a maximum of 50 marks</b>                                                                   |

|                      |     |    |                                                                                                           |
|----------------------|-----|----|-----------------------------------------------------------------------------------------------------------|
| SEE (C)              | 50  | 18 | SEE is a theory exam conducted for 100 marks and scaled down to 50 marks. Exam duration shall be 3 hours. |
| CIE + SEE<br>(A+B+C) | 100 | 40 | Final marks shall be the sum of marks scored in Components A, B and C.                                    |

The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to appear for SEE.

### Suggested Learning Resources:

#### Textbooks

1. S. Vinod, *Lean Manufacturing: Fundamentals, Tools, Approaches, and Industry 4.0 Integration*, 1<sup>st</sup> ed. Boca Raton, FL, USA: CRC Press, 2022.
2. K. Das and M. Dixon, *Lean Manufacturing and Service: Fundamentals, Applications, and Case Studies*, 1st ed., FL, USA: CRC Press (Taylor & Francis Group), 2021.
3. SWAYAM, Lean Manufacturing (Course ID: IMB26\_MG40). [Online]. Available: [https://onlinecourses.swayam2.ac.in/e-learning/course/imb26\\_mg40](https://onlinecourses.swayam2.ac.in/e-learning/course/imb26_mg40)

#### Reference books

1. D. T. Phillips and B. E. Tokgoz, *Fundamentals of Lean Manufacturing*. College Station, TX, USA: Virtualbookworm.com Publishing, 2020.
2. L. Wilson, *How to Implement Lean Manufacturing*, 2<sup>nd</sup> ed. New York, NY, USA: McGraw-Hill Education, 2015.

| B.E. (Civil Engineering)<br>Outcome-Based Education (OBE) and Choice-Based Credit System (CBCS)                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                             |             |              |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|-------------|--------------|
| Course Title:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Remote Sensing and GIS      |             |              |
| Course Code:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | BCV654C                     | Scheme      | 2024         |
| Type of Course                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Open Elective Courses (OEC) | Semester    | VI           |
| Teaching Hours/Week (L: T:P)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | (3:0:0) 45 hrs/sem          | CIE Marks   | 50           |
| Total Hours of Pedagogy per semester (L:T:P: TW& SL)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | (45:0:0:45) 90 hrs/sem      | SEE Marks   | 50           |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 3                           | Total Marks | 100          |
| Examination type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Theory                      | Exam Hours  | 3            |
| <b>COURSE LEARNING OBJECTIVES:</b><br><i>The purpose of the course is to facilitate the learner to:</i> <ol style="list-style-type: none"> <li>1. Explain the fundamental concepts of Remote Sensing and GIS.</li> <li>2. Describe spatial and attribute data, coordinate systems, map projections, and GIS components.</li> <li>3. Illustrate remote sensing techniques for image processing, interpretation, and error correction.</li> <li>4. Discuss GIS tools and data models (vector and raster) for spatial data analysis and real-world applications.</li> </ol> |                             |             |              |
| <b>Module–1: Remote Sensing</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                             |             | <b>9 hrs</b> |
| Basic concept of Remote sensing, Data and Information, Remote sensing data collection, Remote sensing advantages & Limitations, Remote Sensing process. Electromagnetic Spectrum. Energy interacts with the atmosphere and with Earth's surface features (soil, water, and vegetation). Elements of Visual Interpretation Techniques.                                                                                                                                                                                                                                    |                             |             |              |
| <b>Module–2: Remote Sensing Platforms and Sensors</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                             |             | <b>9 hrs</b> |
| Remote Sensing Platforms, Sensor resolutions (spatial, spectral, radiometric and temporal), Satellites and Sensors characteristics (IRS, Landsat).<br><b>Basics of digital image processing-</b> Introduction to digital data, Errors in Remote Sensing Data: Systematic errors (Scan Skew, Mirror-Scan Velocity, Panoramic Distortion, Platform Velocity, Earth Rotation) and Non-Systematic Errors (Altitude, Attitude), Image enhancements (Grey Level Thresholding, level slicing, contrast stretching), Image Filtering.                                            |                             |             |              |
| <b>Module– 3: Geographic Information System</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                             |             | <b>9 hrs</b> |
| Introduction to GIS, components of a GIS, Geographically Referenced Data, Types of Data in GIS: Spatial Data & Attribute data, Joining Spatial and attribute data.<br>Coordinate System: Geographic coordinate System, Projected coordinate Systems, Map Projections: Types of Map Projections, Datum, UTM Zones.                                                                                                                                                                                                                                                        |                             |             |              |
| <b>Module–4: Data Models</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                             |             | <b>9 hrs</b> |
| Raster Data Model: Elements of the Raster data model, Types of Raster Data, Raster Data Structure, and Data conversion.<br>Vector data model: Representation of simple features – Topology and its importance; coverage and its data structure, Shape file; Relational Database.                                                                                                                                                                                                                                                                                         |                             |             |              |
| <b>Module–5: Applications of Remote Sensing and GIS</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                             |             | <b>9 hrs</b> |
| Applications in land use and land cover analysis, change detection, water resources, urban planning, environmental planning, Natural resource management and Traffic management. Location-Based Services and their Applications.                                                                                                                                                                                                                                                                                                                                         |                             |             |              |

### COURSE OUTCOMES:

*After successfully completing the course, the student will be able to:*

|            |                                                                                                  |
|------------|--------------------------------------------------------------------------------------------------|
| <b>CO1</b> | Understand the basic concepts of Remote Sensing and GIS.                                         |
| <b>CO2</b> | Describe GIS components, spatial data, and coordinate systems                                    |
| <b>CO3</b> | Illustrate image processing and interpretation techniques in Remote Sensing.                     |
| <b>CO4</b> | Utilize GIS data models and tools to perform basic spatial analysis for engineering applications |

### ASSESSMENT DETAILS (Both CIE and SEE)

| 2, 3 and 4-Credit Theory Courses                                                                                                                                                                                                                                                                           |               |                       |                                                                                                                           |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-----------------------|---------------------------------------------------------------------------------------------------------------------------|
| Assessment Type                                                                                                                                                                                                                                                                                            | Maximum Marks | Minimum Passing Marks | Evaluation Details                                                                                                        |
| CIE – IA Tests (A)                                                                                                                                                                                                                                                                                         | 30            | -                     | Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 30 marks. |
| Continuous and Comprehensive Evaluation (B)                                                                                                                                                                                                                                                                | 20            | -                     | Any two Assessment methods as per 24RNBE4.2 (*if it is project based, one assignment shall be given), scaled to 20 marks. |
| <b>Total CIE (A+B)</b>                                                                                                                                                                                                                                                                                     | <b>50</b>     | <b>20</b>             | <b>CIE Evaluation is done for a maximum of 50 marks</b>                                                                   |
| <b>SEE (C)</b>                                                                                                                                                                                                                                                                                             | <b>50</b>     | <b>18</b>             | <b>SEE is a theory exam conducted for 100 marks and scaled down to 50 marks. Exam duration shall be 3 hours.</b>          |
| <b>CIE + SEE (A+B+C)</b>                                                                                                                                                                                                                                                                                   | <b>100</b>    | <b>40</b>             | Final marks shall be the sum of marks scored in Components A, B and C.                                                    |
| <ul style="list-style-type: none"> <li>The minimum marks to be secured in CIE are 20 (40%) out of the allotted 50 marks to appear for SEE.</li> <li>If any courses of 3 credits are of the Integrated Course type, for such courses, the method suggested for 4 credits IPCC shall be followed.</li> </ul> |               |                       |                                                                                                                           |

## Suggested Learning Resources:

### Textbooks

1. M. Anji Reddy, *Remote Sensing and Geographical Information System*, B.S. Publications, 2008.
2. Narayan Panigrahi, *Geographical Information Science*, ISBN: 9788173716287, University Press, 2008.
3. Basudeb Bhatta, *Remote Sensing and GIS*, ISBN: 9780198072393, Oxford University Press, 2011.
4. Kang-Tsung Chang, *Introduction to Geographic Information Systems*, Tata McGraw-Hill Education, 2015.
5. Thomas M. Lillesand, Ralph W. Kiefer, Jonathan W. Chipman, *Remote Sensing and Image Interpretation*, Wiley, 2011.

### Reference Books

1. Chor Pang Lo and Albert K. W. Yeung, *Concepts and Techniques of Geographic Information Systems*, PHI Learning, 2006.
2. John R. Jensen, *Remote Sensing of the Environment: An Earth Resource Perspective* (2nd Edition), Pearson Education, 2007.
3. Peter A. Burrough, Rachael A. McDonnell, and Christopher D. Lloyd, *Principles of Geographical Information Systems*, Oxford University Press, 2004.
4. S. Kumar, *Basics of Remote Sensing and GIS*, Laxmi Publications, 2005.

| <b>B.E. (Civil Engineering)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                |                    |              |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|--------------------|--------------|
| <b>Outcome Based Education (OBE) and Choice Based Credit System (CBCS)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                |                    |              |
| <b>Course Title</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>Environmental Protection and Management</b> |                    |              |
| <b>Course Code</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>BCV654D</b>                                 | <b>Scheme</b>      | <b>2024</b>  |
| <b>Type of Course</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>Open Elective Course (OEC)</b>              | <b>Semester</b>    | <b>VI</b>    |
| <b>Teaching Hours/Week (L:T:P)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>(3:0:0) 45 hrs/sem</b>                      | <b>CIE Marks</b>   | <b>50</b>    |
| <b>Total Hours of Pedagogy per semester (L:T:P: TW&amp; SL)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>(45:0:0:45) 90 hrs/sem</b>                  | <b>SEE Marks</b>   | <b>50</b>    |
| <b>Credits</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>3</b>                                       | <b>Total Marks</b> | <b>100</b>   |
| <b>Examination type</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>Theory</b>                                  | <b>Exam Hours</b>  | <b>3</b>     |
| <b>COURSE LEARNING OBJECTIVES:</b><br><i>The purpose of the course is to enable the learner to:</i> <ol style="list-style-type: none"> <li>Understand the principles of environmental management, sustainability, environmental policies, and regulatory standards.</li> <li>Apply the concepts and requirements of Environmental Management Systems (EMS) as per codal provisions and EMAS, for environmental planning and compliance.</li> <li>Interpret environmental quality standards, pollution prevention measures, and cleaner production techniques.</li> </ol> |                                                |                    |              |
| <b>Module–1:Environmental Management Standards</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                |                    | <b>9 hrs</b> |
| Unique Characteristics of Environmental Problems - Systems approach to Corporate environmental management - Classification of Environmental Impact Reduction Efforts - Business Charter for Sustainable Production and Consumption – Tools, Business strategy drivers and Barriers - Evolution of Environmental Stewardship. Environmental Management Principles - National policies on environment, abatement of pollution and conservation of resources - Charter on Corporate responsibility for Environmental protection.                                            |                                                |                    |              |
| <b>Module–2: Environmental Management Objectives</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                |                    | <b>9 hrs</b> |
| Environmental quality objectives – Rationale of Environmental standards: Concentration and Mass standards, Effluent and stream standards, Emission and ambient standards, Minimum national standards, environmental performance evaluation: Indicators, benchmarking. Pollution control Vs Pollution Prevention - Opportunities and Barriers – Cleaner production and Clean technology, closing the loops, zero discharge technologies.                                                                                                                                  |                                                |                    |              |
| <b>Module–3: Environmental Management System</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                |                    | <b>9 hrs</b> |
| EMAS, ISO 14000 - EMS as per ISO 14001– benefits and barriers of EMS – Concept of continual improvement and pollution prevention - environmental policy – initial environmental review – environmental aspect and impact analysis – legal and other requirements- objectives and targets – environmental management programs – structure and responsibility – training awareness and competence- communication – documentation and document control – operational control – monitoring and measurement – management review                                               |                                                |                    |              |
| <b>Module–4: Environmental Audit</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                |                    | <b>9 hrs</b> |
| Environmental management system audits as per ISO 19011- – Roles and qualifications of auditors - Environmental performance indicators and their evaluation – Non conformance –                                                                                                                                                                                                                                                                                                                                                                                          |                                                |                    |              |

Corrective and preventive actions -compliance audits – waste audits and waste minimization planning – Environmental statement (form V) - Due diligence audit.

**Module-5: Environmental Social and Governance and LCA** **9 hrs**

**Ground Water Development:**

**Circular Economy and Resource Efficiency:** Principles and applications in sustainable development.

Carbon Footprint and Carbon Management: Concepts, estimation, reduction strategies, and Net-Zero initiatives.

**Environmental, Social and Governance (ESG):** Framework, sustainability reporting, and corporate sustainability practices.

**Life Cycle Assessment (LCA):** Principles, methodology, and applications in environmental decision-making.

**COURSE OUTCOMES:**

*After successfully completing the course, the student will be able to:*

|            |                                                                                                                                  |
|------------|----------------------------------------------------------------------------------------------------------------------------------|
| <b>CO1</b> | Understand the principles of Environmental management system and environmental impact assessment.                                |
| <b>CO2</b> | Apply Environmental Management Systems for environmental auditing as per codal provision.                                        |
| <b>CO3</b> | Assess environmental quality, pollution prevention methods, cleaner production, and environmental performance.                   |
| <b>CO4</b> | Predict sustainable environmental management practices, carbon management, and modern technologies for environmental protection. |

**ASSESSMENT DETAILS (Both CIE and SEE)**

| Assessment Type                             | Maximum Marks | Minimum Passing Marks | Evaluation Details                                                                                                        |
|---------------------------------------------|---------------|-----------------------|---------------------------------------------------------------------------------------------------------------------------|
| CIE – IA Tests (A)                          | 30            | -                     | Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 30 marks. |
| Continuous and Comprehensive Evaluation (B) | 20            | -                     | Any two Assessment methods as per 24RNBE4.2 (*if it is project based, one assignment shall be given), scaled to 20 marks. |

|                                                                                                |            |           |                                                                                                                  |
|------------------------------------------------------------------------------------------------|------------|-----------|------------------------------------------------------------------------------------------------------------------|
| <b>Total CIE (A+B)</b>                                                                         | <b>50</b>  | <b>20</b> | <b>CIE Evaluation is done for a maximum of 50 marks</b>                                                          |
| <b>SEE (C)</b>                                                                                 | <b>50</b>  | <b>18</b> | <b>SEE is a theory exam conducted for 100 marks and scaled down to 50 marks. Exam duration shall be 3 hours.</b> |
| <b>CIE + SEE (A+B+C)</b>                                                                       | <b>100</b> | <b>40</b> | Final marks shall be the sum of marks scored in Components <b>A, B and C</b> .                                   |
| The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to appear for SEE. |            |           |                                                                                                                  |

### Suggested Learning Resources:

#### Textbooks

1. ISO 14001/14004: Environmental management systems – Requirements and Guidelines – International Organisation for Standardisation, 2004
2. ISO 19011: 2002, “Guidelines for quality and/or Environmental Management System auditing, Bureau of Indian Standards, New Delhi, 2002

#### Reference books

1. Christopher Sheldon and Mark Yoxon, “Installing Environmental management Systems – a step by step guide” Earthscan Publications Ltd, London, 1999. W H Mosley, R Husle, J H Bungey, “Reinforced Concrete Design”, MacMillan Education, Palgrave publishers.
2. Environmental Management Systems: An Implementation Guide for Small and Medium-Sized Organizations, Second Edition, NSF International, Ann Arbor, Michigan, January 2001. A W Beeby and Narayan R S, “Introduction to Design for Civil Engineers”, CRC Press.

| B.E. (Civil Engineering)<br>Outcome Based Education (OBE) and Choice Based Credit System (CBCS)                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                        |             |               |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|-------------|---------------|
| Course Title                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Major Project Phase-1  |             |               |
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | BCV685                 | Scheme      | 2024          |
| Type of Course                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Project                | Semester    | VI            |
| Teaching Hours/Week (L:T:P)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | (0:0:4) 60 hrs/sem     | CIE Marks   | 100           |
| Total Hours of Pedagogy per semester (L:T:P: TW& SL)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | (0:0:4:0) 60 hrs/sem   | SEE Marks   | -             |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 2                      | Total Marks | 100           |
| Examination type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Presentation/Viva Voce | Exam Hours  | 3             |
| <b>COURSE LEARNING OBJECTIVES:</b><br><i>The purpose of the course is to facilitate the learner to:</i> <ol style="list-style-type: none"> <li>1. Apply engineering knowledge in practical problem solving.</li> <li>2. Foster innovation in design of products, processes or systems.</li> <li>3. Develop creative thinking in finding viable solutions to engineering problems.</li> </ol>                                                                                                                                                        |                        |             |               |
| <b>PROJECT PHASE I</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                        |             | <b>30 hrs</b> |
| <b>Phase 1 Target</b> <ol style="list-style-type: none"> <li>1. Literature study/survey of published literature on the assigned topic</li> <li>2. Formulation of objectives</li> <li>3. Formulation of hypothesis/ design/ methodology</li> <li>4. Formulation of work plan and task allocation.</li> <li>5. Block level design documentation</li> <li>6. Seeking project funds from various agencies</li> <li>7. Preliminary Analysis/Modeling/Simulation/Experiment/Design/Feasibility study</li> <li>8. Preparation of Phase 1 report</li> </ol> |                        |             |               |

### COURSE OUTCOMES:

*After successfully completing the course, the student will be able to:*

|     |                                                                                                                 |
|-----|-----------------------------------------------------------------------------------------------------------------|
| CO1 | Model and solve real world problems by applying knowledge across domains                                        |
| CO2 | Plan and execute tasks utilizing available resources within timelines, following ethical and professional norms |
| CO3 | Identify technology/research gaps and propose innovative/creative solutions                                     |

## ASSESSMENT DETAILS (Both CIE and SEE)

### Project Phase -1 (Rubrics)

| Sl. No. | Content               | Review Assessment Weightage | Marks |
|---------|-----------------------|-----------------------------|-------|
| 1       | Presentation          | 25 %                        | 25    |
| 2       | Questions and Answers | 25 %                        | 25    |
| 3       | Project Report        | 50 %                        | 50    |
| Total   |                       | 100 %                       | 100   |

Note: Detailed Rubrics: Refer to the college website.



| B.E. (Civil Engineering)<br>Outcome Based Education (OBE) and Choice Based Credit System (CBCS)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                           |             |      |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|------|
| Course Title                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Building Information Modelling in Civil Engineering (Advanced)                                                                                                                                                            |             |      |
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | BCVL606                                                                                                                                                                                                                   | Scheme      | 2024 |
| Type of Course                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Professional Core Course Laboratory (PCCL)                                                                                                                                                                                | Semester    | VI   |
| Teaching Hours/Week (L:T:P)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | (0:0:2) 30 hrs/sem                                                                                                                                                                                                        | CIE Marks   | 50   |
| Total Hours of Pedagogy per semester (L:T:P: TW& SL)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | (0:0:30:0) 30 hrs/sem                                                                                                                                                                                                     | SEE Marks   | 50   |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1                                                                                                                                                                                                                         | Total Marks | 100  |
| Examination type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Practical                                                                                                                                                                                                                 | Exam Hours  | 3    |
| <b>COURSE LEARNING OBJECTIVES:</b><br><i>The purpose of the course is to facilitate the learner to:</i> <ol style="list-style-type: none"> <li>Understand the concepts of Structural Building Information Modelling (BIM), Autodesk Revit Structure, and their applications in Buildings.</li> <li>Create structural BIM projects by setting up project templates, levels, grids, and structural reference systems using BIM and Autodesk Revit Structure for structural elements.</li> <li>Generate structural documentation, schedules, quantity take-offs, and coordinated BIM models for interdisciplinary collaboration and clash detection.</li> </ol> |                                                                                                                                                                                                                           |             |      |
| Sl. No.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Experiments                                                                                                                                                                                                               |             |      |
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>Introduction to Structural BIM:</b> Overview of Building Information Modelling in structural engineering, importance of BIM in construction industry, introduction to Autodesk Revit Structure interface and workflow. |             |      |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>BIM Project Setup for Structural Models:</b> Creating structural project templates, understanding Revit file types, working with structural families, starting a structural project.                                   |             |      |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>Levels, Grids and Structural Reference Planes:</b> Creating and modifying levels and grids, setting up structural datum planes for modelling.                                                                          |             |      |
| 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>Structural Columns and Beams:</b> Modelling structural columns and beam systems, modifying beam types, beam placement and structural framing.                                                                          |             |      |
| 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>Structural Floors and Slabs:</b> Creating and modifying structural slabs, slab openings, slab edges and slab properties.                                                                                               |             |      |
| 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>Structural Foundations:</b> Modelling different types of foundations such as isolated footing, combined footing, raft foundation and pile foundation (basic modelling).                                                |             |      |
| 7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>Structural Walls and Core Elements:</b> Creating structural walls, modifying wall types, modelling shear walls and structural cores.                                                                                   |             |      |
| 8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>Reinforcement Modelling:</b> Introduction to reinforcement tools, modelling rebar in beams, columns and slabs, creating reinforcement layouts and rebar shapes.                                                        |             |      |
| 9                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>Structural Documentation, Schedules and Quantity Take-Off:</b> Generating structural plans and sections, creating beam, column and reinforcement schedules, and extracting material quantities from the BIM model.     |             |      |
| 10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>Coordination and Clash Detection:</b> Linking architectural models with structural models, performing interference checks, identifying and resolving clashes between structural and architectural elements.            |             |      |

### COURSE OUTCOMES:

*After successfully completing the course, the student will be able to:*

|            |                                                                                                                                                          |
|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>CO1</b> | Explain the concepts of Structural Building Information Modelling (BIM), Autodesk Revit Structure, and BIM-based structural workflows.                   |
| <b>CO2</b> | Create structural BIM projects by developing project templates, levels, grids, structural framing, and reference systems using Autodesk Revit Structure. |
| <b>CO3</b> | Model structural components including columns, beams, slabs, foundations, structural walls, and reinforcement using Autodesk Revit Structure.            |
| <b>CO4</b> | Generate structural drawings, schedules, quantity take-offs, and coordinated BIM models, and perform clash detection with architectural models.          |

### ASSESSMENT DETAILS (Both CIE and SEE)

| <b>1-Credit Lab Course</b>                                                                                                                       |                      |                              |                                                                                                                |
|--------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|------------------------------|----------------------------------------------------------------------------------------------------------------|
| <b>Assessment Type</b>                                                                                                                           | <b>Maximum Marks</b> | <b>Minimum Passing Marks</b> | <b>Evaluation Details</b>                                                                                      |
| CIE Practical (A)                                                                                                                                | 30                   | -                            | Marks awarded for Weekly Conduction of Experiments and Submission of Laboratory records, scaled to 30 marks.   |
| CIE Practical Test (B)                                                                                                                           | 20                   | -                            | Average of marks of Two tests, each conducted for 100 marks covering all experiments, scaled to 20.            |
| <b>Total CIE Practical (A+B)</b>                                                                                                                 | <b>50</b>            | <b>20</b>                    | <b>Sum of Marks of Experiments, Record and Test shall be CIE marks awarded for a maximum of 50.</b>            |
| <b>SEE (C)</b>                                                                                                                                   | <b>50</b>            | <b>20</b>                    | <b>SEE is a lab exam, conducted for 100 marks and scaled down to 50 marks. Exam duration shall be 3 hours.</b> |
| <b>CIE + SEE (A+B+C)</b>                                                                                                                         | <b>100</b>           | <b>40</b>                    | Final marks shall be the sum of marks scored in Components <b>A, B and C.</b>                                  |
| <ul style="list-style-type: none"> <li>The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to appear for SEE.</li> </ul> |                      |                              |                                                                                                                |

## Suggested Learning Resources:

### Textbooks

1. R. Sacks, C. Eastman, G. Lee, P. Teicholz and K. Liston, "BIM Handbook: A Guide to Building Information Modeling for Owners, Designers, Engineers, Contractors, and Facility Managers," 4<sup>th</sup> ed., John Wiley & Sons, 2024.
2. W. Kymmell, "Building Information Modeling: Planning and Managing Construction Projects with 4D CAD and Simulations," McGraw-Hill Education, 2008.

### Reference books

1. Autodesk, "Autodesk Revit Structure User Guide and Official Tutorials," Autodesk Learning Hub, 2024.
2. M. González García, F. Rodrigues and J. S. Baptista, "New Advances in Building Information Modeling and Engineering Management," Springer, 2023.
3. "ISO 19650 Series: Organization and Digitization of Information About Buildings and Civil Engineering Works, Including Building Information Modelling (BIM)," International Organization for Standardization (ISO), 2018–2025.

| B.E. (Civil Engineering)<br>Outcome Based Education (OBE) and Choice Based Credit System (CBCS)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                             |             |      |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|-------------|------|
| Course Title                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Structural Design Software Lab              |             |      |
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | BCVL657A                                    | Scheme      | 2024 |
| Type of Course                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Ability/ Skill Enhancement Course (AEC/SEC) | Semester    | VI   |
| Teaching Hours/Week (L:T:P)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | (0:0:2) 30 hrs/sem                          | CIE Marks   | 50   |
| Total Hours of Pedagogy per semester (L:T:P: TW& SL)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | (0:0:30:0) 30 hrs/sem                       | SEE Marks   | 50   |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1                                           | Total Marks | 100  |
| Examination type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Practical                                   | Exam Hours  | 3    |
| <b>COURSE LEARNING OBJECTIVES:</b><br><i>The purpose of the course is to enable the learner to:</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                             |             |      |
| <ol style="list-style-type: none"> <li>1. Identify the principles of residential building planning, municipal bye-laws, and structural framing systems.</li> <li>2. Explain the procedures for preparing architectural drawings and structural models using AutoCAD and ETABS.</li> <li>3. Apply the principles of structural analysis and reinforced concrete design using ETABS and relevant Indian Standard codes.</li> <li>4. Analyze the structural behaviour and design requirements of residential buildings to prepare complete structural design documentation.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                             |             |      |
| <b>Experiments</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                             |             |      |
| <ol style="list-style-type: none"> <li>1. <b>Building Planning and Line Diagram Preparation:</b> Study the functional requirements of a residential building, plot orientation, Vastu principles, municipal bye-laws, setbacks, FAR, and prepare the line diagram for a Stilt + Ground + First Floor residential building.</li> <li>2. <b>Preparation of Architectural Working Drawings Using AutoCAD:</b> Develop the detailed floor plans from the line diagram with dimensions and prepare the final architectural working drawings.</li> <li>3. <b>Development of Structural Grid and Beam-Column Layout:</b> Prepare the structural grid, beam-column layout, and finalize the structural framing plan using AutoCAD.</li> <li>4. <b>Structural Modelling of Building Using ETABS:</b> Create the ETABS model by defining grids, storeys, material properties, section properties, and modelling beams, columns, slabs, and staircase.</li> <li>5. <b>Load Definition and Load Combinations in ETABS:</b> Define dead load, live load and other applicable loads, assign loads, and generate load combinations as per IS 875 and IS 456.</li> <li>6. <b>Structural Analysis of Building Using ETABS:</b> Perform structural analysis, verify model stability and connectivity, and review the overall structural response.</li> <li>7. <b>Interpretation of Structural Analysis Results:</b> Extract and interpret bending moment, shear force, axial force diagrams, slab stress contours, and identify critical structural members.</li> <li>8. <b>Design of Reinforced Concrete Structural Elements:</b> Design slabs, beams, and columns in ETABS as per IS 456:2000 and extract reinforcement details.</li> <li>9. <b>Design of Isolated Footings and Optimization of Structural Members:</b> Design isolated footings using column reactions, optimize member sizes based on design requirements, and verify design adequacy.</li> <li>10. <b>Preparation of Structural Design Report and Reinforcement Detailing:</b> Prepare</li> </ol> |                                             |             |      |

reinforcement detailing sketches and compile the complete structural design report, including drawings, analysis results, design outputs, and detailing for the residential building.

### COURSE OUTCOMES:

*After successfully completing the course, the student will be able to:*

|            |                                                                                                                                         |
|------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| <b>CO1</b> | Identify the planning requirements, building components, and structural framing system of a residential building.                       |
| <b>CO2</b> | Explain the procedures for developing architectural drawings, structural models, and load combinations using AutoCAD and ETABS.         |
| <b>CO3</b> | Perform structural analysis and design reinforced concrete members using ETABS and relevant Indian Standard codes.                      |
| <b>CO4</b> | Analyze the structural response and prepare reinforcement detailing and a complete structural design report for a residential building. |

### ASSESSMENT DETAILS (Both CIE and SEE)

| 1-Credit Lab Course                                                                                                                              |               |                       |                                                                                                                |
|--------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-----------------------|----------------------------------------------------------------------------------------------------------------|
| Assessment Type                                                                                                                                  | Maximum Marks | Minimum Passing Marks | Evaluation Details                                                                                             |
| CIE Practical (A)                                                                                                                                | 30            | -                     | Marks awarded for Weekly Conduction of Experiments and Submission of Laboratory records, scaled to 30 marks.   |
| CIE Practical Test (B)                                                                                                                           | 20            | -                     | Average of marks of Two tests, each conducted for 100 marks covering all experiments, scaled to 20.            |
| <b>Total CIE Practical (A+B)</b>                                                                                                                 | <b>50</b>     | <b>20</b>             | <b>Sum of Marks of Experiments, Record and Test shall be CIE marks awarded for a maximum of 50.</b>            |
| <b>SEE (C)</b>                                                                                                                                   | <b>50</b>     | <b>20</b>             | <b>SEE is a lab exam, conducted for 100 marks and scaled down to 50 marks. Exam duration shall be 3 hours.</b> |
| <b>CIE + SEE (A+B+C)</b>                                                                                                                         | <b>100</b>    | <b>40</b>             | Final marks shall be the sum of marks scored in Components A, B and C.                                         |
| <ul style="list-style-type: none"> <li>The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to appear for SEE.</li> </ul> |               |                       |                                                                                                                |

## Suggested Learning Resources:

### Textbooks

1. H. J. Shah and S. R. Karve, *Illustrated Design of Reinforced Concrete Buildings*, 1<sup>st</sup> ed. Pune, India: Structures Publications, 2008.
2. S. S. Bhavikatti, *Design of R.C.C. Structural Elements*, 3<sup>rd</sup> ed. New Delhi, India: New Age International Publishers, 2014.
3. S. Ramamrutham, *Design of Reinforced Concrete Structures*, 18<sup>th</sup> ed. New Delhi, India: Dhanpat Rai Publishing Company, 2012.

### Reference books

1. P. Dayaratnam, *Design of Reinforced Concrete Structures*, 2<sup>nd</sup> ed. New Delhi, India: Oxford & IBH Publishing Co. Pvt. Ltd., 2007.
2. Bureau of Indian Standards, *IS 456:2000 – Plain and Reinforced Concrete – Code of Practice*. New Delhi, India: Bureau of Indian Standards, 2000.
3. Bureau of Indian Standards, *IS 875 (Part 1):1987 – Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures, Part 1: Dead Loads*. New Delhi, India: Bureau of Indian Standards, 1987.
4. Bureau of Indian Standards, *IS 875 (Part 2):1987 – Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures, Part 2: Imposed Loads*. New Delhi, India: Bureau of Indian Standards, 1987.

| B.E. (Civil Engineering)<br>Outcome Based Education (OBE) and Choice Based Credit System (CBCS)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                             |             |      |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|-------------|------|
| Course Title                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | MATLAB Applications for Civil Engineering   |             |      |
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | BCVL657B                                    | Scheme      | 2024 |
| Type of Course                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Ability/ Skill Enhancement Course (AEC/SEC) | Semester    | VI   |
| Teaching Hours/Week (L:T:P)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | (0:0:2) 30 hrs/sem                          | CIE Marks   | 50   |
| Total Hours of Pedagogy per semester (L:T:P: TW& SL)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | (0:0:30:0) 30 hrs/sem                       | SEE Marks   | 50   |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1                                           | Total Marks | 100  |
| Examination type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Practical                                   | Exam Hours  | 3    |
| <b>COURSE LEARNING OBJECTIVES:</b><br><i>The purpose of the course is to enable the learner to:</i> <ol style="list-style-type: none"> <li>1. Understand the MATLAB environment, programming fundamentals, and computational tools used in engineering applications.</li> <li>2. Apply MATLAB programming constructs and numerical techniques for solving engineering problems.</li> <li>3. Analyze engineering data using statistical methods, visualization techniques, and regression models.</li> <li>4. Integrate MATLAB tools for civil engineering computations and data-driven applications.</li> </ol> |                                             |             |      |

### LIST OF EXPERIMENTS

| Sl. No. | Experiments                                                                                                                              |
|---------|------------------------------------------------------------------------------------------------------------------------------------------|
| 1       | Introduction to MATLAB Environment: Familiarization with the MATLAB interface, variables, data types, operators, and built-in functions. |
| 2       | Vectors and Matrix Operations: Creation and manipulation of vectors and matrices using MATLAB matrix functions.                          |
| 3       | Decision Making and Loops: Implementation of if, switch, for, and while statements for program control.                                  |
| 4       | Curve fitting & regression – fit material/load data and generate trendlines and design charts                                            |
| 5       | Solving Linear Systems: Solution of systems of linear equations using matrix operations and MATLAB built-in functions.                   |
| 6       | Data Import and Statistics: Importing Excel/CSV data and performing basic statistical analysis.                                          |
| 7       | Data Visualization: Creating and customizing 2D plots, bar charts, histograms, and scatter plots.                                        |
| 8       | Curve Fitting and Regression: Performing polynomial fitting, interpolation, and linear regression.                                       |

|    |                                                                                                                      |
|----|----------------------------------------------------------------------------------------------------------------------|
| 9  | Numerical Methods: Solving engineering problems using root finding, interpolation, differentiation, and integration. |
| 10 | Mini Project: Development of a simple MATLAB application for a civil engineering problem.                            |

### COURSE OUTCOMES:

*After successfully completing the course, the student will be able to:*

|            |                                                                          |
|------------|--------------------------------------------------------------------------|
| <b>CO1</b> | Describe MATLAB programming fundamentals and computational tools.        |
| <b>CO2</b> | Implement MATLAB techniques for engineering computations.                |
| <b>CO3</b> | Examine engineering data using statistical and visualization techniques. |
| <b>CO4</b> | Integrate MATLAB tools for civil engineering applications.               |

### ASSESSMENT DETAILS (Both CIE and SEE)

| Assessment Type                                                                                | Maximum Marks | Minimum Passing Marks | Evaluation Details                                                                                             |
|------------------------------------------------------------------------------------------------|---------------|-----------------------|----------------------------------------------------------------------------------------------------------------|
| CIE Practical (A)                                                                              | 30            | -                     | Marks awarded for Weekly Conduction of Experiments and Submission of Laboratory records, scaled to 30 marks.   |
| CIE Practical Test (B)                                                                         | 20            | -                     | Average of marks of Two tests, each conducted for 100 marks covering all experiments, scaled to 20.            |
| <b>Total CIE Practical (A+B)</b>                                                               | <b>50</b>     | <b>20</b>             | <b>Sum of Marks of Experiments, Record and Test shall be CIE marks awarded for a maximum of 50.</b>            |
| <b>SEE (C)</b>                                                                                 | <b>50</b>     | <b>20</b>             | <b>SEE is a lab exam, conducted for 100 marks and scaled down to 50 marks. Exam duration shall be 3 hours.</b> |
| <b>CIE + SEE (A+B+C)</b>                                                                       | <b>100</b>    | <b>40</b>             | <b>Final marks shall be the sum of marks scored in Components A, B and C.</b>                                  |
| The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to appear for SEE. |               |                       |                                                                                                                |

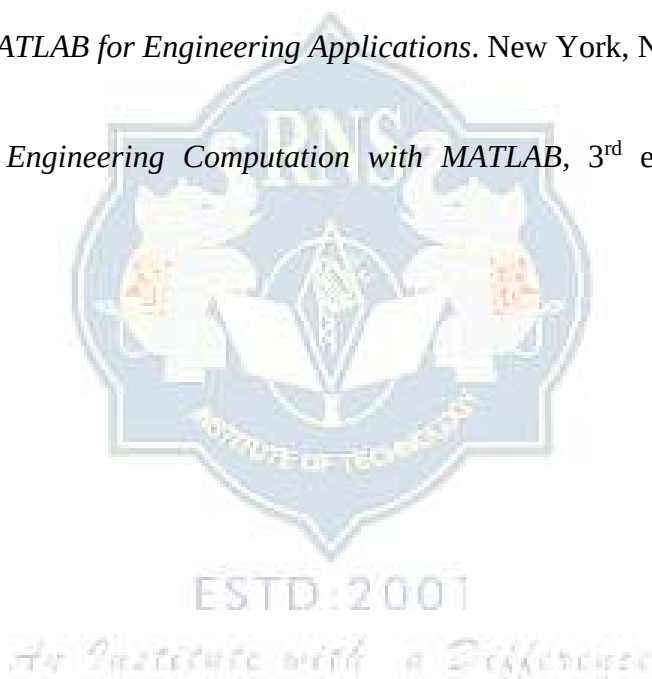
## Suggested Learning Resources:

### Textbooks

1. R. Pratap, *Getting Started with MATLAB: A Quick Introduction for Scientists and Engineers*. New York, NY, USA: Oxford University Press, 2010.
2. R. Pratap, *MATLAB 7 for Engineers*. New York, NY, USA: Oxford University Press, 2006.
3. B. M. K. Babu, *MATLAB Programming with Applications to Engineering*. Chennai, India: Scitech Publications (India), 2006.

### Reference books:

1. W. Palm III, *MATLAB for Engineering Applications*. New York, NY, USA: McGraw-Hill, 2018.
2. D. M. Smith, *Engineering Computation with MATLAB*, 3<sup>rd</sup> ed. Boston, MA, USA: Pearson, 2013.



| B.E. (Civil Engineering)<br>Outcome-Based Education (OBE) and Choice-Based Credit System (CBCS)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                   |             |      |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|------|
| Course Title:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Quantum GIS Lab                                                                                                                                                   |             |      |
| Course Code:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | BCVL657C                                                                                                                                                          | Scheme      | 2024 |
| Type of Course                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Ability/ Skill Enhancement Course (AEC/SEC)                                                                                                                       | Semester    | VI   |
| Teaching Hours/Weeks (L:T : P)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | (0:0:2) 30 hrs/sem                                                                                                                                                | CIE Marks   | 50   |
| Total Hours of Pedagogy per semester (L:T:P: TW& SL)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | (0:0:30:0) 30 hrs/sem                                                                                                                                             | SEE Marks   | 50   |
| Credits:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 1                                                                                                                                                                 | Total Marks | 100  |
| Examination type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Practical                                                                                                                                                         | Exam Hours  | 3    |
| <b>COURSE LEARNING OBJECTIVES:</b><br><i>The purpose of the course is to facilitate the learner to:</i> <ol style="list-style-type: none"> <li>1. Understand geospatial data models, coordinate reference systems, and the QGIS environment for spatial data management.</li> <li>2. Develop geospatial datasets through digitization, georeferencing, and raster-vector data processing techniques.</li> <li>3. Evaluate geospatial information using image interpretation, thematic mapping, and spatial analysis tools.</li> <li>4. Create cartographic products and terrain models for civil engineering and environmental applications.</li> </ol> |                                                                                                                                                                   |             |      |
| Sl. No.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Experiments                                                                                                                                                       |             |      |
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Introduction to QGIS, loading spatial data, and Digitization of Maps/Topo sheets using point, line, and polygon features.                                         |             |      |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Georeferencing scanned maps/topo sheets and understanding Coordinate Reference Systems (CRS) and map projections.                                                 |             |      |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Working with Raster and Vector Data: loading, visualization, attribute editing, querying, and layer management.                                                   |             |      |
| 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Image Interpretation and Classification using satellite imagery through visual interpretation and basic supervised/unsupervised classification concepts.          |             |      |
| 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Creation of Thematic Maps using symbology, labelling, graduated and categorized mapping techniques.                                                               |             |      |
| 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Satellite Imagery Interpretation for identification of land use/land cover, drainage, transportation, and built-up features.                                      |             |      |
| 7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Spatial Data Analysis: Estimation and interpretation of spatial features using geo processing tools such as Buffer, Clip, Dissolve, and Overlay Analysis.         |             |      |
| 8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Developing a Digital Elevation Model (DEM), terrain visualization, contour generation, slope analysis, and preparation of map layouts with cartographic elements. |             |      |

### COURSE OUTCOMES:

After completing the course, the student will be able to:

|            |                                                                                                                                    |
|------------|------------------------------------------------------------------------------------------------------------------------------------|
| <b>CO1</b> | Demonstrate the ability to digitize maps, georeferenced spatial data, and organize raster and vector datasets using QGIS.          |
| <b>CO2</b> | Analyze satellite imagery to identify spatial features and prepare thematic maps using appropriate visualization techniques.       |
| <b>CO3</b> | Assess the suitability of geospatial analysis tools for interpreting spatial relationships and solving basic engineering problems. |
| <b>CO4</b> | Develop Digital Elevation Models (DEMs) and produce publication-quality maps incorporating standard cartographic elements.         |

### ASSESSMENT DETAILS (Both CIE and SEE)

| Assessment Type                                                                                | Maximum Marks | Minimum Passing Marks | Evaluation Details                                                                                                                     |
|------------------------------------------------------------------------------------------------|---------------|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| CIE Practical (A)                                                                              | 30            | –                     | Marks awarded for weekly conduct of experiments and submission of laboratory records, scaled to 30 marks.                              |
| CIE Practical Test (B)                                                                         | 20            | –                     | Average of marks of two tests, each conducted for 100 marks covering all experiments, scaled to 20 marks.                              |
| <b>Total CIE Practical (A+B)</b>                                                               | 50            | 20                    | Sum of marks of experiments, record, and test shall be the CIE marks awarded for a maximum of 50.                                      |
| <b>SEE (C)</b>                                                                                 | 50            | 20                    | <b>SEE is a laboratory examination conducted for 100 marks and scaled down to 50 marks. The examination duration shall be 3 hours.</b> |
| <b>CIE + SEE (A+B+C)</b>                                                                       | 100           | 40                    | Final marks shall be the sum of marks scored in Components A, B, and C.                                                                |
| The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to appear for SEE. |               |                       |                                                                                                                                        |

## Text Books

1. Satheesh Gopi, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson Education India, Latest Edition.
2. M. Anji Reddy, Textbook of Remote Sensing and Geographical Information Systems, BS Publications, Latest Edition.
3. C. P. Loomba, Geographical Information System, Surendra Publications, Latest Edition.

## Reference Books

1. Kurt Menke, G. Smith, L. Pirelli and J. Van Hoesen, Mastering QGIS: Go Beyond the Basics and Unleash the Full Power of QGIS, Locate Press, Latest Edition.
2. Anita Graser, Learning QGIS: Create, Edit, Visualize, Analyze and Publish Geospatial Information, Packt Publishing, Latest Edition.
3. Erik Westra, Building Mapping Applications with QGIS, Packt Publishing, Latest Edition.
4. Marguerite Madden, Introduction to QGIS: A Practical Guide to Open Source Geographic Information Systems, CRC Press, Latest Edition.
5. Gary Sherman, The QGIS Training Manual, Open Source Geospatial Foundation (OSGeo), Latest Edition.

| B.E. (Civil Engineering)<br>Outcome Based Education (OBE) and Choice Based Credit System (CBCS)                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                   |             |      |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|------|
| Course Title                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Water Distribution Network Modelling With EPANET Lab                                                                                                                                              |             |      |
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | BCVL657D                                                                                                                                                                                          | Scheme      | 2024 |
| Type of Course                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Ability/ Skill Enhancement Course (AEC/SEC)                                                                                                                                                       | Semester    | VI   |
| Teaching Hours/Week (L:T:P)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | (0:0:2) 30 hrs/sem                                                                                                                                                                                | CIE Marks   | 50   |
| Total Hours of Pedagogy per semester (L:T:P: TW& SL)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | (0:0:2:0) 30 hrs/sem                                                                                                                                                                              | SEE Marks   | 50   |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1                                                                                                                                                                                                 | Total Marks | 100  |
| Examination type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Practical                                                                                                                                                                                         | Exam Hours  | 3    |
| <b>COURSE LEARNING OBJECTIVES:</b><br><i>The purpose of the course is to facilitate the learner to:</i> <ol style="list-style-type: none"> <li>1. Understand the components and operation of water distribution systems.</li> <li>2. Analyze the hydraulic behaviour of pipe networks under varying operating conditions.</li> <li>3. Evaluate the performance of storage reservoirs, pumps, valves, and water demand patterns in distribution systems.</li> <li>4. Develop water supply network models using EPANET for hydraulic analysis.</li> </ol> |                                                                                                                                                                                                   |             |      |
| Sl. No.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Set of Experiments (30 hrs)                                                                                                                                                                       |             |      |
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Introduction to EPANET Interface: Introduction to EPANET software, explore interface (toolbars, nodes, links), create a simple network, units (reservoir, junctions, pipes, valves, tanks).       |             |      |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Basic Hydraulic Network Modelling: Create a network with pipes and junctions, assign elevations and base demands, define pipe properties (length, diameter, roughness), Run hydraulic simulation. |             |      |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Analysis of Looped Distribution Network: Develop a looped water distribution network, assign hydraulic parameters, run simulation and observe flow distribution, analyse pressure variation.      |             |      |
| 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Head Loss Analysis: Assign varying pipe diameters and roughness values, run simulation, compare head loss across different pipes.                                                                 |             |      |
| 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Extended Period Simulation (EPS): Define demand patterns, set simulation duration, run EPS analysis, observe variation of parameters over time.                                                   |             |      |
| 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Pump Curves and Patterns Modelling: Add pump to the network, define pump characteristics/curve, introduce valves (PRV/FCV), Apply control settings and run simulation.                            |             |      |

|    |                                                                                                                                                                                                                     |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7  | Water Quality simulation basics: Constituent setup, reaction coefficients, and tracing a conservative tracer.                                                                                                       |
| 8  | Leak/closed pipe and Scenario: Introduce leakage at selected nodes, simulate system before and after leak, closure, identify alternate flows and critical links                                                     |
| 9  | Model calibration exercise: Compare simulated vs provided field pressures/flows, adjust demands or roughness to improve fit.                                                                                        |
| 10 | Case Study / Mini Project: Model a real or hypothetical water distribution system, perform demand and supply analysis, optimize pipe sizing or network design, evaluate system performance under varying conditions |

### COURSE OUTCOMES:

*After successfully completing the course, the student will be able to:*

|            |                                                                                                                 |
|------------|-----------------------------------------------------------------------------------------------------------------|
| <b>CO1</b> | Explain the components and operational principles of water distribution systems.                                |
| <b>CO2</b> | Analyze pressure, flow, velocity, and head loss in water distribution pipe networks.                            |
| <b>CO3</b> | Assess the performance of storage reservoirs, pumps, valves, and demand patterns in water distribution systems. |
| <b>CO4</b> | Develop hydraulic models of water distribution networks using EPANET.                                           |

### ASSESSMENT DETAILS (Both CIE and SEE)

| Assessment Type                  | Maximum Marks | Minimum Passing Marks | Evaluation Details                                                                                        |
|----------------------------------|---------------|-----------------------|-----------------------------------------------------------------------------------------------------------|
| CIE Practical (A)                | 30            | –                     | Marks awarded for weekly conduct of experiments and submission of laboratory records, scaled to 30 marks. |
| CIE Practical Test (B)           | 20            | –                     | Average of marks of two tests, each conducted for 100 marks covering all experiments, scaled to 20 marks. |
| <b>Total CIE Practical (A+B)</b> | <b>50</b>     | <b>20</b>             | <b>Sum of marks of experiments, record, and test shall be the CIE marks awarded for a maximum of 50.</b>  |

|                                                                                                |     |    |                                                                                                                                        |
|------------------------------------------------------------------------------------------------|-----|----|----------------------------------------------------------------------------------------------------------------------------------------|
| <b>SEE (C)</b>                                                                                 | 50  | 20 | <b>SEE is a laboratory examination conducted for 100 marks and scaled down to 50 marks. The examination duration shall be 3 hours.</b> |
| <b>CIE + SEE (A+B+C)</b>                                                                       | 100 | 40 | Final marks shall be the sum of marks scored in Components A, B, and C.                                                                |
| The minimum marks to be secured in CIE is 20 (40%) out of allotted 50 marks to appear for SEE. |     |    |                                                                                                                                        |

### Suggested Learning Resources:

#### Text Books

1. Rossman, L. A. EPANET 2 User's Manual / EPANET technical documentation. This is the core reference for hydraulic and water quality modelling in EPANET.
2. Walski, T. M., et al. Advanced Water Distribution Modeling and Management. A useful reference for network analysis, calibration, and operational studies.

#### Reference Books

1. Mays, L. W. Water Distribution Systems Handbook. Helpful for design principles, pressure management, and system planning.
2. AWWA manuals and selected civil engineering water supply texts for distribution network fundamentals and practical design guidance.

| B.E. (Civil Engineering)<br>Outcome Based Education (OBE) and Choice Based Credit System (CBCS)                                                                                                                                                                                                                                                                                                            |                          |             |              |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|-------------|--------------|
| Course Title                                                                                                                                                                                                                                                                                                                                                                                               | Indian Knowledge Systems |             |              |
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                | BIKS608                  | Scheme      | 2024         |
| Type of Course                                                                                                                                                                                                                                                                                                                                                                                             | Mandatory Course (MC)    | Semester    | VI           |
| Teaching Hours/Week (L:T:P)                                                                                                                                                                                                                                                                                                                                                                                | (1:0:0) 15 hrs/sem       | CIE Marks   | 100          |
| Total Hours of Pedagogy per semester (L:T:P: TW& SL)                                                                                                                                                                                                                                                                                                                                                       | (1:0:0:0) 15 hrs/sem     | SEE Marks   | -            |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                    | -                        | Total Marks | 100          |
| Examination type                                                                                                                                                                                                                                                                                                                                                                                           | Theory- MCQs             | Exam Hours  | 2            |
| <b>COURSE LEARNING OBJECTIVES:</b><br><i>The purpose of the course is</i> <ol style="list-style-type: none"> <li>To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system.</li> <li>To make the students understand the traditional knowledge and analyze it and apply it to their day-to-day life.</li> </ol> |                          |             |              |
| <b>Module-1</b>                                                                                                                                                                                                                                                                                                                                                                                            |                          |             | <b>5 hrs</b> |
| <b>Introduction to Indian Knowledge Systems (IKS):</b> Overview, Importance of ancient knowledge, The IKS corpus, Vedic Corpus, Philosophical systems, Character scope and importance, traditional knowledge vis-a-vis indigenous knowledge, traditional knowledge vs. western knowledge.                                                                                                                  |                          |             |              |
| <b>Module-2</b>                                                                                                                                                                                                                                                                                                                                                                                            |                          |             | <b>5 hrs</b> |
| <b>Fundamental concepts for science and technology:</b> Linguistics, Numbers and measurements- Mathematics, Chemistry, Physics, Art, Astronomy, Astrology, Crafts and Trade in India and Engineering and Technology.                                                                                                                                                                                       |                          |             |              |
| <b>Module-3</b>                                                                                                                                                                                                                                                                                                                                                                                            |                          |             | <b>5 hrs</b> |
| Traditional Knowledge in Professional Domain: Town planning and architecture, Construction, Health, wellness and Psychology-Medicine, Agriculture, Governance and Public administration.                                                                                                                                                                                                                   |                          |             |              |

### COURSE OUTCOMES:

*After successfully completing the course, the student will be able to:*

|     |                                                                                   |
|-----|-----------------------------------------------------------------------------------|
| CO1 | Provide an overview of the concept of the Indian Knowledge System and its         |
| CO2 | Appreciate the need for and importance of protecting traditional knowledge.       |
| CO3 | Recognize the relevance of Traditional knowledge in different domains.            |
| CO4 | Establish the significance of Indian Knowledge systems in the contemporary world. |

### ASSESSMENT DETAILS (CIE)

| Assessment Type           | Maximum Marks | Minimum Passing Marks | Evaluation Details                                                                                           |
|---------------------------|---------------|-----------------------|--------------------------------------------------------------------------------------------------------------|
| CIE – IA Tests (A)        | 40            | --                    | Each test will be conducted for 25 Marks adding upto 50 marks. Final test marks will be reduced to 40 Marks  |
| Experimental Learning (B) | 40            | ---                   | Case Study-based Teaching-Learning.<br>Video-based Seminar (4-5 minutes per student on a relevant IKS topic) |
| Quiz(C )                  | 20            | ---                   | Each quiz is evaluated for 10 marks adding up to 20 Marks.                                                   |
| Total CIE (A+B+C)         | 100           | 40                    | CIE Evaluation is done for a maximum of 100 marks                                                            |
|                           |               |                       |                                                                                                              |

### Suggested Learning Resources:

#### Text Book:

1. Introduction to Indian Knowledge System- concepts and applications, B Mahadevan, Vinayak Rajat Bhat, Nagendra Pavana R N, 2022, PHI Learning Private Ltd, ISBN-978-93- 91818-21-0M. M. Mano, Digital Logic and Computer Design. PHI Learning, 2008. ISBN: 978-81-203-0417-84.

#### Reference Books:

1. Traditional Knowledge System in India, Amit Jha, 2009, Atlantic Publishers and Distributors (P) Ltd., ISBN-13: 978-8126912230
2. Knowledge Traditions and Practices of India, Kapil Kapoor, Avadesh Kumar Singh, Vol. 1, 2005, DK Print World (P) Ltd., ISBN 81-246-0334

### Suggested Web Links:

1. <https://www.youtube.com/watch?v=LZP1StpYEPM>
2. <http://nptel.ac.in/courses/121106003/>  
<http://www.iitkgp.ac.in/departement/KS;jsessionid=C5042785F727F6EB46CBF432D7683B63>
3. (Centre of Excellence for Indian Knowledge System, IIT Kharagpur)
4. [https://www.wipo.int/pressroom/en/briefs/tk\\_ip.html](https://www.wipo.int/pressroom/en/briefs/tk_ip.html)
5. [https://unctad.org/system/files/official-document/ditcted10\\_en.pdf](https://unctad.org/system/files/official-document/ditcted10_en.pdf)
6. [http://nbaindia.org/uploaded/docs/traditionalknowledge\\_190707.pdf](http://nbaindia.org/uploaded/docs/traditionalknowledge_190707.pdf)  
[https://unfoundation.org/what-we-do/issues/sustainable-development-goals/?gclid=EAIaIQobChMIInp-Jtb\\_p8gIVTeN3Ch27LAmPEAAAYASAAEgIm1vD\\_BwE](https://unfoundation.org/what-we-do/issues/sustainable-development-goals/?gclid=EAIaIQobChMIInp-Jtb_p8gIVTeN3Ch27LAmPEAAAYASAAEgIm1vD_BwE)



| B.E. (Common to All Branches)<br>Outcome Based Education (OBE) and Choice Based Credit System (CBCS)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                               |             |      |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|-------------|------|
| Course Title                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | National Service Scheme (NSS) |             |      |
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | BNSK659                       | Scheme      | 2024 |
| Type of Course                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Mandatory Course (MC)         | Semester    | VI   |
| Teaching Hours/Week (L:T:P)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | (0:0:2) 30 hrs/sem            | CIE Marks   | 100  |
| Total Hours of Pedagogy per semester (L:T:P: TW& SL)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | (0:0:30:0) 30 hrs/sem         | SEE Marks   | -    |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | -                             | Total Marks | 100  |
| Examination type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | -                             | Exam Hours  | -    |
| <b>COURSE LEARNING OBJECTIVES:</b><br><i>The purpose of the course is to facilitate the learner to:</i> <ol style="list-style-type: none"> <li>1. Identify the needs and problems of the community and involve the problem-solving.</li> <li>2. Develop among them a sense of social &amp; civic responsibility &amp; utilize their knowledge in finding practical solutions to individual and community problems.</li> <li>3. Develop competence required for group-living and sharing of responsibilities &amp; gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.</li> </ol> |                               |             |      |
| <b>Module-1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                               |             |      |
| Waste management– Public, Private and Govt organization, 5 R's.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                               |             |      |
| <b>Module-2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                               |             |      |
| Automation of local Activities                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                               |             |      |
| <b>Module-3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                               |             |      |
| Organic farming, Indian Agriculture (Past, Present and Future), Connectivity for marketing.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                               |             |      |
| <b>Module-4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                               |             |      |
| Spreading public awareness under rural outreach Programs.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                               |             |      |
| <b>Module-5</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                               |             |      |
| Food preservation and Packaging                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                               |             |      |

### COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

|     |                                                                                                           |
|-----|-----------------------------------------------------------------------------------------------------------|
| CO1 | Understand the motto and concepts of NSS                                                                  |
| CO2 | Develop overall personality of volunteers and make them as leaders and responsible citizens of our nation |
| CO3 | Analyze the environmental and societal problems/issues and will be able to design solutions for the same. |
| CO4 | Communicate effectively with the community and with the officials.                                        |

### ASSESSMENT DETAILS (Both CIE and SEE)

| Assessment Type                                                                                                                                                                                              | Maximum Marks | Minimum Passing Marks | Evaluation Details                                                     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-----------------------|------------------------------------------------------------------------|
| Evaluation based on Reports (A)                                                                                                                                                                              | 100           | -                     | 5 modules Reports, 5 modules X 10 M each = 50 M                        |
| <b>Total CIE Theory (A)</b>                                                                                                                                                                                  | <b>100</b>    | <b>40</b>             |                                                                        |
| <b>SEE (B)</b>                                                                                                                                                                                               | -             | -                     | -                                                                      |
| <b>CIE+SEE (A+B)</b>                                                                                                                                                                                         | <b>100</b>    | <b>40</b>             | <b>Final marks shall be the sum of marks scored in Components A, B</b> |
| <ul style="list-style-type: none"> <li>The minimum marks to be secured in CIE is 40 out of allotted 50 marks with minimum 40 % scored in every component of CIE.</li> <li>No SEE for this subject</li> </ul> |               |                       |                                                                        |

### Suggested Learning Resources:

#### Reference Books:

- 1) NSS Course Manual, Published by NSS Cell, VTU Belagavi.
- 2) Government of Karnataka, NSS cell, activities reports and its manual.
- 3) Government of India, NSS cell, Activities reports and its manual.

#### Web links:

- 1) <https://nss.gov.in/>
- 2) <https://pledge.mygov.in/>

| B.E. (Common to All Branches)<br>Outcome Based Education (OBE) and Choice Based Credit System (CBCS)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                       |             |              |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|-------------|--------------|
| Course Title                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Physical Education    |             |              |
| Course Code                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | BPEK659               | Scheme      | 2024         |
| Type of Course                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Mandatory Course (MC) | Semester    | VI           |
| Teaching Hours/Week (L:T:P)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | (0:0:2) 30 hrs/sem    | CIE Marks   | 100          |
| Total Hours of Pedagogy per semester (L:T:P: TW& SL)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | (0:0:30:0) 30 hrs/sem | SEE Marks   | -            |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | -                     | Total Marks | 100          |
| Examination type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | -                     | Exam Hours  | -            |
| <b>COURSE LEARNING OBJECTIVES:</b><br><i>The purpose of the course is to facilitate the learner to:</i> <ol style="list-style-type: none"> <li>Understand the fundamental concepts of Physical Education, games and sports skills, Health, Nutrition and Fitness</li> <li>Familiarization of health-related Exercises, Sports for overall growth and development</li> <li>Participate in the competition at regional/state / national / international levels.</li> <li>Create consciousness among the students on Health, Fitness and Wellness in developing and maintaining a healthy lifestyle.</li> </ol> |                       |             |              |
| <b>Module-1: Athletics - Track Events</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                       |             | <b>3 hrs</b> |
| <b>110 Mtrs and 400Mtrs:</b><br>Hurdling Technique: Lead leg Technique, Trail leg Technique<br>Crouch start (its variations) use of Starting Block.                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                       |             |              |
| <b>Module-2: Athletics – Jumps</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                       |             | <b>3 hrs</b> |
| <b>High Jump</b> <ol style="list-style-type: none"> <li>Approach Run</li> <li>Take-off</li> <li>Bar Clearance (Straddle)</li> <li>Landing</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                       |             |              |
| <b>Module-3: Title: Athletics – Throws</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                       |             | <b>3 hrs</b> |
| <b>Discuss Throw</b> <ol style="list-style-type: none"> <li>Holding the Discus</li> <li>Initial Stance Primary Swing</li> <li>Rotation</li> <li>Release and Recovery (Rotation in the circle)</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                     |                       |             |              |
| <b>Module-4: Football</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                       |             | <b>3 hrs</b> |
| <b>A. Fundamental skills</b> <ol style="list-style-type: none"> <li>Kicking: Kicking the ball with inside of the foot, Kicking the ball with Full Instep of the foot, Kicking the ball with Inner Instep of the foot, Kicking the ball with Outer Instep of the foot and Lofted Kick.</li> <li>Trapping: Trapping- the Rolling ball, and the Bouncing ball with sole of the foot.</li> </ol>                                                                                                                                                                                                                 |                       |             |              |

3. Dribbling: Dribbling the ball with Instep of the foot, Dribbling the ball with Inner and Outer Instep of the foot.
4. Heading: In standing, running and jumping condition.
5. Throw-in: Standing throw-in and Running throw-in.
6. Tackling: Simple Tackling, Slide Tackling.
7. Goal Keeping: Collection of Ball, Ball clearance- kicking, throwing and deflecting.
8. Game practice with application of Rules and Regulations

### B. Rules and their interpretation and duties of the officials

#### Module-5: Hockey

3 hrs

#### A. Fundamental skills

1. Passing: Short pass, Long pass , push pass, hit
2. Trapping.
3. Dribbling and Dozing.
4. Penalty stroke practice.
5. Penalty corner practice.
6. Tackling: Simple Tackling, Slide Tackling.
7. Goal Keeping, Ball clearance- kicking, and deflecting.
8. Game practice with application of Rules and Regulations

#### B. Rules and their interpretation and duties of the officials

### COURSE OUTCOMES:

After successfully completing the course, the student will be able to:

|     |                                                                                                                                                                                      |
|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CO1 | Understand and demonstrate fundamental techniques of <b>track events</b> including 110m and 400m hurdles, with proper use of starting blocks and hurdling skills.                    |
| CO2 | Apply technical knowledge of <b>athletic jumps</b> , particularly high jump, including approach run, take-off, bar clearance, and landing techniques.                                |
| CO3 | Develop skills and perform <b>throwing events</b> , specifically discus throw, with correct techniques such as grip, stance, rotation, release, and recovery.                        |
| CO4 | Demonstrate fundamental skills of <b>football</b> such as kicking, trapping, dribbling, heading, throw-in, tackling, and goalkeeping along with understanding rules and regulations. |
| CO5 | Exhibit basic skills and techniques in <b>hockey</b> , including passing, trapping, dribbling, tackling, penalty strokes/corners, and understand rules and duties of officials.      |

### ASSESSMENT DETAILS (Both CIE and SEE)

| Assessment Type    | Maximum Marks | Minimum Passing Marks | Evaluation Details                                                       |
|--------------------|---------------|-----------------------|--------------------------------------------------------------------------|
| CIE – IA Tests (A) | 60            | ---                   | Sum of Two Internal Assessment Tests (MCQs) each conducted for 30 marks. |

|                                                                                                                                         |     |     |                                                   |
|-----------------------------------------------------------------------------------------------------------------------------------------|-----|-----|---------------------------------------------------|
| Project (B)                                                                                                                             | 40  | --- | -----                                             |
| Total CIE<br>(A+B)                                                                                                                      | 100 | 40  | CIE Evaluation is done for a maximum of 100 marks |
| <ul style="list-style-type: none"> <li>The minimum marks to be secured in CIE is 40 (40%) out of 100 marks allotted to Pass.</li> </ul> |     |     |                                                   |

### Suggested Learning Resources:

#### Textbooks

1. Health and Physical Education by V.K. Sharma
2. Introduction to Physical Education, Fitness, and Sport by Daryl Siedentop
3. Physical Education Activities, Sports and Games: The Origin and Background, Rules of Play, Teaching Hints and Fundamentals by Louis E. Means

#### Reference Books

1. Saraswati Health and Physical Education Textbook
2. Foundations of Physical Education, Exercise Science and Sport by Deborah A. Wuest



| B.E. (Common to All Branches)                                                                                                                                                                                                                                                                                                                                                                           |                       |             |              |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|-------------|--------------|
| Outcome Based Education (OBE) and Choice Based Credit System (CBCS)                                                                                                                                                                                                                                                                                                                                     |                       |             |              |
| Course Title                                                                                                                                                                                                                                                                                                                                                                                            | Yoga                  |             |              |
| Course Code                                                                                                                                                                                                                                                                                                                                                                                             | BYOK659               | Scheme      | 2024         |
| Type of Course                                                                                                                                                                                                                                                                                                                                                                                          | Mandatory Course (MC) | Semester    | VI           |
| Teaching Hours/Week (L:T:P)                                                                                                                                                                                                                                                                                                                                                                             | (0:0:2) 30 hrs/sem    | CIE Marks   | 100          |
| Total Hours of Pedagogy per semester (L:T:P: TW& SL)                                                                                                                                                                                                                                                                                                                                                    | (0:0:30:0) 30 hrs/sem | SEE Marks   | -            |
| Credits                                                                                                                                                                                                                                                                                                                                                                                                 | -                     | Total Marks | 100          |
| Examination type                                                                                                                                                                                                                                                                                                                                                                                        | -                     | Exam Hours  | -            |
| <b>COURSE LEARNING OBJECTIVES:</b><br><i>The purpose of the course is to facilitate the learner to:</i><br><div><div>1. Physical, Mental &amp; spiritual Objectives of Yoga</div><div>2. Explain the meaning of Yoga.</div><div>3. Discuss the importance of the Yoga and its scope.</div><div>4. Describe the aims and objectives of Yoga.</div><div>5. Clarify the misconceptions on Yoga</div></div> |                       |             |              |
| <b>Module-1: Suryanamaskara</b>                                                                                                                                                                                                                                                                                                                                                                         |                       |             | <b>3 hrs</b> |
| Suryanamaskar 12 count 6 rounds<br><div><div>a) Suryanamaskar prayer.</div><div>b) Meaning, need &amp; Importance</div><div>c) Benefits of Suryanamaskara</div></div>                                                                                                                                                                                                                                   |                       |             |              |
| <b>Module-2: Yoga</b>                                                                                                                                                                                                                                                                                                                                                                                   |                       |             | <b>3 hrs</b> |
| <div><div>a) Meaning and definition.</div><div>b) Brief introduction of yogic practices for the common man</div><div>c) Rules and regulations</div><div>d) Misconceptions of Yoga</div></div>                                                                                                                                                                                                           |                       |             |              |
| <b>Module-3: Asanas - Sitting &amp; Standing:</b>                                                                                                                                                                                                                                                                                                                                                       |                       |             | <b>3 hrs</b> |
| Need & importance of different Asana, Asana its meaning by name, technique, precautionary measures and benefits of each asana.<br><div><div>Sitting</div><div><div>1 . Ardha Ushtrasana</div><div>2. Yogamudra in Padmasana</div></div></div> <div><div>Standing</div><div><div>1 . Hastapadasana</div><div>2. Utkatasana</div></div></div>                                                             |                       |             |              |
| <b>Module-4: Asanas - Supine line</b>                                                                                                                                                                                                                                                                                                                                                                   |                       |             | <b>3 hrs</b> |
| Need & importance of different Asana, Asana its meaning by name, technique, precautionary measures and benefits of each asana.<br><div><div>Supine line</div><div><div>1 . Sarvangasana</div><div>2. Chakraasana</div></div></div>                                                                                                                                                                      |                       |             |              |
| <b>Module-5: Pranayama</b>                                                                                                                                                                                                                                                                                                                                                                              |                       |             | <b>3 hrs</b> |

Kapalabhati - Revision of practice 40 strokes/min - 3 rounds

Pranayama -- 1. Ujjayi  
2. Sheetali

Meaning, Need, importance of Pranayama. Different types. Meaning by name, technique, precautionary measures and benefits of each Pranayama





ESTD:2001

*An Institute with a Difference*