



MOOGAMBIGAI CHARITABLE AND EDUCATIONAL TRUST

# Rajarajeswari College of Engineering

(An Autonomous Institution under Visvesvaraya Technological University, Belagavi)

#14, Ramohalli Cross, Kumbalagodu, Mysore Road, Bengaluru-560074



## Civil Engineering

III & IV Semester Scheme and Syllabus

(2025 Scheme)

## **VISION**

To empower young minds through technology, research and innovation, to produce technically competent and socially responsible professionals in higher education.

## **MISSION**

1. To deliver excellence in education through innovative teaching, impactful research, and continuous skill development, preparing students to meet global challenges with technical expertise and ethical responsibility.
2. To foster a transformative learning environment that integrates technology, research and practical experience, empowering students to become skilled professionals and socially conscious leaders.
3. To cultivate a culture of lifelong learning and professional excellence by encouraging creativity, research, and community engagement, equipping students with the skills to thrive in a dynamic world.
4. To provide a holistic educational experience that combines advanced technology, hands-on research, and community-focused learning, shaping students into competent, ethical professionals who contribute positively to society.

## **QUALITY POLICY**

Rajarajeswari College of Engineering is committed to imparting quality technical education that nurtures competent, ethical professionals with global relevance. We ensure academic excellence through a dynamic, outcome-based curriculum, experienced faculty, and cutting-edge infrastructure. Continuous improvement is driven by innovation, research and strong industry collaboration. We foster holistic development and a progressive environment that supports lifelong learning, teamwork, and professional growth.

## **CORE VALUES**

Academic Excellence, Integrity, Innovation, Global Competence, Continuous Improvement.

# Civil Engineering

## DEPARTMENT VISION

To initiate graduate and research programmes in civil engineering for the country's long-term growth and sustainable development.

## DEPARTMENT MISSION

1. To generate high skilled civil engineers with moral principles who can benefit society.
2. Transforming the department into a premier hub for civil engineer and allied research.
3. To offer community support in all facets of civil engineering and provide consultancy services.
4. To encourage young engineers to think creative and innovative to meet potential challenges in the civil engineering career

# PROGRAM OUTCOMES (POs)

**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.

**PO2: Problem Analysis:** Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

**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)

**PO4: Conduct Investigations of Complex Problems:** Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modeling, analysis & interpretation of data to provide valid conclusions. (WK8).

**PO5: Engineering Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modeling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

**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, WK7).

**PO7: Ethics:** Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

**PO8: Individual and Collaborative Team work:** Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

**PO9: Communication:** Communicate effectively and inclusively within the 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

**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.

**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)

## **PROGRAM EDUCATIONAL OBJECTIVES (PEOs)**

**PEO1:** Demonstrate proficiency in applying fundamental mathematical, scientific and engineering principles in identifying, formulating, analyzing and solving civil engineering problems.

**PEO2:** To achieve expertise in design and analysis of various civil engineering structures.

**PEO3:** Exhibit professionalism, ethical attitude, communication skills, team work in their profession and adapt to current trends by engaging in lifelong learning.

## **PROGRAM SPECIFIC OUTCOMES (PSOs)**

**PSO1: Competence in Civil Engineering:** Educating students with fundamental mathematical, scientific, and Engineering knowledge to have a significant and positive long-term impact on the field of civil engineering.

**PSO2: Usage of Cutting Edge Technology:** Inspiring students and preparing them for successful professional careers using appropriate techniques, resources and modern attitudes and modeling to complex engineering activities with practical knowledge and research exposure.

**PSO3: Continuous improvement:** Motivate students in learning to learn and the ability to keep learning for a lifetime to increase their professionalism, update and deepen their knowledge through the development of the profession.

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**DEPARTMENT OF CIVIL ENGINEERING**

Scheme of Teaching and Examinations – 2025 Scheme  
 Outcome Based Education (OBE) and Choice Based Credit System (CBCS)



**III Semester**

**Academic Year: 2026-27**

| S.No  | Course Category and Course Code |                    | Course Title                                                                       | TD/ PSB         | Teaching Hours / Semester |          |           |               | Examination |           |             |                       | Credits |
|-------|---------------------------------|--------------------|------------------------------------------------------------------------------------|-----------------|---------------------------|----------|-----------|---------------|-------------|-----------|-------------|-----------------------|---------|
|       |                                 |                    |                                                                                    |                 | Lecture                   | Tutorial | Practical | Self-Learning | CIE Marks   | SEE Marks | Total marks | SEE Duration in hours |         |
|       |                                 |                    |                                                                                    |                 | L                         | T        | P         | S             |             |           |             |                       |         |
| 1.    | ASC                             | B25MCR301          | Probability, Statistics and Complex variables                                      | Maths           | 42                        | 28       | 0         | 50            | 50          | 50        | 100         | 3                     | 4       |
| 2.    | PCC                             | B25CV302           | Strength of Materials                                                              | CV              | 42                        | 0        | 0         | 48            | 50          | 50        | 100         | 3                     | 3       |
| 3.    | IPCC                            | B25CV303           | Advanced Surveying                                                                 | CV              | 42                        | 0        | 28        | 50            | 50          | 50        | 100         | 3                     | 4       |
| 4.    | PCC                             | B25CV304           | Engineering Geology                                                                | CV              | 42                        | 0        | 0         | 48            | 50          | 50        | 100         | 3                     | 3       |
| 5.    | PCC                             | B25CV305           | Building Materials and Construction                                                | CV              | 42                        | 0        | 0         | 48            | 50          | 50        | 100         | 3                     | 3       |
| 6.    | PCCL                            | B25CVL306          | Building Materials Lab                                                             | CV              | 0                         | 0        | 28        | 2             | 50          | 50        | 100         | 3                     | 1       |
| 7.    | AEC                             | B25CVL307          | Engineering Geology Lab                                                            | CV              | 0                         | 0        | 28        | 2             | 50          | 50        | 100         | 3                     | 1       |
| 8.    | SDC                             | B25CVP308          | Community / Societal project                                                       | CV              | 0                         | 0        | 0         | 30            | 50          | 50        | 100         | 3                     | 1       |
| 9.    | NCMC                            | B25MAD309          | Additional Mathematics - I                                                         | Maths           | 42                        | 0        | 0         | 0             | 100         | -         | 100         | -                     | PP      |
| 10.   | NCMC                            | B25NSK310A/B/C/D/E | National Service Scheme /National Cadet Corps / Physical Education<br>Yoga / Music | HSS             | 0                         | 0        | 0         | 28            | 100         | -         | 100         |                       | PP      |
| 11.   | SEC                             | B25SKL300          | Skill Laboratory                                                                   | Concerned Dept. | 0                         | 0        | 30        | 0             | 100         | -         | 100         | -                     | 1       |
| TOTAL |                                 |                    |                                                                                    |                 |                           |          |           |               | 700         | 400       | 1100        |                       | 21      |

BSC: Basic Science Course, HSMC: Humanity, Social sciences including Management courses, IPCC: Integrated Professional Core Course, PCC: Professional Core Course, PCCL: Professional Core Course laboratory, NCMC: Non-Credit Mandatory Course, AEC: Ability Enhancement Course, SDC: Skill Development Course, L: Lecture, T: Tutorial, P: Practical, Self-Learning, S:SDA- Skill Development Activity, CIE: Continuous Internal Evaluation, SEE: Semester End Evaluation, PP: Pass, NP: Not Pass, XX: Programme Code (EC, CS, IS etc.), Y: A/B/C/D, K: Indicates Common Course to all the streams of Engineering



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**NSS / NCC / PE / Yoga / Music:** All students are required to register for any one of the following courses: National Service Scheme/National Cadet Corps/Physical Education/Yoga/ Music - with the respective course coordinator during the first week of the third semester. College shall submit Continuous Internal Evaluation (CIE) marks for each semester based on the activities completed by students under these selected courses. Students may opt for different activities/options across semesters. For instance, a student participating in PE during 3<sup>rd</sup> semester may choose NSS in the 4<sup>th</sup> semester or Yoga. Activities shall be conducted over two semesters (III&IV), and successful completion of the registered course/or courses along with the required CIE score is mandatory for the award of the degree. Institutions must ensure that events are appropriately scheduled and reflected in the semester-wise calendar for NSS, PE, Music, and Yoga activities.

These courses shall not be considered for the calculation of SGPA or CGPA and for vertical progression. However, completion of course(s) is compulsory for degree eligibility.

**The course B25XX307Y** – Ability Enhancement Course Laboratory can be offered either as a single compulsory course. Alternatively, the course B25XX307Y - Ability Enhancement Course Laboratory shall be offered as multiple elective options under the course codes B25XX307Y (where Y = A/B/C/D)

**HOD**

**Dean-Academics**

**Principal**



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**IV Semester**

**Academic Year: 2026-27**

| S. No | Course Category and Course Code |                    | Course Title                                                                    | TD / PSB        | Teaching Hours / Semester |          |           |               | Examination |           |             |                       | Credits |
|-------|---------------------------------|--------------------|---------------------------------------------------------------------------------|-----------------|---------------------------|----------|-----------|---------------|-------------|-----------|-------------|-----------------------|---------|
|       |                                 |                    |                                                                                 |                 | Lecture                   | Tutorial | Practical | Self-Learning | CIE Marks   | SEE Marks | Total marks | SEE Duration in hours |         |
|       |                                 |                    |                                                                                 |                 | L                         | T        | P         | S             |             |           |             |                       |         |
| 1.    | PCC                             | B25CV401           | Analysis of Structures                                                          | CV              | 42                        | 28       | 0         | 50            | 50          | 50        | 100         | 3                     | 4       |
| 2.    | PCC                             | B25CV402           | Concrete Technology                                                             | CV              | 42                        | 28       | 0         | 50            | 50          | 50        | 100         | 3                     | 4       |
| 3.    | IPCC                            | B25CV403           | Fluid mechanics & Hydraulics                                                    | CV              | 42                        | 0        | 28        | 50            | 50          | 50        | 100         | 3                     | 4       |
| 4.    | PCC                             | B25CV404           | Transportation Engineering                                                      | CV              | 42                        | 0        | 0         | 48            | 50          | 50        | 100         | 3                     | 3       |
| 5.    | PCC                             | B25BEK405          | Biology for Engineers                                                           | CV              | 28                        | 0        | 0         | 2             | 50          | 50        | 100         | 2                     | 2       |
| 6.    | PCCL                            | B25CVL406          | Concrete and Highway Materials Laboratory                                       | CV              | 0                         | 0        | 28        | 2             | 50          | 50        | 100         | 3                     | 1       |
| 7.    | AEC                             | B25CVL407          | Sketchup Lab                                                                    | CV              | 0                         | 0        | 28        | 2             | 50          | 50        | 100         | 3                     | 1       |
| 8.    | BSC                             | B25CVP408          | Environmental Science Project                                                   | CV              | 0                         | 0        | 0         | 30            | 50          | 50        | 100         | 3                     | 1       |
| 9.    | NCMC                            | B25MAD409          | Additional Mathematics - II                                                     | CV              | 42                        | 0        | 0         | 0             | 100         | -         | 100         | -                     | PP      |
| 10.   | NCMC                            | B25NSK410A/B/C/D/E | National Service Scheme /National Cadet Corps / Physical Education Yoga / Music | HSS             | 0                         | 0        | 0         | 28            | 100         | -         | 100         |                       | PP      |
| 11.   | SEC                             | B25SKL400          | Skill Laboratory                                                                | Concerned Dept. | 0                         | 0        | 30        | 0             | 100         | -         | 100         | -                     | 1       |
| TOTAL |                                 |                    |                                                                                 |                 |                           |          |           |               | 700         | 400       | 1100        |                       | 21      |

BSC: Basic Science Course, IPCC: Integrated Professional Core Course, PCC: Professional Core Course, PCCL: Professional Core Course Laboratory, NCMC: Non-Credit Mandatory Course, AEC: Ability Enhancement Course, L: Lecture, T: Tutorial, P: Practical, S: Self-Learning, CIE: Continuous Internal Evaluation, SEE: Semester End Evaluation, PP: Pass, NP: Not Pass, XX: Programme Code (EC, CS, IS etc.), Y: A/B/C/D, K: Indicates Common Course to all the streams of Engineering.



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The course **B25XX407Y** – Ability Enhancement Course Laboratory can be offered either as a single compulsory course. Alternatively, the course **B25XX407Y** - Ability Enhancement Course Laboratory shall be offered as multiple elective options under the course codes **B25XX407Y** (where Y =A/B/C/D)

**Environmental Science Project:** The Environmental Science Project is an applied learning component designed to develop students' awareness, understanding, and responsibility toward the environment. It provides an opportunity to study real-world environmental issues and apply scientific and engineering principles to design feasible and sustainable solutions.

**HoD**

**Dean-Academics**

**Principal**



| Semester- III                                 |   |            |              |   |           |
|-----------------------------------------------|---|------------|--------------|---|-----------|
| Probability, Statistics and Complex Variables |   |            |              |   |           |
| Category: PCC                                 |   |            |              |   |           |
| (Common to RA & CV)                           |   |            |              |   |           |
| Course Code                                   | : | B25MCR301  | CIE          | : | 50 Marks  |
| Teaching Hours L : T : P : S                  | : | 42:28:0:50 | SEE          | : | 50 Marks  |
| Total Hours/Semester                          | : | 120        | Total        | : | 100 Marks |
| Credits                                       | : | 4          | SEE Duration | : | 3 Hrs     |

| Course Learning Objective is |                                                                                                                                     |
|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| 1.                           | To explain the basic concepts of probability, random variables, probability distribution                                            |
| 2.                           | Calculate and interpret correlation coefficients to determine the strength and direction of linear relationships between variables. |
| 3.                           | To develop mathematical model to integrate some non integrable functions using special theorems.                                    |
| 4.                           | To perform complex variables and to apply in signal transformation .                                                                |
| 5.                           | To ability to formulate a variational problem for a given geometric setting.                                                        |

| Module-1                                                                                                                                                                                                                                                                                                                                                                                                                 | No.of hrs |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Probability Distribution:</b> Review of basic probability theory. Random variables (discrete and continuous), Probability Mass and density functions. Mathematical expectation, mean and variance. Binomial, Poisson, Exponential and Normal distributions- problems (Derivations for mean and standard deviation for Binomial and Poisson distributions only)-Illustrative Examples.                                 | 14        |
| Module-2                                                                                                                                                                                                                                                                                                                                                                                                                 | No.of hrs |
| <b>Curve Fitting &amp; Statistical Methods:</b> Curve Fitting: Curve Fitting by the method of Least squares-fitting the curves of the Form: $y = ax + b$ , $y = ax^2 + bx + c$ and $y = ax^b$ .<br><b>Statistical Methods:</b> Introduction to moments, Skewness, Kurtosis and problems. Karl Pearson's coefficient of correlation and lines of Regression.                                                              | 14        |
| Module-3                                                                                                                                                                                                                                                                                                                                                                                                                 | No.of hrs |
| <b>Complex Variable –I:</b> Review of a function of a Complex variable, Limits, Continuity and Differentiability. Analytic function and It's properties, Cauchy-Riemann equations in Cartesian and Polar forms, Milne-Thomson method.<br><b>Transformations:</b> Conformal Transformations, Discussion of Transformations: $w = z^2$ , $w = e^z$ and $w = z + (1/z)$ ( $z \neq 0$ ). Bilinear transformations- problems. | 14        |
| Module-4                                                                                                                                                                                                                                                                                                                                                                                                                 | No.of hrs |
| <b>Complex Variable –II:</b> Complex Line Integral and It's properties, Cauchy's theorem, Consequences of Cauchy's theorem, Cauchy's integral formula, Generalized Cauchy's Integral formula, Laurent's series, Singularity and Residue, formulae for the Residue at the pole, Cauchy's Residue theorem (without proof) and problems.                                                                                    | 14        |
| Module-5                                                                                                                                                                                                                                                                                                                                                                                                                 | No.of hrs |
| <b>Calculus Of Variations:</b> Introduction to variation of functionals, Extremal of functional, Euler equation– Special cases, problems. Geodesics, Hanging cable and Brachistochrone problems.                                                                                                                                                                                                                         | 14        |

| Course Outcomes: At the end of the course, the students will be able to |                                                                                                                                      |
|-------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| CO1                                                                     | Apply probability concepts and distributions to engineering problems.                                                                |
| CO2                                                                     | Analyze statistical data using correlation and regression methods.                                                                   |
| CO3                                                                     | Apply the fundamental concepts of multivariate statistics, complex analysis, partial differential equations and variational problems |
| CO4                                                                     | Apply the concept of complex variables and their applications in signal transformation.                                              |
| CO5                                                                     | Apply the ideas of complex differentiation and integration for solving related problems through theoretical approach.                |

| Text Books |                                                                                                        |
|------------|--------------------------------------------------------------------------------------------------------|
| 1.         | B.S.Grewal: "Higher Engineering Mathematics", Khanna publishers, 44 <sup>th</sup> Ed. 2018             |
| 2.         | E.Kreyszig: "Advanced Engineering Mathematics", John Wiley & Sons, 8 <sup>th</sup> Ed. (Reprint), 2016 |



**Reference Text Books**

|    |                                                                                                                                                                                 |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | H. K. Dass, "Advanced Engineering Mathematics" S. Chand publication. 4. C. Ray Wylie, Louis C. Barrett : "Advanced Engineering Mathematics", 6 <sup>th</sup> Edition, 2. McGraw |
| 2. | C. Ray Wylie, Louis C. Barrett : "Advanced Engineering Mathematics", 6 <sup>th</sup> Edition, 2. McGraw                                                                         |
| 3. | B.V. Ramana: "Higher Engineering Mathematics" 11 <sup>th</sup> Edition, Tata McGraw-Hill, 208.                                                                                  |

**Web links and Video lectures (e-Resources)**

- <https://nptel.ac.in/courses/12286025>
- [VTUEDUSATPROGRAMME –20](#)
- [http://www.class-central.com/subject/math\(MOOCs\)](http://www.class-central.com/subject/math(MOOCs))

**ASSESSMENT STRUCTURE:**

The assessment in each course is divided equally between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each carrying 50% weightage. To qualify and become eligible to appear for SEE, in the CIE, a student must score at least 40% of 50 marks, i.e., 20 marks. To pass the SEE, a student must score at least 35% of 50 marks, i.e., 18 marks. Notwithstanding the above, a student is considered to have passed the course, provided the combined total of CIE and SEE is at least 40 out of 100 marks.

**CONTINUOUS INTERNAL EVALUATION (CIE):**

| CIE                | Type of Assessment                     | Max. Marks | Max. Marks Scaling Down to              | Total Marks |
|--------------------|----------------------------------------|------------|-----------------------------------------|-------------|
| Theory             | Internal Assessment1                   | 50         | 40<br>(Average of Best two Assessments) | 50          |
|                    | Internal Assessment2                   | 50         |                                         |             |
|                    | Internal Assessment3                   | 50         |                                         |             |
| AAT                | Any Two Assessments as per regulations | 20         | 10                                      |             |
| SEE                | Semester End Examination               | 100        | 50                                      | 50          |
| <b>Total Marks</b> |                                        |            |                                         | <b>100</b>  |

**SEMESTER END EXAMINATION (SEE):**

1. The Question paper for each course contains two parts, Part – A and Part – B.
2. Part – A consists of **Short Answer Questions** (2 Marks/1 mark) for 20 marks covering the complete syllabus and it is compulsory. Multiple Choice Questions are not allowed.
3. Part – B consists of 10 questions, two questions of 16 marks (with max. of 3 sub questions) from each module with internal choice. Students shall answer five full questions, selecting one full question from each module.

**CO-PO Mapping:**

| PO \ CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|
| CO1     | 3   | 2   | -   | -   | -   | 1   | -   | -   | -   | -    | -    |
| CO2     | 2   | 3   | -   | 1   | -   | -   | 1   | -   | -   | -    | -    |
| CO3     | 2   | 1   | -   | -   | -   | -   | -   | 1   | -   | -    | -    |
| CO4     | 1   | 1   | -   | -   | -   | -   | -   | -   | -   | -    | -    |

Level 3 - High, Level 2 – Moderate, Level 1 - Low



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**Departments of Civil Engineering**

| <b>Semester - III</b>        |   |                 |              |   |           |
|------------------------------|---|-----------------|--------------|---|-----------|
| <b>Strength of Materials</b> |   |                 |              |   |           |
| <b>Category: PCC</b>         |   |                 |              |   |           |
| Course Code                  | : | <b>B25CV302</b> | CIE          | : | 50 Marks  |
| Teaching Hours L : T : P : S | : | 42:0:0:48       | SEE          | : | 50 Marks  |
| Total Hours/Semester         | : | 90              | Total        | : | 100 Marks |
| Credits                      | : | 3               | SEE Duration | : | 3 Hrs     |

| <b>Course Learning Objective is</b> |                                                                                                                                                                                                    |
|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.                                  | To understand the basic concepts of the stresses and strains for different materials and strength of structural elements.                                                                          |
| 2.                                  | To understand compound stresses and stress distribution in thin and thick cylinders under pressure.                                                                                                |
| 3.                                  | To know the mechanical relationships between shear force, and bending moment for analyzing statically determinate beams under various loading conditions.                                          |
| 4.                                  | To analyze the theory of pure bending and transverse shear to derive stress distribution profiles for various beam sections and the derivation of buckling loads under various boundary condition. |
| 5.                                  | To master the mechanics of torsion in circular shafts, focusing on power transmission and evaluate material safety using established failure theories.                                             |

| <b>Module-1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>No. of Hours</b> |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| <b>Simple Stresses and Strain:</b> Introduction, Definition and concept and of stress and strain. Hooke's law, Stress-Strain diagrams for ferrous and non-ferrous materials, factor of safety, Elongation of tapering bars of circular and rectangular cross sections, Elongation due to self-weight. Saint Venant's principle, Compound bars, Temperature stresses, Compound section subjected to temperature stresses, state of simple shear, Elastic constants and their relationship.                                                                                                          | 9                   |
| <b>Module-2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>No. of Hours</b> |
| <b>Compound Stresses:</b> Introduction, state of stress at a point, General two-dimensional stress system, Principal stresses and principal planes. Mohr's circle of stresses.<br><b>Thin and Thick Cylinders:</b> Introduction, Thin cylinders subjected to internal pressure; Hoop stresses, Longitudinal stress and change in volume. Thick cylinders subjected to both internal and external pressure; Lamé's equation, radial and hoop stress distribution.                                                                                                                                   | 9                   |
| <b>Module-3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>No. of Hours</b> |
| <b>Shear Force and Bending Moment in Beams:</b> Introduction to types of beams, supports and loadings. Definition of bending moment and shear force, Sign conventions, relationship between load intensity, bending moment and shear force. Shear force and bending moment diagrams for statically determinate. beams subjected to points load, uniformly distributed loads, uniformly varying loads, couple and their combinations.                                                                                                                                                               | 8                   |
| <b>Module-4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>No. of Hours</b> |
| <b>Bending and Shear Stresses in Beams:</b> Introduction, pure bending theory, Assumptions, derivation of bending equation, modulus of rupture, section modulus, flexural rigidity. Expression for transverse. Shear stress in beams, Bending and shear stress distribution diagrams for circular, rectangular, and 'I', and. Shear centre(only concept).<br><b>Columns and Struts:</b> Introduction, short and long columns. Euler's theory; Assumptions, Derivation for Euler's Buckling load for different end conditions, Limitations of Euler's theory. Rankine-Gordon's formula for columns. | 8                   |
| <b>Module-5</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>No. of Hours</b> |
| <b>Torsion in Circular Shaft:</b> Introduction, pure torsion, Assumptions, derivation of torsion equation for circular shafts, torsional rigidity and polar modulus Power transmitted by a shaft, combined bending and torsion. <b>Theories of Failure:</b> Introduction, maximum principal stress theory (Rankine's theory), Maximum shearing stress theory (Tresca's theory), Strain energy theory (Beltrami and Haigh), and maximum strain theory (St. Venant's theory).                                                                                                                        | 8                   |

| <b>Course Outcomes:</b> At the end of the course, the students will be able to |                                                                                                                                                                    |
|--------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CO1                                                                            | Analyze deformations and principal stresses in varied geometries and pressure vessels to evaluate structural safety under complex loading conditions.              |
| CO2                                                                            | Ability to analyze principal stresses and evaluate hoop, longitudinal, and radial stresses in pressure vessels.                                                    |
| CO3                                                                            | Construct accurate Shear Force Diagrams (SFD) and Bending Moment Diagrams (BMD) for complex loading scenarios to identify critical sections for structural design. |



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|     |                                                                                                                                                                                                                     |
|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CO4 | Calculate flexural and shear stresses and. evaluate the load-carrying capacity of columns using Euler's and Rankine-Gordon formulas to prevent structural failure.                                                  |
| CO5 | Analyze shafts for torsional rigidity and determine structural adequacy by applying criteria such as <b>Rankine's</b> , <b>Tresca's</b> , and <b>St. Venant's</b> theories to prevent material yielding or rupture. |

| Text Books |                                                                                                            |
|------------|------------------------------------------------------------------------------------------------------------|
| 1.         | B.C Punmia Ashok Jain, Arun Jain, "Strength of Materials", Laxmi - 2018-22 Publications, 10th Edition-2018 |
| 2.         | R K Bansal, "A Textbook of Strength of Materials", 4 <sup>th</sup> Edition, Laxmi Publications, 2010       |
| 3.         | S SBhavikatti, "Strength of Materials" Vikas Publishing (5 <sup>th</sup> Edition).                         |

| Reference Text Books |                                                                                         |
|----------------------|-----------------------------------------------------------------------------------------|
| 1.                   | Timoshenko and Young, "Elements of Strength of Materials", Affiliated East-West Press.. |
| 2.                   | James M. Gere, "Mechanics of Materials (Fifth Edition)", Thomson Learning.              |
| 3.                   | A S Arunkumar, Sreekeesha, B V Ravishankar, "Mechanics of Materials", JK Publishers.    |
| 4.                   | I.B. Prasad, "Strength of Materials", Khanna Publisher.                                 |
| 5.                   | P N Chandramouli, "Fundamentals of Strength of Materials", PHI Learning Pvt. Ltd.       |
| 6.                   | Subramanian R, "Strength of Materials", Oxford University Press.                        |

#### ASSESSMENT STRUCTURE:

The assessment in each course is divided equally between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each carrying 50% weightage. To qualify and become eligible to appear for SEE, in the CIE, a student must score at least 40% of 50 marks, i.e., 20 marks. To pass the SEE, a student must score at least 35% of 50 marks, i.e., 18 marks. Notwithstanding the above, a student is considered to have passed the course, provided the combined total of CIE and SEE is at least 40 out of 100 marks.

#### CONTINUOUS INTERNAL EVALUATION (CIE):

| CIE         | Type of Assessment                     | Max. Marks | Max. Marks Scaling Down to              | Total Marks |
|-------------|----------------------------------------|------------|-----------------------------------------|-------------|
| Theory      | Internal Assessment 1                  | 50         | 40<br>(Average of Best two Assessments) | 50          |
|             | Internal Assessment 2                  | 50         |                                         |             |
|             | Internal Assessment 3                  | 50         |                                         |             |
| AAT         | Any Two Assessments as per regulations | 20         | 10                                      |             |
| SEE         | Semester End Examination               | 100        | 50                                      | 50          |
| Grand Total |                                        |            |                                         | 100         |

#### SEMESTER END EXAMINATION (SEE):

- The Question paper for each course contains two parts, Part – A and Part – B.
- Part – A consists of **Short Answer Questions** (2 Marks/1 mark) for 20 marks covering the complete syllabus and it is compulsory. Multiple Choice Questions are not allowed.
- Part – B consists of 10 questions, two questions of 16 marks (with max. of 3 sub questions) from each module with internal choice. Students shall answer five full questions, selecting one full question from each module.

#### CO-PO Mapping

| PO \ CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|
| CO1     | 3   | 1   | -   | 1   | -   | 1   | -   | -   | -   | -    | 2    |
| CO2     | 3   | 1   | -   | 1   | -   | 1   | -   | -   | -   | -    | 2    |
| CO3     | 3   | 1   | -   | 1   | -   | 1   | -   | -   | -   | -    | 2    |
| CO4     | 3   | 1   | -   | 1   | -   | 1   | -   | -   | -   | -    | 2    |
| CO5     | 3   | 1   | -   | 1   | -   | 1   | -   | -   | -   | -    | 2    |

Level 3 - High, Level 2 - Moderate, Level 1 - Low



| <b>Semester-III</b>          |   |                 |              |   |           |
|------------------------------|---|-----------------|--------------|---|-----------|
| <b>Advanced Surveying</b>    |   |                 |              |   |           |
| <b>Category: IPCC</b>        |   |                 |              |   |           |
| Course Code                  | : | <b>B25CV303</b> | CIE          | : | 50 Marks  |
| Teaching Hours L : T : P : S | : | 42:0:28:50      | SEE          | : | 50 Marks  |
| Total Hours/Semester         | : | 120             | Total        | : | 100 Marks |
| Credits                      | : | 4               | SEE Duration | : | 3Hrs      |

| <b>Course Learning Objective is</b> |                                                                                                                                                                                                                                  |
|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.                                  | To provide a fundamental understanding of surveying classifications and the evolution of measurement techniques, enabling students to select the most suitable traditional or electronic distance measurement (EDM) tools.       |
| 2.                                  | To develop technical proficiency in Theodolite techniques alongside modern total Station operations for the precise measurement of elevations, angles, areas, and volumes in engineering projects.                               |
| 3.                                  | To understand contouring and sectioning by integrating traditional instrumentation with total Station workflows and CAD software to produce professional engineering drawings.                                                   |
| 4.                                  | To master the geometric design and field execution of Horizontal and Vertical Curves and to perform accurate Earthwork estimations and Building layouts using traditional mathematical rules and modern Total Station workflows. |
| 5.                                  | To introduce advanced geospatial technologies, mapping and workflows for large-scale engineering projects.                                                                                                                       |

| <b>Module- 1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>No. of Hours</b> |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| <b>Introduction to Surveying:</b> Engineering surveying – Definition & importance of surveying for Civil Engineers. Surveying types- Control survey, Topographical surveying, Construction Survey, Cadastral survey, Hydrographic survey and Underground Survey. Surveying through the ages- Chain surveying, Compass surveying and Plane Table Surveying (concepts and limitations only).<br><b>Measurement of Distance:</b> Chain surveying, Various types of tapes, Laser distance meter, Distance measuring wheel, Electronic Distance measurement, GPS.                                                                                                                                                                                                 | 9                   |
| <b>Module- 2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>No. of Hours</b> |
| <b>Vertical Control:</b> Concepts of various types of Datum – Mean Sea level, Bench marks – Temporary and Permanent.<br><b>Levelling:</b> Terms used in levelling, Setting up of Dumpy level. Differential levelling by plane of collimation method using Dumpy level.<br><b>Theodolite Surveying:</b> Terms used in Theodolite surveying. Setting up a Theodolite. Measurement of horizontal and vertical angles with Theodolite.<br><b>Total Station Surveying:</b> Features, parts, accessories and advantages of Total Station. Surveying with total station – Measurement of Horizontal angle, vertical angle, distance, slope, vertical distance, multiple angles with Total station. Using Total station for Area measurement and Volume calculation. | 9                   |
| <b>Module- 3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>No. of Hours</b> |
| <b>Contours:</b> Definition, terms used, characteristics of contours and applications of contours in civil engineering practice. Contouring using level, Theodolite and total station. Plotting of contours in CAD.<br><b>Longitudinal and cross sectioning:</b> Definition, importance of L/S & C/S. L/S & C/S using level, Theodolite and Total station. Plotting of L/S & C/S in CAD.<br><b>Coordinate survey with Total station:</b> Measurement of coordinates using total station. Creating Job files, importance of back sight data, coordinate data recording. Data transferring, data refinement and plotting in CAD.                                                                                                                               | 8                   |
| <b>Module- 4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>No. of Hours</b> |
| <b>Curves –Types of Curves:</b> Application of curves in civil engineering. Setting out of Horizontal curve by Theodolite (Rankine's method) and using Total Station.<br>Theory: Components of Compound, Reverse curve. Transition Curve and Combined curve. Various types of vertical curves and its applications.<br><b>Areas and Volumes-</b> Methods of determining areas by trapezoidal and Simpsons' rule. Measurement of volume by prismoidal and trapezoidal formula. Earthwork volume calculations from spot levels and from contour maps; Earthwork calculation in Embankments.<br><b>Construction Surveying -</b> Setting out works using Total Station, Setting out buildings by Centre line method.                                             | 8                   |



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| Module– 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | No. of Hours |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| <b>GPS Surveying</b> – Introduction. Overview of GPS system- space, control and user segments. Reference co- ordinate systems. Absolute and Differential positioning with GPS. Gagan system in India. Types of GPS Receivers. Engineering survey using Differential GPS.<br><b>Surveying with Drone</b> – Introduction, applications and advantages. Features of photogrammetric mapping method. Drone surveying requirements- Drone platform, Flight planning software, Sensor. DGPS equipment and Image processing software. Types of drones and sensors. Process of drone surveying – flight planning, DGPS markers, capturing images, post processing of images using photogrammetry software and output maps. Application and uses of Remote sensing and GIS in engineering surveying. | 8            |

**LABORATORY**

| Sl. No | List of Experiments                                                                                                                                                                     |
|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.     | To conduct a chain survey of flat area with details including field book entry, perpendicular and offsets.                                                                              |
| 2.     | Distance measurement by Use of Various types of tapes, Laser distance meter.                                                                                                            |
| 3.     | Differential leveling by Dumpy level by plane of collimation method.                                                                                                                    |
| 4.     | Measurement of horizontal and vertical angles by Theodolite method of repetition.                                                                                                       |
| 5.     | Setting out simple curve using Rankine’s method using Theodolite.                                                                                                                       |
| 6.     | Setting out central line of a small residential building.                                                                                                                               |
| 7.     | Measurement of Distance, slope and vertical distance using Total station.                                                                                                               |
| 8.     | Measurement horizontal and vertical angles using Total station.                                                                                                                         |
| 9.     | Coordinate measurement with Total station.                                                                                                                                              |
| 10.    | Demonstration of Equipment’s used for chain, compass and plane table surveying, Visit to railway station/ large construction site to understand the importance of datum and bench mark. |

| <b>Course Outcomes:</b> At the end of the course, the students will be able to |                                                                                                                                                                                                                                            |
|--------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CO1                                                                            | Distinguish between various survey types (such as Cadastral, Hydrographic, and Underground) and evaluate the historical limitations of Chain, Compass, and Plane Table surveying in modern practice.                                       |
| CO2                                                                            | Perform precise vertical and horizontal measurements by operating Dumpy levels, Theodolites, and Total Stations to establish control points and compute critical engineering data, including elevations, angles, areas, and volumes.       |
| CO3                                                                            | Execute field surveys for Contouring, Longitudinal Sectioning (L/S), and Cross-Sectioning (C/S) using levels and Total Stations, then process the recorded Coordinate Data to generate accurate, industry-standard plots in CAD software.  |
| CO4                                                                            | Set out simple Circular, Transition, and Vertical curves using Rankine’s Method and Total Stations, while accurately computing Earthwork Volumes and Building Centerlines for construction projects using Trapezoidal and Simpson’s Rules. |
| CO5                                                                            | Execute high-accuracy surveys using Differential GPS (DGPS) and Drone platforms.                                                                                                                                                           |

| <b>Text Books</b> |                                                                                                                        |
|-------------------|------------------------------------------------------------------------------------------------------------------------|
| 1.                | Punmia B. C, “Surveying” Vol.I and Vol.II, Laxmi Publications, (P) Ltd, New Delhi 2010. ISBN81-7008-853-4              |
| 2.                | Duggal S. K, “Surveying”, Vol.I & II, Tata McGraw Hill Publishing Co., 2009, ISBN 978-0-07-015137-6; SBN0-07-015137-7. |

| <b>Reference Text Books</b> |                                                                                                                                                 |
|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.                          | Chandra A.M, “Plane surveying”, Newage International (P) Ltd., 2009. ISBN81-224-1902-X                                                          |
| 2.                          | Remote Sensing and GIS by B Bhatia, Oxford University Press, New Delhi                                                                          |
| 3.                          | Arora K. R, “Surveying”, Vol.I & II, Standard Book House, 2009. ISBN81-89401-23-8                                                               |
| 4.                          | Lillesand and Kiefer, “Principles of Remote sensing and Image Interpretation”, (5 <sup>th</sup> Edition) John Wiley Publishers, New Delhi, 2007 |



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**ASSESSMENT STRUCTURE:**

The assessment in each course is divided equally between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each carrying 50% weightage. To qualify and become eligible to appear for SEE, in the CIE, a student must score at least 40% of 50 marks, i.e., 20 marks. To pass the SEE, a student must score at least 35% of 50 marks, i.e., 18 marks. Notwithstanding the above, a student is considered to have passed the course, provided the combined total of CIE and SEE is at least 40 out of 100 marks.

**CONTINUOUS INTERNAL EVALUATION (CIE):**

| CIE                | Type of Assessment                    | Max. Marks                         | Max. Marks Scaling Down to              | Total Marks |
|--------------------|---------------------------------------|------------------------------------|-----------------------------------------|-------------|
| Theory             | Internal Assessment1                  | 50                                 | 40<br>(Average of Best two Assessments) | 50/2 = 25   |
|                    | Internal Assessment2                  | 50                                 |                                         |             |
|                    | Internal Assessment3                  | 50                                 |                                         |             |
| AAT                | Any One Assessment as per Regulations | 10+10                              | 10                                      |             |
| Laboratory         | Lab Conduction & Record               | Evaluating each expt. for 10 marks | 10                                      | 25          |
|                    | Lab Internal Test                     | 50                                 | 15                                      |             |
| SEE                | Semester End Examination              | 100                                | 50                                      | 50          |
| <b>Total Marks</b> |                                       |                                    |                                         | <b>100</b>  |

**SEMESTER END EXAMINATION (SEE):**

1. The Question paper for each course contains two parts, Part – A and Part – B.
2. Part – A consists of **Short Answer Questions** (2 Marks/1 mark) for 20 marks covering the complete syllabus and it is compulsory. Multiple Choice Questions are not allowed.
3. Part – B consists of 10 questions, two questions of 16 marks (with max. of 3 sub questions) from each module with internal choice. Students shall answer five full questions, selecting one full question from each module.
4. The laboratory component of the **integrated course** shall be CIE only. However, in SEE, the questions from the practical component shall be included.
5. The maximum marks from the practical component to be included in the SEE question paper is **16 marks**.
6. Question papers to be set as per the Blooms Taxonomy levels

**CO-PO Mapping:**

| PO \ CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|
| CO1     | 2   | 2   | 1   | 1   | 1   | 1   | -   | 1   | 1   | -    | 2    |
| CO2     | 2   | 2   | 1   | 1   | 1   | 1   | -   | 1   | 1   | -    | 2    |
| CO3     | 2   | 2   | 1   | 1   | 1   | 1   | -   | 1   | 1   | -    | 2    |
| CO4     | 2   | 2   | 1   | 1   | 1   | 1   | -   | 1   | 1   | -    | 2    |
| CO5     | 2   | 2   | 1   | 0   | 0   | 1   | -   | 0   | 1   | -    | 2    |

Level 3 - High, Level 2 - Moderate, Level 1 - Low



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| <b>Semester - III</b>        |   |                 |              |   |           |
|------------------------------|---|-----------------|--------------|---|-----------|
| <b>Engineering Geology</b>   |   |                 |              |   |           |
| <b>Category: PCC</b>         |   |                 |              |   |           |
| Course Code                  | : | <b>B25CV304</b> | CIE          | : | 50 Marks  |
| Teaching Hours L : T : P : S | : | 42:0:0:48       | SEE          | : | 50 Marks  |
| Total Hours/Semester         | : | 90              | Total        | : | 100 Marks |
| Credits                      | : | 3               | SEE Duration | : | 3 Hrs     |

| <b>Course Learning Objective is</b> |                                                                                                                                                                                              |
|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.                                  | To master Earth's internal dynamics and plate tectonics for analyzing natural hazards and designing disaster-resilient engineering solutions                                                 |
| 2.                                  | To understand the properties and classification of minerals and rocks to evaluate their engineering suitability for construction, masonry, and architectural applications.                   |
| 3.                                  | To evaluate weathering mechanisms and soil profiles to understand the mineralogical transformation of rocks and the engineering behavior of various soil types.                              |
| 4.                                  | To apply trigonometric and geometrical methods to borehole and outcrop data for analyzing structural features like folds and faults to ensure the integrity of tunnels, dams, and reservoirs |
| 5.                                  | To master the use of geospatial tools and geophysical methods to map geological structures and evaluate the groundwater potential of various rock aquifers.                                  |

| <b>Module-1</b>                                                                                                                                                                                                                                                                                                                                                                                             | <b>No. of Hours</b> |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| <b>Introduction, the scope of earth science in Engineering:</b> Earth's internal structure and composition, internal dynamics and Plate tectonics, Earthquakes - types, causes, co-seismic lines, seismiczonation, seismic proof structures. Volcanic eruption - types, causes. Landslides-causes types, preventive measures; Tsunami – causes, consequences, mitigation. Cyclones - causes and management. | 9                   |
| <b>Module-2</b>                                                                                                                                                                                                                                                                                                                                                                                             | <b>No. of Hours</b> |
| <b>Earth Materials in Construction:</b> Minerals -Industrial, rock-forming and ore minerals. Physical properties, composition. Rocks Types, structure/Texture, mineral composition occurrence, properties. Decorative (facing/polishing), railway ballast, rocks for masonry work, monumental/architecture, Dressing of stones, Requirement of good building stones.                                        | 9                   |
| <b>Module-3</b>                                                                                                                                                                                                                                                                                                                                                                                             | <b>No. of Hours</b> |
| <b>Earth Surface process and Resources:</b> Weathering, type, causes, soil in-situ, drifted soil, soil profile, soil mineralogy, structure, types of soil, Black cotton soil v/s Lateritic soil; effects of weathering on monumental rocks. Soil Horizon, Soil Classification by Grain Size.                                                                                                                | 8                   |
| <b>Module-4</b>                                                                                                                                                                                                                                                                                                                                                                                             | <b>No. of Hours</b> |
| <b>Surface and sub investigation for deep foundation:</b> Dip and strike, and outcrop problems (numerical problem geometrical/ simple trigonometry based), Borehole data(and problems), Faults, folds, unconformity, joints, types, recognition and their significance in Civil engineering projects like tunnel project, dam project, Reservoir site.                                                      | 8                   |
| <b>Module-5</b>                                                                                                                                                                                                                                                                                                                                                                                             | <b>No. of Hours</b> |
| <b>Modern Tools and geophysical methods:</b> Topographic maps, geologic maps, preparation of geologic sections, aerial photographs, LIDAR, SAR, GIS Rocks as aquifers, water-bearing properties igneous, sedimentary and metamorphic rocks, Electrical Resistivity meter, depth of water table, (numerical problems).                                                                                       | 8                   |

| <b>Course Outcomes:</b> At the end of the course, the students will be able to |                                                                                                                                                                                |
|--------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CO1                                                                            | Evaluate geological and climatic risks to implement effective mitigation strategies and seismic-proof structural designs.                                                      |
| CO2                                                                            | Identify, test, and process appropriate stone materials for diverse civil engineering needs based on their mineral composition and physical performance.                       |
| CO3                                                                            | Classify soils by grain size and mineralogy to address site-specific challenges, such as the stability of Black Cotton soil or the preservation of weathered monumental rocks. |
| CO4                                                                            | Solve structural orientation problems and interpret geological discontinuities to mitigate site-specific risks in heavy civil engineering infrastructure.                      |
| CO5                                                                            | Interpret remote sensing data and solve numerical resistivity problems to locate water tables and assess subsurface conditions for engineering and hydrogeological projects.   |



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| <b>Text Books</b> |                                                                                                                                    |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------|
| 1.                | Physical and Engineering Geology, by S.K. Garg, Khanna publishers                                                                  |
| 2.                | Engineering & General Geology For Be Civil Mining Metallurgy Bsc Pass & Amie by Parbin Singh (Author), SkKataria& Sons (Publisher) |
| 3.                | Introduction to Environmental Geology by Edward A Keller, Pearson publications.                                                    |

| <b>Reference Text Books</b> |                                                                                                       |
|-----------------------------|-------------------------------------------------------------------------------------------------------|
| 1.                          | Engineering Geology, by Parthasarathy et al, Wiley publications                                       |
| 2.                          | Principles Of Engineering Geology by Km Bangar (Author), Standard Publishers Distributors (Publisher) |
| 3.                          | Engineering Geology and Rock Mechanics B. P. Verma, Khanna publishers                                 |
| 4.                          | Principles of Engineering Geology and Geotechnics, Krynine and Judd, CBS Publications                 |

### **ASSESSMENT STRUCTURE:**

The assessment in each course is divided equally between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each carrying 50% weightage. To qualify and become eligible to appear for SEE, in the CIE, a student must score at least 40% of 50 marks, i.e., 20 marks. To pass the SEE, a student must score at least 35% of 50 marks, i.e., 18 marks. Notwithstanding the above, a student is considered to have passed the course, provided the combined total of CIE and SEE is at least 40 out of 100 marks.

### **CONTINUOUS INTERNAL EVALUATION (CIE):**

| CIE         | Type of Assessment                     | Max. Marks | Max. Marks Scaling Down to              | Total Marks |
|-------------|----------------------------------------|------------|-----------------------------------------|-------------|
| Theory      | Internal Assessment1                   | 50         | 40<br>(Average of Best two Assessments) | 50          |
|             | Internal Assessment2                   | 50         |                                         |             |
|             | Internal Assessment3                   | 50         |                                         |             |
| AAT         | Any Two Assessments as per regulations | 20         | 10                                      |             |
| SEE         | Semester End Examination               | 100        | 50                                      | 50          |
| Total Marks |                                        |            |                                         | 100         |

### **SEMESTER END EXAMINATION (SEE):**

1. The Question paper for each course contains two parts, Part – A and Part – B.
2. Part – A consists of **Short Answer Questions** (2 Marks/1 mark) for 20 marks covering the complete syllabus and it is compulsory. Multiple Choice Questions are not allowed.
3. Part – B consists of 10 questions, two questions of 16 marks (with max. of 3 sub questions) from each module with internal choice. Students shall answer five full questions, selecting one full question from each module.

### **CO-PO Mapping**

| PO \ CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|---------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|
| CO1     | 3   | 1   | -   | -   | -   | 1   | -   | -   | -   | -    | 1    |
| CO2     | 3   | 1   | -   | -   | -   | 1   | -   | -   | -   | -    | 1    |
| CO3     | 3   | 1   | -   | -   | -   | 1   | -   | -   | -   | -    | 1    |
| CO4     | 3   | 2   | -   | -   | -   | 1   | -   | -   | -   | -    | 1    |
| CO5     | 3   | 2   | -   | -   | -   | 1   | -   | -   | -   | -    | 1    |

Level 3 - High, Level 2 - Moderate, Level 1 - Low



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| <b>Semester - III</b>                      |   |                 |              |   |           |
|--------------------------------------------|---|-----------------|--------------|---|-----------|
| <b>Building Materials and Construction</b> |   |                 |              |   |           |
| <b>Category: PCC</b>                       |   |                 |              |   |           |
| Course Code                                | : | <b>B25CV305</b> | CIE          | : | 50 Marks  |
| Teaching Hours L : T : P : S               | : | 42:0:0:48       | SEE          | : | 50 Marks  |
| Total Hours/Semester                       | : | 90              | Total        | : | 100 Marks |
| Credits                                    | : | 3               | SEE Duration | : | 3 Hrs     |

| <b>Course learning Objective is</b> |                                                                                                                                                                                              |
|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.                                  | To introduce the properties, requirements, testing, and uses of stones, aggregates, and timber as essential building materials.                                                              |
| 2.                                  | To understand soil investigation, foundation systems, wall types, and basic structural elements such as lintels, arches, balconies, chajjas, and canopies.                                   |
| 3.                                  | To understand the requirements, components, and construction procedures of floors, roofs, and stairs in buildings.                                                                           |
| 4.                                  | To study the planning, materials, types, and standard sizes of doors and windows, and to understand the basics of formwork, scaffolding, shoring, and underpinning in building construction. |
| 5.                                  | To understand mortars, plastering and pointing techniques, damp-proofing methods, waterproofing, and painting materials and applications in building construction.                           |

| <b>Module-1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>No. of Hours</b> |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| <b>Stone:</b> Stone as building material, Requirement of good building stones, Dressing of stones, Deterioration and Preservation of stone work.<br><b>Fine aggregate:</b> Natural and manufactured: Sieve analysis, zoning, specify gravity, bulking, moisture content, deleterious materials.<br><b>Coarse aggregate:</b> Natural and manufactured: Importance of size, shape and texture. Grading of aggregates, Sieve analysis, specific gravity.<br><b>Timber:</b> Varieties and uses – defects in timber and causes of decay, Test for good timber, seasoning, Preservation & fire proofing, plywood & its uses. | 9                   |
| <b>Module-2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>No. of Hours</b> |
| <b>Foundation:</b> Preliminary investigation of soil, safe-bearing capacity of soil, Function and requirements of good foundation, types of foundation, introduction to spread, combined, strap, mat and pile foundation.<br><b>Types of walls:</b> Load bearing, partition walls, and cavity walls.<br><b>Lintels and Arches:</b> Definition, function and classification of lintels, Balconies, chejja and canopy. Arches; Elements and Stability of an Arch.                                                                                                                                                        | 9                   |
| <b>Module-3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>No. of Hours</b> |
| <b>Floors:</b> Requirement of good floor, Components of ground floor, Selection of flooring material Procedure for laying of Concrete (VDF), Mosaic, Kota, Slate, Marble, Granite, Tile flooring, Cladding of tiles.<br><b>Roof:</b> Requirement of good roof, Types of roof, Elements of apitchedroof, Trussedroof, King post Truss, Queen Post Truss, Steel Truss, Different roofing materials, R.C.C. Roof.<br><b>Stairs:</b> Definitions, technical terms and types of stairs: Wood, RCC, and Metal. Requirements of good stairs.                                                                                  | 8                   |
| <b>Module-4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>No. of Hours</b> |
| <b>Doors and Windows:</b> Location of doors and windows, technical terms, Materials for doors and windows: PVC, CPVC and Aluminum. Types of Doors and Windows: Paneled, Flush, Collapsible, Rolling shutter, Paneled and glazed Window, Bay Window, French window. Steel windows, Ventilators. Sizes as per IS recommendations.<br><b>Formwork:</b> Introduction to form work, scaffolding, shoring, underpinning.                                                                                                                                                                                                     | 8                   |
| <b>Module-5</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>No. of Hours</b> |
| <b>Plastering and Pointing:</b> Mortar and its types. Purpose, materials and methods of plastering and pointing: Sand faced plastering, Stucco plastering, lathe plastering, and defects in plastering. Water proofing with various thicknesses.<br><b>Damp proofing:</b> causes, effects and methods.<br><b>Paints:</b> Purpose, types, technical terms, ingredients and defects, Preparation and applications of paints to new and old plastered surfaces, wooden and steel surfaces.                                                                                                                                | 8                   |



| <b>Course Outcomes:</b> At the end of the course, the students will be able to |                                                                                                                                                                                  |
|--------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CO1                                                                            | Identify, test, and assess the suitability of stones, fine and coarse aggregates, and timber for construction applications.                                                      |
| CO2                                                                            | Select suitable foundations and wall types and explain the function and stability of lintels and arches in building construction.                                                |
| CO3                                                                            | Select suitable flooring, roofing, and stair systems and explain their construction methods and requirements in building practice.                                               |
| CO4                                                                            | Select and detail appropriate doors, windows, and ventilators as per IS recommendations and explain the functions and applications of formwork and temporary supporting systems. |
| CO5                                                                            | Identify suitable mortars, execute plastering, damp-proofing, waterproofing, and painting works, and recognize common defects and their remedies.                                |

| <b>Text Books</b> |                                                                                                                      |
|-------------------|----------------------------------------------------------------------------------------------------------------------|
| 1.                | Dr. B. C. Punmia, Ashok kumar Jain, Arun Kumar Jain, “Building Construction, Laxmi Publications (P) Ltd., New Delhi. |
| 2.                | Sushil Kumar “Building Materials and construction”, 20 <sup>th</sup> edition, reprint 2015, Standard Publishers.     |
| 3.                | Dr. B. C. Punmia, Ashok kumar Jain, Arun Kumar Jain, “Building Construction, Laxmi Publications (P) Ltd., New Delhi. |

| <b>Reference Text Books</b> |                                                                                                                                     |
|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| 1.                          | S. K. Duggal, “Building Materials”, (Fourth Edition) New Age International (P) Limited, 2016 National Building Code (NBC) of India. |
| 2.                          | P C Vergese, “Building Materials”, PHI Learning Pvt.Ltd.                                                                            |
| 3.                          | Building Materials and Components, CBRI, 1990, India.                                                                               |
| 4.                          | Rangawala S. C. “Engineering Materials”, Charter Publishing House, Anand, India.                                                    |

### **ASSESSMENT STRUCTURE:**

The assessment in each course is divided equally between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each carrying 50% weightage. To qualify and become eligible to appear for SEE, in the CIE, a student must score at least 40% of 50 marks, i.e., 20 marks. To pass the SEE, a student must score at least 35% of 50 marks, i.e., 18 marks. Notwithstanding the above, a student is considered to have passed the course, provided the combined total of CIE and SEE is at least 40 out of 100 marks.

### **CONTINUOUS INTERNAL EVALUATION (CIE):**

| CIE                | Type of Assessment                     | Max. Marks | Max. Marks Scaling Down to              | Total Marks |
|--------------------|----------------------------------------|------------|-----------------------------------------|-------------|
| Theory             | Internal Assessment1                   | 50         | 40<br>(Average of Best two Assessments) | 50          |
|                    | Internal Assessment2                   | 50         |                                         |             |
|                    | Internal Assessment3                   | 50         |                                         |             |
| AAT                | Any Two Assessments as per regulations | 20         | 10                                      |             |
| SEE                | Semester End Examination               | 100        | 50                                      | 50          |
| <b>Total Marks</b> |                                        |            |                                         | <b>100</b>  |

### **SEMESTER END EXAMINATION (SEE):**

- The Question paper for each course contains two parts, Part – A and Part – B.
- Part – A consists of **Short Answer Questions** (2 Marks/1 mark) for 20 marks covering the complete syllabus and it is compulsory. Multiple Choice Questions are not allowed.
- Part – B consists of 10 questions, two questions of 16 marks (with max. of 3 sub questions) from each module with internal choice. Students shall answer five full questions, selecting one full question from each module.



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**CO-PO Mapping**

| PO<br>CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|
| CO1      | -   | -   | -   | -   | 1   | 1   | -   | 1   | -   | 1    | -    |
| CO2      | -   | -   | -   | -   | 1   | 1   | -   | 1   | -   | 1    | -    |
| CO3      | -   | -   | -   | -   | 1   | 1   | -   | 1   | -   | 1    | -    |
| CO4      | -   | -   | -   | -   | 1   | 1   | -   | 1   | -   | 1    | -    |
| CO5      | -   | -   | -   | -   | 1   | 1   | -   | 1   | -   | 1    | -    |

Level 3 - High, Level 2 - Moderate, Level 1 - Low



**Department of Civil Engineering**

| <b>Semester-III</b>           |   |                  |              |   |           |
|-------------------------------|---|------------------|--------------|---|-----------|
| <b>Building Materials Lab</b> |   |                  |              |   |           |
| <b>Category: PCCL</b>         |   |                  |              |   |           |
| Course Code                   | : | <b>B25CVL306</b> | CIE          | : | 50 Marks  |
| Teaching Hours L : T : P : S  | : | 0:0:28:2         | SEE          | : | 50 Marks  |
| Total Hours/Semester          | : | 30               | Total        | : | 100 Marks |
| Credits                       | : | 1                | SEE Duration | : | 3 Hrs     |

**Course Objective is**

|    |                                                                                                                                                                                    |
|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | To provide hands-on training in evaluating the physical and mechanical properties of masonry units (bricks, tiles, blocks) and aggregates through standardized testing procedures. |
| 2. | To demonstrate the behavior of engineering materials (metals and wood) under diverse loading conditions including tension, compression, torsion, and bending.                      |
| 3. | To introduce the methods of measuring material toughness, shear strength, and hardness using specialized testing equipment and industry-standard protocols.                        |

| Sl. No | Name of the Programs / List of the experiments                                                                                                         |
|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.     | Tests on Bricks, Tiles, Cement Concrete blocks (Weight & Dimensionality, Water Absorption, Strength)                                                   |
| 2.     | Tests on Fine aggregates - Sieve Analysis, Moisture content, Specific gravity, Bulk density, Bulking and Silt Content.                                 |
| 3.     | Tests on Coarse aggregates- Sieve Analysis, Water absorption, Moisture content, specific Gravity, flakiness index, elongation index, and Bulk density. |
| 4.     | Compression test on mild steel, cast iron and wood.                                                                                                    |
| 5.     | Tension test on mild steel and HYSD bars.                                                                                                              |
| 6.     | Torsion test on mild steel circular sections.                                                                                                          |
| 7.     | Bending Test on Wood Under two-point loading.                                                                                                          |
| 8.     | Shear Test on Mild steel- single and double shear.                                                                                                     |
| 9.     | Impact test on Mild Steel (Charpy & Izod).                                                                                                             |
| 10.    | Hardness tests on ferrous and non-ferrous metals - Brinell's, Rockwell and Vicker's.                                                                   |

**Course Outcomes:** At the end of the course, the students will be able to

|     |                                                                                                                                                                                                                           |
|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CO1 | Perform quality control tests on bricks, blocks, and aggregates to determine if their physical properties—such as <b>water absorption</b> , <b>silt content</b> and <b>fineness modulus</b> —meet project specifications. |
| CO2 | Execute and interpret <b>Tension</b> , <b>Compression</b> , and <b>Bending</b> tests on mild steel, HYSD bars, and wood to derive critical design parameters like yield strength and modulus of elasticity.               |
| CO3 | Conduct <b>Impact (Charpy/Izod)</b> , <b>Torsion</b> , and <b>Hardness</b> tests to determine a material's resistance to fracture, twisting, and surface indentation for safe engineering applications.                   |

**ASSESSMENT STRUCTURE FOR LABORATORY:**

- The assessment for each course is equally divided between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each component carrying 50% weightage.
- For both CIE and SEE, the student is required to conduct Two experiments
- To qualify and become eligible to appear for SEE, in the CIE component, a student must secure a minimum of 40% of 50 marks, i.e., 20 marks.
- To pass the SEE component, a student must secure a minimum of 35% of 50 marks, i.e., 18 marks. A student is deemed to have successfully completed the course if the combined total of CIE and SEE is at least 40 out of 100 marks.



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| CIE         | Type of Assessment       | Max. Marks                           | Max. Marks<br>Scaling Down to | Total Marks |
|-------------|--------------------------|--------------------------------------|-------------------------------|-------------|
| Laboratory  | Lab Conduction & Record  | Evaluate each expt.<br>for 10 marks. | 15                            | 50          |
|             | Laboratory Test 1        | 50                                   | 15                            |             |
|             | Laboratory Test 2        | 50                                   | 20                            |             |
| SEE         | Semester End Examination | 100                                  | 50                            | 50          |
| Total Marks |                          |                                      |                               | 100         |



**Department of Civil Engineering**

| <b>Semester-III</b>            |   |                  |              |             |
|--------------------------------|---|------------------|--------------|-------------|
| <b>Engineering Geology Lab</b> |   |                  |              |             |
| <b>Category: AEC</b>           |   |                  |              |             |
| Course Code                    | : | <b>B25CVL307</b> | CIE          | : 50 Marks  |
| Teaching Hours L : T : P : S   | : | 0:0:28:2         | SEE          | : 50 Marks  |
| Total Hours/Semester           | : | 30               | Total        | : 100 Marks |
| Credits                        | : | 1                | SEE Duration | : 3 Hrs     |

| <b>Course Learning Objective is</b> |                                                                                                                                  |
|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| 1.                                  | To train students in the identification of common minerals and construction rocks based on their physical properties.            |
| 2.                                  | To develop the ability to interpret geological maps and field data for assessing the suitability of aqueducts, tunnels and dams. |

| <b>Sl. No</b> | <b>Name of the Programs / List of the experiments</b>                               |
|---------------|-------------------------------------------------------------------------------------|
| 1.            | Identification of common minerals based on Physical Properties.                     |
| 2.            | Identification of rocks used in building construction based on Physical properties. |
| 3.            | Solving Geological maps for suitability for aqueduct.                               |
| 4.            | Geological maps with inclined beds, suitability for tunnels/ Dams.                  |
| 5.            | Geological maps with folds, in tunnels/ Dams.                                       |
| 6.            | Geological maps with unconformity, in tunnel/dam project.                           |
| 7.            | Geological maps with faults in Dams/tunnels project.                                |
| 8.            | One Day Nearest Field Visit Investigation.                                          |

| <b>Course Outcomes:</b> At the end of the course, the students will be able to |                                                                                                                                                                                    |
|--------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CO1                                                                            | Students will be able to identify minerals and rocks used in construction using physical properties and field observations.                                                        |
| CO2                                                                            | Students will be able to analyze geological maps involving inclined beds, folds, faults, and unconformities and evaluate their suitability for aqueduct, tunnel, and dam projects. |
| CO3                                                                            | Students will be able to identify minerals and rocks used in construction using physical properties and field observations.                                                        |

**ASSESSMENT STRUCTURE FOR LABORATORY:**

- The assessment for each course is equally divided between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each component carrying 50% weightage.
- For both CIE and SEE, the student is required to conduct Two experiments
- To qualify and become eligible to appear for SEE, in the CIE component, a student must secure a minimum of 40% of 50 marks, i.e., 20 marks.
- To pass the SEE component, a student must secure a minimum of 35% of 50 marks, i.e., 18 marks. A student is deemed to have successfully completed the course if the combined total of CIE and SEE is at least 40 out of 100 marks.

| <b>CIE</b>         | <b>Type of Assessment</b>          | <b>Max. Marks</b>                           | <b>Max. Marks<br/>Scaling Down to</b> | <b>Total Marks</b> |
|--------------------|------------------------------------|---------------------------------------------|---------------------------------------|--------------------|
| <b>Laboratory</b>  | <b>Lab Conduction &amp; Record</b> | <b>Evaluate each expt.<br/>for 10 marks</b> | <b>15</b>                             | <b>50</b>          |
|                    | <b>Laboratory Test 1</b>           | <b>50</b>                                   | <b>15</b>                             |                    |
|                    | <b>Laboratory Test 2</b>           | <b>50</b>                                   | <b>20</b>                             |                    |
| <b>SEE</b>         | <b>Semester End Examination</b>    | <b>100</b>                                  | <b>50</b>                             | <b>50</b>          |
| <b>Total Marks</b> |                                    |                                             |                                       | <b>100</b>         |



**Department of Civil Engineering**

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**CO-PO Mapping:**

| PO<br>CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1      | 1   | 3   | 1   | 2   | -   | -   | -   | -   | -   | -    | -    | 1    |
| CO2      | 1   | 1   | 1   | 1   | 3   | -   | -   | -   | 1   | 2    | -    | 1    |

Level3-High, Level2-Moderate,Level 1-Low



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| <b>Semester - IV</b>          |   |                 |              |   |           |
|-------------------------------|---|-----------------|--------------|---|-----------|
| <b>Analysis of Structures</b> |   |                 |              |   |           |
| <b>Category: PCC</b>          |   |                 |              |   |           |
| Course Code                   | : | <b>B25CV401</b> | CIE          | : | 50 Marks  |
| Teaching Hours L : T : P : S  | : | 42:28:0:50      | SEE          | : | 50 Marks  |
| Total Hours/Semester          | : | 120             | Total        | : | 100 Marks |
| Credits                       | : | 4               | SEE Duration | : | 3 Hrs     |

| <b>Course Learning Objective is</b> |                                                                                                                                        |
|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| 1.                                  | To evaluate structural stability and indeterminacy while mastering equilibrium-based analysis of determinate trusses.                  |
| 2.                                  | To apply Energy Methods and Virtual Work Principles for calculating deflections in determinate beams, frames, and trusses.             |
| 3.                                  | To analyze the structural behaviour of three-hinged arches and suspension cables under varying load conditions and support elevations. |
| 4.                                  | To analyze continuous beams and rigid frames by formulating and solving slope-deflection equations for indeterminate structures.       |
| 5.                                  | To comparing matrix methods to classical techniques and mastering the Stiffness Matrix formulation for computer-oriented solutions.    |

| <b>Module-1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>No. of Hours</b> |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| <b>Introduction and Analysis of Plane Trusses:</b> Structural forms, Conditions of equilibrium, Compatibility conditions, Degree of freedom, Linear and nonlinear analysis, Static and kinematic indeterminacies of structural systems, Types of trusses, Assumptions in analysis, Analysis of determinate trusses by method of joints and method of sections.                                                                                                                                                | 14                  |
| <b>Module-2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>No. of Hours</b> |
| <b>Energy Principles and Energy Theorems:</b> Principle of virtual displacements; Principle of virtual forces, Strain energy and complementary energy; Strain energy due to axial force, bending shear and torsion. Deflection of determinate beams and trusses using total strain energy; Deflection at the point of application of single point load; Castigliano's theorems, application of Castigliano's theorems to calculate deflection of trusses, frames; Special application–Dummy unit load method. | 14                  |
| <b>Module-3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>No. of Hours</b> |
| <b>Arches and Cables:</b> Three hinged parabolic arches with supports at the same and different levels. Determination of normal thrust, radial shear and bending moment. Analysis of cables under point loads and UDL. Length of cables for supports at same and at different levels- Stiffening trusses for suspension cables.                                                                                                                                                                               | 14                  |
| <b>Module-4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>No. of Hours</b> |
| <b>Slope Deflection Method:</b> Introduction, sign convention, development of slope deflection equation; Analysis of continuous beams including settlement of supports; Analysis of orthogonal rigid plane frames including way frames with kinematic indeterminacy up to 3.                                                                                                                                                                                                                                  | 14                  |
| <b>Module-5</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>No. of Hours</b> |
| <b>Matrix Methods of Structural Analysis:</b> Definition of stiffness and flexibility methods, comparison to classical methods.<br><b>Stiffness Method:</b> Stiffness matrix, Analysis of continuous beams and plane trusses using system. approach; Analysis of simple orthogonal plane frames using system approach with kinematic indeterminacy up to 3.                                                                                                                                                   | 14                  |

| <b>Course Outcomes:</b> At the end of the course, the students will be able to |                                                                                                                                                                                            |
|--------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CO1                                                                            | Calculate static and kinematic indeterminacies and determine internal forces in plane trusses using the methods of joints and sections.                                                    |
| CO2                                                                            | Utilize Castigliano's Theorems, Strain Energy concepts, and the Unit Load Method to compute slopes and displacements in structures                                                         |
| CO3                                                                            | Calculate normal thrust, radial shear, and bending moments in three-hinged parabolic arches and determine tension and length for suspension cables with or without stiffening trusses.     |
| CO4                                                                            | Formulate and solve slope-deflection equations to determine moments, rotations, and displacements in continuous beams and sway frames with up to three degrees of kinematic indeterminacy. |
| CO5                                                                            | Construct global stiffness matrices and solve for unknown displacements and internal forces in continuous                                                                                  |



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|  |                                              |
|--|----------------------------------------------|
|  | beams, plane trusses, and orthogonal frames. |
|--|----------------------------------------------|

| Text Books |                                                                                                                  |
|------------|------------------------------------------------------------------------------------------------------------------|
| 1.         | Comprehensive Structural Analysis" (Vol. I & II) by Dr. R. Vaidyanathan and Dr. P. Perumal                       |
| 2.         | <b>Structural Analysis - Vol. I &amp; II (S.S. Bhavikatti)</b> , Vikas Publishing,                               |
| 3.         | Thandavamoorthy, T. S., Structural Analysis, 6 <sup>th</sup> edition, Oxford University press., New Delhi, 2015. |

| Reference Text Books |                                                                                                                                               |
|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| 1.                   | Theory of Structures, S. Rama mrutham and R. Narayan, 11 <sup>th</sup> Edition was published around 2021/2022, published by DhanpatRai& Sons, |
| 2.                   | Hall, A. and Kabaila, A. P., Basic Concepts of Structural Analysis, Pitman Publishing, London, John Wiley& Sons, NewYork, 1977.               |
| 3.                   | Wang,C.K.,IntermediateStructuralAnalysis,McGraw-HillInternationalBookCo.,1985.                                                                |

**ASSESSMENT STRUCTURE:**

The assessment in each course is divided equally between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each carrying 50% weightage. To qualify and become eligible to appear for SEE, in the CIE, a student must score at least 40% of 50 marks, i.e., 20 marks. To pass the SEE, a student must score at least 35% of 50 marks, i.e., 18 marks. Notwithstanding the above, a student is considered to have passed the course, provided the combined total of CIE and SEE is at least 40 out of 100 marks.

**CONTINUOUS INTERNAL EVALUATION (CIE):**

| CIE         | Type of Assessment                     | Max. Marks | Max. Marks Scaling Down to              | Total Marks |
|-------------|----------------------------------------|------------|-----------------------------------------|-------------|
| Theory      | Internal Assessment1                   | 50         | 40<br>(Average of Best two Assessments) | 50          |
|             | Internal Assessment2                   | 50         |                                         |             |
|             | Internal Assessment3                   | 50         |                                         |             |
| AAT         | Any Two Assessments as per regulations | 20         | 10                                      |             |
| SEE         | Semester End Examination               | 100        | 50                                      | 50          |
| Total Marks |                                        |            |                                         | 100         |

**SEMESTER END EXAMINATION (SEE):**

1. The Question paper for each course contains two parts, Part – A and Part – B.
2. Part – A consists of **Short Answer Questions** (2 Marks/1 mark) for 20 marks covering the complete syllabus and it is compulsory. Multiple Choice Questions are not allowed.
3. Part – B consists of 10 questions, two questions of 16 marks (with max. of 3 sub questions) from each module with internal choice. Students shall answer five full questions, selecting one full question from each module.

**CO-PO Mapping**

| PO<br>CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|
| CO1      | 2   | 3   | 1   | 3   | -   | -   | -   | -   | 1   | -    | 1    |
| CO2      | 2   | 3   | 1   | 3   | -   | -   | -   | -   | 1   | -    | 1    |
| CO3      | 2   | 3   | 1   | 3   | -   | -   | -   | -   | 1   | -    | 1    |
| CO4      | 2   | 3   | 1   | 3   | -   | -   | -   | -   | 1   | -    | 1    |
| CO5      | 2   | 3   | 1   | 3   | -   | -   | -   | -   | 1   | -    | 1    |

Level 3 - High, Level 2 - Moderate, Level 1 - Low



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| <b>Semester - IV</b>         |   |                 |              |             |
|------------------------------|---|-----------------|--------------|-------------|
| <b>Concrete Technology</b>   |   |                 |              |             |
| <b>Category: PCC</b>         |   |                 |              |             |
| Course Code                  | : | <b>B25CV402</b> | CIE          | : 50 Marks  |
| Teaching Hours L : T : P : S | : | 42:28:0:50      | SEE          | : 50 Marks  |
| Total Hours/Semester         | : | 120             | Total        | : 100 Marks |
| Credits                      | : | 4               | SEE Duration | : 3 Hrs     |

| <b>Course Learning Objectives is</b> |                                                                                                                                                                                   |
|--------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.                                   | To analyze the properties of concrete constituent materials for effective selection and testing during concrete production.                                                       |
| 2.                                   | To master fresh concrete behavior through workability testing and standardized manufacturing protocols                                                                            |
| 3.                                   | To analyze the factors governing strength, volume stability, and long-term durability of hardened concrete while mastering destructive and non-destructive testing methodologies. |
| 4.                                   | To apply the principles of mix proportioning using IS-10262:2019 to design economical and durable concrete mixes tailored to specific exposure conditions and material variables. |
| 5.                                   | To evaluate the design, properties, and industrial applications of modern special concretes.                                                                                      |

| <b>Module-1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>No. of Hours</b> |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| <b>Concrete Ingredients:</b> Cement manufacturing process, steps to reduce carbon footprint, chemical composition and their importance, hydration of cement, types of cement. Testing of cement. Fine aggregate: Functions, requirement, Alternatives to River sand, M-sand introduction and manufacturing. Coarse aggregate: Importance of size, shape and texture. Grading and blending of aggregate. Testing on aggregate, requirement. Recycled aggregates Water – qualities of water. Chemical admixtures – plasticizers, accelerators, retarders and air entraining agents. Mineral admixtures – Pozzolan and cementitious materials, Fly ash, GGBS, silica fumes, Metakaolin and rice husk ash. | 14                  |
| <b>Module-2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>No. of Hours</b> |
| <b>Fresh Concrete:</b> Factors affecting workability. Measurement of workability–slump, Compaction factor and Vee-Bee Consistometer tests, flow tests. Segregation and bleeding. Process of manufacturing of concrete- Batching, Mixing, Transporting, Placing and Compaction. Curing – Methods of curing – Water curing, membrane curing, steam curing, accelerated curing, self- curing. Good and Bad practices of making and using fresh concrete and Effect of heat of hydration during mass concreting at project sites.                                                                                                                                                                          | 14                  |
| <b>Module-3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>No. of Hours</b> |
| <b>Hardened Concrete:</b> Factors influencing strength, W/C ratio, gel/space ratio, Maturity concept, Testing of hardened concrete, Creep –factors affecting creep. Shrinkage of concrete – plastic shrinking and drying shrinkage, Factors affecting shrinkage. Definition and significance of durability. Internal and external factors influencing durability, Mechanisms- Sulphate attack – chloride attack, carbonation, freezing and thawing. Corrosion, Durability requirements as per IS-456, In situ testing of concrete- Penetration and pull-out test, rebound hammer test, ultrasonic pulse velocity, core extraction – Principal, applications and limitations.                           | 14                  |
| <b>Module-4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>No. of Hours</b> |
| <b>Concrete Mix Proportioning:</b> Concept of Mix Design with and without admixtures, variables in proportioning and Exposure conditions, Selection criteria of ingredients used for mix design, Procedure of mix proportioning. Numerical Examples of Mix Proportioning using IS-10262:2019.                                                                                                                                                                                                                                                                                                                                                                                                          | 14                  |
| <b>Module-5</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>No. of Hours</b> |
| <b>Special Concretes:</b> Manufacture and requirement as per QCI-RMCPSCS, properties, advantages and disadvantages. Self- Compacting concrete- concept, materials, tests, properties, application and typical mix Fiber reinforced concrete - Fibers types, properties, application of FRC. Light weight concrete-material properties and types. Typical light weight concrete mix and applications, materials, requirements, mix proportion and properties of Geo polymer Concrete, High Strength Concrete and High-Performance Concrete.                                                                                                                                                             | 14                  |

| <b>Course Outcomes:</b> At the end of the course, the students will be able to |                                                                                                                                                                              |
|--------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CO1                                                                            | Evaluate and test the physical and chemical characteristics of cement, sustainable aggregates (like M-sand), and admixtures to optimize concrete performance and durability. |
| CO2                                                                            | Evaluate workability and execute optimal production and curing workflows to mitigate defects like                                                                            |



**Departments of Civil Engineering**

|     |                                                                                                                                                                                            |
|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|     | segregation, bleeding, and thermal cracking in various field conditions.                                                                                                                   |
| CO3 | Predict concrete performance based on maturity and environmental degradation mechanisms and perform in-situ evaluations to ensure compliance with IS-456 durability and strength standards |
| CO4 | Design precise concrete mix proportions, with and without admixtures, to satisfy strength and durability requirements for various field engineering applications.                          |
| CO5 | Analyse and proportion advanced concrete types for specialized structural needs, applying appropriate materials and testing protocols for high-performance and eco-friendly construction.  |

**Text Books**

|    |                                                                                                      |
|----|------------------------------------------------------------------------------------------------------|
| 1. | M.S. Shetty, Concrete Technology - Theory and Practice Published by S. Chand and Company, New Delhi. |
| 2. | A.R. Santha Kumar, "Concrete Technology", Oxford University Press, New Delhi (New Edition).          |

**Reference Text Books**

|    |                                                                                                                                     |
|----|-------------------------------------------------------------------------------------------------------------------------------------|
| 1. | M L Gambir, "Concrete Technology", McGraw Hill Education, 2014.                                                                     |
| 2. | IS 10262:2019 "Concrete Mix Proportioning — Guidelines (Second Revision)                                                            |
| 3. | Neville A.M. "Properties of Concrete"- 4 <sup>th</sup> Ed., Longman.                                                                |
| 4. | Kumar Mehta. P and Paulo J.M. Monteiro "Concrete-Microstructure, Property and Materials", 4th Edition, McGraw Hill Education, 2014. |

**ASSESSMENT STRUCTURE:**

The assessment in each course is divided equally between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each carrying 50% weightage. To qualify and become eligible to appear for SEE, in the CIE, a student must score at least 40% of 50 marks, i.e., 20 marks. To pass the SEE, a student must score at least 35% of 50 marks, i.e., 18 marks. Notwithstanding the above, a student is considered to have passed the course, provided the combined total of CIE and SEE is at least 40 out of 100 marks.

**CONTINUOUS INTERNAL EVALUATION (CIE):**

| CIE         | Type of Assessment                     | Max. Marks | Max. Marks Scaling Down to              | Total Marks |
|-------------|----------------------------------------|------------|-----------------------------------------|-------------|
| Theory      | Internal Assessment1                   | 50         | 40<br>(Average of Best two Assessments) | 50          |
|             | Internal Assessment2                   | 50         |                                         |             |
|             | Internal Assessment3                   | 50         |                                         |             |
| AAT         | Any Two Assessments as per regulations | 20         | 10                                      |             |
| SEE         | Semester End Examination               | 100        | 50                                      | 50          |
| Grand Total |                                        |            |                                         | 100         |

**SEMESTER END EXAMINATION (SEE):**

1. The Question paper for each course contains two parts, Part – A and Part – B.
2. Part – A consists of **Short Answer Questions** (2 Marks/1 mark) for 20 marks covering the complete syllabus and it is compulsory. Multiple Choice Questions are not allowed.
3. Part – B consists of 10 questions, two questions of 16 marks (with max. of 3 sub questions) from each module with internal choice. Students shall answer five full questions, selecting one full question from each module.

**CO-PO Mapping**

| PO<br>CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|
| CO1      | 2   | 3   | 1   | 3   | -   | -   | -   | -   | 1   | -    | 1    |
| CO2      | 2   | 3   | 1   | 3   | -   | -   | -   | -   | 1   | -    | 1    |
| CO3      | 2   | 3   | 1   | 3   | -   | -   | -   | -   | 1   | -    | 1    |
| CO4      | 2   | 3   | 1   | 3   | -   | -   | -   | -   | 1   | -    | 1    |
| CO5      | 2   | 3   | 1   | 3   | -   | -   | -   | -   | 1   | -    | 1    |

Level 3 - High, Level 2 - Moderate, Level 1 - Low



| <b>SEMESTER-IV</b>                      |   |                 |              |   |           |
|-----------------------------------------|---|-----------------|--------------|---|-----------|
| <b>Fluid mechanics &amp; Hydraulics</b> |   |                 |              |   |           |
| <b>Category: IPCC</b>                   |   |                 |              |   |           |
| Course Code                             | : | <b>B25CV403</b> | CIE          | : | 50 Marks  |
| Teaching Hours L : T : P : S            | : | 42:0:28:50      | SEE          | : | 50 Marks  |
| Total Hours/Semester                    | : | 120             | Total        | : | 100 Marks |
| Credits                                 | : | 4               | SEE Duration | : | 3Hrs      |

| <b>Course Learning Objective is</b> |                                                                                        |
|-------------------------------------|----------------------------------------------------------------------------------------|
| 1.                                  | To impart the knowledge of fluid statics and kinematics.                               |
| 2.                                  | To gain knowledge on fluid dynamics.                                                   |
| 3.                                  | To understand the Hydro Electric power plant and importance of impact of jet on vanes  |
| 4.                                  | To acquire knowledge on pumps and their performance characteristics.                   |
| 5.                                  | To familiarize about different types of turbines and their performance characteristics |

| <b>Module- 1</b>                                                                                                                                                                                                                                                                                  | <b>No. of Hours</b> |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| <b>Fluids and their properties:</b> Fluid pressure measurements, Pascal's law, Measurement of pressure using manometer, Total pressure and centre of pressure on vertical and inclined plane surfaces                                                                                             | 9                   |
| <b>Module- 2</b>                                                                                                                                                                                                                                                                                  | <b>No. of Hours</b> |
| <b>Kinematics:</b> Types of fluid flow, continuity equation in Cartesian coordinates, flow nets, Dynamics-Euler's equation of motion, Bernoulli's equation, Application-Venturimeter, Orificemeter, Pitot tube                                                                                    | 9                   |
| <b>Module- 3</b>                                                                                                                                                                                                                                                                                  | <b>No. of Hours</b> |
| <b>Classification of orifice and mouth piece:</b> Classification of orifice and mouth piece, Hydraulic coefficients, Discharge over Rectangular, Triangular and Cipoletti notch Flow through pipes-Major and minor losses, pipes in series and parallel, concepts of water hammer and surge tanks | 8                   |
| <b>Module- 4</b>                                                                                                                                                                                                                                                                                  | <b>No. of Hours</b> |
| <b>Open Channel Hydraulics:</b> Classification of Flow through channels, Most economical channel sections: Rectangular, Triangular, Circular, Uniform flow, Specific energy Non-Uniform flow-Hydraulic jump, GVF equation.                                                                        | 8                   |
| <b>Module- 5</b>                                                                                                                                                                                                                                                                                  | <b>No. of Hours</b> |
| <b>Impact of jet on curved vanes:</b> Momentum equation, Impact of jet on stationary and moving curved vanes Turbines- Pelton wheel and components, Velocity triangle Reaction turbine-Francis turbine ,Working proportions Centrifugal Pumps-Work done and efficiency, Multi stage pumps.        | 8                   |

#### **LABORATORY**

| <b>Sl. No</b> | <b>List of Experiments</b>                                         |
|---------------|--------------------------------------------------------------------|
| 1.            | Verification of Bernoulli's equation.                              |
| 2.            | Determination of Cd for Venturimeter or Orificemeter.              |
| 3.            | Determination of Hydraulic coefficients of small vertical orifice. |
| 4.            | Calibration of Triangular notch.                                   |
| 5.            | Determination of Major losses in pipes.                            |
| 6.            | Determination of Cd for ogee or broad crested weir.                |
| 7.            | Determination of force exerted by a jet on flat and curved vanes.  |
| 8.            | Determination of efficiency of centrifugal pump.                   |
| 9.            | Determination of efficiency of Kaplan or Francis turbine.          |
| 10.           | Determination of efficiency of Pelton wheel turbine.               |



| <b>Course Outcomes:</b> At the end of the course, the students will be able to |                                                                                       |
|--------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| CO1                                                                            | Understand fundamental properties of fluids and solve problems on Hydrostatics.       |
| CO2                                                                            | Apply Principles of Mathematics to represent Kinematics and Bernoulli's principles.   |
| CO3                                                                            | Compute discharge through pipes, notches and weirs.                                   |
| CO4                                                                            | Design of open channels of various cross sections.                                    |
| CO5                                                                            | Design of turbines for the given data and understand their operation characteristics. |

| <b>Text Books</b> |                                                                                                                            |
|-------------------|----------------------------------------------------------------------------------------------------------------------------|
| 1.                | Fluid Mechanics and Hydraulic machines by Dr. R.K. Bansal latest edition November 2023                                     |
| 2.                | Hydraulics and Fluid Mechanics including Hydraulic Machines by Dr. P.N. Modi and Dr. S.M. Seth latest edition January 2019 |

| <b>Reference Text Books</b> |                                                                                                                                       |
|-----------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| 1.                          | D.S. Kumar, Fluid Mechanics and Fluid Power Engineering. Kotaria & Sons – 2013 edition                                                |
| 2.                          | D. Rama Durgaiah, Fluid Mechanics and Machinery. New Age International, 1 <sup>st</sup> edition – 2002                                |
| 3.                          | Banga & Sharma, Hydraulic Machines. Khanna Publishers.                                                                                |
| 4.                          | James W. Dally, William E. Riley, Instrumentation for Engineering Measurements. John Wiley & Sons Inc, 2 <sup>nd</sup> edition – 2010 |

| <b>Web links and Video lectures (e-Resources)</b> |                                                                                                       |
|---------------------------------------------------|-------------------------------------------------------------------------------------------------------|
| •                                                 | <a href="https://www.youtube.com/watch?v=whCu4Xl3m98">https://www.youtube.com/watch?v=whCu4Xl3m98</a> |
| •                                                 | <a href="https://www.youtube.com/watch?v=DW4rItB20h4">https://www.youtube.com/watch?v=DW4rItB20h4</a> |
| •                                                 | <a href="https://www.youtube.com/watch?v=GgVCTNCwfQk">https://www.youtube.com/watch?v=GgVCTNCwfQk</a> |
| •                                                 | <a href="https://www.youtube.com/watch?v=GQHCnWl2U6I">https://www.youtube.com/watch?v=GQHCnWl2U6I</a> |
| •                                                 | <a href="https://www.youtube.com/watch?v=LCzIk0VDVQc">https://www.youtube.com/watch?v=LCzIk0VDVQc</a> |

#### **ASSESSMENT STRUCTURE:**

The assessment in each course is divided equally between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each carrying 50% weightage. To qualify and become eligible to appear for SEE, in the CIE, a student must score at least 40% of 50 marks, i.e., 20 marks. To pass the SEE, a student must score at least 35% of 50 marks, i.e., 18 marks. Notwithstanding the above, a student is considered to have passed the course, provided the combined total of CIE and SEE is at least 40 out of 100 marks.

#### **CONTINUOUS INTERNAL EVALUATION (CIE):**

| CIE                | Type of Assessment                           | Max. Marks                                | Max. Marks Scaling Down to                            | Total Marks      |
|--------------------|----------------------------------------------|-------------------------------------------|-------------------------------------------------------|------------------|
| <b>Theory</b>      | <b>Internal Assessment1</b>                  | <b>50</b>                                 | <b>40</b><br><b>(Average of Best two Assessments)</b> | <b>50/2 = 25</b> |
|                    | <b>Internal Assessment2</b>                  | <b>50</b>                                 |                                                       |                  |
|                    | <b>Internal Assessment3</b>                  | <b>50</b>                                 |                                                       |                  |
| <b>AAT</b>         | <b>Any One Assessment as per Regulations</b> | <b>20</b>                                 | <b>10</b>                                             |                  |
| <b>Laboratory</b>  | <b>Lab Conduction &amp; Record</b>           | <b>Evaluating each expt. for 10 marks</b> | <b>10</b>                                             | <b>25</b>        |
|                    | <b>Internal Test</b>                         | <b>50</b>                                 | <b>15</b>                                             |                  |
| <b>SEE</b>         | <b>Semester End Examination</b>              | <b>100</b>                                | <b>50</b>                                             | <b>50</b>        |
| <b>Total Marks</b> |                                              |                                           |                                                       | <b>100</b>       |

#### **SEMESTER END EXAMINATION (SEE):**

- The Question paper for each course contains two parts, Part – A and Part – B.
- Part – A consists of **Short Answer Questions** (2 Marks/1 mark) for 20 marks covering the complete syllabus and it is compulsory. Multiple choice questions are not allowed.
- Part – B consists of 10 questions, two questions of 16 marks (with max. of 3 sub questions) from each module with internal choice. Students shall answer five full questions, selecting one full question from each module.
- The laboratory component of the **integrated course** shall be CIE only. However, in SEE, the questions from the practical component shall be included.



5. The maximum marks from the practical component to be included in the SEE question paper is **16 marks**.
6. Question papers to be set as per the Blooms Taxonomy levels

**CO-PO Mapping:**

| PO<br>CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|
| CO1      | 3   | 2   | -   | 2   | -   | -   | -   | 2   | -   | 2    | 1    |
| CO2      | 3   | -   | -   | 3   | -   | -   | -   | 1   | -   | 1    | 1    |
| CO3      | 1   | 3   | -   | -   | -   | -   | -   | 1   | -   | 1    | 1    |
| CO4      | 3   | -   | -   | 1   | -   | -   | -   | 3   | -   | 2    | 1    |
| CO5      | 3   | 1   | -   | 1   | -   | -   | -   | 1   | -   | 1    | 1    |

Level 3 - High, Level 2 - Moderate, Level 1 – Low



**Departments of Civil Engineering**

| <b>Semester - IV</b>              |   |                 |              |             |
|-----------------------------------|---|-----------------|--------------|-------------|
| <b>Transportation Engineering</b> |   |                 |              |             |
| <b>Category: PCC</b>              |   |                 |              |             |
| Course Code                       | : | <b>B25CV404</b> | CIE          | : 50 Marks  |
| Teaching Hours L : T : P : S      | : | 42:0:0:48       | SEE          | : 50 Marks  |
| Total Hours/Semester              | : | 90              | Total        | : 100 Marks |
| Credits                           | : | 3               | SEE Duration | : 3 Hrs     |

| <b>Course Learning Objective is</b> |                                                                                                                                                                                                             |
|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.                                  | To master highway planning principles and geometric design standards to create safe, efficient road alignments using conventional and modern survey techniques.                                             |
| 2.                                  | To analyze the engineering properties of pavement materials and drainage systems to design durable flexible and rigid pavements that withstand environmental and traffic stresses.                          |
| 3.                                  | To master the principles of traffic engineering by analyzing road user behavior and vehicle characteristics to conduct comprehensive traffic studies and design efficient control systems.                  |
| 4.                                  | To master the design and component analysis of permanent ways—including rails, sleepers, and ballast—while evaluating the geometric requirements for points, crossings, and modern high-speed rail systems. |
| 5.                                  | To analyze aircraft performance and wind data to plan airport layouts, orient runways using wind rose diagrams, and determine corrected runway lengths based on environmental factors.                      |

| <b>Module-1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>No. of Hours</b> |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| <b>Introduction to Transportation &amp; Highway Design:</b> Introduction, Different Modes of Transportation, M R Jayakar Committee recommendations, Road Classifications and Road Patterns.<br><b>Highway Alignment:</b> Factors affecting highway alignment, Engineering surveys for alignment conventional and modern methods.<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. (No derivations)<br><b>Problems on Sight distance, Super elevation, extra widening of curves, Length of transition curve, Length of summit and valley curve.</b> | 9                   |
| <b>Module-2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>No. of Hours</b> |
| <b>Highway Materials and Pavements:</b> Desirable properties of aggregates, soil sub grade & Bitumen, Application of bituminous emulsion, Desirable properties of Bituminous Mixes Pavement Design: Factors Controlling design of highway pavements, Pavement types, component parts of pavements and their functions; types of joints used in rigid pavement. Critical stresses inflexible and rigid pavement. Highway Drainage: 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>                                                                                                   | 9                   |
| <b>Module-3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>No. of Hours</b> |
| <b>Traffic Engineering:</b> Objectives and scope of Traffic Engineering. Traffic Characteristics: Road user characteristics, vehicular characteristics – static and dynamic characteristics, Reaction time of driver and PIEV theory, Types of traffic engineering studies-volume, spot speed, speed and delay, parking, accident, origin & destination, objectives of studies and data collection, method of study, analysis. PCU concept, factors affecting and PCU at different locations and applications. Traffic signs, Signal design by IRC method; Types of intersections.<br><b>Problems on Spot speed studies, Speed and delay studies, accident studies, Signal design by IRC Method.</b>                                                           | 8                   |
| <b>Module-4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>No. of Hours</b> |
| <b>Railway Engineering:</b> Permanent way and its requirements, Gauges and types, Typical cross sections single and double-line BG track Coning of wheels and tilting of rails, Rails-Functions requirements, types and defects of rails. Sleepers and Ballast: Functions, requirements, Track fitting and fasteners, Calculation of quantity of materials required for laying a track, Points & crossings, Railway Station and Yards. Metro train & high speed train- Design factors considered.<br><b>Problem on Quantity calculation for laying railway track. Super-elevation.</b>                                                                                                                                                                         | 8                   |



MOOGAMBIGAI CHARITABLE AND EDUCATIONAL TRUST  
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**Departments of Civil Engineering**

| Module-5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | No. of Hours |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| <b>Airport Engineering:</b> AIRPORT ENGINEERING: 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.<br><b>Runway:</b> 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.<br><b>Problems on Runway orientation, Basic Runway length, Exit taxiway design.</b> | 8            |

| Course Outcomes: At the end of the course, the students will be able to |                                                                                                                                                                                                                   |
|-------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CO1                                                                     | Design critical highway elements—including cross-sections, sight distances, and horizontal/vertical curves—to meet standard safety and operational requirements.                                                  |
| CO2                                                                     | Evaluate material suitability, design effective surface and sub-surface drainage, and determine critical stresses and joint types for resilient highway infrastructure.                                           |
| CO3                                                                     | Conduct traffic volume and speed analyses apply the PCU concept, and design traffic signals and signage using IRC methods to optimize intersection safety and flow.                                               |
| CO4                                                                     | Evaluate material quantities for track laying and design railway layouts (stations, yards, and metro tracks) that incorporate critical features like coning of wheels and rail tilting for operational stability. |
| CO5                                                                     | Perform site selection and design geometric elements for runways and taxiways—including critical corrections and exit taxiway geometry—to meet aviation safety standards.                                         |

| Text Books |                                                                         |
|------------|-------------------------------------------------------------------------|
| 1.         | SK Khanna and CE GJusto, "Highway Engineering", NemChand Bros, Roorkee. |
| 2.         | A Text Book of Railway Engineering" by S C Saxena and S P Arora.        |
| 3.         | Airport Engineering" by S C Rangwala                                    |

| Reference Text Books |                                                                                                                  |
|----------------------|------------------------------------------------------------------------------------------------------------------|
| 1.                   | Roads, Railways, Bridges, Tunnels and Harbour Dock Engineering by BL Gupta, Amit Gupta.                          |
| 2.                   | SK Khanna, CEG Justo and A Veeraragavan, "Highway Materials Testing Laboratory Manual", Nem Chand Bros, Roorkee. |
| 3.                   | LR Kadiyali, "Highway Engineering", Khanna Publishers, New Delhi                                                 |

**ASSESSMENT STRUCTURE:**

The assessment in each course is divided equally between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each carrying 50% weightage. To qualify and become eligible to appear for SEE, in the CIE, a student must score at least 40% of 50 marks, i.e., 20 marks. To pass the SEE, a student must score at least 35% of 50 marks, i.e., 18 marks. Notwithstanding the above, a student is considered to have passed the course, provided the combined total of CIE and SEE is at least 40 out of 100 marks.

**CONTINUOUS INTERNAL EVALUATION (CIE):**

| CIE         | Type of Assessment                     | Max. Marks | Max. Marks Scaling Down to              | Total Marks |
|-------------|----------------------------------------|------------|-----------------------------------------|-------------|
| Theory      | Internal Assessment1                   | 50         | 40<br>(Average of Best two Assessments) | 50          |
|             | Internal Assessment2                   | 50         |                                         |             |
|             | Internal Assessment3                   | 50         |                                         |             |
| AAT         | Any Two Assessments as per regulations | 20         | 10                                      |             |
| SEE         | Semester End Examination               | 100        | 50                                      | 50          |
| Total Marks |                                        |            |                                         | 100         |

**SEMESTER END EXAMINATION (SEE):**

- The Question paper for each course contains two parts, Part – A and Part – B.
- Part – A consists of **Short Answer Questions** (2 Marks/1 mark) for 20 marks covering the complete syllabus and it is compulsory. Multiple Choice Questions are not allowed.



3. Part – B consists of 10 questions, two questions of 16 marks (with max. of 3 sub questions) from each module with internal choice. Students shall answer five full questions, selecting one full question from each module.

**CO-PO Mapping**

| PO<br>CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|
| CO1      | 2   | -   | 2   | -   | 1   | 1   | 1   | 1   | 1   | 1    | 1    |
| CO2      | 2   | -   | 2   | -   | 1   | 1   | 1   | 1   | 1   | 1    | 1    |
| CO3      | 2   | -   | 2   | -   | 1   | 1   | 1   | 1   | 1   | 1    | 1    |
| CO4      | 2   | -   | 2   | -   | -   | 1   | 1   | 1   | 1   | 1    | 1    |
| CO5      | 2   | -   | 2   | -   | -   | 1   | 1   | 1   | 1   | 1    | 1    |

Level 3 - High, Level 2 - Moderate, Level 1 - Low



**Department of Civil Engineering**

| <b>Semester-IV</b>                               |   |                  |              |   |           |
|--------------------------------------------------|---|------------------|--------------|---|-----------|
| <b>Concrete and Highway Materials Laboratory</b> |   |                  |              |   |           |
| <b>Category: PCCL</b>                            |   |                  |              |   |           |
| Course Code                                      | : | <b>B25CVL406</b> | CIE          | : | 50 Marks  |
| Teaching Hours L : T : P : S                     | : | 0:0:28:2         | SEE          | : | 50 Marks  |
| Total Hours/Semester                             | : | 30               | Total        | : | 100 Marks |
| Credits                                          | : | 1                | SEE Duration | : | 3 Hrs     |

**Course Learning Objective is**

|    |                                                                                                                                                                                                                               |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | To impart practical knowledge of laboratory testing of <b>cement and concrete</b> (fresh, hardened, self-compacting, and NDT) for evaluating strength, workability, durability, and quality control in building construction. |
| 2. | To familiarize students with laboratory tests related to <b>highway engineering materials</b> , including aggregates, bituminous materials, and soils, for assessing their suitability in pavement design and construction.   |

| <b>Sl. No</b> | <b>List of Experiments</b>                                                                                                                                                                                                             |
|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.            | Tests on Cement:<br>a. Normal Consistency, b. Setting time, c. Compressive strength, d. fineness test, e. specific gravity f) Soundness                                                                                                |
| 2.            | Tests on Concrete:<br>i. slump,<br>ii. compaction factor and<br>iii. Vee Bee test                                                                                                                                                      |
| 3.            | Tests on hardened concrete:<br>i. compressive strength test,<br>ii. split tensile strength test,<br>iii. flexural strength test                                                                                                        |
| 4.            | NDT tests by rebound hammer and pulse velocity test.                                                                                                                                                                                   |
| 5.            | Tests on Self Compacting Concrete:<br>a. Design of self compacting concrete, As per Is 10262:2019<br>b. slump flow test,<br>c. V-funnel test,<br>d. J-Ring test,<br>e. U Box test and<br>f. L Box test                                 |
| 6.            | Tests on Aggregates<br>a. Aggregate Crushing value<br>b. Los Angeles abrasion test<br>c. Aggregate impact test                                                                                                                         |
| 7.            | Tests on Bituminous Materials<br>a. Penetration test b. Ductility test<br>c. Softening point test<br>d. Specific gravity test<br>e. Viscosity test by tarviscometer<br>f. Bituminous Mix Design by Marshal Method (Demonstration only) |
| 8.            | Tests on Soil<br>a. Wet sieve analysis<br>b. CBR test                                                                                                                                                                                  |

**Course Outcomes:** At the end of the course, the students will be able to

|     |                                                                                                                                                               |
|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CO1 | <b>Conduct and interpret laboratory tests on cement and concrete</b> to assess material performance, mix design requirements, and structural quality.         |
| CO2 | Evaluate highway construction materials (aggregates, bitumen, and soils) using standard tests and apply the results in pavement design and quality assurance. |



**ASSESSMENT STRUCTURE FOR LABORATORY:**

- The assessment for each course is equally divided between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each component carrying 50% weightage.
- For both CIE and SEE, the student is required to conduct Two experiments
- To qualify and become eligible to appear for SEE, in the CIE component, a student must secure a minimum of 40% of 50 marks, i.e., 20 marks.
- To pass the SEE component, a student must secure a minimum of 35% of 50 marks, i.e., 18 marks. A student is deemed to have successfully completed the course if the combined total of CIE and SEE is at least 40 out of 100 marks.

| <b>CIE</b>         | <b>Type of Assessment</b>          | <b>Max. Marks</b>                           | <b>Max. Marks<br/>Scaling Down to</b> | <b>Total Marks</b> |
|--------------------|------------------------------------|---------------------------------------------|---------------------------------------|--------------------|
| <b>Laboratory</b>  | <b>Lab Conduction &amp; Record</b> | <b>Evaluate each expt.<br/>for 10 marks</b> | <b>15</b>                             | <b>50</b>          |
|                    | <b>Laboratory Test 1</b>           | <b>50</b>                                   | <b>15</b>                             |                    |
|                    | <b>Laboratory Test 2</b>           | <b>50</b>                                   | <b>20</b>                             |                    |
| <b>SEE</b>         | <b>Semester End Examination</b>    | <b>100</b>                                  | <b>50</b>                             | <b>50</b>          |
| <b>Grand Total</b> |                                    |                                             |                                       | <b>100</b>         |



**Department of Civil Engineering**

| <b>Semester-IV</b>           |   |                  |              |   |           |
|------------------------------|---|------------------|--------------|---|-----------|
| <b>Sketchup Lab</b>          |   |                  |              |   |           |
| <b>Category: AEC</b>         |   |                  |              |   |           |
| Course Code                  | : | <b>B25CVL407</b> | CIE          | : | 50 Marks  |
| Teaching Hours L : T : P : S | : | 0:0:28:2         | SEE          | : | 50 Marks  |
| Total Hours/Semester         | : | 30               | Total        | : | 100 Marks |
| Credits                      | : | 1                | SEE Duration | : | 3 Hrs     |

| <b>Course Learning Objective is</b> |                                                                                                                                                                         |
|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.                                  | To introduce students to the SketchUp interface and core modelling tools for creating accurate 2D drawings and converting them into 3D architectural models.            |
| 2.                                  | To develop skills in modelling building elements, applying materials, site and terrain modelling, and preparing drawings with dimensions, layouts, and visual analysis. |

| <b>Sl. No</b> | <b>List of Experiments</b>                                                                                             |
|---------------|------------------------------------------------------------------------------------------------------------------------|
| 1.            | Introduction to SketchUp Interface (workspace, tools, menus, and navigation controls), Introduction to building bylaw. |
| 2.            | Drawing Basic 2D Geometric Shapes (square, rectangle, circle, and polygon), push-pull tool.                            |
| 3.            | Conversion of 2D Plan to 3D Model.                                                                                     |
| 4.            | Modelling of a single-storey residential building.                                                                     |
| 5.            | Components and Groups in Sketch Up.                                                                                    |
| 6.            | Applying Materials and Textures (brick, concrete, glass, wood, and tiles)                                              |
| 7.            | Modelling of Building Elements (Columns, Beams, Staircase, Doors and windows)                                          |
| 8.            | Terrain and Site Modelling (using sandbox tools)                                                                       |
| 9.            | Shadow and Sun Path Analysis (date, time, and location settings)                                                       |
| 10.           | Layout, Dimensioning, and Model Export (add dimensions, annotations, scenes, and export drawings)                      |

| <b>Course Outcomes:</b> At the end of the course, the students will be able to |                                                                                                                                                                |
|--------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CO1                                                                            | Create complete 3D models of simple residential buildings, including structural and architectural components, using appropriate modelling techniques.          |
| CO2                                                                            | Apply materials, perform basic shadow and sun path analysis, and generate annotated layouts and exported drawings suitable for presentation and documentation. |

**ASSESSMENT STRUCTURE FOR LABORATORY:**

- The assessment for each course is equally divided between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each component carrying 50% weightage.
- For both CIE and SEE, the student is required to conduct Two experiments
- To qualify and become eligible to appear for SEE, in the CIE component, a student must secure a minimum of 40% of 50 marks, i.e., 20 marks.
- To pass the SEE component, a student must secure a minimum of 35% of 50 marks, i.e., 18 marks. A student is deemed to have successfully completed the course if the combined total of CIE and SEE is at least 40 out of 100 marks.

| <b>CIE</b>         | <b>Type of Assessment</b>          | <b>Max. Marks</b>                       | <b>Max. Marks Scaling Down to</b> | <b>Total Marks</b> |
|--------------------|------------------------------------|-----------------------------------------|-----------------------------------|--------------------|
| <b>Laboratory</b>  | <b>Lab Conduction &amp; Record</b> | <b>Evaluate each expt. for 10 marks</b> | <b>15</b>                         | <b>50</b>          |
|                    | <b>Laboratory Test 1</b>           | <b>50</b>                               | <b>15</b>                         |                    |
|                    | <b>Laboratory Test 2</b>           | <b>50</b>                               | <b>20</b>                         |                    |
| <b>SEE</b>         | <b>Semester End Examination</b>    | <b>100</b>                              | <b>50</b>                         | <b>50</b>          |
| <b>Total Marks</b> |                                    |                                         |                                   | <b>100</b>         |



| Semester-III                                                                      |   |           |              |   |           |
|-----------------------------------------------------------------------------------|---|-----------|--------------|---|-----------|
| Community Project / Societal Project<br>(Project Based Learning)<br>Category: SDC |   |           |              |   |           |
| Course Code                                                                       | : | B25CVP308 | CIE          | : | 50 Marks  |
| Teaching Hours L : T : P : S                                                      | : | 0:0:0:30  | SEE          | : | 50 Marks  |
| Total Hours/Semester                                                              | : | 30        | Total        | : | 100 Marks |
| Credits                                                                           | : | 1         | SEE Duration | : | 3 Hrs     |

#### Course Learning Objective is

Rapid urbanization, population growth, environmental concerns, energy demand, water scarcity, waste management, transportation issues and rural development challenges have created practical problems affecting communities and public welfare. This course aims to integrate technical knowledge, field exposure and societal engagement so that students identify real community issues, frame problem statements and attempt appropriate, feasible and sustainable engineering responses within the scope of a one-semester project.

**Course outcome (Course Skill Set):** At the end of the course, the student will be able to:

1. Identify and analyse societal problems through field interaction and technical assessment.
2. Develop skills in **project planning, field survey, data collection, implementation**, documentation and reporting.
3. Formulate feasible engineering problem statements and solutions considering practical constraints and sustainability aspects.
4. Apply principles of environmental responsibility, ethics and societal welfare in engineering practice through community-oriented interventions.
5. Exhibit multidisciplinary learning and problem-solving ability based on collected data, user feedback and baseline conditions.
6. Demonstrate teamwork and communication skills while interacting with technical and non-technical stakeholders and reflect on project impact on society.

**Sustainable Development Goals:** The faculty shall encourage students to undertake community projects that align with and contribute towards satisfying the National Board of Accreditation (NBA) Criterion 3.6, namely, Evidence of Addressing Sustainable Development Goals (SDGs), which is a major emphasis of the United Nations (UN).

#### Methods for project identification:

Students may identify the project topic using one or more of the following methods:

- Interaction with local rural or urban stakeholders such as local leaders, corporation/municipality personnel, NGOs, panchayat representatives, etc.
- Review of issues highlighted in print and electronic media, and social networks (WhatsApp, Facebook, X, Instagram, etc.).
- After selecting a broad topic, students shall collect data, conduct a feasibility survey, estimate timelines and resources, approximate expenditure, and then define the problem statement and objectives clearly.

List of Project Topics and Engineering Outcomes:

The following structured sequence of activities is to be carried out during the semester:

| Sl. No. | Project title                                             | Measurable engineering outcome                                                                                                                         | Mapped POs                     | SDGs                   |
|---------|-----------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|------------------------|
| 1       | Rural and urban water conservation and management systems | Prepare a site-specific water-saving plan, estimate water demand-supply gap, and propose a feasible conservation intervention with quantified savings. | PO1, PO2, PO3, PO4, PO10, PO11 | SDG 6, SDG 11, SDG 12  |
| 2       | Waste management and recycling                            | Conduct waste audit, classify waste streams, and design a segregation/recycling workflow with measurable reduction in mixed waste.                     | PO2, PO3, PO4, PO6, PO8, PO10  | SDG 11, SDG 12, SDG 13 |
| 3       | Afforestation                                             | Identify a degraded area, prepare plantation layout, and demonstrate survival-rate tracking and maintenance schedule for saplings.                     | PO2, PO3, PO4, PO6, PO7, PO11  | SDG 11, SDG 13, SDG 15 |
| 4       | Biogas generation and power generation                    | Estimate organic waste availability, size a small biogas system, and document expected gas output or energy yield.                                     | PO1, PO2, PO3, PO4, PO5, PO10  | SDG 7, SDG 11, SDG 12  |
| 5       | DPR for solar power rural plant                           | Prepare a DPR with load assessment, panel sizing, cost estimate, and projected energy                                                                  | PO1, PO2, PO3, PO4,            | SDG 7, SDG 9,          |



|    |                                                     |                                                                                                                                      |                                |                              |
|----|-----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|------------------------------|
|    |                                                     | generation and payback.                                                                                                              | PO5, PO10                      | SDG 11                       |
| 6  | DPR for electrification of village/tribal community | Map unserved/underserved households, propose electrification layout, and estimate coverage, losses, and implementation cost.         | PO1, PO2, PO3, PO4, PO10, PO11 | SDG 7, SDG 9, SDG 10         |
| 7  | DPR for rural drainage system                       | Survey drainage bottlenecks, develop a drainage layout, and estimate runoff handling capacity and flood-risk reduction               | PO1, PO2, PO3, PO4, PO6, PO10  | SDG 6, SDG 9, SDG 11         |
| 8  | Sustainability and environmental health projects    | Assess local environmental health issues and propose interventions with measurable improvement in hygiene, safety, or resource use.  | PO2, PO3, PO4, PO6, PO7, PO8   | SDG 3, SDG 6, SDG 11, SDG 12 |
| 9  | Plastic free campaigns                              | Measure plastic usage before and after awareness intervention and report percentage reduction or behavioural change.                 | PO2, PO3, PO6, PO7, PO8, PO10  | SDG 11, SDG 12, SDG 13       |
| 10 | Health and nutrition awareness                      | Conduct baseline and post-program awareness survey and document improvement in awareness score or adoption of healthier practices.   | PO2, PO6, PO7, PO8, PO9, PO10  | SDG 2, SDG 3, SDG 11         |
| 11 | Societal projects involving health wellness         | Identify a community health need and develop an awareness/service module with measurable participation and feedback outcomes.        | PO2, PO3, PO6, PO8, PO9, PO10  | SDG 3, SDG 11, SDG 17        |
| 12 | Air quality monitoring system                       | Collect air-quality data, compare with reference limits, and present trends along with possible mitigation suggestions.              | PO2, PO3, PO4, PO5, PO6, PO10  | SDG 3, SDG 11, SDG 13        |
| 13 | Plastic waste reduction campaign                    | Track collection, segregation, and replacement actions, and quantify reduction in plastic waste generation or littering.             | PO2, PO3, PO6, PO7, PO8, PO10  | SDG 11, SDG 12, SDG 13       |
| 14 | Urban greening projects                             | Prepare greening plan, identify planting locations, and assess environmental benefits such as shade, aesthetics, or heat mitigation. | PO2, PO3, PO4, PO6, PO7, PO11  | SDG 11, SDG 13, SDG 15       |
| 15 | Smart agriculture solution                          | Design a low-cost monitoring or irrigation support solution and estimate improvement in water use efficiency or crop support.        | PO1, PO2, PO3, PO4, PO5, PO10  | SDG 2, SDG 6, SDG 9          |
| 16 | Smart irrigation system                             | Estimate crop water requirement, propose control logic, and quantify water savings compared with conventional irrigation.            | PO1, PO2, PO3, PO4, PO5, PO10  | SDG 2, SDG 6, SDG 12         |
| 17 | Food security initiatives / cold storage system     | Estimate storage need, design a simple cold-chain concept, and document reduction in spoilage or wastage.                            | PO1, PO2, PO3, PO4, PO5, PO10  | SDG 2, SDG 9, SDG 12         |
| 18 | Human rights awareness with legal systems           | Prepare and deliver an awareness module and assess increase in legal awareness and access-to-rights understanding.                   | PO6, PO7, PO8, PO9, PO10       | SDG 5, SDG 10, SDG 16        |
| 19 | Use of application / application program            | Build or demonstrate a useful community app and measure usability, adoption, or efficiency improvement.                              | PO1, PO3, PO4, PO5, PO9, PO10  | SDG 9, SDG 11, SDG 17        |
| 20 | House tax collection through digital media          | Develop a simple digital workflow or awareness support and measure improvement in compliance, convenience, or response time.         | PO2, PO3, PO4, PO5, PO10, PO11 | SDG 9, SDG 11, SDG 16        |

**Suggested Learning Resources: Textbooks:**

1. Phadke, N. D. Community Engagement and Social Innovation. 1st ed., Oxford University Press, New Delhi.
2. Garg, N. R. Project-Based Learning in Engineering Education. 1st ed., Pearson India Education Services, Noida.
3. Gupta, A. and P. Singh. Service Learning and Community Projects. 1st ed., McGraw-Hill Education (India), New Delhi.
4. Wilson, G. Practical Guide to Community Development Projects. 2nd ed., Routledge, London.

**Reference books:**

1. NPTEL courses on Project-Based Learning and Social Innovation.



2. SWAYAM courses on community engagement and sustainability.
3. UN Sustainable Development Goals portal: <https://sdgs.un.org>
4. MyGov India and local civic body portals for community initiatives.
5. YouTube resources on design thinking, social innovation, and community service learning.
6. NGO and government field-action case studies related to sanitation, water, health, education, and environment.

**Web links and Video Lectures (e-Resources):**

- NPTEL courses on Engineering Geology (IIT Roorkee, IIT Kharagpur).
- NPTEL courses on Soil Mechanics and Foundation Engineering (IIT Delhi, IIT Bombay).
- Virtual Labs – Geotechnical Engineering Virtual Lab (IIT Kanpur): <https://vlab.co.in> • Geological Survey of India (GSI) – Maps, reports, and publications: <https://www.gsi.gov.in>
- YouTube channels: Civil Engineering Essentials, The Engineering Classroom (soil mechanics experiments).
- American Society of Civil Engineers (ASCE) – Geotechnical resources and standards

**Teaching Learning Process:** The suggested TLP for Community / Societal Project is as follows;

| Week | Teaching–Learning Activity                                                | Faculty Role                                                    | Student Activity                                         | Output                                    |
|------|---------------------------------------------------------------------------|-----------------------------------------------------------------|----------------------------------------------------------|-------------------------------------------|
| 1    | Course introduction, objectives, ethics, conduct, and assessment briefing | Explain course scope, rules, rubrics, and expected deliverables | Understand course requirements and form teams            | Team list, course plan                    |
| 2    | Community problem identification and topic selection                      | Guide topic framing and feasibility                             | Identify local issues through discussion and observation | Shortlisted project topic                 |
| 3    | Stakeholder interaction and preliminary survey                            | Demonstrate survey methods and stakeholder engagement           | Collect initial data from community/users                | Survey notes, interview record            |
| 4    | Problem statement and objective formulation                               | Review and refine problem statement                             | Prepare problem statement, scope, and objectives         | Approved problem statement                |
| 5    | Literature/case study review and baseline analysis                        | Suggest relevant references and examples                        | Study existing solutions and compare approaches          | Baseline analysis summary                 |
| 6    | Project planning and role assignment                                      | Help teams organize tasks, timeline, and responsibilities       | Plan activities, divide roles, and prepare schedule      | Work plan / Gantt chart                   |
| 7    | Feasibility analysis and solution brainstorming                           | Check technical feasibility and practicality                    | Generate possible engineering solutions                  | Solution alternatives sheet               |
| 8    | Selection of final solution and design approach                           | Review final concept and design logic                           | Finalize concept, methods, and expected outcome          | Concept note / design outline             |
| 9    | Data processing / calculations / sizing / mapping                         | Support computations and technical review                       | Analyze data, perform calculations, prepare maps/charts  | Technical analysis sheet                  |
| 10   | Prototype / model / audit / DPR / app development                         | Monitor progress and correct technical issues                   | Develop the selected output                              | Working model / draft DPR / map / app     |
| 11   | Testing, refinement, and implementation planning                          | Evaluate technical correctness and improvements                 | Test prototype or validate proposal with users           | Test results / revised output             |
| 12   | Field implementation / demonstration / awareness activity                 | Facilitate community interaction and documentation              | Conduct implementation or demonstration                  | Photos, attendance, implementation record |
| 13   | Documentation of outcomes, feedback, and impact                           | Review report structure and completeness                        | Compile findings, stakeholder feedback, and observations | Draft report                              |
| 14   | Presentation preparation and viva practice                                | Conduct mock presentation and feedback                          | Prepare slides/poster and rehearse                       | Presentation deck                         |



|    |                                                |                                    |                                                     |                                  |
|----|------------------------------------------------|------------------------------------|-----------------------------------------------------|----------------------------------|
| 15 | Final presentation, submission, and reflection | Evaluate performance using rubrics | Present project, submit report, reflect on learning | Final report, presentation, viva |
|----|------------------------------------------------|------------------------------------|-----------------------------------------------------|----------------------------------|

#### ASSESSMENT STRUCTURE:

##### A. Continuous Internal Evaluation (CIE) – 50 marks

- Students, in batches of 3–4, shall undertake at least one project (or a combination of two related activities) aiming, as far as possible, at a logical implemented or implementable outcome.
- CIE will be conducted by a departmental committee (HoD/nominee, guide and one senior faculty) using the following rubrics totalling 50 marks:

CIE pass requirement:

- A student shall secure a minimum of 20 marks out of 50 in CIE to become eligible to appear for SEE.
- Students who fail to earn the required CIE marks may be given additional opportunities before closure of the semester; no re-doing of CIE is permitted after the end of the semester.

##### B. Semester End Examination (SEE)

- Examination duration: 3 hours.
- Maximum examination marks: 100
- The SEE shall be conducted batch-wise by a committee of three faculties: project guide, one faculty from the same department and one from a different department.

SEE pass requirement and overall passing rule:

- For a pass in SEE, a student shall secure minimum 35 marks out of 100.
- For declaration of a pass grade, the sum of CIE marks (out of 50) and scaled SEE marks (out of 50) shall be  $\geq 40$ ; otherwise, the student is awarded grade F (Fail).

#### CIE Rubric — Continuous Internal Evaluation (Total 50 marks):

| Criterion                                                                      | Weight (marks) | Excellent (Full marks)                                                                           | Good                                                                      | Fair                                                          | Needs Improvement                                                 |
|--------------------------------------------------------------------------------|----------------|--------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|---------------------------------------------------------------|-------------------------------------------------------------------|
| Problem identification & Relevance to society/industry /community              | 8              | Problem is clearly identified with strong evidence of societal relevance and well-defined scope. | Problem is relevant and scope is clear with adequate supporting evidence. | Problem defined but justification or evidence is weak.        | Problem unclear or not relevant; little/no supporting evidence.   |
| Formation of problem statement; Engineering approach, innovation & feasibility | 10             | Problem statement is precise; approach is sound, innovative and clearly feasible.                | Problem statement adequate; approach feasible with minor gaps.            | Problem statement partial; approach feasibility is marginal.  | Problem statement missing or approach not feasible.               |
| Interaction with stakeholders; Data collection, analysis & interpretation      | 8              | Thorough stakeholder engagement; data collection is comprehensive; analysis is well interpreted. | Good engagement; data and analysis adequate with minor gaps.              | Limited engagement; data incomplete and analysis superficial. | Little/no stakeholder contact; insufficient or no data/ analysis. |
| Project documentation; Clarity, organization & problem solving demonstrated    | 10             | Documentation is complete, well organized, analytical, and shows strong problem-solving.         | Documentation complete and clear with some analytical content.            | Documentation basic with omissions; problem-solving limited.  | Documentation missing/poorly organized; no clear problem-solving  |



|                                                            |          |                                                                                            |                                                                |                                                                         |                                                                       |
|------------------------------------------------------------|----------|--------------------------------------------------------------------------------------------|----------------------------------------------------------------|-------------------------------------------------------------------------|-----------------------------------------------------------------------|
| Communication & Presentation skills                        | <b>6</b> | Presentation is confident, structured, and answers queries fully; visuals effective.       | Presentation clear and satisfactory; responds to most queries. | Presentation acceptable but lacks clarity or confidence; weak responses | Presentation poor or absent; unable to respond.                       |
| Contribution & Benefit to society (impact, sustainability) | <b>8</b> | Clear, demonstrable societal benefit and sustainability; realistic path to implementation. | Benefit plausible; sustainability considered with minor gaps.  | Limited or unclear societal benefit; sustainability not well addressed. | No evident benefit or sustainability; project not community-oriented. |

**SEE Rubric — Semester End Examination** (Enter marks out of 100; scaled to 50 later):

| Criterion                                                                      | Weight (marks) | Excellent (Full marks)                                                                           | Good                                                                      | Fair                                                                    | Needs Improvement                                                     |
|--------------------------------------------------------------------------------|----------------|--------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|-------------------------------------------------------------------------|-----------------------------------------------------------------------|
| Problem identification & Relevance to society/industry /community              | <b>16</b>      | Problem is clearly identified with strong evidence of societal relevance and well-defined scope. | Problem is relevant and scope is clear with adequate supporting evidence. | Problem defined but justification or evidence is weak.                  | Problem unclear or not relevant; little/no supporting evidence.       |
| Formation of problem statement; Engineering approach, innovation & feasibility | <b>20</b>      | Problem statement is precise; approach is sound, innovative and clearly feasible.                | Problem statement adequate; approach feasible with minor gaps.            | Problem statement partial; approach feasibility is marginal.            | Problem statement missing or approach not feasible.                   |
| Interaction with stakeholders; Data collection, analysis & interpretation      | <b>16</b>      | Thorough stakeholder engagement; data collection is comprehensive; analysis is well interpreted. | Good engagement; data and analysis adequate with minor gaps.              | Limited engagement; data incomplete and analysis superficial.           | Little/no stakeholder contact; insufficient or no data/ analysis.     |
| Project documentation; Clarity, organization & problem solving demonstrated    | <b>20</b>      | Documentation is complete, well organized, analytical, and shows strong problem-solving.         | Documentation complete and clear with some analytical content.            | Documentation basic with omissions; problem-solving limited.            | Documentation missing/poorly organized; no clear problem-solving      |
| Communication & Presentation skills                                            | <b>12</b>      | Presentation is confident, structured, and answers queries fully; visuals effective.             | Presentation clear and satisfactory; responds to most queries.            | Presentation acceptable but lacks clarity or confidence; weak responses | Presentation poor or absent; unable to respond.                       |
| Contribution & Benefit to society (impact, sustainability)                     | <b>16</b>      | Clear, demonstrable societal benefit and sustainability; realistic path to implementation.       | Benefit plausible; sustainability considered with minor gaps.             | Limited or unclear societal benefit; sustainability not well addressed. | No evident benefit or sustainability; project not community-oriented. |



### Semester III

#### Additional Mathematics – I

**Category: NCMC**

(Common to all disciplines of Engineering)

|                              |   |           |              |   |           |
|------------------------------|---|-----------|--------------|---|-----------|
| Course Code                  | : | B25MAD309 | CIE          | : | 100 Marks |
| Teaching Hours L : T : P : S | : | 42:0:0:0  | SEE          | : | --        |
| Total Hours                  | : | 42        | Total        | : | 100 Marks |
| Credits                      | : | PP        | SEE Duration | : | --        |

#### Course Objective is

1. To Develop the knowledge of solving engineering problems of multivariable and algebraic series.
2. To Provide insight into applications of complex numbers and vector algebra.
3. To Apply the fundamentals of Vector differentiation.
4. To Familiarize the importance of Integral calculus.
5. To provide compressive understand of first order and first-degree differential equations.

| Module-1                                                                                                                                                                                                                                                                                            | No. of Hours |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| Successive differentiation-problems. Taylor's & Maclaurin's series expansions-problems. Partial Differentiation: Euler's theorem (without Proof)-problems on first order derivatives only. Total derivatives-differentiation of composite functions. Jacobians -Problems.                           | <b>9</b>     |
| Module-2                                                                                                                                                                                                                                                                                            | No. of Hours |
| Definitions and properties. Modulus and amplitude of a complex number, Argand's diagram, De-Moivre's theorem (without proof), Problems. Vector Algebra: Scalar and vectors. Addition, subtraction and multiplication of vectors- Dot and Cross products, problems. Scalar triple product, Problems. | <b>8</b>     |
| Module-3                                                                                                                                                                                                                                                                                            | No. of Hours |
| Differentiation of vector functions. Velocity and acceleration of a particle moving on a space curve. Scalar and vector point functions. Gradient, Divergence, Curl-simple problems. Solenoidal and irrotational vector fields-Problems.                                                            | <b>8</b>     |
| Module-4                                                                                                                                                                                                                                                                                            | No. of Hours |
| Review of elementary integral calculus. Reduction formulae for $\sin^n x$ , $\cos^n x$ (without proof)-problems. Double and triple integrals-Simple problems.                                                                                                                                       | <b>9</b>     |
| Module-5                                                                                                                                                                                                                                                                                            | No. of Hours |
| Introduction-solutions of first order and first-degree differential equations: Variable separable method, Homogeneous differential equations, linear differential equations. Exact differential equations.                                                                                          | <b>8</b>     |

**Course Outcomes:** At the end of the course, the students will be able to

|     |                                                                                                     |
|-----|-----------------------------------------------------------------------------------------------------|
| CO1 | Use derivatives and partial derivatives to calculate the rate of change of multivariate functions.  |
| CO2 | Apply concepts of complex numbers and vector algebra to analyse the problems arising in that area.  |
| CO3 | Analyse position, velocity and acceleration in two and three dimensions of vector-valued functions. |
| CO4 | Learn techniques of integration including the evaluation of double and triple integrals.            |
| CO5 | Identify and solve first-order ordinary differential equations.                                     |

#### Text Books

|   |                                                                                            |
|---|--------------------------------------------------------------------------------------------|
| 1 | B.S.Grewal: "Higher Engineering Mathematics", Khanna publishers, 44th Ed. 2018             |
| 2 | E.Kreyszig: "Advanced Engineering Mathematics", John Wiley & Sons, 8th Ed. (Reprint), 2016 |

#### Reference Text Books

|   |                                                                                                                                                                     |
|---|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | H. K. Dass, "Advanced Engineering Mathematics" S. Chand publication. 4. C. Ray Wylie, Louis C. Barrett : "Advanced Engineering Mathematics", 6th Edition, 2. McGraw |
| 2 | C. Ray Wylie, Louis C. Barrett : "Advanced Engineering Mathematics", 6th Edition, 2. McGraw                                                                         |
| 3 | B.V. Ramana: "Higher Engineering Mathematics" 11th Edition, Tata McGraw-Hill, 208.                                                                                  |



| Web links and Video lectures (e-Resources) |                                                                                                                 |
|--------------------------------------------|-----------------------------------------------------------------------------------------------------------------|
| 1.                                         | <a href="https://nptel.ac.in/courses/12286025">https://nptel.ac.in/courses/12286025</a>                         |
| 2.                                         | <a href="#">VTU EDUSAT PROGRAMME – 20</a>                                                                       |
| 3.                                         | <a href="http://www.class-central.com/subject/math(MOOCs)">http://www.class-central.com/subject/math(MOOCs)</a> |

#### Assessment Details both (CIE only)

The weightage of continuous Internal Evaluation (CIE) is 100%. The minimum passing mark for the CIE is 40% of maximum marks (40 marks out of 100).

The CIE may comprise Assessment tests, assignments, quizzes or other academic activities, as decided by the concerned teacher. The distribution of marks among these activities shall be determined by the course teacher. The total marks awarded for all CIE activities shall be 100 marks.

| CIE         | Type of Assessment                     | Max. Marks | Max. Marks Scaling Down to              | Total Marks |
|-------------|----------------------------------------|------------|-----------------------------------------|-------------|
| Theory      | Internal Assessment1                   | 50         | 80<br>(Average of Best two Assessments) | 100         |
|             | Internal Assessment2                   | 50         |                                         |             |
|             | Internal Assessment3                   | 50         |                                         |             |
| AAT         | Any One Assessments as per regulations | 20         | 20                                      |             |
| Total Marks |                                        |            |                                         | 100         |

#### CO-PO Mapping

| PO<br>CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|
| CO1      | 3   | 3   | 3   | 2   | -   | -   | -   | -   | 1   | -    | 2    |
| CO2      | 3   | 3   | 3   | 2   | -   | -   | -   | -   | 1   | -    | 2    |
| CO3      | 3   | 3   | 3   | 2   | -   | -   | -   | -   | -   | -    | 2    |
| CO4      | 3   | 3   | 3   | 2   | -   | -   | -   | -   | -   | -    | 2    |
| CO5      | 3   | 3   | 3   | 2   | -   | -   | -   | -   | -   | -    | 2    |

Level 3 - High, Level 2 - Moderate, Level 1 - Low



MOOGAMBIGAI CHARITABLE AND EDUCATIONAL TRUST  
**Rajarajeswari College of Engineering**  
 (An Autonomous Institution under Visvesvaraya Technological University, Belagavi)  
**Department of Computer Science and Engineering**

| <b>Semester-IV</b>                                |   |                  |              |             |
|---------------------------------------------------|---|------------------|--------------|-------------|
| <b>Biology for Engineers</b>                      |   |                  |              |             |
| <b>Category: BSC</b>                              |   |                  |              |             |
| <b>(Common to all disciplines of Engineering)</b> |   |                  |              |             |
| Course Code                                       | : | <b>B25BEK405</b> | CIE          | : 50 Marks  |
| Teaching Hours L : T : P : S                      | : | 28:0:0:32        | SEE          | : 50 Marks  |
| Total Hours/Semester                              | : | 60               | Total        | : 100 Marks |
| Credits                                           | : | 2                | SEE Duration | : 2Hrs      |

| <b>Course Learning Objective is</b> |                                                                                              |
|-------------------------------------|----------------------------------------------------------------------------------------------|
| 1.                                  | To study the concepts and types of artificial intelligence.                                  |
| 2.                                  | To Demonstrate basic machine learning methods for regression, classification and clustering. |
| 3.                                  | To understand real-world applications across different disciplines.                          |
| 4.                                  | To make use of prompt engineering techniques to interact with generative AI tools.           |
| 5.                                  | To study recent trends in artificial intelligence and machine learning.                      |

| <b>Module- 1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>No. of Hours</b> |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| <b>Introduction to Biology:</b> The cell (as an information-processing unit): the basic unit of life, Structure and functions of a cell. The Plant Cell and animal cell, Prokaryotic and Eukaryotic cell, Stem cells (inspiration for regenerative bioelectronics) and their application. Importance of special biomolecules: Enzymes, vitamins and hormones. (Classification with one example each, Properties and functions)                                                                                                                                                                                                                                                                                                                                                                       | 6                   |
| <b>Module- 2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>No. of Hours</b> |
| <b>Biomolecules and Their Applications:</b> DNA/RNA for bio-computing and molecular electronics, Forensics – DNA fingerprinting, lipids (biodiesel, cleaning agents/detergents), Enzymes (glucose-oxidase in biosensors, lignolytic enzyme in bio-bleaching). Human Blood substitutes - hemoglobin-based oxygen carriers (HBOCs) and perfluorocarbons (PFCs).                                                                                                                                                                                                                                                                                                                                                                                                                                        | 6                   |
| <b>Module- 3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>No. of Hours</b> |
| <b>Human Organ Systems and Bio Designs:</b> Brain as a CPU system (architecture, CNS and Peripheral Nervous System, signal transmission, EEG, Robotic arms for prosthetics. Engineering solutions for Parkinson's disease). Eye as a Camera system (architecture of rod and cone cells, optical corrections, cataract, lens materials, bionic eye). Heart as a pump system (architecture, electrical signalling - ECG monitoring and heart related issues, reasons for blockages of blood vessels, design of stents, pace makers, defibrillators). Lungs as purification system (architecture, gas exchange mechanisms, spirometry, abnormal lung physiology - COPD, Ventilators, Heart-lung machine). Kidney as a filtration system (architecture, mechanism of filtration, CKD, dialysis systems). | 5                   |
| <b>Module- 4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>No. of Hours</b> |
| <b>Nature-Bioinspired Materials and Mechanisms:</b> Echolocation (ultrasonography, sonars), Photosynthesis (photovoltaic cells, bionic leaf). Bird flying (GPS and aircrafts), Lotus leaf effect (Super hydrophobic and self-cleaning surfaces), Plant burrs (Velcro), Shark skin (Friction reducing swim suits), Kingfisher beak (Bullet train).                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 6                   |
| <b>Module- 5</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>No. of Hours</b> |
| <b>Trends Bioengineering:</b> Bioprinting techniques and materials, 3D printing of ear, bone and skin. 3D printed foods. Electrical tongue and electrical nose in food science, DNA origami and Biocomputing, Bioimaging and Artificial Intelligence for disease diagnosis. Bioremediation and Bio mining. Medical imaging technologies—X-ray, CT, MRI and Ultrasound (overview);                                                                                                                                                                                                                                                                                                                                                                                                                    | 5                   |

| <b>Course Outcomes:</b> At the end of the course, the students will be able to |                                                                                                 |
|--------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| CO1                                                                            | Elucidate the basic biological concepts via relevant industrial applications and case studies.  |
| CO2                                                                            | Evaluate the principles of design and development, for exploring novel bioengineering projects. |
| CO3                                                                            | Corroborate the concepts of biomimetics for specific requirements.                              |



|                   |                                                                                                                                                                                                    |
|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CO4               | Think critically towards exploring innovative biobased solutions for socially relevant problems.                                                                                                   |
| <b>Text Books</b> |                                                                                                                                                                                                    |
| 1.                | Engineering with Biology- Fundamentals and Applications, 2nd Edition, S. Fatima, R. S. Deshpande, M. Ziaullah, MahanteshMattada, Santosh Nejekar and Sadashiv Halbhavi, Najekar Publications, 2026 |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                     |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Reference Text Books</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                     |
| 1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Biology for Engineers, Rajendra Singh C and Rathnakar Rao N, Rajendra Singh C and Rathnakar Rao N Publishing, Bengaluru, 2023.                                      |
| 2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Human Physiology, Stuart Fox, Krista Rompolski, McGraw-Hill eBook. 16th Edition, 2022                                                                               |
| 3.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Biology for Engineers, Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W., 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 Biomedical Instrumentation, Leslie Cromwell, Prentice Hall 2011.                      |
| <b>Web links and Video lectures (e-Resources)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                     |
| <ul style="list-style-type: none"> <li>•<a href="https://nptel.ac.in/courses/121106008">https://nptel.ac.in/courses/121106008</a></li> <li>•<a href="https://freevideolectures.com/course/4877/nptel-biology-engineers-other-non-biologists">https://freevideolectures.com/course/4877/nptel-biology-engineers-other-non-biologists</a></li> <li>•<a href="https://ocw.mit.edu/courses/20-020-introduction-to-biological-engineering-design-spring-2009">https://ocw.mit.edu/courses/20-020-introduction-to-biological-engineering-design-spring-2009</a></li> </ul> |                                                                                                                                                                     |

### ASSESSMENT STRUCTURE:

The assessment in each course is divided equally between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each carrying 50% weightage. To qualify and become eligible to appear for SEE, in the CIE, a student must score at least 40% of 50 marks, i.e., 20 marks. To pass the SEE, a student must score at least 35% of 50 marks, i.e., 18 marks. Notwithstanding the above, a student is considered to have passed the course, provided the combined total of CIE and SEE is at least 40marks out of 100 marks.

### CONTINUOUS INTERNAL EVALUATION (CIE):

| CIE                | Type of Assessment                     | Max. Marks | Max. Marks Scaling Down to              | Total Marks |
|--------------------|----------------------------------------|------------|-----------------------------------------|-------------|
| Theory             | Internal Assessment1                   | 50         | 40<br>(Average of Best two Assessments) | 50          |
|                    | Internal Assessment2                   | 50         |                                         |             |
|                    | Internal Assessment3                   | 50         |                                         |             |
| AAT                | Any Two Assessments as per Regulations | 20         | 10                                      |             |
| SEE                | Semester End Examination               | 50         | -                                       | 50          |
| <b>Grand Total</b> |                                        |            |                                         | <b>100</b>  |

### SEMESTER END EXAMINATION (SEE):

1. The Question paper shall be set for 50 marks and duration of SEE is 2 Hours.
2. Two questions of 10 marks (with minimum two sub questions) from each module with internal choice.
3. Students should answer five full questions, selecting one full question from each module.
4. Mention COs, POs, Bloom's Taxonomy levels in the question paper.

### CO-PO Mapping:

| PO<br>CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|
| CO1      | 1   | 1   | -   | -   | 1   | -   | -   | -   | 1   | -    | 1    |
| CO2      | 1   | 1   | -   | -   | 1   | -   | -   | -   | 1   | -    | 1    |
| CO3      | 1   | 1   | -   | -   | 1   | -   | -   | -   | 1   | -    | 1    |
| CO4      | 1   | 1   | -   | -   | 1   | -   | -   | -   | 1   | -    | 1    |
| CO5      | 1   | 1   | -   | -   | 1   | -   | -   | -   | 1   | -    | 1    |

Level 3 - High, Level 2 - Moderate, Level 1 - Low



| <b>Semester-IV</b>                                                                       |   |                  |              |             |
|------------------------------------------------------------------------------------------|---|------------------|--------------|-------------|
| <b>Environmental Science Project</b><br>(Project Based Learning)<br><b>Category: SDC</b> |   |                  |              |             |
| Course Code                                                                              | : | <b>B25CVP408</b> | CIE          | : 50 Marks  |
| Teaching Hours L : T : P : S                                                             | : | 0:0:0:30         | SEE          | : 50 Marks  |
| Total Hours/Semester                                                                     | : | 30               | Total        | : 100 Marks |
| Credits                                                                                  | : | 1                | SEE Duration | : 3 Hrs     |

**Course Learning Objective is**

The Environmental Science Project is a practical, applied-learning course that builds students' environmental awareness and responsibility. It focuses on real issues such as climate change, pollution, biodiversity, resource use, soil erosion, and thermal comfort, using field surveys, case studies, data collection, audits, and analysis to develop feasible and sustainable solutions. Students may work individually or in groups of up to four, including interdisciplinary topics, and assessment is based on the prescribed rubrics.

Course outcome (Course Skill Set): At the end of the course, the student will be able to:

1. Identify and analyse environmental problems through field interaction and technical assessment.
2. Develop skills in project planning, field survey, data collection, implementation, documentation and reporting.
3. Formulate feasible environmental problem statements and solutions considering practical constraints and sustainability aspects.
4. Apply principles of environmental responsibility, ethics and societal welfare in engineering practice through community-oriented interventions.
5. Exhibit multidisciplinary learning and problem-solving ability based on collected data, user feedback and baseline conditions.
6. Demonstrate teamwork and communication skills while interacting with technical and non-technical stakeholders and reflect on project impact on society.

**Sustainable Development Goals:** The faculty shall encourage students to undertake community projects that align with and contribute towards satisfying the National Board of Accreditation (NBA) Criterion 3.6, namely, Evidence of Addressing Sustainable Development Goals (SDGs), which is a major emphasis of the United Nations (UN).

**Methods for project identification:**

Students may identify the project topic using one or more of the following methods: interaction with local rural or urban stakeholders such as local leaders, corporation/municipality personnel, NGOs, panchayat representatives, etc.; review of issues highlighted in print and electronic media, and social networks; and, after selecting a broad topic, collect data, conduct a feasibility survey, estimate timelines and resources, approximate expenditure, and define the problem statement and objectives clearly.

List of Project Topics and Engineering Outcomes:

The following structured sequence of activities is to be carried out during the semester:

| Sl. No. | Project title                                             | Measurable engineering outcome                                                                                                                         | Mapped POs                     | SDGs                   |
|---------|-----------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|------------------------|
| 1       | Rural and urban water conservation and management systems | Prepare a site-specific water-saving plan, estimate water demand-supply gap, and propose a feasible conservation intervention with quantified savings. | PO1, PO2, PO3, PO4, PO10, PO11 | SDG 6, SDG 11, SDG 12  |
| 2       | Waste management and recycling                            | Conduct waste audit, classify waste streams, and design a segregation/recycling workflow with measurable reduction in mixed waste.                     | PO2, PO3, PO4, PO6, PO8, PO10  | SDG 11, SDG 12, SDG 13 |
| 3       | Afforestation                                             | Identify a degraded area, prepare plantation layout, and demonstrate survival-rate tracking and maintenance schedule for saplings.                     | PO2, PO3, PO4, PO6, PO7, PO11  | SDG 11, SDG 13, SDG 15 |
| 4       | Biogas generation and                                     | Estimate organic waste availability, size                                                                                                              | PO1, PO2,                      | SDG 7,                 |



|    |                                                     |                                                                                                                                      |                                |                              |
|----|-----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|------------------------------|
|    | power generation                                    | a small biogas system, and document expected gas output or energy yield.                                                             | PO3, PO4, PO5, PO10            | SDG 11, SDG 12               |
| 5  | DPR for solar power rural plant                     | Prepare a DPR with load assessment, panel sizing, cost estimate, and projected energy generation and payback.                        | PO1, PO2, PO3, PO4, PO5, PO10  | SDG 7, SDG 9, SDG 11         |
| 6  | DPR for electrification of village/tribal community | Map unserved/underserved households, propose electrification layout, and estimate coverage, losses, and implementation cost.         | PO1, PO2, PO3, PO4, PO10, PO11 | SDG 7, SDG 9, SDG 10         |
| 7  | DPR for rural drainage system                       | Survey drainage bottlenecks, develop a drainage layout, and estimate runoff handling capacity and flood-risk reduction               | PO1, PO2, PO3, PO4, PO6, PO10  | SDG 6, SDG 9, SDG 11         |
| 8  | Sustainability and environmental health projects    | Assess local environmental health issues and propose interventions with measurable improvement in hygiene, safety, or resource use.  | PO2, PO3, PO4, PO6, PO7, PO8   | SDG 3, SDG 6, SDG 11, SDG 12 |
| 9  | Plastic free campaigns                              | Measure plastic usage before and after awareness intervention and report percentage reduction or behavioural change.                 | PO2, PO3, PO6, PO7, PO8, PO10  | SDG 11, SDG 12, SDG 13       |
| 10 | Health and nutrition awareness                      | Conduct baseline and post-program awareness survey and document improvement in awareness score or adoption of healthier practices.   | PO2, PO6, PO7, PO8, PO9, PO10  | SDG 2, SDG 3, SDG 11         |
| 11 | Societal projects involving health wellness         | Identify a community health need and develop an awareness/service module with measurable participation and feedback outcomes.        | PO2, PO3, PO6, PO8, PO9, PO10  | SDG 3, SDG 11, SDG 17        |
| 12 | Air quality monitoring system                       | Collect air-quality data, compare with reference limits, and present trends along with possible mitigation suggestions.              | PO2, PO3, PO4, PO5, PO6, PO10  | SDG 3, SDG 11, SDG 13        |
| 13 | Plastic waste reduction campaign                    | Track collection, segregation, and replacement actions, and quantify reduction in plastic waste generation or littering.             | PO2, PO3, PO6, PO7, PO8, PO10  | SDG 11, SDG 12, SDG 13       |
| 14 | Urban greening projects                             | Prepare greening plan, identify planting locations, and assess environmental benefits such as shade, aesthetics, or heat mitigation. | PO2, PO3, PO4, PO6, PO7, PO11  | SDG 11, SDG 13, SDG 15       |
| 15 | Smart agriculture solution                          | Design a low-cost monitoring or irrigation support solution and estimate improvement in water use efficiency or crop support.        | PO1, PO2, PO3, PO4, PO5, PO10  | SDG 2, SDG 6, SDG 9          |
| 16 | Smart irrigation system                             | Estimate crop water requirement, propose control logic, and quantify water savings compared with conventional irrigation.            | PO1, PO2, PO3, PO4, PO5, PO10  | SDG 2, SDG 6, SDG 12         |
| 17 | Food security initiatives / cold storage system     | Estimate storage need, design a simple cold-chain concept, and document reduction in spoilage or wastage.                            | PO1, PO2, PO3, PO4, PO5, PO10  | SDG 2, SDG 9, SDG 12         |
| 18 | Human rights awareness with legal systems           | Prepare and deliver an awareness module and assess increase in legal awareness and access-to-rights understanding.                   | PO6, PO7, PO8, PO9, PO10       | SDG 5, SDG 10, SDG 16        |



|    |                                            |                                                                                                                              |                                |                       |
|----|--------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|--------------------------------|-----------------------|
| 19 | Use of application / application program   | Build or demonstrate a useful community app and measure usability, adoption, or efficiency improvement.                      | PO1, PO3, PO4, PO5, PO9, PO10  | SDG 9, SDG 11, SDG 17 |
| 20 | House tax collection through digital media | Develop a simple digital workflow or awareness support and measure improvement in compliance, convenience, or response time. | PO2, PO3, PO4, PO5, PO10, PO11 | SDG 9, SDG 11, SDG 16 |

#### Textbooks:

1. Phadke, N. D., Community Engagement and Social Innovation, Oxford University Press, New Delhi.
2. Garg, N. R., Project-Based Learning in Engineering Education, Pearson India Education, Services, Noida.
3. Gupta, A. and P. Singh, Service Learning and Community Projects, McGraw-Hill, Education (India), New Delhi.
4. Wilson, G., Practical Guide to Community Development Projects, Routledge, London.

#### Reference books:

1. NPTEL courses on Project-Based Learning and Social Innovation.
2. SWAYAM courses on community engagement and sustainability.
3. UN Sustainable Development Goals portal: <https://sdgs.un.org>
4. MyGov India and local civic body portals for community initiatives.
5. YouTube resources on design thinking, social innovation, and community service learning.
6. NGO and government field-action case studies related to sanitation, water, health, education, and environment.

#### Web links and Video Lectures (e-Resources):

- NPTEL courses on Engineering Geology (IIT Roorkee, IIT Kharagpur).
- NPTEL courses on Soil Mechanics and Foundation Engineering (IIT Delhi, IIT Bombay).
- Virtual Labs – Geotechnical Engineering Virtual Lab (IIT Kanpur): <https://vlab.co.in>
- Geological Survey of India (GSI) – Maps, reports, and publications: <https://www.gsi.gov.in>
- YouTube channels: Civil Engineering Essentials, The Engineering Classroom (soil mechanics experiments).
- American Society of Civil Engineers (ASCE) – Geotechnical resources and standards

#### Teaching Learning Process: The suggested TLP for Community / Societal Project is as follows;

| Week | Teaching–Learning Activity                                                | Faculty Role                                                    | Student Activity                                         | Output                         |
|------|---------------------------------------------------------------------------|-----------------------------------------------------------------|----------------------------------------------------------|--------------------------------|
| 1    | Course introduction, objectives, ethics, conduct, and assessment briefing | Explain course scope, rules, rubrics, and expected deliverables | Understand course requirements and form teams            | Team list, course plan         |
| 2    | Community problem identification and topic selection                      | Guide topic framing and feasibility                             | Identify local issues through discussion and observation | Shortlisted project topic      |
| 3    | Stakeholder interaction and preliminary survey                            | Demonstrate survey methods and stakeholder engagement           | Collect initial data from community/users                | Survey notes, interview record |
| 4    | Problem statement and objective formulation                               | Review and refine problem statement                             | Prepare problem statement, scope, and objectives         | Approved problem statement     |
| 5    | Literature/case study review and baseline analysis                        | Suggest relevant references and examples                        | Study existing solutions and compare approaches          | Baseline analysis summary      |
| 6    | Project planning and role assignment                                      | Help teams organize tasks, timeline, and                        | Plan activities, divide roles, and prepare               | Work plan / Gantt chart        |



|    |                                                           | responsibilities                                   | schedule                                                 |                                           |
|----|-----------------------------------------------------------|----------------------------------------------------|----------------------------------------------------------|-------------------------------------------|
| 7  | Feasibility analysis and solution brainstorming           | Check technical feasibility and practicality       | Generate possible engineering solutions                  | Solution alternatives sheet               |
| 8  | Selection of final solution and design approach           | Review final concept and design logic              | Finalize concept, methods, and expected outcome          | Concept note / design outline             |
| 9  | Data processing / calculations / sizing / mapping         | Support computations and technical review          | Analyze data, perform calculations, prepare maps/charts  | Technical analysis sheet                  |
| 10 | Prototype / model / audit / DPR / app development         | Monitor progress and correct technical issues      | Develop the selected output                              | Working model / draft DPR / map / app     |
| 11 | Testing, refinement, and implementation planning          | Evaluate technical correctness and improvements    | Test prototype or validate proposal with users           | Test results / revised output             |
| 12 | Field implementation / demonstration / awareness activity | Facilitate community interaction and documentation | Conduct implementation or demonstration                  | Photos, attendance, implementation record |
| 13 | Documentation of outcomes, feedback, and impact           | Review report structure and completeness           | Compile findings, stakeholder feedback, and observations | Draft report                              |
| 14 | Presentation preparation and viva practice                | Conduct mock presentation and feedback             | Prepare slides/poster and rehearse                       | Presentation deck                         |
| 15 | Final presentation, submission, and reflection            | Evaluate performance using rubrics                 | Present project, submit report, reflect on learning      | Final report, presentation, viva          |

## Assessment structure:

### Continuous Internal Evaluation (CIE) – 50 marks

- Students, in batches of 3–4, shall undertake at least one project (or a combination of two related activities) aiming, as far as possible, at a logical implemented or implementable outcome.
- CIE will be conducted by a departmental committee (HoD/nominee, guide and one senior faculty) using the following rubrics totalling 50 marks:
- A student shall secure a minimum of 20 marks out of 50 in CIE to become eligible to appear for SEE.
- Students who fail to earn the required CIE marks may be given additional opportunities before closure of the semester; no re-doing of CIE is permitted after the end of the semester.

#### A. Semester End Examination (SEE)

- Examination duration: 3 hours. Maximum examination marks: 100
- The SEE shall be conducted batch-wise by a committee of three faculties: project guide, one faculty from the same department and one from a different department.
- For a pass in SEE, a student shall secure minimum 35 marks out of 100.
- For declaration of a pass grade, the sum of CIE marks (out of 50) and scaled SEE marks (out of 50) shall be  $\geq 40$ ; otherwise, the student is awarded grade F (Fail).



**CIE Rubric — Continuous Internal Evaluation (Total 50 marks):**

| Criterion                                                                      | Weight (marks) | Excellent (Full marks)                                                                           | Good                                                                      | Fair                                                                    | Needs Improvement                                                     |
|--------------------------------------------------------------------------------|----------------|--------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|-------------------------------------------------------------------------|-----------------------------------------------------------------------|
| Problem identification & Relevance to society/industry /community              | <b>8</b>       | Problem is clearly identified with strong evidence of societal relevance and well-defined scope. | Problem is relevant and scope is clear with adequate supporting evidence. | Problem defined but justification or evidence is weak.                  | Problem unclear or not relevant; little/no supporting evidence.       |
| Formation of problem statement; Engineering approach, innovation & feasibility | <b>10</b>      | Problem statement is precise; approach is sound, innovative and clearly feasible.                | Problem statement adequate; approach feasible with minor gaps.            | Problem statement partial; approach feasibility is marginal.            | Problem statement missing or approach not feasible.                   |
| Interaction with stakeholders; Data collection, analysis & interpretation      | <b>8</b>       | Thorough stakeholder engagement; data collection is comprehensive; analysis is well interpreted. | Good engagement; data and analysis adequate with minor gaps.              | Limited engagement; data incomplete and analysis superficial.           | Little/no stakeholder contact; insufficient or no data/ analysis.     |
| Project documentation; Clarity, organization & problem solving demonstrated    | <b>10</b>      | Documentation is complete, well organized, analytical, and shows strong problem-solving.         | Documentation complete and clear with some analytical content.            | Documentation basic with omissions; problem-solving limited.            | Documentation missing/poorly organized; no clear problem-solving      |
| Communication & Presentation skills                                            | <b>6</b>       | Presentation is confident, structured, and answers queries fully; visuals effective.             | Presentation clear and satisfactory; responds to most queries.            | Presentation acceptable but lacks clarity or confidence; weak responses | Presentation poor or absent; unable to respond.                       |
| Contribution & Benefit to society (impact, sustainability)                     | <b>8</b>       | Clear, demonstrable societal benefit and sustainability; realistic path to implementation.       | Benefit plausible; sustainability considered with minor gaps.             | Limited or unclear societal benefit; sustainability not well addressed. | No evident benefit or sustainability; project not community-oriented. |

**SEE Rubric — Semester End Examination (Enter marks out of 100; scaled to 50 later):**

| Criterion                                                         | Weight (marks) | Excellent (Full marks)                                                                           | Good                                                                      | Fair                                                   | Needs Improvement                                               |
|-------------------------------------------------------------------|----------------|--------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|--------------------------------------------------------|-----------------------------------------------------------------|
| Problem identification & Relevance to society/industry /community | <b>16</b>      | Problem is clearly identified with strong evidence of societal relevance and well-defined scope. | Problem is relevant and scope is clear with adequate supporting evidence. | Problem defined but justification or evidence is weak. | Problem unclear or not relevant; little/no supporting evidence. |
| Formation of problem statement; Engineering approach, innovation  |                | Problem statement is precise; approach is sound, innovative and                                  | Problem statement adequate; approach                                      | Problem statement partial; approach feasibility is     | Problem statement missing or approach not                       |



| & feasibility                                                               | <b>20</b> | clearly feasible.                                                                                | feasible with minor gaps.                                      | marginal.                                                               | feasible.                                                             |
|-----------------------------------------------------------------------------|-----------|--------------------------------------------------------------------------------------------------|----------------------------------------------------------------|-------------------------------------------------------------------------|-----------------------------------------------------------------------|
| Interaction with stakeholders; Data collection, analysis & interpretation   | <b>16</b> | Thorough stakeholder engagement; data collection is comprehensive; analysis is well interpreted. | Good engagement; data and analysis adequate with minor gaps.   | Limited engagement; data incomplete and analysis superficial.           | Little/no stakeholder contact; insufficient or no data/ analysis.     |
| Project documentation; Clarity, organization & problem solving demonstrated | <b>20</b> | Documentation is complete, well organized, analytical, and shows strong problem-solving.         | Documentation complete and clear with some analytical content. | Documentation basic with omissions; problem-solving limited.            | Documentation missing/poorly organized; no clear problem-solving      |
| Communication & Presentation skills                                         | <b>12</b> | Presentation is confident, structured, and answers queries fully; visuals effective.             | Presentation clear and satisfactory; responds to most queries. | Presentation acceptable but lacks clarity or confidence; weak responses | Presentation poor or absent; unable to respond.                       |
| Contribution & Benefit to society (impact, sustainability)                  | <b>16</b> | Clear, demonstrable societal benefit and sustainability; realistic path to implementation.       | Benefit plausible; sustainability considered with minor gaps.  | Limited or unclear societal benefit; sustainability not well addressed. | No evident benefit or sustainability; project not community-oriented. |



### Semester IV

### Additional Mathematics –II

**Category: NCMC**

(Common to all disciplines of Engineering)

|                             |   |                  |              |   |           |
|-----------------------------|---|------------------|--------------|---|-----------|
| Course Code                 | : | <b>B25MAD409</b> | CIE          | : | 100 Marks |
| Teaching Hours L : T : P: S | : | 42:0:0:0         | SEE          | : | --        |
| Total Hours                 | : | 42               | Total        | : | 100 Marks |
| Credits                     |   | PP               | SEE Duration | : | --        |

#### Course Learning Objective is

|   |                                                                                                                            |
|---|----------------------------------------------------------------------------------------------------------------------------|
| 1 | To Compute the solution by applying the acquired knowledge of linear algebra to the problems of engineering applications.  |
| 2 | To Develop the knowledge of solving differential equations and their applications in engineering.                          |
| 3 | To introduce the concept of basic probability theory with practical application in engineering and social life situations. |
| 4 | To Develop the knowledge of numerical methods and apply them to solve algebraic and Transcendental equations.              |
| 5 | To Develop the knowledge of numerical methods and apply them to solve differential equations.                              |

| Module-1                                                                                                                                                                                                                                                                                                                         | No. of Hours |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| Introduction, Rank of a matrix by elementary row operations, Consistency of system of linear equations, Solution by Gauss Elimination method. Eigenvalues and eigenvectors of a square matrix. Problems.                                                                                                                         | 9            |
| Module-2                                                                                                                                                                                                                                                                                                                         | No. of Hours |
| Linear homogeneous/non homogeneous differential equations of second and higher-order with constant coefficients. Solution by using the inverse differential operator method. [Particular Integrals restricted to $(x) = e^{ax}$ , $\sin ax / \cos ax$ , $x^n$ .                                                                  | 9            |
| Module 3                                                                                                                                                                                                                                                                                                                         | No. of Hours |
| Introduction, Sample space and Events, Axioms of Probability. Addition and Multiplication theorem. Conditional Probability. Independent events. Baye's theorem, Problems.                                                                                                                                                        | 8            |
| Module-4                                                                                                                                                                                                                                                                                                                         | No. of Hours |
| Finite differences, Interpolation/extrapolation using Newton's forward and Backward difference formulae (No derivation), Problems. Solution of polynomial and transcendental equations by Newton–Raphson and Regula–Falsi methods (no derivation), Problems. Numerical Integration: Simson's 1/3 rd rule and 3/8 rule, problems. | 8            |
| Module-5                                                                                                                                                                                                                                                                                                                         | No. of Hours |
| Numerical solution of first-order ordinary differential equations: Taylor's series method, Modified Euler's method, Runge-Kutta method of order 4, Milne's predictor-corrector method. Problems.                                                                                                                                 | 8            |

**Course Outcomes:** At the end of the course, the students will be able to

|     |                                                                                     |
|-----|-------------------------------------------------------------------------------------|
| CO1 | Test for consistency and solve the system of linear equations.                      |
| CO2 | Solve higher order differential equations.                                          |
| CO3 | Apply elementary probability theory and solve related problems.                     |
| CO4 | Acquiring the knowledge of interpolation and solution of transcendental equations.. |
| CO5 | Acquiring the knowledge of numerical solution of differential equations.            |

#### Text Books

|   |                                                                                                                                                             |
|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Ronald E. Walpole, Raymond H Myers, Sharon L Myers & Keying Ye “Probability & Statistics for Engineers & Scientists”, Pearson Education, 9th edition, 2017. |
| 2 | Peter Bruce, Andrew Bruce & Peter Gedeck “Practical Statistics for Data Scientists” O'Reilly Media, Inc., 2nd edition 2020.                                 |

#### Reference Text Books

|   |                                                                                                   |
|---|---------------------------------------------------------------------------------------------------|
| 1 | Erwin Kreyszig, “Advanced Engineering Mathematics”, John Wiley & Sons, 9th Edition, 2006.         |
| 2 | B. S. Grewal “Higher Engineering Mathematics”, Khanna publishers, 44th Ed., 2021.                 |
| 3 | G Haribaskaran “Probability, Queuing Theory & Reliability Engineering”, Laxmi Publication, Latest |



Edition, 2006

**Web links and Video lectures (e-Resources)**

1. <https://nptel.ac.in/courses/12286025>
2. [VTU EDUSAT PROGRAMME – 20](#)
3. [http://www.class-central.com/subject/math\(MOOCs\)](http://www.class-central.com/subject/math(MOOCs))

**Assessment Details both (CIE Only)**

The weightage of continuous Internal Evaluation (CIE) is 100%. The minimum passing mark for the CIE is 40% of maximum marks (40 marks out of 100).

The CIE may comprise Assessment tests, assignments, quizzes or other academic activities, as decided by the concerned teacher. The distribution of marks among these activities shall be determined by the course teacher. The total marks awarded for all CIE activities shall be 100 marks.

| CIE         | Type of Assessment                        | Max. Marks | Max. Marks Scaling<br>Down to              | Total Marks |
|-------------|-------------------------------------------|------------|--------------------------------------------|-------------|
| Theory      | Internal Assessment1                      | 50         | 80<br>(Average of Best two<br>Assessments) | 100         |
|             | Internal Assessment2                      | 50         |                                            |             |
|             | Internal Assessment3                      | 50         |                                            |             |
| AAT         | Any One Assessments as per<br>regulations | 20         | 20                                         |             |
| Total Marks |                                           |            |                                            | 100         |

**CO-PO Mapping**

| PO<br>CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|
| CO1      | 3   | 3   | 3   | 2   | -   | -   | -   | -   | 1   | -    | 2    |
| CO2      | 3   | 3   | 3   | 2   | -   | -   | -   | -   | 1   | -    | 2    |
| CO3      | 3   | 3   | 3   | 2   | -   | -   | -   | -   | -   | -    | 2    |
| CO4      | 3   | 3   | 3   | 2   | -   | -   | -   | -   | -   | -    | 2    |
| CO5      | 3   | 3   | 3   | 2   | -   | -   | -   | -   | -   | -    | 2    |

Level 3 - High, Level 2 - Moderate, Level 1 - Low



| <b>Semester-III/IV</b>         |   |                        |              |   |           |
|--------------------------------|---|------------------------|--------------|---|-----------|
| <b>National Service Scheme</b> |   |                        |              |   |           |
| <b>Category: NCMC</b>          |   |                        |              |   |           |
| Course Code                    | : | <b>B25NCK310A/410A</b> | CIE          | : | 100 Marks |
| Teaching Hours L : T : P : S   | : | 0:0:30:0               | SEE          | : | --        |
| Total Hours/Semester           | : | 30                     | Total        | : | 100 Marks |
| Credits                        | : | PP                     | SEE Duration | : | --        |

|                                                                               |                                                                                                                                                                                            |
|-------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Course objectives: National Service Scheme (NSS) will enable the students to: |                                                                                                                                                                                            |
| 1.                                                                            | Understand the community in general in which they work.                                                                                                                                    |
| 2.                                                                            | Identify the needs and problems of the community and involve them in problem –solving.                                                                                                     |
| 3.                                                                            | Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.                           |
| 4                                                                             | Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes. |
| 5                                                                             | Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.                                                                  |

| <b>Syllabus</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>30 Hours</b> |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| <b>I.</b> Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.<br><b>II.</b> Waste management– Public, Private and Govt organization.<br><b>III.</b> Setting of the information imparting club for women leading to contribution in social and economic issues.<br><b>IV.</b> Water conservation techniques – Role of different stakeholders– Implementation.<br><b>V.</b> Preparing an actionable business proposal for enhancing the village income and approach for implementation.<br><b>VI.</b> Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.<br><b>VII.</b> Developing Sustainable Water management system for rural areas and implementation approaches.<br><b>VIII.</b> Contribution to any national level initiative of Government of India. Forex. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.<br><b>IX.</b> Spreading public awareness under rural outreach programs.(minimum5 programs).<br><b>X.</b> Plantation and adoption of plants. Know your plants.<br><b>XI.</b> Organize National integration and social harmony events /workshops /seminars. (Minimum 02 programs).<br><b>XII.</b> Govt. school Rejuvenation and helping them to achieve good infrastructure. |                 |

**Pedagogy – Guidelines, it may differ depending on local resources available for the study as well as environment and climatic differences, location and time of execution.**

| Sl. No | Topic                                                                                      | Group Size                | Location                                                                                 | Activity Execution                                                            | Reporting | Evaluation of the Project |
|--------|--------------------------------------------------------------------------------------------|---------------------------|------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|-----------|---------------------------|
| 1      | Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing. | May be individual or team | Farmers land/Villages/ roadside / community area/ College campus etc....                 | Site selection /proper consultation/ Continuous monitoring/ Information board |           |                           |
| 2      | Waste management– Public, Private and Govt organization.                                   | May be individual or team | Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers | Site selection /proper consultation/ Continuous monitoring/ Information board |           |                           |



MOOGAMBIGAI CHARITABLE AND EDUCATIONAL TRUST  
**Rajarajeswari College of Engineering**  
 (An Autonomous Institution under Visvesvaraya Technological University, Belagavi)

|    |                                                                                                                                                                                                        |                           |                                                                                          |                                                                                 |                                                                                |                                                                     |
|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|--------------------------------------------------------------------------------|---------------------------------------------------------------------|
| 3  | Setting of the information imparting club for women leading to contribution in social and economic issues.                                                                                             | May be individual or team | Women empowerment groups/ Consulting NGOs & Govt Teams / College campus etc.             | Group selection/ proper consultation/ Continuous monitoring/ Information board  | Report should be submitted by individual to the concerned evaluation authority | Evaluation as per the rubrics Of scheme and syllabus by NSS officer |
| 4  | Water conservation techniques – Role of different stakeholders– Implementation.                                                                                                                        | May be individual or team | Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers | site selection / proper consultation/ Continuous monitoring/ Information board  |                                                                                |                                                                     |
| 5  | Preparing an actionable business proposal for enhancing the village income and approach for implementation.                                                                                            | May be individual or team | Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers | Group selection/proper consultation/ Continuous monitoring/ Information board   |                                                                                |                                                                     |
| 6  | Helping local schools to achieve good results and enhance their enrolment in Higher/technical/ vocational education.                                                                                   | May be individual or team | Local government / private/ aided schools/Government Schemes officers                    | School selection/proper consultation/ Continuous monitoring/ Information board  |                                                                                |                                                                     |
| 7  | Developing Sustainable Water management system for rural areas and implementation approaches.                                                                                                          | May be individual or team | Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers | site selection/proper consultation/ Continuous monitoring/ Information board    |                                                                                |                                                                     |
| 8  | Contribution to any national level initiative of Government of India. Ex. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc. | May be individual or team | Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers | Group selection/proper consultation/ Continuous monitoring / Information board  |                                                                                |                                                                     |
| 9  | Spreading public awareness under rural outreach programs.(minimum 5 programs).                                                                                                                         | May be individual or team | Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers | Group selection/proper consultation/ Continuous monitoring / Information board  |                                                                                |                                                                     |
| 10 | Plantation and adoption of plants. Know your plants.                                                                                                                                                   | May be individual or team | Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers | Place selection/ proper consultation/ Continuous monitoring / Information board |                                                                                |                                                                     |
| 11 | Organize National integration and                                                                                                                                                                      | May be individual         | Villages/ City Areas / Grama panchayat/                                                  | Place selection/ proper consultation/                                           |                                                                                |                                                                     |



|    |                                                                            |                           |                                                                                          |                                                                                 |  |  |
|----|----------------------------------------------------------------------------|---------------------------|------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|--|--|
|    | social harmony events /workshops /seminars.                                | or team                   | public associations/ Government Schemes officers                                         | Continuous monitoring / Information board                                       |  |  |
| 12 | Govt. school Rejuvenation and helping them to achieve good infrastructure. | May be individual or team | Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers | Place selection/ proper consultation/ Continuous monitoring / Information board |  |  |

**Plan of Action (Execution of Activities For Each Semester)**

| Sl. No                                                                                                                                                                                                                                                                                                    | Practice Session Description                                                           |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|
| 1                                                                                                                                                                                                                                                                                                         | Lecture session by NSS Officer                                                         |
| 2                                                                                                                                                                                                                                                                                                         | Students Presentation on Topics                                                        |
| 3                                                                                                                                                                                                                                                                                                         | Presentation - 1 , Selection of topic, PHASE - 1                                       |
| 4                                                                                                                                                                                                                                                                                                         | Commencement of activity and its progress - PHASE - 2                                  |
| 5                                                                                                                                                                                                                                                                                                         | Execution of Activity                                                                  |
| 6                                                                                                                                                                                                                                                                                                         | Execution of Activity                                                                  |
| 7                                                                                                                                                                                                                                                                                                         | Execution of Activity                                                                  |
| 8                                                                                                                                                                                                                                                                                                         | Execution of Activity                                                                  |
| 9                                                                                                                                                                                                                                                                                                         | Execution of Activity                                                                  |
| 10                                                                                                                                                                                                                                                                                                        | Case study based Assessment, Individual performance                                    |
| 11                                                                                                                                                                                                                                                                                                        | Sector wise study and its consolidation                                                |
| 12                                                                                                                                                                                                                                                                                                        | Video based seminar for 10 minutes by each student At the end of semester with Report. |
| <ul style="list-style-type: none"> <li>In III and IV semester, each student should do activities according to the scheme and syllabus.</li> <li>At the end of every semester student performance has to be evaluated by the NSS officer for the assigned activity progress and its completion.</li> </ul> |                                                                                        |

Course Learning Outcomes: Upon successful completion of this course, the student will be able to:

|    |                                                                                                                           |
|----|---------------------------------------------------------------------------------------------------------------------------|
| 1. | Understand the importance of his / her responsibilities towards society.                                                  |
| 2. | Analyse the environmental and societal problems/issues and will be able to design solutions for the same.                 |
| 3. | Evaluate the existing system and to propose practical solutions for the same for sustainable development.                 |
| 4. | Implement government or self-driven projects effectively in the field. CO5:                                               |
| 5. | Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general. |

- Students should present the progress of the activities as per the schedule in the prescribed practical session in the field. There should be positive progress in the vertical order for the benefit of society in general.
- **Suggested Learning Resources:**
- 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.

**ASSESSMENT STRUCTURE:**

This course is having only Continuous Internal Assessment (CIE) marks of 100. A student shall obtain a minimum of 40% marks out of 100 to qualify in the course.

| Sl. No       | Activity                                 | Max. Marks |
|--------------|------------------------------------------|------------|
| 1.           | Attendance                               | 20         |
| 2.           | Quizzes /Assignment – 2, each of 25marks | 50         |
| 3.           | Report/ Participation Certificate        | 30         |
| <b>Total</b> |                                          | <b>100</b> |



| <b>Semester-III/IV</b>       |   |                        |              |   |           |
|------------------------------|---|------------------------|--------------|---|-----------|
| <b>National Cadet Corps</b>  |   |                        |              |   |           |
| Category: NCMC               |   |                        |              |   |           |
| Course Code                  | : | <b>B25NCK310B/410B</b> | CIE          | : | 100 Marks |
| Teaching Hours L : T : P : S | : | 0:0:30:0               | SEE          | : | --        |
| Total Hours/Semester         | : | 30                     | Total        | : | 100 Marks |
| Credits                      | : | PP                     | SEE Duration | : | --        |

#### Course Objectives

|    |                                                                                                                                                                                                                                                                                              |
|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | To develop character, camaraderie, discipline, secular outlook, the spirit of adventure, sportsman spirit, and ideals of selfless service amongst cadets by working in teams, honing qualities such as self-discipline, self-confidence, self-reliance, and dignity of labour in the cadets. |
| 2. | To create a pool of organized, trained, and motivated youth with leadership qualities from all walks of life, who will serve the Nation regardless of which career they choose                                                                                                               |
| 3. | To provide a conducive environment to motivate young Indians to choose the Armed Forces as a career                                                                                                                                                                                          |

| Content                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | No. of Hours |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| <b>Unit 1.</b> Personality Development: Group Discussions - Change your Mindset, Public Speaking.<br><b>Unit 2.</b> Leadership Development: Case Studies– APJ Abdul Kalam, Deepa Malik, Maharana Pratap, N Narayan Murthy etc.<br><b>Unit 3.</b> Disaster management: Disaster Management Capsule, Organization, Types of Disasters, Essential Services, Assistance, Civil Defense Organization.<br><b>Unit 4.</b> Adventure: Adventure Activities<br><b>Unit 5.</b> Border & Coastal Areas: History, Geography & Topography of Border/ Coastal Areas.<br><b>Unit 6.</b> Drill: Arm Drill, Rifle ke saath Savdhan, Vishram aur Aram se, Rifle ke saath Parade Paraur Saj, Rifle ke saath Visarjan, Line Tod, Bhumi Shastra aur Uthao Shastra, Bagal Shastra aur Baju Shastra.<br><b>Unit 7.</b> Weapon Training: Short Range firing.<br><b>Unit 8.</b> Map Reading: Setting of Map, Findings North and Own Position<br><b>Unit 9.</b> Field Craft & Battle Craft: Observation, Camouflage, Concealment.<br><b>Unit 10.</b> Obstacle Training: Obstacle training - Introduction, Safety-measures, Benefits. Obstacle Course- Straight balance, Clear Jump, Gate Vault, Zig- Zag Balance, High Wall | 50           |

#### ASSESSMENT STRUCTURE:

This course is having only Continuous Internal Assessment (CIE) marks of 100. A student shall obtain a minimum of 40% marks out of 100 to qualify in the course.

| Sl. No       | Activity                                  | Max. Marks |
|--------------|-------------------------------------------|------------|
| 1.           | Attendance                                | 20         |
| 2.           | Quizzes /Assignment – 2, each of 25 marks | 50         |
| 3.           | Report/ Participation Certificate         | 30         |
| <b>Total</b> |                                           | <b>100</b> |



| <b>Semester-III/IV</b>                                                 |                                                                                                                            |                        |              |   |           |
|------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|------------------------|--------------|---|-----------|
| <b>Physical Education</b>                                              |                                                                                                                            |                        |              |   |           |
| <b>Category: NCMC</b>                                                  |                                                                                                                            |                        |              |   |           |
| Course Code                                                            | :                                                                                                                          | <b>B25NCK310C/410C</b> | CIE          | : | 100 Marks |
| Teaching Hours L : T : P : S                                           | :                                                                                                                          | 0:0:30:0               | SEE          | : | --        |
| Total Hours/Semester                                                   | :                                                                                                                          | 30                     | Total        | : | 100 Marks |
| Credits                                                                | :                                                                                                                          | PP                     | SEE Duration | : | --        |
| Course Outcomes: At the end of the course, the student will be able to |                                                                                                                            |                        |              |   |           |
| 1.                                                                     | Understand the fundamental concepts and skills of Physical Education, Health, Nutrition and Fitness                        |                        |              |   |           |
| 2.                                                                     | Familiarization of health-related Exercises, Sports for overall growth and development                                     |                        |              |   |           |
| 3.                                                                     | Create a foundation for the professionals in Physical Education and Sports                                                 |                        |              |   |           |
| 4.                                                                     | Participate in the competition at regional/state / national / international levels.                                        |                        |              |   |           |
| 5.                                                                     | Create consciousness among the students on Health, Fitness and Wellness in developing and maintaining a healthy lifestyle. |                        |              |   |           |
| 6                                                                      | Understand and practice of Traditional Games                                                                               |                        |              |   |           |

| <b>Syllabus</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>30 Hours</b> |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| <b>I. Orientation</b><br>1. Lifestyle<br>2. Health & Wellness<br>3. Pre-Fitness test.<br><b>II. General Fitness &amp; Components of Fitness</b><br>1. Warming up (Free Hand exercises)<br>2. Strength – Push-up / Pull-ups<br>3. Speed – 30 Mtr Dash<br><b>III. Specific games (Any one to be selected by the student)</b><br>1. Kabaddi – Hand touch, Toe Touch, Thigh Hold, Ankle hold and Bonus.<br>2. Kho-Kho – Giving Kho, Single Chain, Pole dive, Pole turning, 3-6 Up.<br><b>IV. Ethics and Moral Values</b><br>1. Ethics in Sports<br>2. Moral Values in Sports and Games<br><b>V. Specific Games (Any one to be selected by the student)</b><br>1. Volleyball – Attack, Block, Service, Upper Hand Pass and Lower hand Pass.<br>2. Athletics (Track Events) – Any event as per availability of Ground.<br><b>VI. Role of Organisation and administration</b> |                 |

#### ASSESSMENT STRUCTURE:

This course is having only Continuous Internal Assessment (CIE) marks of 100. A student shall obtain a minimum of 40% marks out of 100 to qualify in the course.

| <b>Sl. No</b> | <b>Activity</b>                          | <b>Max. Marks</b> |
|---------------|------------------------------------------|-------------------|
| 1.            | Attendance                               | 20                |
| 2.            | Quizzes /Assignment – 2, each of 25marks | 50                |
| 3.            | Report/ Participation Certificate        | 30                |
| <b>Total</b>  |                                          | <b>100</b>        |



| Semester-III/IV              |   |                        |              |   |           |
|------------------------------|---|------------------------|--------------|---|-----------|
| YOGA                         |   |                        |              |   |           |
| Category: NCMC               |   |                        |              |   |           |
| Course Code                  | : | <b>B25NCK310D/410D</b> | CIE          | : | 100 Marks |
| Teaching Hours L : T : P : S | : | 0:0:30:0               | SEE          | : | --        |
| Total Hours/Semester         | : | 30                     | Total        | : | 100 Marks |
| Credits                      | : | PP                     | SEE Duration | : | --        |

| Course Learning Objective is |                                                                                                                                                                                |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.                           | Introduce students to the origin, history, philosophy, and fundamental concepts of Yoga.                                                                                       |
| 2.                           | Familiarize students with the different schools of Yoga, its aims, objectives, and the importance of prayer in Yogic practice.                                                 |
| 3.                           | Develop awareness of the rules, regulations, and safety precautions to be followed during Yogic practices.                                                                     |
| 4                            | Enable students to learn and practice Suryanamaskara and selected Yogasanas with proper techniques for improving physical and mental well-being.                               |
| 5                            | Promote a healthy lifestyle by encouraging regular Yogic practice, correcting misconceptions about Yoga, and fostering positive health, self-discipline, and overall wellness. |

| Syllabus                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 30 Hours |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| <b>I. Introduction of Yoga:</b> Yoga, its origin, history and development. Yoga, its meaning, definitions. Different schools of yoga, Aim and Objectives of yoga,<br><br><b>II. Prayer:</b> importance of prayer Brief introduction of yogic practices for Yogic practices for common man to promote positive health,<br><br><b>III. Rules and regulations:</b> Rules to be followed during yogic practices by practitioner Suryanamaskara: Suryanamaskar prayer and its meaning, Need, importance and benefits of Suryanamaskar 12 count, 2 rounds,<br><br><b>IV. Misconceptions of yoga:</b> Yoga its misconceptions, Difference between yogic and non yogic practices<br><br><b>V. Different types of Asanas-1:</b> Asana, Need, importance of Asana. Different types of asana. Asana its meaning by name, technique, precautionary measures and benefits of each asana, Sitting 1. Padmasana, 2. Vajrasana, Standing 1. Vrikshana, 2. Trikonasana, Prone line 1. Bhujangasana, 2. Shalabhasana, Supine line 1. Utthitadvipadasana, 2. Ardhalasana<br>I. Patanjali's Ashtanga Yoga: Patanjali's Ashtanga Yoga, its need and importance. Suryanamaskar 12 count 4 rounds.<br><br><b>VI. Different types of Asanas-2:</b> Sitting 1. Sukhasana, 2. Paschimottanasana, Standing 1. Ardhakati Chakrasana, 2. Parshva Chakrasana, Prone line 1. Dhanurasana Supine line 1. Halasana, 2. Karna Peedadasana<br><br><b>VII. Kapalabhati:</b> Meaning, importance and benefits of Kapalabhati. 40 strokes/min 3 rounds<br><br><b>VIII. Pranayama:</b> 1. Suryanuloma –Viloma, 2. Chandranuloma-Viloma, 3-Suryabhedana, 4-Chandra Bhedana, |          |

| Course Learning Outcomes: Upon successful completion of this course, the student will be able to: |                                                                                                                                                                   |
|---------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.                                                                                                | Explain the origin, history, philosophy, objectives, and different schools of Yoga, along with its role in promoting holistic health and well-being.              |
| 2.                                                                                                | Understand and apply the rules, regulations, and ethical practices associated with Yogic exercises, including the significance of prayer and Suryanamaskara.      |
| 3.                                                                                                | Demonstrate the correct techniques of selected Yogasanas, such as sitting, standing, prone, and supine postures, while observing appropriate precautions.         |
| 4                                                                                                 | Analyze the physical, mental, and therapeutic benefits of Yogic practices and distinguish between authentic Yogic practices and common misconceptions about Yoga. |
| 5                                                                                                 | Adopt Yoga as a regular lifestyle practice to enhance physical fitness, mental wellness, discipline, and overall quality of life.                                 |



**Text books:**

1. George Feuerstein : the yoga Tradition ( its history, literature, philosophy and practice)
2. Sri Ananda: The complete Book of yoga Harmony of Body and Mind (Orient paper Backs: Vision Books Pvt.Ltd..1982.
3. B.K.S Iyengar: Light on the Yoga sutras of Patanjali ( Harper Collins Publications India Pvt.Ltd.New Delhi.)
4. Science of Divinity and Realization of Self Vethathiri Publication, (6-11) WCSC, Erode

**Reference books / Manuals:**

1. Principles and Practice of Yoga in Health Care, Publisher: Handspring Publishing Limited. ISBN:9781909141209, 978190914209
2. Basavaraddi I V: Yoga in School Health, MDNIY New Delhi. 2009
3. Dr. HR. Nagendra: Yoga Research and application (Vivekananda Kendra Yoga Prakashana Bangalore)
4. Dr. Shirley Telles: Glimpses of Human Body (Vivekanda Kendra Yoga Prakashana Bangalore).

**ASSESSMENT STRUCTURE:**

This course is having only Continuous Internal Assessment (CIE) marks of 100. A student shall obtain a minimum of 40% marks out of 100 to qualify in the course.

| Sl. No       | Activity                                 | Max. Marks |
|--------------|------------------------------------------|------------|
| 1.           | Attendance                               | 20         |
| 2.           | Quizzes /Assignment – 2, each of 25marks | 50         |
| 3.           | Report/ Participation Certificate        | 30         |
| <b>Total</b> |                                          | <b>100</b> |



| Semester-III/IV              |   |                          |              |   |           |
|------------------------------|---|--------------------------|--------------|---|-----------|
| MUSIC                        |   |                          |              |   |           |
| Category: NCMC               |   |                          |              |   |           |
| Course Code                  | : | <b>B25NCK310E / 410E</b> | CIE          | : | 100 Marks |
| Teaching Hours L : T : P : S | : | 0:0:30:0                 | SEE          | : | --        |
| Total Hours/Semester         | : | 30                       | Total        | : | 100 Marks |
| Credits                      | : | PP                       | SEE Duration | : | --        |

| Course Learning objectives: The course Will enable the students to: |                                                                                       |
|---------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| 1.                                                                  | Identify the major traditions Of Indian music. through notations and aurally.         |
| 2.                                                                  | Analyse the compositions with respect to musical and lyrical content                  |
| 3.                                                                  | Demonstrate an ability to use music technology appropriately in a variety of setting. |

| Syllabus                                                                                                                                                                                                                                                                                                                                                                                                   | 30 Hours                                                                            |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| <b>I. Preamble:</b> Contents of the curriculum intend to promote music as language to develop an analytical, Creative and intuitive Understanding. For this the student must experience music through study and direct participation in improvisation and composition.<br>Origin of the Indian Music: Evolution of the Indian music system, Understanding Of Shruthi, Nada, Swara, Lay-a, Raga Talau Mela. |                                                                                     |
| <b>II. Compositions:</b> Introduction to the types of composition in Carnatic Music. Geethe, lath i, Swara, Swarajathi, Varna, Krithi. and Thillana, Notation System.                                                                                                                                                                                                                                      |                                                                                     |
| <b>III. Composers:</b> Biography and contributions Of purandaradasa. Thyagaraja, Mysoro Vasudevacharya.                                                                                                                                                                                                                                                                                                    |                                                                                     |
| <b>IV. Music Instruments:</b> Classification and construction of string instruments, Wind instrutnents. E*rcussion instruments, Idiophones (Ghana Vaadya), Examples of each class of Instrum ents                                                                                                                                                                                                          |                                                                                     |
| <b>V. Abhyasa Gana:</b> Singing the swara exercises (Sarale Varase Only). dotation writing for Sarale Varase and Suladi Saptha Tala ( Only in Mayamalavagowla Raga), Singing 4 Geethe in M alahari. And one jathi Swara One Krithi in a Mela raga                                                                                                                                                          |                                                                                     |
| Course Learning Outcomes: Upon successful completion of this course, the student will be able to:                                                                                                                                                                                                                                                                                                          |                                                                                     |
| 1.                                                                                                                                                                                                                                                                                                                                                                                                         | Discuss the Indian system Of music and relate it to Other genres (Cognitive domain) |
| 2.                                                                                                                                                                                                                                                                                                                                                                                                         | Experience the emotions Of and develop empathy (AffRtive Domain)                    |
| 3.                                                                                                                                                                                                                                                                                                                                                                                                         | Ressond to queries on various patterns in a composition (Psycho Motor Domain)       |

#### ASSESSMENT STRUCTURE (CIE Only):

This course is having only Continuous Internal Assessment (CIE) marks of 100. A student shall obtain a minimum of 40% marks out of 100 to qualify in the course.

| Sl. No       | Activity                                 | Max. Marks |
|--------------|------------------------------------------|------------|
| 1.           | Attendance                               | 20         |
| 2.           | Quizzes /Assignment – 2, each of 25marks | 50         |
| 3.           | Report/ Participation Certificate        | 30         |
| <b>Total</b> |                                          | <b>100</b> |

#### Text Books

1. Vldushi Vasantha Madhavi, “Theory of Music” Prism Publication, 2007
2. T Sachidevi and T Sharadha “Karnataka Sangeetha Dharpana” Vol. 1 (English). Shreenivaas Prakaashana, 2018

#### References:

1. Lakshminarayana Subramaniam. Viji Subramanaim. -Classical Music of India: A Practical Guigee, Tranquer, 2018.