Syllabus of

# Bachelor of Technology in Civil Engineering

Semester-I-II-III-IV-V-VI-VII-VIII

for Batch (2020-24)

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ARKA JAIN University
Jharkhand

Syllabus of

# B.Tech. in Civil Engineering

## Semester-I

**ARKAJAIN University, Jharkhand**
School of Engineering & IT
Department of Engineering
Faculty – Bachelor of Technology in Civil Engineering
**Scheme of Study (w.e.f Batch 2020-24)**

## SEMESTER –I

| Sr. No. | Name of the Subject | Group | L-T-P | Credit |
|---|---|---|---|---|
| 1 | Engineering Mathematics–I | A & B | 3-1-0 | 4 |
| 2 | Engineering Chemistry | A | 3-0-0 | 3 |
| | Programming for Problem Solving | B | 3-0-0 | 3 |
| 3 | Basic Electrical Engineering | A | 3-1-0 | 4 |
| | Engineering physics | B | 3-1-0 | 4 |
| 4 | Engineering Mechanics | A | 3-0-0 | 3 |
| | English for Communication | B | 3-0-0 | 3 |
| 5 | Constitution of India | B | 0-0-0 | 0 |
| | **Practical** | | | |
| 6 | Engineering Chemistry Lab | A | 0-0-1 | 1 |
| | Engineering Physics Lab | B | 0-0-1 | 1 |
| 7 | Basic Electrical Engineering Lab | A | 0-0-1 | 1 |
| | Programming for Problem Solving Lab | B | 0-0-2 | 2 |
| 8 | Engineering Mechanics Lab | A | 0-0-1 | 1 |
| 9 | Engineering Graphics & Design | A | 0-0-2 | 2 |
| | Workshop Practices | B | 0-0-2 | 2 |
| | TOTAL | A or B | 12-2-5 | 19 |

# SCHEME OF THE STUDY
# SEMESTER –II

| Sr. No. | Name of the Subject | Group | L-T-P | Credit |
|---|---|---|---|---|
| 1 | Engineering Mathematics–II | A & B | 3-1-0 | 4 |
| 2 | Engineering Chemistry | B | 3-0-0 | 3 |
| | Programming for Problem Solving | A | 3-0-0 | 3 |
| 3 | Basic Electrical Engineering | B | 3-1-0 | 4 |
| | Engineering physics | A | 3-1-0 | 4 |
| 4 | Engineering Mechanics | B | 3-0-0 | 3 |
| | English for Communication | A | 3-0-0 | 3 |
| 5 | Constitution of India | A | 0-0-0 | 0 |
| | **Practical** | | | |
| 6 | Engineering Chemistry Lab | B | 0-0-1 | 1 |
| | Engineering Physics Lab | A | 0-0-1 | 1 |
| 7 | Basic Electrical Engineering Lab | B | 0-0-1 | 1 |
| | Programming for Problem Solving Lab | A | 0-0-2 | 2 |
| 8 | Engineering Mechanics Lab | B | 0-0-1 | 1 |
| | Engineering Graphics& Design | B | 0-0-2 | 2 |
| 9 | Workshop Practices | A | 0-0-2 | 2 |
| | TOTAL | A or B | 12-2-5 | 19 |

# SEMESTER –I (Group-A)

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Engineering Chemistry | BSC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 2 | Engineering Mathematics–I | BSC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 3 | Basic Electrical Engineering | ESC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 4 | Engineering Mechanics | ESC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| | **Practical** | | | | | | | | |
| 5 | Engineering Chemistry Lab | BSC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 6 | Basic Electrical Engineering Lab | ESC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 7 | Engineering Mechanics Lab | ESC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 8 | Engineering Graphics& Design | ESC | 2 | 4 | 50 | 35 | 5 | 5 | 5 |
| | **TOTAL** | | **19** | **24** | **600** | **420** | **100** | **40** | **40** |

# SEMESTER I (Group-B)

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Engineering physics | BSC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 2 | Engineering Mathematics –I | BSC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 3 | Programming for Problem Solving | ESC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | English for Communication | HSMC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 5 | Constitution of India | MC | 0 | 2 | 50 | 35 | 10 | 2.5 | 2.5 |
| | **Practical** | | | | | | | | |
| 6 | Engineering physics Lab | BSC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 7 | Programming for Problem Solving Lab | ESC | 2 | 4 | 50 | 35 | 5 | 5 | 5 |
| 8 | Workshop Practices | ESC | 2 | 4 | 50 | 35 | 5 | 5 | 5 |
| | **TOTAL** | | **19** | **26** | **600** | **420** | **105** | **37.5** | **37.5** |

# SEMESTER II (Group-A)

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Engineering physics | BSC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 2 | Engineering Mathematics –II | BSC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 3 | Programming for Problem Solving | ESC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | English for Communication | HSMC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 5 | Constitution of India | MC | 0 | 2 | 50 | 35 | 10 | 2.5 | 2.5 |
| | **Practical** | | | | | | | | |
| 6 | Engineering physics Lab | BSC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 7 | Programming for Problem Solving Lab | ESC | 2 | 4 | 50 | 35 | 5 | 5 | 5 |
| 8 | Workshop Practices | ESC | 2 | 4 | 50 | 35 | 5 | 5 | 5 |
| | **TOTAL** | | **19** | **26** | **600** | **420** | **105** | **37.5** | **37.5** |

# SEMESTER –II (Group-B)

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Engineering Chemistry | BSC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 2 | Engineering Mathematics–II | BSC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 3 | Basic Electrical Engineering | ESC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 4 | Engineering Mechanics | ESC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| | **Practical** | | | | | | | | |
| 5 | Engineering Chemistry Lab | BSC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 6 | Basic Electrical Engineering Lab | ESC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 7 | Engineering Mechanics Lab | ESC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 8 | Engineering Graphics& Design | ESC | 2 | 4 | 50 | 35 | 5 | 5 | 5 |
| | **TOTAL** | | **19** | **24** | **600** | **420** | **100** | **40** | **40** |

# SEMESTER-III

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Engineering Mathematics -III | BSC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 2 | Biology for Engineers | BSC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 3 | Surveying &Geomatics | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | Mechanics of Solid | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 5 | Introduction to Civil Engineering | HSMC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 6 | Environmental Science | MC | 0 | 2 | 50 | 35 | 10 | 2.5 | 2.5 |
| | **Practical** | | | | | | | | |
| 7 | Surveying &Geomatics Lab | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 8 | Mechanics of Solid | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 9 | Computer Aided Civil Engineering Drawing | ESC | 2 | 4 | 50 | 35 | 5 | 5 | 5 |
| | **TOTAL** | | **20** | **26** | **700** | **490** | **125** | **42.5** | **42.5** |

# SEMESTER-IV

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Material Testing & Evaluation | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 2 | Engineering Geology | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 3 | Fluid Mechanics | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | Structural Analysis - I | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 5 | Geotechnical Engineering | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 6 | Civil Engineering-Societal & Global Impact | HSMC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| | **Practical** | | | | | | | | |
| 7 | Material Testing & Evaluation | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 8 | Engineering Geology Lab | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 9 | Geotechnical Engineering Lab | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 10 | Fluid Mechanics Lab | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| | **TOTAL** | | **22** | **26** | **800** | **560** | **140** | **50** | **50** |

# SEMESTER V

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Hydraulic Engineering | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 2 | Structural Analysis II | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 3 | Hydrology & Water Resource Engineering | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | Environmental Engineering-I | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 5 | Open Elective I Humanities I<br>Professional Practice, Law & Ethics<br>Organizational Behavior | HSMC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 6 | Disaster Preparedness & Planning | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 7 | Essence of Indian Knowledge Tradition | MC | 0 | 2 | 50 | 35 | 10 | 2.5 | 2.5 |
| | PRACTICAL | | | | | | | | |
| 8 | Hydraulic Engineering Lab | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 9 | Structural Analysis II Lab | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 10 | Internship / Industrial Training/Vocational Training (3-4 week) | PROJ | 2 | 0 | 50 | 35 | 15 | 0 | 0 |
| | **TOTAL** | | **22** | **24** | **800** | **560** | **155** | **42.5** | **42.5** |

# SEMESTER VI

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory / Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Construction Engineering & Management | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 2 | Transportation Engineering-I | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 6 | Engineering Economics, Estimation & Costing | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 3 | Elective I<br>Rock Mechanics<br>Foundation Engineering | PEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | Elective II<br>Environmental Engineering II<br>Rural water supply & Onsite Sanitation System | PEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 6 | Elective III<br>Design of Steel Structure<br>Earthquake Engineering | PEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 7 | Design of Concrete Structures-I | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| | **Practical** | | | | | | | | |
| 8 | Transportation Engineering I Lab | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| | **TOTAL** | | **22** | **23** | **750** | **525** | **145** | **40** | **40** |

# SEMESTER VII

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Elective IV<br>Air and Noise Pollution and Control<br>Solid and hazardous Waste Management | PEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 2 | Elective V<br>Design of Concrete Structure - II<br>Prestressed Concrete | PEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 3 | Open Elective II<br>Metro System & Engineering<br>History of Science & Engineering | OEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | River Engineering | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| | **Practical** | | | | | | | | |
| 5 | Minor Project | PROJ | 3 | 6 | 100 | 70 | 30 | 0 | 0 |
| 6 | Summer Internship –II –(4-6 Week) | PROJ | 3 | 0 | 100 | 70 | 30 | 0 | 0 |
| | **TOTAL** | | **18** | **18** | **600** | **420** | **140** | **20** | **20** |

# SEMESTER VIII

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Elective VI<br>Bridge Engineering<br>Ground Water Engineering | PEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 2 | Elective VII<br>Railway Engineering<br>Traffic Engineering and Management | PEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 3 | Open Elective III<br>Soft Skills and Interpersonal Communication<br>Human Resource Development and Organizational Behavior | OEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | Open Elective IV<br>Civil Engineering Design-I<br>Geographic Information Systems and Science | OEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| | **Practical** | | | | | | | | |
| 5 | Major Project | PROJ | 8 | 16 | 200 | 140 | 60 | 0 | 0 |
| 6 | Extra- Curricular/ Co-Curricular Activity | PROJ | 0 | 0 | 100 | 70 | 30 | 0 | 0 |
| | **TOTAL** | | **20** | **28** | **700** | **490** | **170** | **20** | **20** |

## Distribution of Credit across 8 semesters:

| Sl. No | Type of Paper | No. of Paper | Total Credit |
|---|---|---|---|
| 1 | Humanities and Social Sciences including Management courses **(HSMC)** | 4 | 12 |
| 2 | Basic Science courses**(BSC)** | 8 | 24 |
| 3 | Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc**(ESC)** | 9 | 20 |
| 4 | Professional core courses (**PCC)** | 26 | 60 |
| 5 | Professional Elective courses relevant to chosen specialization/branch**(PEC)** | 7 | 21 |
| 6 | Open subjects – Electives from other technical and /or emerging subjects (**OEC)** | 3 | 9 |
| 7 | Project work, seminar and internship in industry or elsewhere**(PROJ)** | 5 | 16 |
| 8 | Mandatory Courses [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Knowledge Tradition]**(MC)** | 3 | 0 |
| | **Total** | 65 | 162 |

**CIA – Continuous Internal Assessment – Based on Projects / Assignment during the semester**

**Note:**
**AICTE Activity Points to be earned by students admitted to Degree program (For more details refer to Chapter 6, AICTE, Activity Point Program, Model Internship Guidelines):**
**Every regular student, who is admitted to the 4-year Degree program, is required to earn 100 activity points in addition to the total credits earned for the program. Students entering 4 years Degree Program through lateral entry are required to earn 75 activity points in addition to the total credits earned for the program. The activity points earned by the student shall be reflected on the students 8th Semester grade card.**
**The activities to earn the points can be spread over the duration of the course. However, minimum prescribed duration should be fulfilled.**
**Activity Points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression.**
**Incase student fail to earn the prescribed activity points;eight semester Grade Card shall be issued only after earning the required activity Points.**
**Students shall be eligible for the award of degree only after the release of the Eight Semester grade card.**

***There are two groups (A & B) in semester 1 & 2. The Group division will be decided by The Dean SoE& IT before commencement of classes***

**ARKAJAIN University, Jharkhand**
School of Engineering & IT
Department of Engineering
Faculty – Bachelor of Technology in Civil Engineering
**PROGRAM OUTCOMES &PROGRAM SPECIFIC OUTCOMES**

**PROGRAM OUTCOMES**

After completing this undergraduate program, a learner:

**[PO.1]. Engineering knowledge:** An ability to apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to get the solution of the engineering problems.

**[PO.2]. Problem analysis:** Ability to Identify, formulates, review research literature, and analyze complex engineering problems.

**[PO.3]. Design/Development of Solutions:** Ability to design solutions for complex Engineering Problems by considering social, Economic and Environmental aspects.

**[PO.4]. Conduct investigations of complex problems:** Use research-based knowledge to design, conduct analyses experiments to get valid conclusion.

**[PO.5]. Modern tool usage:** ability to create, select, and apply appropriate techniques, and to model complex engineering activities with an understanding of the limitations.

**[PO.6]. The engineer and society:** Ability to apply knowledge by considering social health, safety, legal and cultural issues.

**[PO.7]. Environment and sustainability:** Understanding of the impact of the adopted engineering solutions in social and environmental contexts.

**[PO.8]. Ethics:** Understanding of the ethical issues of the civil engineering and applying ethical principles in engineering practices.

**[PO.9]. Individual and teamwork:** Ability to work effectively as an individual or in team, as a member or as a leader.

**[PO.10]. Communication:** An ability to communicate clearly and effectively through different modes of communication.

**[PO.11]. Project management and finance:** Ability to handle project and to manage finance related issue.

**[PO.12]. Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning.

**PROGRAM SPECIFIC OUTCOMES**

**[PSO.1]. Professional skills** – The ability to analyze and design civil engineering structures as per the guidelines in Indian standards and other relevant codes like buildings, bridges, tunnels, railways, airports, water and sewage treatment plants etc

**[PSO.2]. Problem solving skills** – The ability to managed large infrastructural projects by making use of latest techniques of project management for optimum utilization of resources via man, material and money.

**[PSO.3]. Successful Career and Entrepreneurship** – Strong desire to acquire modern scientific knowledge by pursuing higher studies, which will lead them to identify problems in the civil engineering domains and thereby become entrepreneur to propose solution

**[PSO.4]. Communication:** Communicate effectively on complex engineering activities with the engineering community & with society at large, such as, being able to comprehend & write effective reports & design documentation, make effective presentations & give & receive clear instructions

**PROGRAM ARTICULATION MATRIX**

| SEM | COURSECODE | PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| I | Engineering Chemistry-BTE22011 | 1 | | 1 | | 1 | 1 | | | | | | 1 | | 1 | | |
| | Engineering Mathematics–I-BTE21001 | 2 | | | 1 | | 1 | | | | | 1 | 1 | 1 | | 1 | |
| | Basic Electrical Engineering-BTE21003 | 1 | 1 | 1 | 1 | 1 | | 1 | 1 | 1 | 1 | | | | 1 | 1 | |
| | Engineering Mechanics-BTE22009 | 1 | | 1 | | | | 1 | | | | | 1 | | | | 1 |
| | Engineering Chemistry Lab-BTE22015 | 1 | | | 1 | 1 | | | | | | | | | | | 1 |
| | Basic Electrical Engineering Lab-BTE21005 | 1 | 1 | 1 | 1 | | 1 | 1 | 1 | 1 | | 1 | 1 | 1 | 1 | 1 | 1 |
| | Engineering Mechanics Lab-BTE22013 | 1 | | 1 | | | | 1 | | | | | 1 | | | | 1 |
| | Engineering Graphics & Design-BTE21004 | 1 | | | | 1 | | | | 1 | | 1 | | 1 | 1 | | 1 |
| II | Engineering Physics-BTE22010 | 1 | 2 | 2 | 2 | 1 | | | | | 1 | | 2 | | 1 | | 1 |
| | Engineering Mathematics –II-BTE22008 | | 2 | 1 | 1 | 2 | | | 2 | | | | | | | 1 | 1 |
| | Programming for Problem Solving-BTE212159 | 1 | 1 | | 1 | | | 1 | | | | | | | | | |
| | English for Communication-BTE22370 | 1 | 1 | 1 | | | 1 | | | | 2 | | 1 | | | | 1 |
| | Constitution of India-BTE25095 | | | | | | | | | | | | | | | | |
| | Engineering physics Lab-BTE22014 | | | 2 | 2 | 1 | | 1 | | | | | | | 1 | 1 | 1 |
| | Programming for Problem Solving Lab-BTE21262 | | | | | | | | | | | | | | | | |
| | Workshop Practices-BTE21007 | 1 | 1 | 1 | 1 | | 1 | | | | | | 1 | | | | |
| III | Engineering Mathematics –III-BTE23046 | 3 | 2 | 2 | | 1 | | | | | | | | | 2 | | 1 |
| | Biology for Engineers-BTE23018 | 3 | 2 | 1 | 1 | | | | | | 2 | 1 | 1 | 3 | 2 | 1 | 1 |
| | Surveying & Geomatics-BTE23272 | 3 | 3 | 3 | 3 | | | | | | 3 | 3 | 3 | 3 | 2 | 1 | 2 |
| | Mechanics of Solid-BTE23021 | 3 | 3 | 3 | 3 | 1 | 1 | 1 | | 1 | 4 | 1 | 3 | 3 | 3 | 1 | 2 |
| | Introduction to Civil Engineering-BTE23273 | 3 | 2 | 3 | 1 | 3 | 6 | | | | | 1 | 2 | 3 | 3 | 2 | 1 |
| | Environmental Science-BTE24085 | 3 | 3 | 3 | 3 | 3 | 2 | | | | | 3 | 3 | 3 | 2 | 1 | 1 |
| | Surveying &Geomatics Lab-BTE23274 | 2 | 3 | 3 | 3 | 1 | | 1 | | | 2 | | 1 | 3 | 1 | 3 | 3 |
| | Mechanics of Solid Lab-BTE23025 | 2 | 3 | 3 | 2 | 1 | | 1 | | | | | 1 | 3 | | 2 | |
| | Computer Aided Civil Engineering Drawing-BTE23275 | 3 | 2 | 2 | 2 | 2 | 1 | | | 1 | 1 | | 1 | 3 | 2 | 2 | 2 |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| IV | Material Testing & Evaluation-BTE24280 | 3 | 2 | 2 | 1 | 2 | 1 | 1 | 1 | 2 | 1 | 1 | 2 | 3 | 2 | 3 | 0 |
| | Engineering Geology-BTE24055 | 3 | 2 | 2 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 3 | 3 | 2 | 3 | 2 |
| | Fluid Mechanics-BTE24080 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 3 | 3 | 3 | 2 | 1 |
| | Structural Analysis – I-BTE24057 | 3 | 3 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 3 | 3 | 3 | 2 | 2 |
| | Geotechnical Engineering – I-BTE24056 | 3 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 3 | 2 | 2 | 2 | 2 |
| | Civil Engineering-Societal & Global Impact-BTE24059 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 2 | 2 | 2 | 2 |
| | Material Testing & Evaluation Lab-BTE24388 | 3 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 3 | 3 | 2 | 2 | 1 |
| | Engineering Geology Lab-BTE24062 | 3 | 2 | 2 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 3 | 3 | 2 | 3 | 2 |
| | Geotechnical Engineering Lab-BTE24063 | 3 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 3 | 2 | 2 | 2 | 2 |
| | Fluid Mechanics Lab-BTE23023 | 3 | 2 | 2 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 3 | 3 | 2 | 3 | 2 |
| V | Hydraulic Engineering-BTE25089 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 1 | 1 | | | 2 | 3 | 3 | 1 | 1 |
| | Structural Analysis II-BTE25090 | 3 | 3 | 2 | 3 | 1 | 1 | 1 | | 1 | | | 2 | 2 | 3 | 1 | |
| | Hydrology & Water Resource Engineering-BTE25091 | 3 | 3 | 3 | 2 | 1 | 3 | 2 | 1 | 1 | 1 | | 2 | 3 | 3 | 1 | 1 |
| | Environmental Engineering-I-BTE25092 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 2 | 2 | 1 | 2 | 3 | 3 | 1 | 2 |
| | Open Elective I-Humanities I<br>Professional Practice, Law & Ethics-BTE25373 | | | | 1 | 1 | 3 | 1 | 3 | 3 | 3 | 2 | 2 | 1 | | 3 | 3 |
| | Organizational Behavior-BTE24060 | | | | 2 | | 3 | 1 | 3 | 3 | 3 | 0 | 2 | | | 3 | 3 |
| | Disaster Preparedness & Planning-BTE25298 | 2 | 1 | 0 | 2 | 2 | 3 | 3 | 2 | 3 | 3 | 0 | 3 | 2 | 2 | 1 | 3 |
| | Essence of Indian Traditional Knowledge-BTE25122 | 1 | 1 | 0 | 2 | 1 | 2 | 1 | 3 | 3 | 3 | 0 | 3 | 1 | 2 | 0 | 3 |
| | Hydraulic Engineering Lab-BTE25096 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 1 | 1 | 0 | 0 | 2 | 3 | 3 | 1 | 1 |
| | Structural Analysis II Lab-BTE25097 | 3 | 3 | 2 | 3 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 2 | 2 | 3 | 1 | 0 |
| | Internship / Industrial Training/Vocational Training (3-4 week)-BTE27324 | | | | | | | | | | | | | | | | |
| VI | Construction Engineering & Management-BTE26126 | 3 | 3 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 2 | 2 |
| | Transportation Engineering-I-BTE25093 | 3 | 3 | 3 | 3 | 3 | 2 | 0 | 0 | 0 | 3 | 3 | 3 | 2 | 1 | 1 | 3 |
| | Engineering Economics, Estimation & Costing-BTE26127 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 0 | 0 | 0 | 0 | 2 | 3 | 2 | 2 | 2 |
| | Elective I<br>Rock Mechanics-BTE26315 | 3 | 3 | 3 | 3 | 3 | 2 | 0 | 0 | 0 | 0 | 3 | 3 | 3 | 2 | 1 | 1 |
| | Foundation Engineering-BTE26316 | 2 | 2 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 3 | 3 | 2 | 1 |
| | Elective II | 1 | 3 | 2 | 2 | 2 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 3 | 2 | 1 | 3 |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Environmental Engineering II-BTE26130 | | | | | | | | | | | | | | | | |
| | Rural water supply & Onsite Sanitation System-BTE26317 | 1 | 3 | 2 | 2 | 2 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 2 | 3 | 3 | 3 |
| | Elective III<br>Design of Steel Structure-BTE26134 | 3 | 3 | 3 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 3 | 2 | 2 | 1 |
| | Earthquake Engineering-BTE26318 | 3 | 3 | 3 | 3 | 3 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 3 | 3 | 3 | 3 |
| | Design of Concrete Structures-I-BTE26319 | 3 | 3 | 3 | 3 | 3 | 2 | 0 | 0 | 1 | 1 | 1 | 0 | 3 | 3 | 3 | 3 |
| | Transportation Engineering I Lab-BTE25098 | 3 | 3 | 3 | 3 | 3 | 2 | 0 | 0 | 0 | 0 | 3 | 2 | 2 | 1 | 1 | 3 |
| VII | Elective IV<br>Air and Noise Pollution and Control-BTE27341 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 1 | 2 | 2 | 2 | 1 | 2 | 2 | 1 | 2 |
| | Solid and hazardous Waste Management-BTE27342 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 1 | 2 | 2 | 2 | 1 | 2 | 2 | 1 | 2 |
| | Elective V<br>Design of Concrete Structure – II-BTE27343 | 3 | 3 | 3 | 2 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 2 | 3 | 2 | 3 | 1 |
| | Prestressed Concrete-BTE28218 | 3 | 3 | 3 | 2 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 2 | 3 | 2 | 3 | 1 |
| | Open Elective II<br>Metro System & Engineering-BTE27345 | 3 | 2 | 3 | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 2 | 3 | 2 | 3 | 1 |
| | History of Science & Engineering-BTE27346 | 3 | 3 | 3 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 2 | 3 | 2 | 3 | 1 | 2 |
| | River Engineering-BTE27347 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 3 | 2 | 3 | 2 |
| | Minor Project-BTE27217 | | | | | | | | | | | | | | | | |
| | Industrial Training(Summer Internship -4-6 Week)-BTE27349 | | | | | | | | | | | | | | | | |
| VIII | Elective VI<br>Bridge Engineering-BTE28219 | 3 | 3 | 3 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 2 | 3 | 3 | 2 | 1 |
| | Ground Water Engineering-BTE28389 | 3 | 3 | 2 | 2 | 2 | 3 | 2 | 1 | 2 | 1 | 0 | 2 | 3 | 2 | 2 | 1 |
| | Elective VII<br>Railway Engineering-BTE28366 | 3 | 2 | 3 | 2 | 3 | 1 | 1 | 0 | 2 | 2 | 1 | 3 | 3 | 2 | 3 | 2 |
| | Traffic Engineering and Management-BTE28367 | 2 | 3 | 3 | 2 | 1 | 2 | 1 | 0 | 1 | 2 | 0 | 2 | 2 | 3 | 1 | 2 |
| | Open Elective III<br>Soft Skills and Interpersonal Communication-BTE25386 | 0 | 0 | 0 | 1 | 2 | 3 | 1 | 3 | 3 | 3 | 1 | 2 | 0 | 1 | 3 | 3 |
| | Human Resource Development and Organizational Behavior-BTE26387 | 0 | 0 | 0 | 2 | 0 | 3 | 1 | 3 | 3 | 3 | 0 | 2 | 0 | 0 | 3 | 3 |
| | Open Elective IV<br>Civil Engineering Design-I-BTE28368 | 2 | 2 | 2 | 0 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 1 | 3 | 2 |
| | Geographic Information Systems and Science-BTE28369 | 3 | 3 | 2 | 3 | 3 | 2 | 0 | 0 | 2 | 2 | 1 | 1 | 2 | 3 | 1 | 2 |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Major Project-BTE28297 | | | | | | | | | | | | | | | | |
| | Extra- Curricular/ Co-Curricular Activity-BTE28390 | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |

# Subject: Engineering Chemistry

Code: BTE22011
3 Credits | Semester 1

Total Lecture: 45 Total Tutorial: 9

**A. Introduction:**

Following are the objectives of this course:

- To understand the Concepts of chemical bonding.
- To know the importance of the Periodic Table of the Elements, how it came to be, and its role in organizing chemical information.
- To learn about the basic concepts of Spectroscopy.

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

**[CO1]** Understand the skills required to succeed in graduate school, the chemical industry or professional school.

**[CO2]** Acquire a foundation of chemistry of sufficient breadth and depthto enable them to understand and critically interpret the primary chemical literature.

**[CO3]** Recognize the exigency and importance of engineering chemistry in the use of industrial and domestic determination.

**[CO4]** Design economically and new methods of synthesis of new materials and apply their knowledge for protection of environment and application in their field.

**[CO5]** Understand an insight into latest (R&D oriented) topics, to enable the engineering student upgrade the existing technologies and pursue further research.

**C. Assessment Plan:**

| Criteria | Description | Maximum Marks |
|---|---|---|
| **Continuous Internal Assessment (CIA)** | Internal Examination | 20 |
| | Attendance | 5 |
| | Assignment | 5 |
| **End Semester Examination(ESE)** | End Semester Examination | 70 |
| **Total** | | 100 |
| **Attendance** | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

**ATOMIC AND MOLECULAR STRUCTURE:** Molecular orbital of diatomic molecules and

plots of the multi-centre orbital. Equations for atomic and molecular orbitals. Energy level diagrams of diatomic. Pi-molecular orbital of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Numerical based on Crystal field stabilization energy. Band structure of solids

**SPECTROSCOPIC TECHNIQUES AND APPLICATIONS:** Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibration and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterization techniques. Diffraction and scattering

**USE OF FREE ENERGY IN CHEMICAL EQUILIBRIA:** Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Cell potentials, the Nernst equation and applications, Relation of free energy with EMF. Acid base, oxidation reduction and solubility equilibrium. Corrosion, Types of corrosion, galvanic series, Cathodic and anodic reactions, corrosion prevention methods.

**PERIODIC PROPERTIES:** Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electro negativity, polarizability, oxidation states, coordination numbers and geometries. Hard soft acids and bases (Classification, pearsons HSAB principle, its application and limitation), molecular geometries (VSEPR theory to NH3, H3O+, SF4, CLF3, ICl2and H2O)

**INDUSTRIAL CHEMISTRY:** Polymers: types of polymers, polymerization, applications, and important synthetic polymers. Ceramics material: Classification and Applications, Water treatment, Air pollution and Control techniques.

## E. TEXT BOOKS

T1. A textbook of Engg. Chemistry-ShashiChawla
T2. Engineering Chemistry by Wiley
T3. Physical Chemistry by Atkins
T4. Engineering chemistry by P.C. Jain (DhantpatRai Publishing company)
T5. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
T6. Fundamentals of Molecular Spectroscopy, by C. N. Banwell

## F. REFERENCE BOOKS

R1. Environmental Engg. - Keiley
R2. Selected topics in inorganic chemistry-MMT
R3. I. A Levine, Physical chemistry, McGraw Hill
R4. Organic chemistry by clayden.
R5.Essentials of Physical chemistry, Bahl&Tuli, S. Chand Publishing.
R6. Inorganic Chemistry by J D Lee.

## G. Course Articulation Matrix: (Mapping of COs with POs)

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| [CO1] | Understand the skills required to succeed in graduate school, the chemical industry or professional school. | 2 | | | | 1 | | | | | | | | | | | |
| [CO2] | Acquire a foundation of chemistry of sufficient breadth and depthto enable them to understand and critically interpret the primary chemical literature. | | 2 | | | | | 1 | | | | | | | 1 | | |
| [CO3] | Recognize the exigency and importance of engineering chemistry in the use of industrial and domestic determination. | | | 2 | | | 1 | | | | | | | | 1 | | |
| [CO4] | Design economically and new methods of synthesis of new materials and apply their knowledge for protection of environment and application in their field. | | | | | 2 | | | | | | | 1 | | | | 1 |
| [CO5] | Understand an insight into latest (R&D oriented) topics, to enable the engineering student upgrade the existing technologies and pursue further research. | | | | 2 | | | | | | | 1 | | | | 1 | |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Engineering Mathematics–I

Code: BTE21001

Credit - 4 | Semester 1

Total Lecture: 60 Total Tutorial: 12

**A. Introduction:**

- To familiarize the prospective engineers with techniques in calculus, multivariate analysis and linear algebra.
- To equip the students with standard concepts and tools at an intermediate to advanced level
- Serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

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

**[CO1]** Remember the differential and integral calculus to notions of curvature and to improper integrals. Apart from some other applications, they will have a basic Understand of Beta and Gamma functions.

**[CO2]** Understand the fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.

**[CO3]** Demonstrate the tool of power series and Fourier series for learning advanced Engineering Mathematics.

**[CO4]** Analyze functions of several variables that is essential in most branches of engineering

**[CO5]** Evaluate the essential tool of matrices and linear algebra in a comprehensive manner.

**C. Assessment Plan:**

| **Criteria** | **Description** | **Maximum Marks** |
|---|---|---|
| **Continuous Internal Assessment (CIA)** | Internal Examination | 20 |
| | Attendance | 5 |
| | Assignment | 5 |
| **End Semester Examination(ESE)** | End Semester Examination | 70 |
| **Total** | | 100 |
| **Attendance** | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

**CALCULUS:** Evolutes and involutes, Evaluation of definite and improper integrals, Beta and Gamma functions and their properties Application of definite integral, Curve tracing, area, evaluate surface areas and volumes of revolutions

**CALCULUS: Rolle's** Theorem, Mean value theorems, Taylor's and Maclaurin's theorems with remainders, Indeterminate forms and Hospitals rule, Maxima and minima

**SEQUENCE AND SERIES:** Convergence of sequence and series, tests for convergence, Power series, Taylors series, series for exponential, trigonometric and logarithmfunctions,2 Fourier series: Half range sine and cosine series, Parseval's theorem

**MULTIVARIABLE CALCULUS (DIFFERENTIATION):** Limit, continuity and partial derivatives, directional derivatives, total derivative, Tangent plane and normal line; Maxima, minima and saddle points, Method of Lagrange multipliers; Gradient, curl and divergence

**MATRICES**: Symmetric, skew- symmetric and orthogonal matrices, ,complex matrix, hermitian, skew hermitian matrix, Inverse and rank of a matrix, rank-nullity theorem; System of linear equations, Eigen values and Eigen vectors; Diagonalization of matrices, Cayley-Hamilton Theorem, and Orthogonal transformation

**E. TEXT BOOKS**

T1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint,2002
T2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006

**F. REFERENCE BOOKS**

R1. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008
R2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| [CO1] | Remember the differential and integral calculus to notions of curvature and to improper integrals. Apart from some other applications, they will have a basic Understand of Beta and Gamma functions. | 1 | | | | | | | | | | 1 | | | | | 1 |
| [CO2] | Understand the fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems. | | 2 | | | 1 | | | | | | | | | | | 1 |
| [CO3] | Demonstratethe tool of power series and Fourier series for learning advanced Engineering Mathematics. | | | 2 | | | | 1 | | | | | | | | 1 | |
| [CO4] | Analyze functions of several variables that is essential in most branches of engineering | | | | | | | | 2 | | | | 1 | | | | |
| [CO5] | Evaluatethe essential tool of matrices and linear algebra in a comprehensive manner. | | | | 1 | | | | | | | 1 | | 1 | | | |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Basic Electrical Engineering

Code: BTE21003
Credits- 4 | Semester 1

Total Lecture: 60 Total Tutorial: 12

**A. Introduction:**

- To Enhancement in understanding the basic concepts of Core Electrical Engineering subjects. The topics covered under this subject will help
- To enhance the basic understanding of Electrical machines and power systems and basic electronics through the topic covered under this Subject

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

**[CO1]** Understand the basic knowledge of electrical quantities such as current, voltage, power, energy and frequency

**[CO2]** Predict the behavior of any electrical and magnetic circuits.

**[CO3]** Formulate and solve complex AC, DC circuits.

**[CO4]** Identify the type of electrical machine used for that particular application.

**[CO5]** Realize the requirement of transformers in transmission and distribution of electric power and other applications.

**C. Assessment Plan:**

| Criteria | Description | Maximum Marks |
|---|---|---|
| **Continuous Internal Assessment (CIA)** | Internal Examination | 20 |
| | Attendance | 5 |
| | Assignment | 5 |
| **End Semester Examination(ESE)** | End Semester Examination | 70 |
| **Total** | | 100 |
| **Attendance** | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**A. SYLLABUS**

**D.C. CIRCUITS:** Electrical circuit elements (R, L and C), voltage and current sources, dependent and independent sources, Units and dimensions, Source Conversion, Kirchhoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin' s theorem and their application for analysis of series and parallel resistive circuits excited by independent voltage sources, Power & Energy in such circuits. Mesh & nodal analysis, Star Delta transformation & circuits and Norton theorems. Time- domain analysis of

first-order RL and RC circuits.

**A.C. CIRCUITS :** Representation and Generation of sinusoidal AC voltage, definition of average value, R.M.S. value, form factor and peak factor of AC quantity , Concept of phasor, Concept of Power factor, Concept of impedance and admittance, Active, reactive and apparent power, Analysis of single-phase ac circuits consisting of R, L, C R-L, R-C, R-L-C series &parallel circuit Resonance Necessity and advantages of three phase systems, Meaning of Phase sequence, balanced and unbalanced supply and loads. Relationship between line and phase values for balanced star and delta connections. Power in balanced & unbalanced three-phase system and their measurements

**TRANSFORMERS:** Types of Magnetic Material, BH characteristics (magnetization characteristics) of Ferro magnetic materials, self - inductance and mutual inductance, energy in linear magnetic systems, AC excitation in magnetic circuits, magnetic field produced by current carrying conductor, Force on a current carrying conductor. Ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency Auto-transformer and three-phase transformer connections

**ELECTRICAL MACHINES:** Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators

**POWER CONVERTERS &ELECTRICAL INSTALLATIONS:** DC-DC buck and boost converters, duty ratio control Single-phase and three-phase voltage source inverters; sinusoidal modulation Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup

**E. TEXT BOOKS**

T1. B.L. Theraja& A.K Theraja, Electrical Technology Volume-I, S. Chand & Co
T2.V.N. Mittle, Basic Electrical Engineering, Tata McGraw Hill
T3. S.N. SinghBasic Electrical Engineering , P.H.I
T4.Rajendra Prasad, Fundamentals of Electrical Engineering, Prentice Hall
T5.C.L. WadhwaBasic Electrical Engineering, New Age International
T6.Ram, H. D.; Chauhan, A. K., Foundations and Applications of Applied Mechanics, Cambridge University Press.
T7.Meriam, J. L., Kraige, L.G., Engineering Mechanics- Statics, Vol. I, Wiley Publication, New Delhi.

**F. REFERENCE BOOKS**

R1. L.S. Bobrow, Fundamentals of Electrical Engineering, Oxford University Press
R2. E. Hughes, Electrical and Electronics Technology, Pearson

## G. Course Articulation Matrix: (Mapping of COs with POs)

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| [CO1] | Understand the basic knowledge of electrical quantities such as current, voltage, power, energy and frequency | 2 | 1 | | | | | | | | | | | | | | |
| [CO2] | Predict the behavior of any electrical and magnetic circuits. | | | 2 | 3 | | | | | | | | | | 1 | | |
| [CO3] | Formulate and solve complex AC, DC circuits. | | | | | 2 | | 2 | | | | | | | | 1 | |
| [CO4] | Identify the type of electrical machine used for that particular application. | | | | | | 2 | | 1 | | | | | | | | |
| [CO5] | Realize the requirement of transformers in transmission and distribution of electric power and other applications. | | | | | | | | | 1 | 2 | | | | | | |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Engineering Mechanics

Code: BTE22009

Credits- 3 | Semester I

Total Lecture: 45 Total Tutorial: 9

**A. Introduction:**

- To obtain resultant of various forces
- To obtain resultant of various forces
- To understand role of friction in equilibrium problems
- To know fundamental laws of machines and their applications to various engineering problems

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

**[CO1]** Identify the force systems for given conditions by applying the basics of mechanics.

**[CO2]** Determine unknown force(s) of different engineering systems.

**[CO3]** Apply the principles of friction in various conditions for useful purposes.

**[CO4]** Find the centroid and center of gravity of various components in engineering systems.

**[CO5]** Select the relevant simple lifting machine(s) for given purposes.

**C. Assessment Plan:**

| Criteria | Description | Maximum Marks |
|---|---|---|
| **Continuous Internal Assessment (CIA)** | Internal Examination | 20 |
| | Attendance | 5 |
| | Assignment | 5 |
| **End Semester Examination(ESE)** | End Semester Examination | 70 |
| **Total** | | 100 |
| **Attendance** | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

**BASICS OF MECHANICS AND FORCE SYSTEM:** Basic concepts, Applied mechanics, Statics, Dynamics. Space, time, mass, particle, flexible body and rigid body. Scalar and vector quantity, Units of measurement (SI units) - Fundamental units and derived units. Force – unit, representation as a vector and by Bow's notation, characteristics and effects of a force, Principle of transmissibility of force, Force system and its classification. Resolution of a force - Orthogonal components of a force, moment of a force, Varignon's Theorem. Composition of forces – Resultant, analytical method for determination of resultant for concurrent, non-concurrent and parallel co-planar force systems – Law of triangle, parallelogram and polygon of forces.

**EQUILIBRIUM:** Equilibrium and Equilibrant, Free body and Free body diagram, Analytical and graphical methods of analyzing equilibrium**,** Lami's Theorem – statement and explanation, Application for various engineering problems. Types of beams, supports (simple, hinged, roller and fixed) and loads acting on beam (vertical and inclined point load, uniformly distributed load, couple), Beam reaction for cantilever, simply supported beam with or without overhang –subjected to combination of Point load and uniformly distributed load, Beam reaction graphically for simply supported beam subjected to vertical point loads only

**FRICTION & VIRTUAL WORK:** Friction and its relevance in engineering, types and laws of friction, limiting equilibrium, limiting friction, co-efficient of friction, angle of friction, angle of repose, relation between co-efficient of friction and angle of friction. Introduction, laws of coulomb friction, simple contact friction problems, belt friction, the square crew thread rolling resistance, Equilibrium of bodies on level surface subjected to force parallel and inclined to plane. Equilibrium of bodies on inclined plane subjected to force parallel to the plane only. Work of a force, Principle of Virtual work and its application.

**CENTROID AND CENTRE OF GRAVITY& TRUSS:** Centroid of geometrical plane figures (square, rectangle, triangle, circle, semi-circle, quarter circle), Centroid of composite figures composed of not more than three geometrical figures, Centre of Gravity of simple solids (Cube, cuboid, cone, cylinder, sphere, hemisphere) Centre of Gravity of composite solids composed of not more than two simple solids. The structural model, simple trusses, analysis of simple trusses: method of joints, Method of sections, graphical method.

**SIMPLE LIFTING MACHINE:** Simple lifting machine, load, effort, mechanical advantage, applications and advantages. Velocity ratio, efficiency of machines, law of machine. Ideal machine, friction in machine, maximum Mechanical advantage and efficiency, reversible and non-reversible machines, conditions for reversibility, Velocity ratios of Simple axle and wheel, Differential axle and wheel, Worm and worm wheel, Single purchase and double purchase crab winch, Simple screw jack, Weston's differential pulley block, geared pulley block.

**E. TEXT BOOKS**

T1.D.S. Bedi, Engineering Mechanics, Khanna Publications, New Delhi (2008)
T2.Khurmi, R.S., Applied Mechanics, S. Chand & Co. New Delhi.
T3.Bansal R K, A text book of Engineering Mechanics, Laxmi Publications.
T4.Ramamrutham, Engineering Mechanics, S. Chand & Co. New Delhi.

**F. REFERENCE BOOKS**

R1.Dhade, Jamadar&Walawelkar, Fundamental of Applied Mechanics, Pune VidhyarthiGruh.
R2. Ram, H. D.; Chauhan, A. K., Foundations and Applications of Applied Mechanics, CambridgeUniversity Press.
R3. Meriam, J. L., Kraige, L.G., Engineering Mechanics- Statics, Vol. I, Wiley Publication, New Delhi.

## G. Course Articulation Matrix: (Mapping of COs with POs)

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| [CO1] | Identify the force systems for given conditions by applying the basics of mechanics. | 3 | 3 | | | | | | | | | | 3 | | | | 2 |
| [CO2] | Determine unknown force(s) of different engineering systems. | | 3 | | | | | | | | | | 3 | | | | 3 |
| [CO3] | Apply the principles of friction in various conditions for useful purposes. | | 3 | | | | | | | | | | 3 | | | | 1 |
| [CO4] | Find the centroid and center of gravity of various components in engineering systems. | 3 | | | 3 | | | | | | | | | | | | 2 |
| [CO5] | Select the relevant simple lifting machine(s) for given purposes. | 3 | | | | | | | | | | | 3 | | | | |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Engineering Chemistry Lab

Code: BTE22015

Credits- 1 | Semester I

Total Lecture: 30

**A. Introduction:**

- To expose the students to a breadth of experimental techniques using modern instrumentation.
- The student will learn the laboratory skills needed to design, safely conduct and interpret chemical research.

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

**[CO1]** Understand the principles of chemistry relevant to the study of science and engineering

**[CO2]** Estimate rate constants of reactions from concentration of reactants/products as a function of time

**[CO3]** Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc.

**[CO4]** Differentiate hard and soft water, solve the related numerical problems on water purification and its significance in industry and daily life.

**C. Assessment Plan:**

| Criteria | Description | Maximum Marks |
|---|---|---|
| Continuous Internal Assessment (CIA) | Internal Examination | 5 |
| | Attendance | 5 |
| | Assignment | 5 |
| End Semester Examination(ESE) | End Semester Examination | 35 |
| Total | | 50 |
| Attendance | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

| S.No. | Name of Experiments |
|---|---|
| 1 | To determine the viscosity and relative viscosity of given sample by using Ostwald's Viscometer. |
| 2 | To prepare buffer solution and standardization of pH meter. |
| 3 | Determination of chloride content of water. |

| | |
|---|---|
| 4 | Determination of cell constant and conductance of solutions. |
| 5 | Determination of the amount of iron in an iron ore solution by $KMnO_4$ |
| 6 | To determine adsorption isotherm of acetic acid by activated charcoal |
| 7 | To determine alkalinity of a given water sample. |
| 8 | To synthesis a polymer/drug. |

**E. TEXT BOOKS**

T1. Practical Chemistry by S.S. Dara

T2.Practical Chemistry by D N Bajpai – S. Chand Publishing

**F. REFERENCE BOOKS**

R1.Advanced Practical Chemistry Book by pragatiprakashan

## G. Course Articulation Matrix: (Mapping of COs with POs)

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| [CO1] | Understand the principles of chemistry relevant to the study of science and engineering | 2 | | | | | | | | | | | | | 1 | | |
| [CO2] | Estimate rate constants of reactions from concentration of reactants/products as a function of time | | | | 2 | | | | | | | | | | | 1 | |
| [CO3] | Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc. | | 2 | | | | | | | | | | | | | | |
| [CO4] | Differentiate hard and soft water, solve the related numerical problems on water purification and its significance in industry and daily life. | | | | | 2 | | | | | | | | | | | 1 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Basic Electrical Engineering Lab

Code: BTE21005

Credits- 1 | Semester I

Total Lecture: 30

**A. Introduction:**

- To impart a basic knowledge of electrical instruments voltmeter, ammeter, multi-meter, and oscilloscope. Real-life resistors, capacitors and inductors. Measurement such as current, voltage, power, energy and frequency to understand the impact of technology in a global and societal context.
- Emphasize the effects of electric shock and precautionary measures.
- Improve the ability to function on multi-disciplinary team.

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

**[CO1]** Understand different meters and instruments for measurement of electrical quantities

**[CO2]** Understand the linear and nonlinear characteristics of different types of loads experimentally

**[CO3]** Design and experiment potential divider circuits

**[CO4]** Experimentally verify the basic circuit theorems

**[CO5]** Measure power and power factor in ac circuits

**C. Assessment Plan:**

| Criteria | Description | Maximum Marks |
|---|---|---|
| Continuous Internal Assessment (CIA) | Internal Examination | 5 |
| | Attendance | 5 |
| | Assignment | 5 |
| End Semester Examination(ESE) | End Semester Examination | 35 |
| Total | | 50 |
| Attendance | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

| S.No. | Name of Experiments |
|---|---|
| 1 | Demonstrate the verification of Ohm's law. |
| 2 | Demonstrate the verification of Resistance in series and parallel apparatus. |
| 3 | Demonstrate the verification of Kirchhoff's current law (KCL). |

| | |
|---|---|
| 4 | Demonstrate the verification of Kirchhoff's voltage law (KVL). |
| 5 | Demonstrate the characteristics of half wave rectifier. |
| 6 | Demonstrate the characteristics of full wave rectifier. |
| 7 | Demonstrate the verification of Thevenin's theorem. |
| 8 | Demonstrate the verification of Norton's theorem. |

**E. TEXT BOOKS**

T1.D.P. Kothari & I.J. Nagrath, Basic Electrical Engineering, Tata McGraw Hill, latest edition.
T2.S.N. Singh , Basic Electrical Engineering, P.H.I.,2013
T3.Rajendra Prasad, Fundamentals of Electrical Engineering, Prentice Hall,2014
T4.M.S. Sukhija, T. K. Nagsarkar, Basic Electrical and electronics engineering, Oxford University press, 2012

**F. REFERENCE BOOKS**

R1.C.L. Wadhwa, Basic Electrical Engineering. New Age International.
R2.B.L. Theraja& A.K Theraja Textbook of Electrical Technology - Vol. 1, S. Chand Publication
R3.E. Hughes & I.M. Smith Hughes Electrical Technology Pearson
R4.Vincent Del Toro Electrical Engineering Fundamentals

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| [CO1] | Understand different meters and instruments for measurement of electrical quantities | 3 | 2 | | | | | | | | | | | | | | |
| [CO2] | Understand the linear and nonlinear characteristics of different types of loads experimentally | | | 2 | 2 | | | | | | | | | | | | |
| [CO3] | Design and experiment potential divider circuits | | | 2 | | | | | | | | | 1 | | 1 | 1 | |
| [CO4] | Experimentally verify the basic circuit theorems | | | | | | 1 | 1 | | | | | | | | | 1 |
| [CO5] | Measure power and power factor in ac circuits | 3 | | | | | | | | | | | 3 | | | | |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Engineering Mechanics Lab

Code: BTE22013

Credits- 1 | Semester I

Total Lecture: 30

**A. Introduction:**

- To obtain resultant of various forces.
- To calculate support reactions through conditions of equilibrium for various structures
- To understand role of friction in equilibrium problems
- To know fundamental laws of machines and their applications to various engineering problems

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

**[CO1]** Identify the force systems for given conditions by applying the basics of mechanics.

**[CO2]** Determine unknown force(s) of different engineering systems.

**[CO3]** Apply the principles of friction in various conditions for useful purposes.

**[CO4]** Find the centroid and center of gravity of various components in engineering systems.

**[CO5]** Select the relevant simple lifting machine(s) for given purposes.

**C. Assessment Plan:**

| Criteria | Description | Maximum Marks |
|---|---|---|
| Continuous Internal Assessment (CIA) | Internal Examination | 5 |
| | Attendance | 5 |
| | Assignment | 5 |
| End Semester Examination(ESE) | End Semester Examination | 35 |
| Total | | 50 |
| Attendance | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

| S.No. | Name of Experiments |
|---|---|
| 1 | To verify the law of moment by using bell crank lever |
| 2 | To verify the support reactions of a simply supported beam |
| 3 | To calculate the Mechanical advantage, Velocity Ratio and efficiency of Single Winch Crab. |

| | |
|---|---|
| 4 | To calculate the Mechanical Advantage, Velocity Ratio and efficiency of double Winch Crab. |
| 5 | To calculate the Mechanical Advantage, Velocity Ratio, and efficiency of Single start Worm & Worm Wheel |
| 6 | To calculate the Mechanical Advantage, Velocity Ratio, and efficiency of Double start Worm & Worm Wheel. |
| 7 | To calculate the Mechanical Advantage, Velocity Ratio, and efficiency of Triple start Worm & Worm Wheel |
| 8 | To verify triangle and parallelogram law of forces with the help of Gravesend's apparatus. |

**E. TEXT BOOKS**

T1.Bedi D.S., Engineering Mechanics, Khanna Publishing House
T2.Khurmi, R.S., Applied Mechanics, S.Chand& Co. New Delhi.
T3.Bansal R K, A text book of Engineering Mechanics, Laxmi Publications.
T4.Ramamrutham, Engineering Mechanics, S.,S Chand & Co. New Delhi.

**F. REFERENCE BOOKS**

R1. Dhade, Jamadar&Walawelkar, Fundamental of Applied Mechanics, Pune VidhyarthiGruh.
R2. Ram, H. D.; Chauhan, A. K. Foundations and Applications of Applied Mechanics, CambridgeUniversityPress.
R3. Meriam, J. L., Kraige, L.G. , Engineering Mechanics- Statics, Vol. I, Wiley Publication, New Delhi.

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| [CO1] | Identify the force systems for given conditions by applying the basics of mechanics. | 1 | | | | | | | | | | | | | | | |
| [CO2] | Determine unknown force(s) of different engineering systems. | | | 1 | | | | | | | | | | | | | |
| [CO3] | Apply the principles of friction in various conditions for useful purposes. | | | | | | | 1 | | | | | | | | | |
| [CO4] | Find the centroid and center of gravity of various components in engineering systems. | | | | | | | | | | | | 1 | | | | 1 |
| [CO5] | Select the relevant simple lifting machine(s) for given purposes. | | | | | | | | | | | | | | | | |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Engineering Graphics & Design

Code: BTE21004

Credits- 2 | Semester I

Total Lecture: 60

**A. Introduction:**

- Increase ability to communicate with people
- Learn to sketch and take field dimensions.
- Learn to take data and transform it into graphic drawings.
- Learn basic Auto Cad skills.
- Learn basic engineering drawing formats
- Prepare the student for future Engineering positions

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

**[CO1]** Perform basic sketching techniques

**[CO2]** Understand of architectural and engineering scales will increase.

**[CO3]** Draw orthographic projections and sections.

**[CO4]** Draft the engineering drawings in practical application

**[CO5]** Become familiar with office practice and standards

**C. Assessment Plan:**

| Criteria | Description | Maximum Marks |
|---|---|---|
| Continuous Internal Assessment (CIA) | Internal Examination | 5 |
| | Attendance | 5 |
| | Assignment | 5 |
| End Semester Examination(ESE) | End Semester Examination | 35 |
| Total | | 50 |
| Attendance | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

| EXPERIMENT NO. | TITLE OF EXPERIMENT |
|---|---|
| 1 | Introduction to Engineering Drawing |
| 2 | Projection of Points and Straight Lines |

| | |
|---|---|
| 3 | Projection Straight Lines |
| 4 | Projection of Planes |
| 5 | Isometric Axes, Lines, Planes, Solids. |
| 6 | Orthographic Projection |
| 7 | Development of Surface |
| 8 | Introduction to AUTO CAD |

**E. TEXT BOOKS**

T1. Engineering Graphics, N.D Bhatt, Charotar Publishing House Pvt. Limited
T2. Principle of Engineering Graphics And Drawing, R.K Dhawan, S. Chand Publishing
T3. Engineering Graphics And Drafting, P.S GILL,S. K. Kataria& Sons

**F. REFERENCE BOOKS**

R1. Engineering Drawing and Computer Graphics, Shah, M.B. &Rana B.C. PearsonEducation
R2. Engineering Graphics, Agrawal B. & Agrawal C. M ,TMH Publication
R3. Text book on Engineering Drawing, Narayana, K.L. & P Kannaiah, Scitech Publishers

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO6 | PO7 | PO8 | PO9 | PO10 | P 11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| [CO1] | Perform basic sketching techniques | 1 | | | | | | | | | | | | | | | |
| [CO2] | Understandof architectural and engineering scales will increase. | 1 | | | | | | | | | | | | | | | |
| [CO3] | Draw orthographic projections and sections. | | | | | | | | | | | 1 | | 2 | | | |
| [CO4] | Draft the engineering drawings in practical application | | | | | 1 | | | | | | | | | 1 | | |
| [CO5] | Become familiar with office practice and standards | | | | | | | | | 1 | | | | | | | 1 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**


Syllabus of

**B.Tech. in Civil Engineering**

**Semester-II**

**ARKAJAIN University, Jharkhand**
School of Engineering & IT
Department of Engineering
Faculty – Bachelor of Technology in Civil Engineering
**Scheme of Study (w.e.f Batch 2020-24)**

## SEMESTER –I

| Sr. No. | Name of the Subject | Group | L-T-P | Credit |
|---|---|---|---|---|
| 1 | Engineering Mathematics–I | A & B | 3-1-0 | 4 |
| 2 | Engineering Chemistry | A | 3-0-0 | 3 |
| | Programming for Problem Solving | B | 3-0-0 | 3 |
| 3 | Basic Electrical Engineering | A | 3-1-0 | 4 |
| | Engineering physics | B | 3-1-0 | 4 |
| 4 | Engineering Mechanics | A | 3-0-0 | 3 |
| | English for Communication | B | 3-0-0 | 3 |
| 5 | Constitution of India | B | 0-0-0 | 0 |
| | **Practical** | | | |
| 6 | Engineering Chemistry Lab | A | 0-0-1 | 1 |
| | Engineering Physics Lab | B | 0-0-1 | 1 |
| 7 | Basic Electrical Engineering Lab | A | 0-0-1 | 1 |
| | Programming for Problem Solving Lab | B | 0-0-2 | 2 |
| 8 | Engineering Mechanics Lab | A | 0-0-1 | 1 |
| 9 | Engineering Graphics & Design | A | 0-0-2 | 2 |
| | Workshop Practices | B | 0-0-2 | 2 |
| | TOTAL | A or B | 12-2-5 | 19 |

## SEMESTER –II

| Sr. No. | Name of the Subject | Group | L-T-P | Credit |
|---|---|---|---|---|
| 1 | Engineering Mathematics–II | A & B | 3-1-0 | 4 |
| 2 | Engineering Chemistry | B | 3-0-0 | 3 |
| | Programming for Problem Solving | A | 3-0-0 | 3 |
| 3 | Basic Electrical Engineering | B | 3-1-0 | 4 |
| | Engineering physics | A | 3-1-0 | 4 |
| 4 | Engineering Mechanics | B | 3-0-0 | 3 |
| | English for Communication | A | 3-0-0 | 3 |
| 5 | Constitution of India | A | 0-0-0 | 0 |
| | **Practical** | | | |
| 6 | Engineering Chemistry Lab | B | 0-0-1 | 1 |
| | Engineering Physics Lab | A | 0-0-1 | 1 |
| 7 | Basic Electrical Engineering Lab | B | 0-0-1 | 1 |
| | Programming for Problem Solving Lab | A | 0-0-2 | 2 |
| 8 | Engineering Mechanics Lab | B | 0-0-1 | 1 |
| | Engineering Graphics& Design | B | 0-0-2 | 2 |
| 9 | Workshop Practices | A | 0-0-2 | 2 |
| | TOTAL | A or B | 12-2-5 | 19 |

# SEMESTER –I (Group-A)

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Engineering Chemistry | BSC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 2 | Engineering Mathematics–I | BSC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 3 | Basic Electrical Engineering | ESC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 4 | Engineering Mechanics | ESC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| | **Practical** | | | | | | | | |
| 5 | Engineering Chemistry Lab | BSC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 6 | Basic Electrical Engineering Lab | ESC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 7 | Engineering Mechanics Lab | ESC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 8 | Engineering Graphics& Design | ESC | 2 | 4 | 50 | 35 | 5 | 5 | 5 |
| | **TOTAL** | | **19** | **24** | **600** | **420** | **100** | **40** | **40** |

# SEMESTER I (Group-B)

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Engineering physics | BSC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 2 | Engineering Mathematics –I | BSC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 3 | Programming for Problem Solving | ESC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | English for Communication | HSMC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 5 | Constitution of India | MC | 0 | 2 | 50 | 35 | 10 | 2.5 | 2.5 |
| | **Practical** | | | | | | | | |
| 6 | Engineering physics Lab | BSC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 7 | Programming for Problem Solving Lab | ESC | 2 | 4 | 50 | 35 | 5 | 5 | 5 |
| 8 | Workshop Practices | ESC | 2 | 4 | 50 | 35 | 5 | 5 | 5 |
| | **TOTAL** | | **19** | **26** | **600** | **420** | **105** | **37.5** | **37.5** |

# SEMESTER II (Group-A)

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Engineering physics | BSC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 2 | Engineering Mathematics –II | BSC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 3 | Programming for Problem Solving | ESC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | English for Communication | HSMC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 5 | Constitution of India | MC | 0 | 2 | 50 | 35 | 10 | 2.5 | 2.5 |
| | **Practical** | | | | | | | | |
| 6 | Engineering physics Lab | BSC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 7 | Programming for Problem Solving Lab | ESC | 2 | 4 | 50 | 35 | 5 | 5 | 5 |
| 8 | Workshop Practices | ESC | 2 | 4 | 50 | 35 | 5 | 5 | 5 |
| | **TOTAL** | | **19** | **26** | **600** | **420** | **105** | **37.5** | **37.5** |

# SEMESTER –II (Group-B)

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Engineering Chemistry | BSC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 2 | Engineering Mathematics–II | BSC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 3 | Basic Electrical Engineering | ESC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 4 | Engineering Mechanics | ESC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| | **Practical** | | | | | | | | |
| 5 | Engineering Chemistry Lab | BSC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 6 | Basic Electrical Engineering Lab | ESC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 7 | Engineering Mechanics Lab | ESC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 8 | Engineering Graphics& Design | ESC | 2 | 4 | 50 | 35 | 5 | 5 | 5 |
| | **TOTAL** | | **19** | **24** | **600** | **420** | **100** | **40** | **40** |

# SEMESTER-III

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA * | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Engineering Mathematics -III | BSC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 2 | Biology for Engineers | BSC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 3 | Surveying &Geomatics | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | Mechanics of Solid | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 5 | Introduction to Civil Engineering | HSMC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 6 | Environmental Science | MC | 0 | 2 | 50 | 35 | 10 | 2.5 | 2.5 |
| | **Practical** | | | | | | | | |
| 7 | Surveying &Geomatics Lab | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 8 | Mechanics of Solid | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 9 | Computer Aided Civil Engineering Drawing | ESC | 2 | 4 | 50 | 35 | 5 | 5 | 5 |
| | **TOTAL** | | **20** | **26** | **700** | **490** | **125** | **42.5** | **42.5** |

# SEMESTER-IV

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Material Testing & Evaluation | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 2 | Engineering Geology | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 3 | Fluid Mechanics | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | Structural Analysis - I | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 5 | Geotechnical Engineering | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 6 | Civil Engineering-Societal & Global Impact | HSMC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| | **Practical** | | | | | | | | |
| 7 | Material Testing & Evaluation | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 8 | Engineering Geology Lab | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 9 | Geotechnical Engineering Lab | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 10 | Fluid Mechanics Lab | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| | **TOTAL** | | **22** | **26** | **800** | **560** | **140** | **50** | **50** |

# SEMESTER V

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Hydraulic Engineering | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 2 | Structural Analysis II | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 3 | Hydrology & Water Resource Engineering | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | Environmental Engineering-I | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 5 | Open Elective I Humanities I<br>Professional Practice, Law & Ethics<br>Organizational Behavior | HSMC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 6 | Disaster Preparedness & Planning | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 7 | Essence of Indian Knowledge Tradition | MC | 0 | 2 | 50 | 35 | 10 | 2.5 | 2.5 |
| | PRACTICAL | | | | | | | | |
| 8 | Hydraulic Engineering Lab | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 9 | Structural Analysis II Lab | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 10 | Summer Internship –I (3-4 week) | PROJ | 2 | 0 | 50 | 35 | 15 | 0 | 0 |
| | **TOTAL** | | **22** | **24** | **800** | **560** | **155** | **42.5** | **42.5** |

# SEMESTER VI

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory / Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Construction Engineering & Management | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 2 | Transportation Engineering-I | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 6 | Engineering Economics, Estimation & Costing | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 3 | Elective I<br>Rock Mechanics<br>Foundation Engineering | PEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | Elective II<br>Environmental Engineering II<br>Rural water supply & Onsite Sanitation System | PEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 6 | Elective III<br>Design of Steel Structure<br>Earthquake Engineering | PEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 7 | Design of Concrete Structures-I | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| | **Practical** | | | | | | | | |
| 8 | Transportation Engineering I Lab | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| | **TOTAL** | | **22** | **23** | **750** | **525** | **145** | **40** | **40** |

# SEMESTER VII

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Elective IV<br>Air and Noise Pollution and Control<br>Solid and hazardous Waste Management | PEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 2 | Elective V<br>Design of Concrete Structure - II<br>Prestressed Concrete | PEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 3 | Open Elective II<br>Metro System & Engineering<br>History of Science & Engineering | OEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | River Engineering | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| | **Practical** | | | | | | | | |
| 5 | Minor Project | PROJ | 3 | 6 | 100 | 70 | 30 | 0 | 0 |
| 6 | Summer Internship –II –(4-6 Week) | PROJ | 3 | 0 | 100 | 70 | 30 | 0 | 0 |
| | **TOTAL** | | **18** | **18** | **600** | **420** | **140** | **20** | **20** |

# SEMESTER VIII

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Elective VI<br>Bridge Engineering<br>Ground Water Engineering | PEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 2 | Elective VII<br>Railway Engineering<br>Traffic Engineering and Management | PEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 3 | Open Elective III<br>Soft Skills and Interpersonal Communication<br>Human Resource Development and Organizational Behavior | OEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | Open Elective IV<br>Civil Engineering Design-I<br>Geographic Information Systems and Science | OEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| | **Practical** | | | | | | | | |
| 5 | Major Project | PROJ | 8 | 16 | 200 | 140 | 60 | 0 | 0 |
| 6 | Extra- Curricular/ Co-Curricular Activity | PROJ | 0 | 0 | 100 | 70 | 30 | 0 | 0 |
| | **TOTAL** | | **20** | **28** | **700** | **490** | **170** | **20** | **20** |

## Distribution of Credit across 8 semesters:

| Sl. No | Type of Paper | No. of Paper | Total Credit |
|---|---|---|---|
| 1 | Humanities and Social Sciences including Management courses **(HSMC)** | 4 | 12 |
| 2 | Basic Science courses**(BSC)** | 8 | 24 |
| 3 | Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc**(ESC)** | 9 | 20 |
| 4 | Professional core courses (**PCC)** | 26 | 60 |
| 5 | Professional Elective courses relevant to chosen specialization/branch**(PEC)** | 7 | 21 |
| 6 | Open subjects – Electives from other technical and /or emerging subjects (**OEC)** | 3 | 9 |
| 7 | Project work, seminar and internship in industry or elsewhere**(PROJ)** | 5 | 16 |
| 8 | Mandatory Courses [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Knowledge Tradition]**(MC)** | 3 | 0 |
| | **Total** | 65 | 162 |

**CIA – Continuous Internal Assessment – Based on Projects / Assignment during the semester**

**Note:**
**AICTE Activity Points to be earned by students admitted to Degree program (For more details refer to Chapter 6, AICTE, Activity Point Program, Model Internship Guidelines):**
**Every regular student, who is admitted to the 4 year Degree program, is required to earn 100 activity points in addition to the total credits earned for the program. Students entering 4 years Degree Program through lateral entry are required to earn 75 activity points in addition to the total credits earned for the program. The activity points earned by the student shall be reflected on the students 8th Semester grade card.**
**The activities to earn the points can be spread over the duration of the course. However, minimum prescribed duration should be fulfilled.**
**Activity Points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression.**
**Incase student fail to earn the prescribed activity points, Eight semester Grade Card shall be issued only after earning the required activity Points.**
**Students shall be eligible for the award of degree only after the release of the Eight Semester grade card.**

***There are two groups (A & B) in semester 1 & 2. The Group division will be decided by The Dean SoE& IT before commencement of classes***

**ARKAJAIN University, Jharkhand**
School of Engineering & IT
Department of Engineering
Faculty – Bachelor of Technology in Civil Engineering
**PROGRAM OUTCOMES &PROGRAM SPECIFIC OUTCOMES**

**PROGRAM OUTCOMES**

After completing this undergraduate program, a learner:

**[PO.1]. Engineering knowledge:** An ability to apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to get the solution of the engineering problems.

**[PO.2]. Problem analysis:** Ability to Identify, formulates, review research literature, and analyze complex engineering problems.

**[PO.3]. Design/Development of Solutions:** Ability to design solutions for complex Engineering Problems by considering social, Economic and Environmental aspects.

**[PO.4]. Conduct investigations of complex problems:** Use research-based knowledge to design, conduct analyses experiments to get valid conclusion.

**[PO.5]. Modern tool usage:** ability to create, select, and apply appropriate techniques, and to model complex engineering activities with an understanding of the limitations.

**[PO.6]. The engineer and society:** Ability to apply knowledge by considering social health, safety, legal and cultural issues.

**[PO.7]. Environment and sustainability:** Understanding of the impact of the adopted engineering solutions in social and environmental contexts.

**[PO.8]. Ethics:** Understanding of the ethical issues of the civil engineering and applying ethical principles in engineering practices.

**[PO.9]. Individual and teamwork:** Ability to work effectively as an individual or in team, as a member or as a leader.

**[PO.10]. Communication:** An ability to communicate clearly and effectively through different modes of communication.
**[PO.11]. Project management and finance:** Ability to handle project and to manage finance related issue.

**[PO.12]. Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning.

**PROGRAM SPECIFIC OUTCOMES**

**[PSO.1]. Professional skills** – The ability to analyze and design civil engineering structures as per the guidelines in Indian standards and other relevant codes like buildings, bridges, tunnels ,railways, airports, water and sewage treatment plants etc

**[PSO.2]. Problem solving skills** – The ability to managed large infrastructural projects by making use of latest techniques of project management for optimum utilization of resources via man, material and money.

**[PSO.3]. Successful Career and Entrepreneurship** – Strong desire to acquire modern scientific knowledge by pursuing higher studies, which will lead them to identify problems in the civil engineering domains and thereby become entrepreneur to propose solution

**[PSO.4]. Communication:** Communicate effectively on complex engineering activities with the engineering community & with society at large, such as, being able to comprehend & write effective reports & design documentation, make effective presentations & give & receive clear instructions

# Subject: Engineering Physics

Code: BTE22010
4 Credits | Semester II

Total Lecture: 60 Total Tutorial: 12

**A. Introduction:**

- To acquire fundamental knowledge about nature and its phenomena including quantitative expression.
- To enhance intellectual, computational, experimental, communication and analytical skills of the students Physics is necessary to satisfy the basic sciences requirement, as appropriate for various engineering disciplines

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

**[CO1]** Identify and understand the kinds of experimental results which are incompatible with classical Physics leading to the development of a quantum theory of matter and light.

**[CO2]** Use basic concepts to analyze and design a wide range of semiconductor devices.

**[CO3]** Understand & solve different types of wave equations.

**[CO4]** Use the principles of optics to solve various complex engineering problems.

**[CO5]** Use fundamental laws and relations to solve problems in electricity, electromagnetism

**C. Assessment Plan:**

| **Criteria** | **Description** | **Maximum Marks** |
|---|---|---|
| **Continuous Internal Assessment (CIA)** | Internal Examination | 20 |
| | Attendance | 5 |
| | Assignment | 5 |
| **EndSemester Examination(ESE)** | End Semester Examination | 70 |
| **Total** | | 100 |
| **Attendance** | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

**QUANTUM MECHANICS:** Introduction to Quantum Physics, black body radiation , Explanation using the photon concept, Photoelectric effect, Compton effect, Wave particle duality, De-Broglie hypothesis, Heisenberg's Uncertainty principle.Born interpretation for wave function, Free-particle wave function and wave-packets, Time-dependent and time independent Schrodinger equation, particle in a box, Finite Potential barrier and tunneling.

**ELECTRONIC MATERIALS AND SEMICONDUTOR:** Free electron theory, Energy bands

in solids, E-k diagram, Direct and indirect band gaps, Types of electronic materials: metals, semiconductors, and insulators, Density of states, Occupation probability, Fermi level, and Effective mass.Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature, Carrier generation and recombination, Carrier transport: diffusion and drift, p-n junction,

**WAVES AND OSCILLATION:** Simple harmonic motion, damped and forced simple harmonic oscillator Mechanical and electrical simple harmonic oscillators,damped harmonic oscillator – heavy, critical and light damping, energy decay in a damped harmonic oscillator, quality factor, forced mechanical and electrical oscillators, electrical and mechanical impedance, resonance.

**OPTICS AND LASER:** Introduction to interference, Analytical treatment of interference, Displacement of fringes, Thin film, Wedge shaped film, Newton's Ring,Concept of diffraction, Fraunhofer and Fresnel diffraction, Fraunhofer diffraction at single slit, double slit, and diffraction grating, Limit of Resolution, Resolving power of grating,Introduction to interaction of radiation with matter, Stimulated and spontaneous emission, Einstein's coefficient, principles and working of laser: population inversion, pumping, types of laser: He-Ne laser, Ruby laser , application of lasers.

**ELECTROMAGNETISM:** Electric field and electrostatic potential for a charge distribution; Laplace's and Poisson's equations for electrostatic potential and uniqueness of their solution. Boundary conditions of electric field and electrostatic potential,Bio-Savart law, vector potential and calculating it for a given magnetic field; the equation for the vector potential and its solution for given current densities. Faraday's law of electromagnetic induction, Equation of continuity, displacement current, Maxwell's equation, Poyting theorem, Electromagnetic waves in free space, conducting and non -conducting medium

**E. TEXT BOOKS**

T1. Concept of Modern Physics by Arthur Beiser: Publication: TMH
T2.Elements of electro magnetics by Mathew N.O. Sadiku: Publication: Oxford University Press
T3.Introduction to electrodynamics by David J. Griffiths; Pub.: Pearson Education.
T4.Optics by AjoyGhatakPub;TMH
T5.Fundamentals of Physics extended volume by Resnick, Halliday and Walker; Pub.:John Wiley & Sons. Inc. Asian Edition.
T6.P. Bhattacharya, Semiconductor Optoelectronic Devices, Prentice Hall of India (1997).
T7.Engineering Physics – HitendraK.Malik& Ajay Kumar Singh by TMH Publication.
T8.The Physics of Vibrations and Waves, H. J. Pain, 2013, John Wiley and Sons.
T9. Introduction to Quantum mechanics, Nikhil Ranjan Roy, 2016, Vikash Publishing House Pvt Ltd

**F. REFERENCE BOOKS**

R1. Modern Physics by G. Aruldhas& P. Rajagopal; Pub: Prentice Hall of India.
R2. Quantum Physics by H.C. Verma Pub.: Surya Publication .
R3. Lasers and Non-Linear Optics by B.B. Laud; Pub: New Age International (P) Ltd.
R4. Principles of electricity by Leigh Page and Normal llsley Adams, Pub.: Eurasia Publishing

House, New Delhi.
R5. Feynmann Lecture Series on Physics
R6. Waves: Berkeley Physics Course, vol.3, Francis Crawford, 2007, Tata McGraw-Hill.
R7. Online course: "Semiconductor Optoelectronics" by M R Shenoy on NPTEL
R8. Introduction to Modern Physics, Rich Meyer, Kennard, Coop, 2002, Tata McGraw Hill

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| [CO1] | Identify and understand the kinds of experimental results which are incompatible with classical Physics leading to the development of a quantum theory of matter and light. | 2 | 3 | | | | | | | | | | 3 | | | | |
| [CO2] | Use basic concepts to analyze and design a wide range of semiconductor devices. | | | 2 | | 3 | | | | | | | | | 1 | | |
| [CO3] | Understand & solve different types of wave equations. | | | | 2 | | | | | | | | 1 | | | | 2 |
| [CO4] | Use the principles of optics to solve various complex engineering problems. | | | 3 | 2 | | | | | | | | | | | | |
| [CO5] | Use fundamental laws and relations to solve problems in electricity, electromagnetism | | 3 | | | | | | | | 2 | | | | | | |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Engineering Mathematics –II

Code: BTE22008
4 Credits |Semester II

Total Lecture: 60 Total Tutorial: 12

**A. Introduction:**

- To familiarize the prospective engineers with techniques in multivariate integration, ordinary and partial differential equations and complex variables.
- To equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines
- To equip the students with standard concepts and tools at an intermediate to advanced level

**B. Course Outcomes: At the end of the course,**

| | |
|---|---|
| **[CO1]** | Remember the mathematical tools needed in the multiple integrals and their usage. |
| **[CO2]** | Understand the effective mathematical tools for the solutions of differential equations that model physical processes. |
| **[CO3]** | Demonstrate the tools of differentiation and integration of functions of a complex variable that are used in various techniques dealing engineering problems. |
| **[CO4]** | Calculate the analytic function**.** |
| **[CO5]** | Evaluate complex integrals by using Cauchy-Goursat integral theorem. |

**C. Assessment Plan:**

| **Criteria** | **Description** | **Maximum Marks** |
|---|---|---|
| **Continuous Internal Assessment (CIA)** | Internal Examination | 20 |
| | Attendance | 5 |
| | Assignment | 5 |
| **End Semester Examination(ESE)** | End Semester Examination | 70 |
| **Total** | | 100 |
| **Attendance** | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

**MULTIVARIABLE CALCULUS (INTEGRATION):** Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes, Center of mass and Gravity. Triple integrals(Cartesian),orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds, Scalar line integrals, vector line integrals, scalar surface integrals,

vector surface integrals, Theorems of Green, Gauss and Stokes

**FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS: Exact**, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: solvable for p,solvable for y Equations solvable for x and Clairaut's equation

**ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER:** Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation

Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties

**COMPLEX VARIABLE – DIFFERENTIATION:** Differentiation, Cauchy-Riemann equations, Analytic functions, harmonic functions, finding harmonic conjugate, Elementary analytic functions (exponential, trigonometric, logarithm)and their properties, Conformal mappings, Mobius transformations and their properties.

**COMPLEX VARIABLE – INTEGRATION:** Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof),Liouville's theorem and Maximum ,Modulus theorem (without proof)Taylor's series, zeros of analytic functions, singularities, Laurent'sseries; Residues, Cauchy Residue theorem (without proof),Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich

**E. TEXT BOOKS**

T1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition,Pearson, Reprint, 2002.

T2.Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley &Sons, 2006.

**F. REFERENCE BOOKS**

R1.W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9thEdn., Wiley India, 2009.

R2.B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| [CO1] | Remember the mathematical tools needed in the multiple integrals and their usage. | | 2 | | 2 | | | | | | | | | | | | |
| [CO2] | Understand the effective mathematical tools for the solutions of differential equations that model physical processes. | | | 1 | | 1 | | | | | | | | | | | |
| [CO3] | Demonstrate the tools of differentiation and integration of functions of a complex variable that are used in various techniques dealing engineering problems. | | | | 2 | | | 1 | | | | | | | | 1 | |
| [CO4] | Calculate the analytic function. | | | | | 2 | | | | | | | | | | | 1 |
| [CO5] | Evaluate complex integrals by using Cauchy-Goursat integral theorem. | | 1 | | | | | | | | | | | | | | |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Programming for Problem Solving

Code: BTE21259

3 Credits | Semester II

Total Lecture: 45 Total Tutorial: 9

**A. Introduction:**

- To understand concept of algorithm and programming
- To know various logical components and
- Syntax used in programming
- To learn different ways of transforming a real world problem into system problem

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

**[CO1]** Formulate simple algorithms for arithmetic and logical problems.

**[CO2]** Test and execute the programs and correct syntax and logical errors and to implement conditional branching, iteration and recursion

**[CO3]** Apply programming to solve matrix addition and multiplication problems and searching and sorting problems.

**[CO4]** Use arrays, pointers and structures to formulate algorithms and programs

**[CO5]** Decompose a problem into functions and synthesize a complete program using divide and conquer approach

**C. Assessment Plan:**

| **Criteria** | **Description** | **Maximum Marks** |
|---|---|---|
| **Continuous Internal Assessment (CIA)** | Internal Examination | 20 |
| | Attendance | 5 |
| | Assignment | 5 |
| **End Semester Examination(ESE)** | End Semester Examination | 70 |
| **Total** | | 100 |
| **Attendance** | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

**FUNDAMENTALS OF INFORMATION TECHNOLOGY**: Evolution of Computers, Generation and Classification of Computers Application of Computers and etc**.** Memory Hierarchy, RAM, ROM, Types of Secondary Storage Devices and etc.Information, Technology, Role of Information Technology, Information Technology and Internet and etc.**Introduction**, Evolution of Internet, Basic Internet Terms, Getting Connected to Internet, Internet Applications, Data over Internet, Web Browser, Browsing Internet Using Internet Explorer, E-mail, search

Engines, Instant Messaging.E-Commerce, Electronic Data Interchange, Smart Cards, Mobile Communication and etc.

**C FUNDAMENTALS, DECISION & LOOPING STATEMENTS**:The C language. Phases of developing a running computer program in C.Data Concepts in C: Constants, Variables, Expressions, Operators, and operator precedence in C. Different basic data types and their sizes. Managing input and output statements, Sequential control statements. Decision making statements (If-Else constructs). Loop control statements (While construct, Do While construct, For construct)

**ARRAYS, STRINGS &FUNCTIONS :**One-dimensional Arrays: Declaration and Initialization. String variables, Reading and writing strings, Arithmetic operations on characters, Putting strings together, Comparison of two strings. Functions: The prototype declaration, Function definition.Function call: Passing arguments to a function (by value, by reference). Scope of variables. Recursive function calls, Tail recursion, Tree of recursion. Sorting problems: Selection sort, Insertion sort. Sorting in multidimensional arrays. Sorting in arrays. Search problems: Linear search and binary search. Recursive and iterative formulations.

**POINTERS &STRUCTURE :**Pointers: Declaring and dereferencing pointer variables. Pointer arithmetic. Accessing arrays through pointers. Pointer types, Pointer and strings. Structures in C: Motivation, examples, declaration, and use. Operations on structures.Passing structures as function arguments. Type defining structures.

**LINKED LISTS & FILE HANDLING :**Self-referential structures, Dynamic data structures, Linked lists with examples.File operations in C: Input, output, and error streams. Opening, closing, and reading from files. Searching through files using functions such as fseek(), ftell(), and rewind(). Programming for command line arguments

**E. TEXT BOOKS**

T1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill .
T2.E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.

**F. REFERENCE BOOKS**

R1.Let us C, YashwantKanetkar, BPI publications
R2.Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

## G. Course Articulation Matrix: (Mapping of COs with POs)

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| [CO1] | Formulate simple algorithms for arithmetic and logical problems. | 1 | 1 | | 1 | | | 1 | | | | | | | | | |
| [CO2] | Test and execute the programs and correct syntax and logical errors and to implement conditional branching, iteration and recursion | 1 | 1 | | 1 | | | 1 | | | | | | | | | |
| [CO3] | Apply programming to solve matrix addition and multiplication problems and searching and sorting problems. | 1 | 1 | | 1 | | | 1 | | | | | | | | | |
| [CO4] | Use arrays, pointers and structures to formulate algorithms and programs | | | | | | | | | | | | | | | | |
| [CO5] | Decompose a problem into functions and synthesize a complete program using divide and conquer approach | 1 | 1 | | 1 | | | 1 | 1 | | | | | | | | |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# English for Communication

Code: BTE22370
3 Credits | Semester II

Total Lecture: 45 Total Tutorial: 9

**A. Introduction:**

- To impart basic skills of Communication in English through intensive practice.
- Students of Engineering so as to enable them to enhance their communicative knowledge and soft skills.

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

**[CO1]** Understand the basic of the communication and represent communication process and to know the practical implementations in the work place.
**[CO2]** Understand verbal and non-verbal modes of communication effectively in practical situations
**[CO3]** Analyze vocalics and basic grammar.
**[CO4]** Create competence in reading and writing.
**[CO5]** Evaluate speaking process.

**C. Assessment Plan:**

| Criteria | Description | Maximum Marks |
|---|---|---|
| Continuous Internal Assessment (CIA) | Internal Examination | 20 |
| | Attendance | 5 |
| | Assignment | 5 |
| End Semester Examination(ESE) | End Semester Examination | 70 |
| Total | | 100 |
| Attendance | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

**VOCABULARY BUILDING: '**Ancient Architecture in India' from prescribed textbook 'English for Engineers published by Cambridge University. Vocabulary: Synonyms and Antonyms Lexical set of words- Formation of hints with lexical set of words- Usage of Lexical sets in framing meaningful sentences. Standard Abbreviation in English.

**IDENTIFYING COMMON ERRORS IN WRITING:** Subject-verb agreement, Noun-pronoun agreement, Misplaced modifiers, Articles, Prepositions, Redundancies, Clichés

**SELF DEVELOPMENT AND ASSESSMENT:** Self-assessment, Awareness, Perception and Attitudes, Values and belief, Personal goal setting, career planning Self-esteem. Managing Time; Personal memory, Rapid reading,

**ORAL COMMUNICATION :** Public speaking, Group discussion, Oral; presentation, Interviews, Graphic presentation, Presentation aids, Personality Development Writing reports, project proposals, brochures, newsletters, technical articles, manuals, official notes, business letters, memos, progress reports, minutes of meetings, event report.

**NATURE AND STYLE OF SENSIBLE WRITING:** Business letters: Enquiry/claim complaint and order. Technical reports, Email writing, Technical articles, Writing reports, Paragraph writing, Techniques for writing precisely. Graphic presentation, Project proposals.

**E. TEXT BOOKS**

T1. David F. Beer and David McMurrey, Guide to writing as an Engineer, John Willey. New York, 2004
T2. Diane Hacker, Pocket Style Manual, Bedford Publication, New York, 2003. (ISBN 0312406843)
T3. Shiv Khera, You Can Win, Macmillan Books, New York, 2003.
T4. Raman Sharma, Technical Communications, Oxford Publication, London, 2004.
T5. Dale Jungk, Applied Writing for Technicians, McGraw Hill, New York, 2004. (ISBN: 07828357-4)
T6. Sharma, R. and Mohan, K. Business Correspondence and Report Writing, TMH New Delhi 2002.
T7. Xebec, Presentation Book, TMH New Delhi, 2000.
T8 . English for Engineers ,Cambridge university.

**F. REFERENCE BOOKS**

R1. Practical English Usage. Michael Swan. OUP. 1995.
R2. Remedial English Grammar. F.T. Wood. Macmillan.2007
R3. On Writing Well. William Zinsser. Harper Resource Book. 2001
R4. AICTE Modal

## G. Course Articulation Matrix: (Mapping of COs with POs)

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| [CO1] | Understand the basic of the communicationand represent communication process and to know the practical implementations in the work place. | 2 | | | | | | | | 2 | | | | | | | |
| [CO2] | Understand verbal and non-verbal modes of communication effectively in practical situations | | | | | | 2 | | | 2 | | | | | | | |
| [CO3] | Analyzevocalics and basic grammar. | | 2 | | | | | | | | | | | | | | 2 |
| [CO4] | Create competence in reading and writing. | | | 2 | | | | | | | | | 2 | | | | |
| [CO5] | Evaluate speaking process. | | | | | | 2 | | | | 3 | | | | | | |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Constitution of India

Code: BTE25095
0 Credits | Semester II

Total Lecture: 30 Total Tutorial: 6

**A. Introduction:**

- The objective of the Constitution of India is to establish a society where there is: Justice - social, economic and political. Liberty - thought, expression, faith, belief and worship

**B. Course Outcomes:**

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

**[CO1]** Understand the emergence and evolution of Indian Constitution. Understand and analyse federalism in the Indian context

**[CO2]** Understand and explain the significance of Indian Constitution as the fundamental law of the land.

**[CO3]** Exercise his fundamental rights in proper sense at the same time identifies his responsibilities in national building.

**[CO4]** Analyse the Indian political system, the powers and functions of the Union, State and Local Governments in detail

**[CO5]** Understand Electoral Process, Emergency provisions and Amendment procedure.

**C. Assessment Plan:**

| **Criteria** | **Description** | **Maximum Marks** |
|---|---|---|
| Continuous Internal Assessment (CIA) | Internal Examination | 20 |
| | Attendance | 5 |
| | Assignment | 5 |
| End Semester Examination(ESE) | End Semester Examination | 70 |
| Total | | 100 |
| Attendance | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

**INTRODUCTION:** Constitution' meaning of the term,, Indian Constitution: Sources and constitutional history, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy

**UNION GOVERNMENT AND ITS ADMINISTRATION:** Structure of the Indian Union: Federalism Centre- State relationship President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat LokSabha, RajyaSabha

**STATE GOVERNMENT AND ITS ADMINISTRATION:** Governor: Role and Position, CM and Council of ministers State Secretariat: Organization, Structure and Functions.

**LOCAL ADMINISTRATION:** District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal CorporationPachayati raj: Introduction, PRI: ZilaPachayat, Elected officials and their roles, CEO ZilaPachayat: Position and role, Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

**ELECTION COMMISSION:** Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women

**E. TEXT BOOKS**

T1. Indian Polity' by Laxmikanth
T2. 'Indian Administration' by SubhashKashyap

**F. REFERENCE BOOKS**

R1. 'Indian Constitution' by D.D. Basu
R2. 'Indian Administration' by Avasti and Avasti

## H. Course Articulation Matrix: (Mapping of COs with POs)

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| [CO1] | Understand the emergence and evolution of Indian Constitution. Understand and analyse federalism in the Indian context | 2 | | | | | | | | 2 | | | | | | | |
| [CO2] | Understand and explain the significance of Indian Constitution as the fundamental law of the land. | | | | | | 2 | | | 2 | | | | | | | |
| [CO3] | Exercise his fundamental rights in proper sense at the same time identifies his responsibilities in national building. | | 2 | | | | | | | | | | | | | | 2 |
| [CO4] | Analyse the Indian political system, the powers and functions of the Union, State and Local Governments in detail | | | 2 | | | | | | | | | 2 | | | | |
| [CO5] | Understand Electoral Process, Emergency provisions and Amendment procedure. | | | | | | 2 | | | | 3 | | | | | | |

**2- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Engineering Physics Lab

Code: BTE21261

1 Credits | Semester II

Total Lecture: 30

**A. Introduction:**

- To study the use of physical principles and analysis in various fields of engineering and technology.
- To supplement the theoretical knowledge gained in the lecture by hands-on experience with the equipment. This will develop scientific temper and help to apply the basic concepts and principles in solving engineering problems.
- Demonstrate an ability to make physical measurements & understand the limits of precision measurement.

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

**[CO1]** Understand calculation of specific resistance of wire by Carey Foster bridge

**[CO2]** Calculate thermal conductivity of poor conductors

**[CO3]** Measure resonance frequency and quality factor of LCR Circuit & RC circuit with AC current

**[CO4]** Understand the characteristics of transistors, photoelectric cells and determine operational parameters associated with their performance.

**[CO5]** Work with laboratory sodium light and lasers. Understand method to measure the wavelength of the light emitted from a laser and Sodium light.

**C. Assessment Plan:**

| Criteria | Description | Maximum Marks |
|---|---|---|
| **Internal Assessment (Summative)** | Internal Examination(Assessment) | 05 |
| | Assignment | 05 |
| | Attendance | 05 |
| **End Term Exam (Summative)** | End Term Examination | 35 |
| | Total | 50 |
| **Attendance (Formative)** | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

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**D. SYLLABUS**

| Experiment No. | TITLE OF EXPERIMENT |
|---|---|
| **1** | To determine the Planck's constant using LED. |

| | |
|---|---|
| **2** | To study various type of losses that occur in optical fibers and measure loss in dB of two optical patch cords |
| **3** | To study the series and parallel resonance with LCR Circuits |
| **4** | To determine V-I Characteristics of P-N Junction Diode |
| **5** | To the Charge to mass (e/m)ratio of Electron by Lorentz Force Apparatus |
| **7** | To determine the number of lines percentimeter of the plane diffraction gratingby using sodium light |
| **8** | To find the wave length of sodium light using fresnel'sbiprism |
| **9** | To determine input & output characteristics of a PNP Junction Transistor in CE and CB configuration. |
| **10** | To determine input & output characteristics of a NPN Junction Transistor in CE and CB configuration. |

**E. Text Book:**

T1. A Text Book of Engineering Physics Practical by Dr. Ruby Das, C.S. Robinson, Dr. Rajesh Kumar &Prashant Kumar Sahu; Pub University Science Press

T2.Fundamentals of Physics extended volume by Resnick, Halliday and Walker; Pub.:John Wiley & Sons. Inc. Asian Edition.

**F. Reference Books:**

R1. Advanced level Physics Practical, Michael Nelson and Jon M. Ogborn, Heinemann Educational Publishers.

R2. Engineering Practical Physics, S.Panigrahi& B.Mallick,2015, Cengage Learning India Pvt. Ltd.

## G.Course Articulation Matrix: (Mapping of COs with POs)

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| **[CO1]** | Understand calculation of specific resistance of wire by Carey Foster bridge | **3** | | | | | | | | | | | | | | | **3** |
| **[CO2]** | Calculate thermal conductivity of poor conductors | | | **1** | **2** | | | | | | | | | | | | |
| **[CO3]** | Measure resonance frequency and quality factor of LCR Circuit & RC circuit with AC current | | | | | **3** | | | | | | | | | | **1** | |
| **[CO4]** | Understand the characteristics of transistors, photoelectric cells and determine operational parameters associated with their performance. | | | | **3** | | | | | | | | | | | | |
| **[CO5]** | Work with laboratory sodium light and lasers. Understand method to measure the wavelength of the light emitted from a laser and Sodium light. | | | **3** | | | | **1** | | | | | | | **3** | | |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Programming for Problem Solving Lab

Code: BTE21262

Credits- 2 | Semester II

Total Lecture: 60

**A. Introduction:**

- To work with an IDE to create, edit, compile, run and debug programs
- To analyze the various steps in program development.
- To develop programs to solve basic problems by understanding basic concepts in C like operators, control statements etc.

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

**[CO1]** **F**ormulate simple algorithms for arithmetic and logical problems. To translate the algorithms to programs (in C language).To test and execute the programs and correct syntax and logical errors.

**[CO2]** Program for solving simple numerical method problems, namely rot finding of function, differentiation of function and simple integration.

**[CO3]** Decompose a problem into functions and synthesize a complete program using divide and conquer approach.

**[CO4]** Analyze the complexity of problems, modularize the problems into small modules and then convert them into programs.

**C. Assessment Plan:**

| Criteria | Description | Maximum Marks |
|---|---|---|
| **Internal Assessment (Summative)** | Internal Examination(Assessment) | 05 |
| | Assignment | 05 |
| | Attendance | 05 |
| **End Term Exam (Summative)** | End Term Examination | 35 |
| | Total | 50 |
| **Attendance (Formative)** | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

| S.No. | Name of Experiments |
|---|---|
| 1 | a) Write a C program to find sum and average of three numbers.<br>b) Write a C program to find the sum of individual digits of a given positive integer |
| 2 | a) Write a C program to generate the first n terms of the Fibonacci sequence |

| | |
|---|---|
| | b) Write a C program to generate prime numbers between 1 to n.<br>c) Write a C program to check if the given number is Armstrong or not |
| 3 | a) Write a C program to check whether the given number is perfect or not<br>b) Write a C program to check whether the given number is strong or not. |
| 4 | a) Write a C program to find the roots of a quadratic equation.<br>b) Write a C program perform arithmetic operations using switch statement. |
| 5 | a) Write a C program to find factorial of a given integer using non-recursive function<br>b) Write a C program to find factorial of a given integer using recursive function |
| 6 | a) Write C program to find GCD of two integers by using recursive function.<br>b) Write C program to find GCD of two integers by using non-recursive function |
| 7 | a) Write a C program to find the largest and smallest number in a list of integers.<br>b) Write a C program to Sort the Array in an Ascending Order.<br>c) Write a C program to find whether the given matrix is symmetric or not. |
| 8 | a) Write a C program to perform addition of two matrices.<br>b) Write a C program using function to perform multiplication of two matrices. |
| 9 | a) Write a C program to use function to insert a sub-string in to given main string from a given position.<br>b)Write a C program to swap the values of two variables using<br>(i) Call by value (ii) Call by reference |
| 10 | a) Write a C program using user-defined functions to determine whether the given string is palindrome or not.<br>b) Write a C program that displays the position or index in the main string S where the sub string T begins, or - 1 if S doesn't contain T |
| 11 | a) Write C program to count the number of lines, words and characters in a given text.<br>b) Write a C program to find the sum of integer array elements using pointers |
| 12 | a) Write a C Program to Calculate Total and Percentage marks of a student using |

| | |
|---|---|
| | structure |

**E. TEXT BOOKS**

T1. C Programming and Data Structures, P.Padmanabham, Third Edition, BS Publications
T2.Computer programming in C.V.RAjaraman, PHI Publishers.
T3.C Programming, E.Balagurusamy, 3rd edition, TMHPublishers.

**F. REFERENCE BOOKS**

R1. C Programming, M.V.S.S.N Venkateswarlu and E.V.Prasad,S.Chand Publishers.
R2. Mastering C,K.R.Venugopal and S.R.Prasad, TMH Publishers.

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| [CO1] | Formulate simple algorithms for arithmetic and logical problems. To translate the algorithms to programs (in C language).To test and execute the programs and correct syntax and logical errors. | 2 | 3 | | | | | | | | | | | | 2 | | |
| [CO2] | Program for solving simple numerical method problems, namely rot finding of function, differentiation of function and simple integration. | | | 2 | 2 | | | | | | | | | | | | 2 |
| [CO3] | Decompose a problem into functions and synthesize a complete program using divide and conquer approach. | | | | | 1 | | | | | | | | | 1 | | |
| [CO4] | Analyze the complexity of problems, modularize the problems into small modules and then convert them into programs. | | | | | | | | | | | | | | | | 3 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Engineering Workshop Practice

Code: BTE22267

2 Credits | Semester II

Total Lecture: 60

**A. Introduction:**

- To understand basic engineering processes for manufacturing and assembly
- To understand, identify, select and use various marking, measuring, and holding, striking and cutting tools and equipment's
- To understand and interpret job drawings, produce jobs, and inspect the job for specified dimension.

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

**[CO1]** Acquire skills in basic engineering practice to identify, select and use various marking, measuring, and holding, striking and cutting tools &equipment's and machines

**[CO2]** Understand job drawing and complete jobs as per specifications in allotted time

**[CO3]** Inspect the job for the desired dimensions and shape

[**CO4**] Operate, control different machines and equipment's adopting safety practices

**C. Assessment Plan:**

| Criteria | Description | Maximum Marks |
|---|---|---|
| **Internal Assessment (Summative)** | Internal Examination(Assessment) | 05 |
| | Assignment | 05 |
| | Attendance | 05 |
| **End Term Exam (Summative)** | End Term Examination | 35 |
| | Total | 50 |
| **Attendance (Formative)** | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

| Experiment No. | TITLE OF EXPERIMENT |
|---|---|
| **1** | To make a V- fitting from the given two M.S pieces. |
| **2** | To make a T- lap joint |

| | |
|---|---|
| **3** | To Make a tray by using GI sheet as per given Drawing |
| **4** | To make a Butt joint using the given two M.S pieces by arc welding. |
| **5** | To make the taper turning operation in cylindrical piece of required angle on lathe machine. |
| **6** | To make an internal thread using tap M10x1.5 |
| **7** | Machining a block on shaper machine. |
| **8** | To make a step turning operation on cylindrical M.S. work piece using lathe machine. |

**E. TEXT BOOKS**

T1. Workshop Technology Vol-I,II,IIIHajraChoudry., Media Promotors and Publishers P Ltd.

T2.Manufacturing Technology vol 1 by P.N. Rao Mc.Grow Hill.

**F. REFERENCE BOOKS**

R1. Workshop technology by R.S. Raghuwanshi.Dhanpat Ray & co

R2. Workshop technology by R.S. Khurmi&J.K.GuptaS.Chand co.

## G. Course Articulation Matrix: (Mapping of COs with POs)

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| [CO1] | Acquire skills in basic engineering practice to identify, select and use various marking, measuring, and holding, striking and cutting tools &equipment's and machines | 2 | | | | | | | | 2 | | | | | | | |
| [CO2] | Understand job drawing and complete jobs as per specifications in allotted time | | | | | | 2 | | | 2 | | | | | | | |
| [CO3] | Inspect the job for the desired dimensions and shape | | 2 | | | | | | | | | | | | | | 2 |
| [CO4] | Operate, control different machines and equipment's adopting safety practices | | | 2 | | | | | | | | | 2 | | | | |

**1-Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

ARKA JAIN University
Jharkhand

Syllabus of

# B.Tech. in Civil Engineering

## Semester-III

**ARKAJAIN University, Jharkhand**
School of Engineering & IT
Department of Engineering
Faculty – Bachelor of Technology in Civil Engineering
**Scheme of Study (w.e.f Batch 2020-24)**

## SEMESTER –I

| Sr. No. | Name of the Subject | Group | L-T-P | Credit |
|---|---|---|---|---|
| 1 | Engineering Mathematics–I | A & B | 3-1-0 | 4 |
| 2 | Engineering Chemistry | A | 3-0-0 | 3 |
| | Programming for Problem Solving | B | 3-0-0 | 3 |
| 3 | Basic Electrical Engineering | A | 3-1-0 | 4 |
| | Engineering physics | B | 3-1-0 | 4 |
| 4 | Engineering Mechanics | A | 3-0-0 | 3 |
| | English for Communication | B | 3-0-0 | 3 |
| 5 | Constitution of India | B | 0-0-0 | 0 |
| | **Practical** | | | |
| 6 | Engineering Chemistry Lab | A | 0-0-1 | 1 |
| | Engineering Physics Lab | B | 0-0-1 | 1 |
| 7 | Basic Electrical Engineering Lab | A | 0-0-1 | 1 |
| | Programming for Problem Solving Lab | B | 0-0-2 | 2 |
| 8 | Engineering Mechanics Lab | A | 0-0-1 | 1 |
| 9 | Engineering Graphics & Design | A | 0-0-2 | 2 |
| | Workshop Practices | B | 0-0-2 | 2 |
| | TOTAL | A or B | 12-2-5 | 19 |

# SCHEME OF THE STUDY
# SEMESTER –II

| Sr. No. | Name of the Subject | Group | L-T-P | Credit |
|---|---|---|---|---|
| 1 | Engineering Mathematics–II | A & B | 3-1-0 | 4 |
| 2 | Engineering Chemistry | B | 3-0-0 | 3 |
| | Programming for Problem Solving | A | 3-0-0 | 3 |
| 3 | Basic Electrical Engineering | B | 3-1-0 | 4 |
| | Engineering physics | A | 3-1-0 | 4 |
| 4 | Engineering Mechanics | B | 3-0-0 | 3 |
| | English for Communication | A | 3-0-0 | 3 |
| 5 | Constitution of India | A | 0-0-0 | 0 |
| | **Practical** | | | |
| 6 | Engineering Chemistry Lab | B | 0-0-1 | 1 |
| | Engineering Physics Lab | A | 0-0-1 | 1 |
| 7 | Basic Electrical Engineering Lab | B | 0-0-1 | 1 |
| | Programming for Problem Solving Lab | A | 0-0-2 | 2 |
| 8 | Engineering Mechanics Lab | B | 0-0-1 | 1 |
| | Engineering Graphics& Design | B | 0-0-2 | 2 |
| 9 | Workshop Practices | A | 0-0-2 | 2 |
| | TOTAL | A or B | 12-2-5 | 19 |

# SEMESTER –I (Group-A)

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Engineering Chemistry | BSC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 2 | Engineering Mathematics–I | BSC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 3 | Basic Electrical Engineering | ESC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 4 | Engineering Mechanics | ESC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| | **Practical** | | | | | | | | |
| 5 | Engineering Chemistry Lab | BSC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 6 | Basic Electrical Engineering Lab | ESC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 7 | Engineering Mechanics Lab | ESC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 8 | Engineering Graphics& Design | ESC | 2 | 4 | 50 | 35 | 5 | 5 | 5 |
| | **TOTAL** | | **19** | **24** | **600** | **420** | **100** | **40** | **40** |

# SEMESTER I (Group-B)

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Engineering physics | BSC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 2 | Engineering Mathematics –I | BSC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 3 | Programming for Problem Solving | ESC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | English for Communication | HSMC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 5 | Constitution of India | MC | 0 | 2 | 50 | 35 | 10 | 2.5 | 2.5 |
| | **Practical** | | | | | | | | |
| 6 | Engineering physics Lab | BSC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 7 | Programming for Problem Solving Lab | ESC | 2 | 4 | 50 | 35 | 5 | 5 | 5 |
| 8 | Workshop Practices | ESC | 2 | 4 | 50 | 35 | 5 | 5 | 5 |
| | **TOTAL** | | **19** | **26** | **600** | **420** | **105** | **37.5** | **37.5** |

# SEMESTER II (Group-A)

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Engineering physics | BSC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 2 | Engineering Mathematics –II | BSC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 3 | Programming for Problem Solving | ESC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | English for Communication | HSMC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 5 | Constitution of India | MC | 0 | 2 | 50 | 35 | 10 | 2.5 | 2.5 |
| | **Practical** | | | | | | | | |
| 6 | Engineering physics Lab | BSC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 7 | Programming for Problem Solving Lab | ESC | 2 | 4 | 50 | 35 | 5 | 5 | 5 |
| 8 | Workshop Practices | ESC | 2 | 4 | 50 | 35 | 5 | 5 | 5 |
| | **TOTAL** | | **19** | **26** | **600** | **420** | **105** | **37.5** | **37.5** |

# SEMESTER –II (Group-B)

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Engineering Chemistry | BSC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 2 | Engineering Mathematics–II | BSC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 3 | Basic Electrical Engineering | ESC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 4 | Engineering Mechanics | ESC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| | **Practical** | | | | | | | | |
| 5 | Engineering Chemistry Lab | BSC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 6 | Basic Electrical Engineering Lab | ESC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 7 | Engineering Mechanics Lab | ESC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 8 | Engineering Graphics& Design | ESC | 2 | 4 | 50 | 35 | 5 | 5 | 5 |
| | **TOTAL** | | **19** | **24** | **600** | **420** | **100** | **40** | **40** |

# SEMESTER-III

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA * | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Engineering Mathematics -III | BSC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 2 | Biology for Engineers | BSC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 3 | Surveying &Geomatics | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | Mechanics of Solid | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 5 | Introduction to Civil Engineering | HSMC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 6 | Environmental Science | MC | 0 | 2 | 50 | 35 | 10 | 2.5 | 2.5 |
| | **Practical** | | | | | | | | |
| 7 | Surveying &Geomatics Lab | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 8 | Mechanics of Solid | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 9 | Computer Aided Civil Engineering Drawing | ESC | 2 | 4 | 50 | 35 | 5 | 5 | 5 |
| | **TOTAL** | | **20** | **26** | **700** | **490** | **125** | **42.5** | **42.5** |

# SEMESTER-IV

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Material Testing & Evaluation | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 2 | Engineering Geology | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 3 | Fluid Mechanics | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | Structural Analysis - I | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 5 | Geotechnical Engineering | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 6 | Civil Engineering-Societal & Global Impact | HSMC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| | **Practical** | | | | | | | | |
| 7 | Material Testing & Evaluation | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 8 | Engineering Geology Lab | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 9 | Geotechnical Engineering Lab | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 10 | Fluid Mechanics Lab | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| | **TOTAL** | | **22** | **26** | **800** | **560** | **140** | **50** | **50** |

# SEMESTER V

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Hydraulic Engineering | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 2 | Structural Analysis II | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 3 | Hydrology & Water Resource Engineering | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | Environmental Engineering-I | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 5 | Open Elective I Humanities I<br>Professional Practice, Law & Ethics<br>Organizational Behavior | HSMC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 6 | Disaster Preparedness & Planning | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 7 | Essence of Indian Knowledge Tradition | MC | 0 | 2 | 50 | 35 | 10 | 2.5 | 2.5 |
| | PRACTICAL | | | | | | | | |
| 8 | Hydraulic Engineering Lab | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 9 | Structural Analysis II Lab | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 10 | Summer Internship –I (3-4 week) | PROJ | 2 | 0 | 50 | 35 | 15 | 0 | 0 |
| | **TOTAL** | | **22** | **24** | **800** | **560** | **155** | **42.5** | **42.5** |

# SEMESTER VI

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory / Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Construction Engineering & Management | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 2 | Transportation Engineering-I | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 6 | Engineering Economics, Estimation & Costing | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 3 | Elective I<br>Rock Mechanics<br>Foundation Engineering | PEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | Elective II<br>Environmental Engineering II<br>Rural water supply & Onsite Sanitation System | PEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 6 | Elective III<br>Design of Steel Structure<br>Earthquake Engineering | PEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 7 | Design of Concrete Structures-I | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| | **Practical** | | | | | | | | |
| 8 | Transportation Engineering I Lab | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| | **TOTAL** | | **22** | **23** | **750** | **525** | **145** | **40** | **40** |

# SEMESTER VII

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Elective IV<br>Air and Noise Pollution and Control<br>Solid and hazardous Waste Management | PEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 2 | Elective V<br>Design of Concrete Structure - II<br>Prestressed Concrete | PEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 3 | Open Elective II<br>Metro System & Engineering<br>History of Science & Engineering | OEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | River Engineering | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| | **Practical** | | | | | | | | |
| 5 | Minor Project | PROJ | 3 | 6 | 100 | 70 | 30 | 0 | 0 |
| 6 | Summer Internship –II –(4-6 Week) | PROJ | 3 | 0 | 100 | 70 | 30 | 0 | 0 |
| | **TOTAL** | | **18** | **18** | **600** | **420** | **140** | **20** | **20** |

# SEMESTER VIII

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Elective VI<br>Bridge Engineering<br>Ground Water Engineering | PEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 2 | Elective VII<br>Railway Engineering<br>Traffic Engineering and Management | PEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 3 | Open Elective III<br>Soft Skills and Interpersonal Communication<br>Human Resource Development and Organizational Behavior | OEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | Open Elective IV<br>Civil Engineering Design-I<br>Geographic Information Systems and Science | OEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| | **Practical** | | | | | | | | |
| 5 | Major Project | PROJ | 8 | 16 | 200 | 140 | 60 | 0 | 0 |
| 6 | Extra- Curricular/ Co-Curricular Activity | PROJ | 0 | 0 | 100 | 70 | 30 | 0 | 0 |
| | **TOTAL** | | **20** | **28** | **700** | **490** | **170** | **20** | **20** |

## Distribution of Credit across 8 semesters:

| Sl. No | Type of Paper | No. of Paper | Total Credit |
|---|---|---|---|
| 1 | Humanities and Social Sciences including Management courses **(HSMC)** | 4 | 12 |
| 2 | Basic Science courses**(BSC)** | 8 | 24 |
| 3 | Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc**(ESC)** | 9 | 20 |
| 4 | Professional core courses (**PCC)** | 26 | 60 |
| 5 | Professional Elective courses relevant to chosen specialization/branch**(PEC)** | 7 | 21 |
| 6 | Open subjects – Electives from other technical and /or emerging subjects (**OEC)** | 3 | 9 |
| 7 | Project work, seminar and internship in industry or elsewhere**(PROJ)** | 5 | 16 |
| 8 | Mandatory Courses [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Knowledge Tradition]**(MC)** | 3 | 0 |
| | **Total** | 65 | 162 |

**CIA – Continuous Internal Assessment – Based on Projects / Assignment during the semester**

**Note:**
**AICTE Activity Points to be earned by students admitted to Degree program (For more details refer to Chapter 6, AICTE, Activity Point Program, Model Internship Guidelines):**
**Every regular student, who is admitted to the 4-year Degree program, is required to earn 100 activity points in addition to the total credits earned for the program. Students entering 4 years Degree Program through lateral entry are required to earn 75 activity points in addition to the total credits earned for the program. The activity points earned by the student shall be reflected on the students 8th Semester grade card.**
**The activities to earn the points can be spread over the duration of the course. However, minimum prescribed duration should be fulfilled.**
**Activity Points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression.**
**Incase student fail to earn the prescribed activity points;eight semester Grade Card shall be issued only after earning the required activity Points.**
**Students shall be eligible for the award of degree only after the release of the Eight Semester grade card.**

***There are two groups (A & B) in semester 1 & 2. The Group division will be decided by The Dean SoE& IT before commencement of classes***

**ARKAJAIN University, Jharkhand**
School of Engineering & IT
Department of Engineering
Faculty – Bachelor of Technology in Civil Engineering
**PROGRAM OUTCOMES &PROGRAM SPECIFIC OUTCOMES**

**PROGRAM OUTCOMES**

After completing this undergraduate program, a learner:

**[PO.1].Engineering knowledge:** An ability to apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to get the solution of the engineering problems.

**[PO.2].Problem analysis:** Ability to Identify, formulates, review research literature, and analyze complex engineering problems.

**[PO.3].Design/Development of Solutions:** Ability to design solutions for complex Engineering Problems by considering social, Economic and Environmental aspects.

**[PO.4].Conduct investigations of complex problems:** Use research-based knowledge to design, conduct analyses experiments to get valid conclusion.

**[PO.5]. Modern tool usage:** ability to create, select, and apply appropriate techniques, and to model complex engineering activities with an understanding of the limitations.

**[PO.6]. The engineer and society:** Ability to apply knowledge by considering social health, safety, legal and cultural issues.

**[PO.7]. Environment and sustainability:** Understanding of the impact of the adopted engineering solutions in social and environmental contexts.

**[PO.8]. Ethics:** Understanding of the ethical issues of the civil engineering and applying ethical principles in engineering practices.

**[PO.9]. Individual and teamwork:** Ability to work effectively as an individual or in team, as a member or as a leader.

**[PO.10]. Communication:** An ability to communicate clearly and effectively through different modes of communication.

**[PO.11]. Project management and finance:** Ability to handle project and to manage finance related issue.

**[PO.12]. Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning.

**PROGRAM SPECIFIC OUTCOMES**

**[PSO.1]. Professional skills** – The ability to analyze and design civil engineering structures as per the guidelines in Indian standards and other relevant codes like buildings, bridges, tunnels, railways, airports, water and sewage treatment plants etc

**[PSO.2]. Problem solving skills** – The ability to managed large infrastructural projects by making use of latest techniques of project management for optimum utilization of resources via man, material and money.

**[PSO.3]. Successful Career and Entrepreneurship** – Strong desire to acquire modern scientific knowledge by pursuing higher studies, which will lead them to identify problems in the civil engineering domains and thereby become entrepreneur to propose solution

**[PSO.4]. Communication:** Communicate effectively on complex engineering activities with the engineering community & with society at large, such as, being able to comprehend & write effective reports & design documentation, make effective presentations & give & receive clear instructions

# Subject: Mathematics III

Code:BTE23046

4 Credits | Semester III

Total Lecture: 60 Total Tutorial: 12

**A. Introduction:**

- To introduce the solution methodologies for second order Partial Differential Equations with applications in engineering
- To Equip students with the concepts of partial differential equations and how to solve linear partial differential equations with different methods.
- To provide an overview of probability and statistics to engineers.

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

**[CO1]** Understand the concept of partial differential equations, theory of probability and its applications on engineering problems, theory of data distribution, standard deviation and different charts.

**[CO2]** Apply concept of differential equation, concept of statics in data sampling for solving general engineering problems.

**[CO3]** Analyze the process of partial differentiation, probability, statically formulation and data sampling.

**[CO4]** Evaluate the result of the partial differentiation and its applications, probability, statics and sampling of data.

**C. Assessment Plan:**

| Criteria | Description | Maximum Marks |
|---|---|---|
| **Continuous Internal Assessment (CIA)** | Internal Examination | 20 |
| | Attendance | 5 |
| | Assignment | 5 |
| **End Semester Examination(ESE)** | End Semester Examination | 70 |
| **Total** | | 100 |
| **Attendance** | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

**PARTIAL DIFFERENTIAL EQUATION:** Definition of Partial Differential Equations, First order partial differential equations, solutions of first order linear PDEs, Solution to homogenous and non-homogenous linear partial differential equations of second order by complimentary function and particular integral method.

**APPLICATION OF DIFFERENTIAL EQUATION:** Second-order linear equations and their classification, Initial and boundary conditions, D' Alembert's solution of the wave equation; Duhamel's principle for one dimensional wave equation,Heat diffusion and vibration problems, Separation of variables method to simple problems in Cartesian coordinates. The Laplacian in plane, cylindrical and spherical polar coordinates,solutions with Bessel functions and Legendre functions. One dimensional diffusion equation and its solution by separation of variables.

**PROBABILITY THEORY:** Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev'sInequality,Continuous random variables and their properties, distribution functions and densities, normal, exponential and gamma densities.Bivariate distributions and their properties, distribution of sums and quotients, conditional densities, Bayes' rule

**STATISTICS:** Basic Statistics, Measures of Central tendency: Moments, skewness and Kurtosis – Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions,Correlation and regression – Rank correlation. Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves

**SAMPLING OF DATA:** Test of significance: Large sample test for single proportion, difference of proportions, Tests for single mean.Difference of means, and difference of standard deviations. Test for ratio of variances - Chi- square test for goodness of fit and independence of attributes

**E. TEXT BOOKS**

T1.Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
T2.N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
T3..B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010

**F.REFERENCE BOOKS**

R1.P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint).
R2.S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| [CO1] | Understand the concept of partial differential equations, theory of probability and its applications on engineering problems, theory of data distribution, standard deviation and different charts. | 2 | 2 | 1 | | | | | | | | | | | | | 1 |
| [CO2] | Apply concept of differential equation, concept of statics in data sampling for solving general engineering problems. | 3 | 1 | 2 | | 1 | | | | | | | | | 2 | | 1 |
| [CO3] | Analyze the process of partial differentiation, probability, statically formulation and data sampling. | 3 | 1 | | | | | | | | | | | | 1 | | |
| [CO4] | Evaluate the result of the partial differentiation and its applications, probability, statics and sampling of data. | 2 | 2 | | | | | | | | | | | | | | |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Biology for Engineers

Code:BTE23018

3 Credits | Semester III

Total Lecture: 45 Total Tutorial: 9

**A. Introduction:**

- To understand Biological concepts from an engineering perspective
- To understand the inter-connection between biology and future technologies
- To motivate technology application for biological and life science challenges

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

**[CO1]** [Understand the biological concepts from an engineering perspective
**[CO2]** Understand the concepts of biological sensing and its challenges
**[CO3]** Understand development of artificial systems mimicking human action
**[CO4]** Integrate biological principles for developing next generation technologies

**C. Assessment Plan:**

| Criteria | Description | Maximum Marks |
|---|---|---|
| **Continuous Internal Assessment (CIA)** | Internal Examination | 20 |
| | Attendance | 5 |
| | Assignment | 5 |
| **End Semester Examination(ESE)** | End Semester Examination | 70 |
| **Total** | | 100 |
| **Attendance** | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

**INTRODUCTION** : Discuss how biological observations of 18$^{th}$Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. These examples will highlight the fundamental importance of observations in any scientific inquiry. Engineering designs inspired by examples in biology-- Micro- to Macro- scales. Comparing natural vs. human-made machines. Biosensor. Engineering aspects of some Nobel Prizes in Physiology and Medicine & Chemistry recent advances in Biology

**TOOLS AND TECHNIQUES** : Biosafety laboratory practices, Buffers in biology, buffering capacity and pKa, observing cell surface and intracellular contents using light

and/or fluorescence microscopy, Measuring mechanical strength of cells - osmolality and elasticity of biological membranes

**CLASSIFICATION** : A common thread weaves this hierarchy Classification. Discuss classification based on (a) cellularity- Unicellular or multicellular (b) ultrastructure- prokaryotes or eucaryotes. (c) energy and Carbon utilization -Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion – aminotelic, uricoteliec, ureotelic (e) Habitata- acquatic or terrestrial (f) Molecular taxonomy- three major kingdoms of life. A given organism can come under different category based on classification. Model organisms for the study of biology come from different groups. E. coli, S. cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M. musculus

**BIO MOLECULES** : Discuss about sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA. Two carbon units and lipids.Enzymology: How to monitor enzyme catalyzed reactions. How does an enzyme catalyze reactions. Enzyme classification. Mechanism of enzyme action. Discuss at least two examples. Enzyme kinetics and kinetic parameters. Why should we know these parameters to understand biology? RNA catalysis

**GENETICS AND INFORMATION TRANSFER** : Molecular Genetics covering, Structures of DNA and RNA; Concept of Gene, Gene regulation, e.g., Operon concept; Mendel's laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis. Teach meiosis and Mitosis as a part of genetics. Meiosis and Mitosis be taught as a part of genetics. Emphasis to be give not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring. Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes. Discuss about the single gene disorders in humans. Discuss the concept of complementation using human genetics. Concept of genetic code. Universality and degeneracy of genetic code. Define gene in terms of complementation and recombination.

**E. TEXT BOOKS**

T1. Molecular Genetics (Second edition),Stent, G.S.; and Calendar, R.W.H.Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher

T2. Microbiology, Prescott, L.MJ.P.HarleyandC.A.Klein1995.

**F. REFERENCE BOOKS**

R1. Biology:Aglobalapproach:Campbell,N.A.;Reece,J.B.;Urry,Lisa;Cain,M,L.;Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B.PearsonEducationLtd

R2. Outlines of Biochemistry, Conn, E.E;Stumpf, P.K;Bruening,G;Doi,R.H.,JohnWileyand Sons

R3. Principles of Biochemistry (VEdition),ByNelson, D.L.;andCox,M.M.W.H.Freemanand Company

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O 1 | PS O 2 | PS O 3 | PS O 4 |
| **[CO1]** | [Understand the biological concepts from an engineering perspective | 3 | 1 | 1 | 1 | - | - | - | - | - | 1 | 1 | 1 | 3 | 1 | 1 | 1 |
| **[CO2]** | Understand the concepts of biological sensing and its challenges | 2 | 2 | 1 | 1 | - | - | - | - | - | 2 | 1 | 1 | 2 | 2 | 1 | 1 |
| **[CO3]** | Understand development of artificial systems mimicking human action | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **[CO4]** | Integrate biological principles for developing next generation technologies | 2 | 2 | 1 | 1 | - | - | - | - | - | 2 | 1 | 1 | 2 | 2 | 1 | 1 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Surveying and Geomatics

Code:BTE23272

3 Credits | Semester III

Total Lecture: 45 Total Tutorial: 9

**A. Introduction:**

- Describe the function of surveying in civil engineering construction,
- Work with survey observations, and perform calculations,
- Customary units of measure. Identify the sources of measurement errors and mistakes; understand the difference between accuracy and precision as it relates to distance, differential leveling, and angular measurements,
- Be familiar with the principals of recording accurate, orderly, complete, and logical field notes from surveying operations, whether recorded manually or with automatic data collection methods,
- Identify and calculate the errors in measurements and to develop corrected values for differential level circuits, horizontal distances and angles for open or closed-loop traverses,
- Operate an automatic level to perform differential and profile leveling; properly record notes; mathematically reduce and check levelling measurements,

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

**[CO1]** Understand the surveying techniques that will remain correct for long period.
**[CO2]** Understand the different methods using instrument such as Chain, Compass, Leveling, minor instruments like plani-meter, etc.
**[CO3]** Understand the Area & Volume calculation.
**[CO4]** Evaluate about trigonometrically leveling.
**[CO5]** Analyze about simple & complex problems of different instrument methods of Survey.

**C. Assessment Plan:**

| Criteria | Description | Maximum Marks |
|---|---|---|
| **Continuous Internal Assessment (CIA)** | Internal Examination | 20 |
| | Attendance | 5 |
| | Assignment | 5 |
| **End Semester Examination(ESE)** | End Semester Examination | 70 |
| **Total** | | 100 |
| **Attendance** | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS:**

**INTRODUCTION TO SURVEYING** : Principles, Linear, angular and graphical methods, Survey stations, Survey lines- ranging, bearing of survey lines, levelling: Plane table surveying, Principles of levelling- booking and reducing levels; differential, reciprocal leveling, profile levelling and cross sectioning. Digital and Auto Level, Errors in levelling; contouring Characteristics, methods, uses; areas and volumes.

**TRIANGULATION, TRILATERATION, AND CURVE** : Theodolite survey: Instruments, Measurement of horizontal and vertical angle; Horizontal and vertical control - methods -triangulation network- Signals. Baseline - choices - instruments and accessories - extension of base lines corrections - Satellite station - reduction to centre - Intervisibility of height and distances - Trigonometric leveling - Axis single corrections, Elements of simple and compound curves–Method of setting out– Elements of Reverse curve-Transition curve–length of curve–Elements of transition curve-Vertical curves.

**MODERN FIELD SURVEY SYSTEMS** : Principle of Electronic Distance Measurement, Modulation, Types of EDM instruments, Distomat, Total Station–Parts of a Total Station – Accessories–Advantages and Applications, Field Procedure for total station survey, Errorsin Total Station Survey; Global Positioning Systems-Segments, GPS measurements, errors and biases, Surveying with GPS, Co-ordinate transformation, accuracy considerations

**PHOTOGRAMMETRY SURVEYING** : Introduction, Basic concepts, perspective geometry of aerial photograph, relief and tilt displacements, terrestrial photogrammetry, flight planning; Stereoscopy, ground control extension for photographic mapping- aerial triangulation, radial triangulation, methods; photographic mapping- mapping using paper prints, mapping using stereo plotting instruments, mosaics, map substitutes.

**REMOTE SENSING** : Introduction –Electromagnetic Spectrum, interaction of electromagnetic radiation with the atmosphere and earth surface, remote sensing data acquisition: platforms and sensors; visual image interpretation; digital image processing.

**E. TEXT BOOKS**

T1. AnjiReddy, M., Remote sensing and Geographical information system, B.S. Publications, 2001.

T2. Arora, K.R., Surveying,Vol-I, II and III, Standard Book House, 2015

**F. REFERENCE BOOKS**

R1. Madhu, N, Sathikumar, R and SatheeshGobi, Advanced Surveying: TotalStation, GIS and Remote Sensing, Pearson India, 2006.

R2. Manoj, K. Arora and Badjatia, GeomaticsEngineering,NemChand&Bros,

20113Bhavikatti,S.S.,Surveying and Levelling,Vol.IandII,I.K.International,2010

R3. Chandra, A.M., Higher Surveying, Third Edition, New Age International (P) Limited, 2002.

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O 1 | PS O 2 | PS O 3 | PS O 4 |
| [CO1] | Understand the surveying techniques that will remain correct for long period. | 3 | 3 | 3 | 2 | - | - | - | - | - | 3 | 3 | 3 | 3 | 1 | 1 | 2 |
| [CO2] | Understand the different methods using instrument such as Chain, Compass, Leveling, minor instruments like plani-meter, etc. | 3 | 3 | 3 | 2 | - | - | - | - | - | 2 | 3 | 2 | 2 | 2 | 1 | 2 |
| [CO3] | Understand the Area & Volume calculation. | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| [CO4] | Evaluate about trigonometrically leveling. | 3 | 3 | 3 | 3 | - | - | - | - | - | 2 | 2 | 2 | 2 | 2 | 1 | 2 |
| [CO5] | Analyze about simple & complex problems of different instrument methods of Survey. | 3 | 3 | 3 | 3 | - | - | - | - | - | 2 | 1 | 2 | 2 | 1 | 1 | 2 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Mechanics of Solid

Code:BTE23021

3 Credits | Semester III

Total Lecture: 45 Total Tutorial: 9

**A. INTRODUCTION:**

- To solve advanced solid mechanics problems using classical methods
- To apply commercial software on select, applied solid mechanics problems

**B. COURSE OUTCOMES:** By the end of this course, students will be able to:

**[CO1]** Interpret the concepts of stress at a point as well as the stress- strain relationships for homogenous, isotropic materials.

**[CO2]** Analyze the stresses and strains associated with thin-wall spherical and cylindrical pressure vessels.

**[CO3]** Demonstrate the capability to conduct experiments, as well as to analyze and interpret data

**[CO4]** Ability to classify a component to meet desired needs within realistic constraints of safety.

**[CO5]** **A**pply various failure criteria for general stress states at points.

**C. ASSESSMENT PLAN:**

| **Criteria** | **Description** | **Maximum Marks** |
|---|---|---|
| **Continuous Internal Assessment (CIA)** | Internal Examination | 20 |
| | Attendance | 5 |
| | Assignment | 5 |
| **End Semester Examination(ESE)** | End Semester Examination | 70 |
| **Total** | | 100 |
| **Attendance** | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS:**

**INTRODUCTION:** Concept of stress and strain, St. Venant‘s principle, stress and strain diagram, Elasticity and plasticity – Types of stresses and strains, Hooke‘s law-stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson‘s ratio and volumetric strain – Elastic moduli and the relationship between them – Bars of varying section – composite bars – Temperature stresses. Strain Energy – Resilience-Gradual, sudden, impact and shock loadings – simple applications.

**COMPOUND STRESSES AND STRAINS** : Two dimensional system, stress at appoint on a plane, principal stresses and principal planes, Mohr circle of stress, ellipse of stress and their

applications. Two dimensional stress-strain system, principal strains and principal axis of strain, circle of strain and ellipse of strain. Relationship between elastic constants.

**BENDING MOMENT AND SHEAR FORCE DIAGRAMS AND SLOPE DEFELECTION** : Bending moment (BM) and shear force (SF) diagrams.BM and SF diagrams for cantilevers simply supported and fixed beams with or without overhangs. Calculation of maximum BM and SF and the point of contra flexure under concentrated loads, uniformly distributed loads over the whole span or part of span, combination of concentrated loads (two or three) and uniformly distributed loads, uniformly varying loads, application of moments. Relationship between moment, slope and deflection, Moment area method, Macaulay's method. Use of these methods to calculate slope and deflection for determinant beams.

**FLEXURAL STRESSES-THEORY OF SIMPLE BENDING** : Assumptions– Derivation of bending equation: M/I=f/y=E/R-Neutral axis–Determination of bending stresses– Section modulus of rectangular and circular sections (Solid and Hollow),I,T, Angle and Channel sections – Design of simple beam sections. Shear Stresses- Derivation of formula – Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T angle sections

**TORSION AND THIN CYLINDER AND SPHERE** : Derivation of torsion equation and its assumptions. Applications of the equation of the hollow and solid circular shafts, torsional rigidity, Combined torsion and bending of circular shafts, principal stress and maximum shear stresses under combined loading of bending and torsion. Analysis of close-coiled-helical springs.Derivation of formulae and calculations of hoop stress, longitudinal stress in a cylinder, and sphere subjected to internal pressures.

**E. TEXT BOOK**

T1. Laboratory Manual of Testing Materials-William Kendrick Hall

T2. MechanicsofMaterials-FerdinandP.Beer, E.RusselJhonstonJr.,JohnT.DEwolf – TMH 2002.

**F. REFERENCES**

R1. Timoshenko, S. and Young, D.H.,―Elements of Strength of Materials‖, DVNC, NewYork, USA.

R2. Kazmi, S.M.A.,―Solid Mechanics‖ TMH,Delhi,India.

R3. Hibbeler, R. C. Mechanics of Materials.6th ed.East Rutherford, NJ: Pearson Prentice Hall, 2004

R4. Crandall, S.H., N.C.Dahl, and T.J. Lardner. An Introduction to the Mechanics of Solids. 2nded.New York, NY: McGrawHill, 1979

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| [CO1] | Interpret the concepts of stress at a point as well as the stress- strain relationships for homogenous, isotropic materials. | 3 | 3 | 3 | 3 | - | - | - | - | - | 1 | - | 2 | 3 | 3 | - | - |
| [CO2] | Analyze the stresses and strains associated with thin-wall spherical and cylindrical pressure vessels. | 3 | 3 | 3 | 2 | 1 | - | - | - | - | 1 | - | 3 | 3 | 2 | 1 | - |
| [CO3] | Demonstrate the capability to conduct experiments, as well as to analyze and interpret data | 2 | 3 | 3 | 3 | 1 | 1 | - | - | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 2 |
| [CO4] | Ability to classify a component to meet desired needs within realistic constraints of safety. | 3 | 2 | 3 | 3 | 1 | - | 1 | - | - | - | - | 1 | 3 | 3 | 1 | - |
| [CO5] | **A**pply various failure criteria for general stress states at points. | 2 | 2 | 3 | 2 | 1 | 1 | 1 | - | 1 | 1 | 1 | 2 | 3 | 2 | 1 | 2 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Introduction to Civil Engineering

Code: BTE23273

4 Credits | Semester III

Total Lecture: 60 Total Tutorial: 12

## A. INTRODUCTION:

- To give an understanding to the students of the vast breadth and numerous areas of engagement available in the overall field of civil engineering
- To motivate the student to pursue a career in one of the many areas of civil engineering with deep interest and keenness.
- To expose the students to the various avenues available for doing creative and innovative work in this field by showcasing the many monuments and inspiring projects of public utility.

**B. COURSE OUTCOMES:** By the end of this course, students will be:

**[CO1]** Understand the fundamental aspects of civil engineering

**[CO2]** Implement plan for the building

**[CO3]** Understand about surveying for making horizontal and vertical measurements.

**[CO4]** Illustrate the uses of various building materials and construction of different components of a building.

## C. ASSESSMENT PLAN:

| Criteria | Description | Maximum Marks |
|---|---|---|
| **Continuous Internal Assessment (CIA)** | Internal Examination | 20 |
| | Attendance | 5 |
| | Assignment | 5 |
| **End Semester Examination(ESE)** | End Semester Examination | 70 |
| **Total** | | 100 |
| **Attendance** | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

## D. SYLLABUS:

**BASIC UNDERSTANDING AND HISTORY OF CIVIL ENGINEERING:** What is Civil Engineering/ Infrastructure? Basics of Engineering and Civil Engineering; Broad disciplines of Civil Engineering; Importance of Civil Engineering, Possible scopes for a career Early constructions and developments over time; Ancient monuments & Modern marvels;

Development of various materials of construction and methods of construction; Works of Eminent civil engineers

**OVERVIEW OF NATIONAL PLANNING FOR CONSTRUCTION AND INFRASTRUCTURE DEVELOPMENT:** Position of construction industry vis-à-vis other industries, five year plan outlays for construction; current budgets for infrastructure works Aesthetics in Civil Engineering, Examples of great architecture, fundamentals of architectural design & town planning; Building Systems (HVAC, Acoustics, Lighting, etc.); LEED ratings; Development of Smart cities

**FUNDAMENTALS OF BUILDING MATERIALS:** Stones, bricks, mortars, Plain, Reinforced &Prestressed Concrete, Construction Chemicals; Structural Steel, High Tensile Steel, Carbon Composites; Plastics in Construction; 3Dprinting;Recyclingof Construction. Basics of Construction Management & Contracts Management: Temporary Structures in Construction; Construction Methods for various types of Structures; Major Construction equipment; Automation & Robotics in Construction; Modern Project management Systems; Advent of Lean Construction; Importance of Contracts Management

**TRAFFIC &TRANSPORTATION ENGINEERING:** Investments in transport infrastructure development in India for different modes of transport; Developments and challenges in integrated transport development in India: road, rail, port and harbour and airport sector; PPP in transport sector; Intelligent Transport Systems; Urban Public and Freight Transportation; Road Safety under heterogeneous traffic; Sustainable and resilient pavement materials, design, construction and management; Case studies and example, Repairs & Rehabilitation of Structures: Basics of corrosion phenomena and other structural distress mechanisms; some simple systems of rehabilitation of structures; Non Destructive testing systems; Use of carbon fibre wrapping and carbon composites in repairs.

**MISLLENIOUS:** Environmental Engineering & Sustainability: Water treatment systems; Effluent treatment systems; Solid waste management; Sustainability in Construction. Geotechnical Engineering: Basics of soil mechanics, rock mechanics and geology; various types of foundations; basics of rock mechanics & tunneling. Hydraulics, Hydrology & Water Resources Engineering: Fundamentals of fluid flow, basics of water supply systems; Underground Structures; Underground Structures Multipurpose reservoir projects Ocean Engineering: Basics of Wave and Current Systems; Sediment transport systems; Ports &Harbours and other marine structures, Structural Engineering: Types of buildings; tall structures; various types of bridges; Water retaining structures; Other structural systems; Experimental Stress Analysis; Wind tunnel studies Surveying&Geomatics:Traditionalsurveyingtechniques,TotalStations,Developmentof Digital Terrain Models; GPS, LIDAR, Computational Methods, IT, IoT in Civil Engineering: Typical software used in Civil Engineering- Finite Element Method, Computational Fluid

Dynamics; Computational Geotechnical Methods; highway design (MX), Building Information Modelling; Highlighting typical available software systems (SAP, STAAD, ABAQUS, MATLAB, ETAB, NASTRAN, NISA, MIKE 21, MODFLOW, REVIT, TEKLA, AUTOCAD,…GEOSTUDIO, EDUSHAKE, MSP, PRIMAVERA, ArcGIS, Vis SIM, …)

**E. TEXT BOOK**

T1. Introduction to Environmental Engineering and Science by Gilbert Masters, Prentice Hall,

T2. Introduction to Environmental Engineering by P. AarneVesilind, Susan M. Morgan,

T3.Tho.mpson /Brooks/Cole; Second Edition 2008

T4. Basic & Applied Soil Mechanics -by Ranjan&Rao, New AgeInternational Publishers.

**F. REFERENCES**

R1. Varghese, P.C., ―Building Construction", Prentice Hall India, 2007.

R2. National Building Code, Bureau of Indian Standards, New Delhi

R3. Khanna, S.K., Justo, C.E.G and Veeraragavan, A, ' Highway Engineering' Revised 10th Edition, Nem Chand & Bros, 2017

R4. Kadiyalai, L.R., ' Traffic Engineering and Transport Planning', Khanna Publishers.

R5. ParthaChakraborty, ' Principles Of Transportation Engineering, PHI Learning

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| [CO1] | Understand the fundamental aspects of civil engineering | 3 | 1 | 1 | 1 | 3 | 1 | - | - | - | - | 1 | 2 | 1 | 3 | 1 | 1 |
| [CO2] | Implement plan for the building | 2 | 2 | 3 | 1 | 3 | 2 | - | - | - | - | 1 | 1 | 1 | 2 | 2 | 1 |
| [CO3] | Understand about surveying for making horizontal and vertical measurements. | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| [CO4] | Illustrate the uses of various building materials and construction of different components of a building. | 2 | 2 | 2 | 1 | 2 | 1 | - | - | - | - | 1 | 2 | 3 | 2 | 2 | 1 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Environmental Science

Code: BTE24085

0 Credits | Semester III

Total Lecture: 30 Total Tutorial: 6

**A. INTRODUCTION:**

- Solve various engineering problems applying ecosystem to produce eco – friendly products.
- Use relevant air and noise control method to solve domestic and industrial problems.
- Use relevant water and soil control method to solve domestic and industrial problems.
- To recognize relevant energy sources required for domestic and industrial applications.
- Solve local solid and e-waste problems.

B. **COURSE OUTCOMES:** By the end of this course, students will be:

**[CO1]** Understand the ecosystem and terminology and solve various engineering problems applying

**[CO2]** Understand the ecosystem knowledge to produce eco – friendly products

**[CO3]** Understand the suitable air, extent of noise pollution, and control measures and acts.

**[CO4]** Understand the water and soil pollution, and control measures and act.

**[CO5]** Understand different renewable energy resources and efficient process of harvesting.

**C. ASSESSMENT PLAN:**

| **Criteria** | **Description** | **Maximum Marks** |
|---|---|---|
| **Continuous Internal Assessment (CIA)** | Internal Examination | 20 |
| | Attendance | 5 |
| | Assignment | 5 |
| **End Semester Examination(ESE)** | End Semester Examination | 70 |
| **Total** | | 100 |
| **Attendance** | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS:**

**INTRODUCTION TO ENVIRONMENTAL SCIENCE:** Definition, Principles and scope of Environmental Science,Earth, Man and Environment. Ecosystems, Pathways in Ecosystems.Physico-chemical and Biological factors in the Environment.Geographical classification and zones'.

**AIR AND NOISE POLLUTION:** Definition of pollution and pollutant, Natural and manmade sources of air pollution (Refrigerants, I.C., Boiler), Air Pollutants: Types, Particulate Pollutants: Effects and control (Bag filter, Cyclone separator, Electrostatic Precipitator) Gaseous Pollution Control: Absorber, Catalytic Converter,Effects of air pollution due to Refrigerants, I.C., Boiler Noise pollution: sources of pollution, measurement of pollution level, Effects of Noise pollution, Noise pollution (Regulation and Control) Rules, 2000

**WATER AND SOIL POLLUTION:** Sources of water pollution, Types of water pollutants, Characteristics of water pollutants Turbidity, pH, total suspended solids, total solids BOD and COD: Definition, calculation**,**Waste Water Treatment: Primary methods: sedimentation, froth floatation, Secondary methods: Activated sludge treatment, Trickling filter, Bioreactor, Tertiary Method: Membrane separation technology, RO (reverse osmosis).Causes, Effects and Preventive measures of Soil Pollution: Causes-Excessive use of Fertilizers, Pesticides and Insecticides, Irrigation, E-Waste.

**RENEWABLE SOURCES OF ENERGY:** Solar Energy: Basics of Solar energy. Flat plate collector (Liquid & Air). Theory of flat plate collector. Importance of coating. Advanced collector. Solar pond. Solar water heater, solar dryer. Solar stills.Biomass: Overview of biomass as energy source. Thermal characteristics of biomass as fuel. Anaerobic digestion. Biogas production mechanism. Utilization and storage of biogas,Wind energy: status and future prospects of wind energy. Wind energy in India. Environmental benefits and problem of wind energy,New Energy Sources: Need of new sources. Different types new energy sources. Applications of (Hydrogen energy, Ocean energy resources, Tidal energy conversion.) Concept, origin andpower plants of geothermal energy.

**SOLID WASTE MANAGEMENT, ISO 14000 & ENVIRONMENTAL MANAGEMENT:** Solid waste generation- Sources and characteristics of: Municipal solid waste, E- waste, biomedical waste. Metallic wastes and Non-Metallic wastes (lubricants, plastics, rubber) from industries,Collection and disposal: MSW (3R, principles, energy recovery, sanitary landfill), Hazardous waste Air quality act 2004, air pollution control act 1981, water pollution, and control act1996.Structure and role of Central and state pollution control board. Concept of Carbon Credit, Carbon Footprint. Environmental management in fabrication industry. ISO14000: Implementation in industries, Benefits.

**E. TEXT BOOK**

T1. S.C. Sharma & M.P. Poonia, Environmental Studies,Khanna Publishing House,NewDelhi
T2.C.N. R. Rao, Understanding Chemistry, Universities Press (India) Pvt. Ltd., 2011.
T3. Arceivala, Soli Asolekar, Shyam, Waste Water Treatment for Pollution Control and
T4. Reuse, Mc-Graw Hill Education India Pvt. Ltd., New York, 2007, ISBN:978-07-062099.

**F. REFERENCES**

R1. O.P. Gupta, Elements of Environmental Pollution Control, Khanna Publishing House, New Delhi

R2. Rao, C. S., Environmental Pollution Control and Engineering, New Age International Publication, 2007, ISBN: 81-224-1835-X.
R3. Rao, M. N.Rao, H.V.N, Air Pollution, Tata Mc-Graw Hill Publication, New delhi, 1988, ISBN: 0-07-451871-8.

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| [CO1] | Understand the ecosystem and terminology and solve various engineering problems applying | 3 | 3 | 3 | 2 | 3 | 1 | - | - | - | - | 3 | 3 | 3 | 1 | 1 | 1 |
| [CO2] | Understand the ecosystem knowledge to produce eco – friendly products | 3 | 3 | 3 | 2 | 2 | 2 | | - | - | - | 3 | 2 | 2 | 2 | 1 | 1 |
| [CO3] | Understand the suitable air, extent of noise pollution, and control measures and acts. | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| [CO4] | Understand the water and soil pollution, and control measures and act. | 3 | 3 | 3 | 3 | 2 | 2 | - | - | - | - | 2 | 2 | 2 | 2 | 1 | 1 |
| [CO5] | Understand different renewable energy resources and efficient process of harvesting. | 3 | 3 | 3 | 3 | 2 | 1 | - | - | - | - | 1 | 2 | 2 | 1 | 1 | 1 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Surveying and Geomatics Lab

Code:BTE23274

1 Credits | Semester III

Total Lecture: 30

**A. Introduction:**

- To determine the relative position of any objects or points of the earth.
- To determine the distance and angle between different objects.
- To prepare a map or plan to represent an area on a horizontal plan.
- To develop methods through the knowledge of modern science and the technology and use them in the field.
- To solve measurement problems in an optimal way.

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

**[CO1]** Prepare a topographical map, which shows the hills, valleys, rivers, villages, towns, forests, etc. of a country.

**[CO2]** Prepare a cadastral map showing the boundaries of fields, houses and other properties

**[CO3]** Prepare an engineering map, which shows the details of engineering works such as roads, railways, reservoirs, irrigation canals, etc.

**[CO4]** Prepare a military map showing the road and railway communications with different parts of a country. Such a map also shows the different strategic points important for the defense of a country.

**[CO5]** Prepare a contour map to determine the capacity of a reservoir and to find the best possible route for roads, railways, etc.

**C. Assessment Plan:**

| **Criteria** | **Description** | **Maximum Marks** |
|---|---|---|
| Continuous Internal Assessment (CIA) | Internal Examination | 5 |
| | Attendance | 5 |
| | Assignment | 5 |
| End Semester Examination(ESE) | End Semester Examination | 35 |
| Total | | 50 |
| Attendance | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

| S.No. | Name of Experiment |
|---|---|
| 1 | Determination of Pace |
| 2 | Measurement of distances with chain & Tape on ground with direct & indirect ranging. |
| 3 | Measurement of Area by Chain(Closed Traverse) |
| 4 | Chaining across Obstacles |
| 5 | Chain Surveying (Mapping by Tape) |
| 6 | Differential evelingpracticeereductionoflevelby H.I. method and Rise & Fall method |
| 7 | Closed Loop Leveling |
| 8 | Profile Leveling (Longitudinal Sectioning & Cross Sectioning) |
| 9 | Contouring- Grid Method |
| 10 | Measuring F.B and B.B (5-6 sided) and identifying stations affected by local attractions and relative corrections. |
| 11 | Use of auto level and taking observation. |
| 12 | Measurement of Area of irregular figure by polar planmeter. |
| 13 | Measuring are enclosed by closed contours on contour appeared earlier, by simple digital plan meter |

**E. TEXT BOOKS**

T1. AnjiReddy, M., Remote sensing and Geographical information system, B.S. Publications, 2001.

T2. Arora, K.R., Surveying,Vol-I, II and III, Standard Book House, 2015

**F. REFERENCE BOOKS**

R1. Madhu, N, Sathikumar, R and SatheeshGobi, Advanced Surveying: TotalStation, GIS and Remote Sensing, Pearson India, 2006.

R2. Manoj, K. Arora and Badjatia, GeomaticsEngineering,NemChand&Bros, 20113Bhavikatti,S.S.,Surveying and Levelling,Vol.IandII,I.K.International,2010

R3. Chandra, A.M., Higher Surveying, Third Edition, New Age International (P) Limited, 2002.

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O 1 | PS O 2 | PS O 3 | PS O 4 |
| [CO1] | Prepare a topographical map, which shows the hills, valleys, rivers, villages, towns, forests, etc. of a country. | - | 3 | 3 | - | - | - | - | - | - | 2 | - | 1 | 3 | 1 | 1 | 1 |
| [CO2] | Prepare a cadastral map showing the boundaries of fields, houses and other properties | - | 2 | 2 | - | - | - | - | - | - | 2 | - | 1 | 2 | 1 | 3 | 1 |
| [CO3] | Prepare an engineering map, which shows the details of engineering works such as roads, railways, reservoirs, irrigation canals, etc. | - | 2 | 2 | 3 | 1 | - | 1 | - | - | 2 | - | 1 | 2 | 1 | 2 | 2 |
| [CO4] | Prepare a military map showing the road and railway communications with different parts of a country. Such a map also shows the different strategic points important for the defense of a country. | 2 | 3 | 2 | - | - | - | - | - | - | 2 | - | 1 | 2 | 1 | 1 | 3 |
| [CO5] | Prepare a contour map to determine the capacity of a reservoir and to find the best possible route for roads, railways, etc. | - | 2 | 2 | - | - | - | - | - | - | 2 | - | 1 | 2 | 1 | 1 | 2 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Mechanics of Solid Lab

Code:BTE23025

1 Credits | Semester III

Total Lecture: 30 Total Tutorial: 6

**A. Introduction:**

- In this laboratory, students will have the opportunity to apply loads to various materials
- Under different equilibrium conditions. The student will perform tests on materials in tension,
- Compression, torsion, bending, and impact. These conditions and/or constraints are designed to
- Reinforce classroom theory by having the student perform required tests, analyze subsequent data, and present the results in a professionally prepared report.

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

**[CO1]** Measure tensile and compressive strength of a specimen for applying in a practical design based project work

**[CO2]** Determine hardness, impact strength, fatigue strength to analyze the application of a specific material for a given design requirements for different loading conditions of structures.

**[CO3]** Observe bending in beams and calculate the bending stresses which further builds the foundation of using modern analysis software.

**[CO4]** Judge the capacity of a material to withstand torsional stresses for a safe and sustainable design of machine elements.

**C. Assessment Plan:**

| **Criteria** | **Description** | **Maximum Marks** |
|---|---|---|
| Continuous Internal Assessment (CIA) | Internal Examination | 5 |
| | Attendance | 5 |
| | Assignment | 5 |
| End Semester Examination(ESE) | End Semester Examination | 35 |
| Total | | 50 |
| Attendance | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

| S.No. | Name of Experiment |
|---|---|
| 1 | To determine the behavior of the given material under tensile loading and to determine the following. |
| 2 | To study the behavior of the given material under compressive load and to determine the following. |
| 3 | To determine the impact strength (specific impact factor) through charpy test. |
| 4 | To determine the Rockwell hardness number of the given specimen using ‘ Rockwell hardness tester’. |
| 5 | To determine the impact strength (specific impact factor) through izod test. |
| 6 | To determine the brinell hardness number of the given specimen using ‘ brinell hardness tester’. |
| 7 | To conduct torsion test on mild steel or cast iron specimens to find out modulus of rigidity. |
| 8 | To determine the deflection of a beam. |
| 9 | Water Absorption & Compression test (Dry &Wet) on bricks |
| 10 | Flexural test on timber. |

**E. TEXT BOOK**

T1. Laboratory Manual of Testing Materials-William Kendrick Hall
T2. MechanicsofMaterials-FerdinandP.Beer, E.RusselJhonstonJr.,JohnT.DEwolf – TMH 2002.

**F. REFERENCES**

R1. Timoshenko, S. and Young, D.H.,―Elements of Strength of Materials‖, DVNC, NewYork, USA.
R2. Kazmi, S.M.A.,―Solid Mechanics‖ TMH,Delhi,India.
R3. Hibbeler, R. C. Mechanics of Materials.6th ed.East Rutherford, NJ: Pearson Prentice Hall, 2004

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O 1 | PS O 2 | PS O 3 | PS O 4 |
| [CO1] | Measure tensile and compressive strength of a specimen for applying in a practical design based project work | - | 3 | 3 | 2 | - | - | - | | - | - | - | 1 | 3 | - | 2 | - |
| [CO2] | Determine hardness, impact strength, fatigue strength to analyze the application of a specific material for a given design requirements for different loading conditions of structures. | - | 2 | 2 | 2 | - | - | - | | - | - | - | 1 | 2 | - | 2 | - |
| [CO3] | Observe bending in beams and calculate the bending stresses which further builds the foundation of using modern analysis software. | - | 2 | 2 | 2 | 1 | - | 1 | | - | - | - | 1 | 2 | - | 2 | - |
| [CO4] | Judge the capacity of a material to withstand torsional stresses for a safe and sustainable design of machine elements. | 2 | 3 | 2 | 2 | - | - | - | | - | - | - | 1 | 2 | - | 2 | - |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Computer Aided Civil Engineering Drawing Lab

Code:BTE23275

1 Credits | Semester III

Total Lecture: 30

**A. Introduction:**

- The objective of this lab is to teach the student usage of AutoCAD and basic drawing fundamentals in various civil engineering applications, especially in building drawing.

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

**[CO1]** Use the AutoCAD commands for drawing 2D & 3D building drawings required for different civil engg applications.

**[CO2]** Plan and draw Civil Engineering Buildings as per aspect and orientation

**[CO3]** Presenting drawings as per user requirements and preparation of technical report.

**[CO4]** Become familiar with computer aided drafting useful to share the design model to different section of industries as well as for research & development.

**[CO5]** Understand projection of line, surface and solids to create the knowledge base of orthographic and isometric view of structures and machine parts.

**C. Assessment Plan:**

| Criteria | Description | Maximum Marks |
|---|---|---|
| Continuous Internal Assessment (CIA) | Internal Examination | 5 |
| | Attendance | 5 |
| | Assignment | 5 |
| End Semester Examination(ESE) | End Semester Examination | 35 |
| Total | | 50 |
| Attendance | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

| S.No. | Name of Experiment |
|---|---|
| 1 | **INTRODUCTION**<br>Introduction to concept of drawings, Interpretation of typical drawings, Planning drawings to show information concisely and comprehensively; optimal layout of drawings and Scales; Introduction to computer aided drawing, coordinate systems, and reference planes. Commands: Initial settings, Drawing aids, Drawing basic entities, Modify commands, Layers, Text and Dimensioning, Blocks. Drawing presentation norms and standards |
| 2 | **SYMBOLS AND SIGN CONVENTIONS**<br>Materials, Architectural, Structural, Electrical and Plumbing symbols. Rebar drawings and structural steel fabrication and connections drawing symbols, welding symbols; dimensioning standards. |
| 3 | **MASONRY BONDS**<br>English Bond and Flemish Bond – Corner wall and Cross walls - One brick wall and one and half brick wall |
| 4 | **BUILDING DRAWING**<br>Terms, Elements of planning building drawing, Methods of making line drawing and detailed drawing. Site plan, floor plan, elevation and section drawing of small residential buildings. Foundation plan. Roof drainage plans. Depicting joinery, standard fittings & fixtures, finishes. Use of Notes to improve clarity. |
| 5 | **PICTORIAL VIEW**<br>Principlesofisometricsandperspectivedrawing.Perspectiveviewofbuilding.Fundamentals of Building Information Modelling(BIM)(3)Total 15sessions<br>Derivationofformulaeandcalculationsofhoopstress,longitudinalstressin a cylinder,and sphere subjected to internal pressures |

**E. TEXT BOOK**

T1. Introduction to Environmental Engineering and Science by Gilbert Masters, Prentice Hall,

T2. Introduction to Environmental Engineering by P. AarneVesilind, Susan M. Morgan,

T3.Tho.mpson /Brooks/Cole; Second Edition 2008

T4. Basic & Applied Soil Mechanics -by Ranjan&Rao, New AgeInternational Publishers.

**F. REFERENCES**

R1. Varghese, P.C., ―Building Construction", Prentice Hall India, 2007.

R2. National Building Code, Bureau of Indian Standards, New Delhi

R3. Khanna, S.K., Justo, C.E.G and Veeraragavan, A, ' Highway Engineering' Revised 10th Edition, Nem Chand & Bros, 2017

R4. Kadiyalai, L.R., ' Traffic Engineering and Transport Planning', Khanna Publishers.

R5. ParthaChakraborty, ' Principles of Transportation Engineering, PHI Learning

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O 1 | PS O 2 | PS O 3 | PS O 4 |
| [CO1] | Use the AutoCAD commands for drawing 2D & 3D building drawings required for different civil engg applications. | 2 | - | 1 | 2 | - | 1 | - | - | 1 | - | - | 1 | 2 | - | 1 | 2 |
| [CO2] | Plan and draw Civil Engineering Buildings as per aspect and orientation | 3 | - | 2 | 2 | - | 1 | - | - | 1 | 1 | - | 1 | 3 | - | 2 | 2 |
| [CO3] | Presenting drawings as per user requirements and preparation of technical report. | 2 | 2 | 2 | 1 | - | 1 | - | - | 1 | - | - | 1 | 2 | 2 | 2 | 1 |
| [CO4] | Become familiar with computer aided drafting useful to share the design model to different section of industries as well as for research & development. | 1 | - | 2 | 2 | 2 | 1 | - | - | 1 | 1 | - | 1 | 1 | - | 2 | 2 |
| [CO5] | Understand projection of line, surface and solids to create the knowledge base of orthographic and isometric view of structures and machine parts. | 2 | 2 | 2 | 1 | - | 1 | - | - | 1 | - | - | 1 | 2 | 2 | 2 | 1 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

ARKA JAIN University
Jharkhand

Syllabus of

# B.Tech. in Civil Engineering

## Semester-IV

**ARKAJAIN University, Jharkhand**
School of Engineering & IT
Department of Engineering
Faculty – Bachelor of Technology in Civil Engineering
**Scheme of Study (w.e.f Batch 2020-24)**

## SEMESTER –I

| Sr. No. | Name of the Subject | Group | L-T-P | Credit |
|---|---|---|---|---|
| 1 | Engineering Mathematics–I | A & B | 3-1-0 | 4 |
| 2 | Engineering Chemistry | A | 3-0-0 | 3 |
| | Programming for Problem Solving | B | 3-0-0 | 3 |
| 3 | Basic Electrical Engineering | A | 3-1-0 | 4 |
| | Engineering physics | B | 3-1-0 | 4 |
| 4 | Engineering Mechanics | A | 3-0-0 | 3 |
| | English for Communication | B | 3-0-0 | 3 |
| 5 | Constitution of India | B | 0-0-0 | 0 |
| | **Practical** | | | |
| 6 | Engineering Chemistry Lab | A | 0-0-1 | 1 |
| | Engineering Physics Lab | B | 0-0-1 | 1 |
| 7 | Basic Electrical Engineering Lab | A | 0-0-1 | 1 |
| | Programming for Problem Solving Lab | B | 0-0-2 | 2 |
| 8 | Engineering Mechanics Lab | A | 0-0-1 | 1 |
| 9 | Engineering Graphics & Design | A | 0-0-2 | 2 |
| | Workshop Practices | B | 0-0-2 | 2 |
| | TOTAL | A or B | 12-2-5 | 19 |

# SCHEME OF THE STUDY
# SEMESTER –II

| Sr. No. | Name of the Subject | Group | L-T-P | Credit |
|---|---|---|---|---|
| 1 | Engineering Mathematics–II | A & B | 3-1-0 | 4 |
| 2 | Engineering Chemistry | B | 3-0-0 | 3 |
| | Programming for Problem Solving | A | 3-0-0 | 3 |
| 3 | Basic Electrical Engineering | B | 3-1-0 | 4 |
| | Engineering physics | A | 3-1-0 | 4 |
| 4 | Engineering Mechanics | B | 3-0-0 | 3 |
| | English for Communication | A | 3-0-0 | 3 |
| 5 | Constitution of India | A | 0-0-0 | 0 |
| | **Practical** | | | |
| 6 | Engineering Chemistry Lab | B | 0-0-1 | 1 |
| | Engineering Physics Lab | A | 0-0-1 | 1 |
| 7 | Basic Electrical Engineering Lab | B | 0-0-1 | 1 |
| | Programming for Problem Solving Lab | A | 0-0-2 | 2 |
| 8 | Engineering Mechanics Lab | B | 0-0-1 | 1 |
| | Engineering Graphics& Design | B | 0-0-2 | 2 |
| 9 | Workshop Practices | A | 0-0-2 | 2 |
| | TOTAL | A or B | 12-2-5 | 19 |

# SEMESTER –I (Group-A)

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Engineering Chemistry | BSC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 2 | Engineering Mathematics–I | BSC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 3 | Basic Electrical Engineering | ESC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 4 | Engineering Mechanics | ESC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| | **Practical** | | | | | | | | |
| 5 | Engineering Chemistry Lab | BSC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 6 | Basic Electrical Engineering Lab | ESC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 7 | Engineering Mechanics Lab | ESC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 8 | Engineering Graphics& Design | ESC | 2 | 4 | 50 | 35 | 5 | 5 | 5 |
| | **TOTAL** | | **19** | **24** | **600** | **420** | **100** | **40** | **40** |

# SEMESTER I (Group-B)

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Engineering physics | BSC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 2 | Engineering Mathematics –I | BSC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 3 | Programming for Problem Solving | ESC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | English for Communication | HSMC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 5 | Constitution of India | MC | 0 | 2 | 50 | 35 | 10 | 2.5 | 2.5 |
| | **Practical** | | | | | | | | |
| 6 | Engineering physics Lab | BSC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 7 | Programming for Problem Solving Lab | ESC | 2 | 4 | 50 | 35 | 5 | 5 | 5 |
| 8 | Workshop Practices | ESC | 2 | 4 | 50 | 35 | 5 | 5 | 5 |
| | **TOTAL** | | **19** | **26** | **600** | **420** | **105** | **37.5** | **37.5** |

# SEMESTER II (Group-A)

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Engineering physics | BSC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 2 | Engineering Mathematics –II | BSC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 3 | Programming for Problem Solving | ESC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | English for Communication | HSMC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 5 | Constitution of India | MC | 0 | 2 | 50 | 35 | 10 | 2.5 | 2.5 |
| | **Practical** | | | | | | | | |
| 6 | Engineering physics Lab | BSC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 7 | Programming for Problem Solving Lab | ESC | 2 | 4 | 50 | 35 | 5 | 5 | 5 |
| 8 | Workshop Practices | ESC | 2 | 4 | 50 | 35 | 5 | 5 | 5 |
| | **TOTAL** | | **19** | **26** | **600** | **420** | **105** | **37.5** | **37.5** |

# SEMESTER –II (Group-B)

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Engineering Chemistry | BSC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 2 | Engineering Mathematics–II | BSC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 3 | Basic Electrical Engineering | ESC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 4 | Engineering Mechanics | ESC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| | **Practical** | | | | | | | | |
| 5 | Engineering Chemistry Lab | BSC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 6 | Basic Electrical Engineering Lab | ESC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 7 | Engineering Mechanics Lab | ESC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 8 | Engineering Graphics& Design | ESC | 2 | 4 | 50 | 35 | 5 | 5 | 5 |
| | **TOTAL** | | **19** | **24** | **600** | **420** | **100** | **40** | **40** |

# SEMESTER-III

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA * | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Engineering Mathematics -III | BSC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 2 | Biology for Engineers | BSC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 3 | Surveying &Geomatics | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | Mechanics of Solid | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 5 | Introduction to Civil Engineering | HSMC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 6 | Environmental Science | MC | 0 | 2 | 50 | 35 | 10 | 2.5 | 2.5 |
| | **Practical** | | | | | | | | |
| 7 | Surveying &Geomatics Lab | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 8 | Mechanics of Solid | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 9 | Computer Aided Civil Engineering Drawing | ESC | 2 | 4 | 50 | 35 | 5 | 5 | 5 |
| | **TOTAL** | | **20** | **26** | **700** | **490** | **125** | **42.5** | **42.5** |

# SEMESTER-IV

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Material Testing & Evaluation | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 2 | Engineering Geology | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 3 | Fluid Mechanics | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | Structural Analysis - I | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 5 | Geotechnical Engineering | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 6 | Civil Engineering-Societal & Global Impact | HSMC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| | **Practical** | | | | | | | | |
| 7 | Material Testing & Evaluation | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 8 | Engineering Geology Lab | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 9 | Geotechnical Engineering Lab | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 10 | Fluid Mechanics Lab | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| | **TOTAL** | | **22** | **26** | **800** | **560** | **140** | **50** | **50** |

# SEMESTER V

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Hydraulic Engineering | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 2 | Structural Analysis II | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 3 | Hydrology & Water Resource Engineering | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | Environmental Engineering-I | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 5 | Open Elective I Humanities I<br>Professional Practice, Law & Ethics<br>Organizational Behavior | HSMC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 6 | Disaster Preparedness & Planning | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 7 | Essence of Indian Knowledge Tradition | MC | 0 | 2 | 50 | 35 | 10 | 2.5 | 2.5 |
| | PRACTICAL | | | | | | | | |
| 8 | Hydraulic Engineering Lab | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 9 | Structural Analysis II Lab | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 10 | Summer Internship –I (3-4 week) | PROJ | 2 | 0 | 50 | 35 | 15 | 0 | 0 |
| | **TOTAL** | | **22** | **24** | **800** | **560** | **155** | **42.5** | **42.5** |

# SEMESTER VI

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory / Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Construction Engineering & Management | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 2 | Transportation Engineering-I | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 6 | Engineering Economics, Estimation & Costing | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 3 | Elective I<br>Rock Mechanics<br>Foundation Engineering | PEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | Elective II<br>Environmental Engineering II<br>Rural water supply & Onsite Sanitation System | PEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 6 | Elective III<br>Design of Steel Structure<br>Earthquake Engineering | PEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 7 | Design of Concrete Structures-I | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| | **Practical** | | | | | | | | |
| 8 | Transportation Engineering I Lab | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| | **TOTAL** | | **22** | **23** | **750** | **525** | **145** | **40** | **40** |

# SEMESTER VII

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Elective IV<br>Air and Noise Pollution and Control<br>Solid and hazardous Waste Management | PEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 2 | Elective V<br>Design of Concrete Structure - II<br>Prestressed Concrete | PEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 3 | Open Elective II<br>Metro System & Engineering<br>History of Science & Engineering | OEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | River Engineering | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| | **Practical** | | | | | | | | |
| 5 | Minor Project | PROJ | 3 | 6 | 100 | 70 | 30 | 0 | 0 |
| 6 | Summer Internship –II –(4-6 Week) | PROJ | 3 | 0 | 100 | 70 | 30 | 0 | 0 |
| | **TOTAL** | | **18** | **18** | **600** | **420** | **140** | **20** | **20** |

# SEMESTER VIII

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Elective VI<br>Bridge Engineering<br>Ground Water Engineering | PEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 2 | Elective VII<br>Railway Engineering<br>Traffic Engineering and Management | PEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 3 | Open Elective III<br>Soft Skills and Interpersonal Communication<br>Human Resource Development and Organizational Behavior | OEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | Open Elective IV<br>Civil Engineering Design-I<br>Geographic Information Systems and Science | OEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| | **Practical** | | | | | | | | |
| 5 | Major Project | PROJ | 8 | 16 | 200 | 140 | 60 | 0 | 0 |
| 6 | Extra- Curricular/ Co-Curricular Activity | PROJ | 0 | 0 | 100 | 70 | 30 | 0 | 0 |
| | **TOTAL** | | **20** | **28** | **700** | **490** | **170** | **20** | **20** |

## Distribution of Credit across 8 semesters:

| Sl. No | Type of Paper | No. of Paper | Total Credit |
|---|---|---|---|
| 1 | Humanities and Social Sciences including Management courses **(HSMC)** | 4 | 12 |
| 2 | Basic Science courses**(BSC)** | 8 | 24 |
| 3 | Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc**(ESC)** | 9 | 20 |
| 4 | Professional core courses (**PCC)** | 26 | 60 |
| 5 | Professional Elective courses relevant to chosen specialization/branch**(PEC)** | 7 | 21 |
| 6 | Open subjects – Electives from other technical and /or emerging subjects (**OEC)** | 3 | 9 |
| 7 | Project work, seminar and internship in industry or elsewhere**(PROJ)** | 5 | 16 |
| 8 | Mandatory Courses [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Knowledge Tradition]**(MC)** | 3 | 0 |
| | **Total** | 65 | 162 |

**CIA – Continuous Internal Assessment – Based on Projects / Assignment during the semester**

**Note:**
**AICTE Activity Points to be earned by students admitted to Degree program (For more details refer to Chapter 6, AICTE, Activity Point Program, Model Internship Guidelines):**
**Every regular student, who is admitted to the 4 year Degree program, is required to earn 100 activity points in addition to the total credits earned for the program. Students entering 4 years Degree Program through lateral entry are required to earn 75 activity points in addition to the total credits earned for the program. The activity points earned by the student shall be reflected on the students 8th Semester grade card.**
**The activities to earn the points can be spread over the duration of the course. However, minimum prescribed duration should be fulfilled.**
**Activity Points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression.**
**Incase student fail to earn the prescribed activity points, Eight semester Grade Card shall be issued only after earning the required activity Points.**
**Students shall be eligible for the award of degree only after the release of the Eight Semester grade card.**

***There are two groups (A & B) in semester 1 & 2. The Group division will be decided by The Dean SoE& IT before commencement of classes***

**ARKAJAIN University, Jharkhand**
School of Engineering & IT
Department of Engineering
Faculty – Bachelor of Technology in Civil Engineering
**PROGRAM OUTCOMES &PROGRAM SPECIFIC OUTCOMES**

**PROGRAM OUTCOMES**

After completing this undergraduate program, a learner:

**[PO.1].Engineering knowledge:** An ability to apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to get the solution of the engineering problems.

**[PO.2].Problem analysis:** Ability to Identify, formulates, review research literature, and analyze complex engineering problems.

**[PO.3].Design/Development of Solutions:** Ability to design solutions for complex Engineering Problems by considering social, Economic and Environmental aspects.

**[PO.4].Conduct investigations of complex problems:** Use research-based knowledge to design, conduct analyses experiments to get valid conclusion.

**[PO.5]. Modern tool usage:** ability to create, select, and apply appropriate techniques, and to model complex engineering activities with an understanding of the limitations.

**[PO.6]. The engineer and society:** Ability to apply knowledge by considering social health, safety, legal and cultural issues.

**[PO.7]. Environment and sustainability:** Understanding of the impact of the adopted engineering solutions in social and environmental contexts.

**[PO.8]. Ethics:** Understanding of the ethical issues of the civil engineering and applying ethical principles in engineering practices.

**[PO.9]. Individual and teamwork:** Ability to work effectively as an individual or in team, as a member or as a leader.

**[PO.10]. Communication:** An ability to communicate clearly and effectively through different modes of communication.

**[PO.11]. Project management and finance:** Ability to handle project and to manage finance related issue.

**[PO.12]. Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning.

**PROGRAM SPECIFIC OUTCOMES**

**[PSO.1]. Professional skills** – The ability to analyze and design civil engineering structures as per the guidelines in Indian standards and other relevant codes like buildings, bridges, tunnels ,railways, airports, water and sewage treatment plants etc

**[PSO.2]. Problem solving skills** – The ability to managed large infrastructural projects by making use of latest techniques of project management for optimum utilization of resources via man, material and money.

**[PSO.3]. Successful Career and Entrepreneurship** – Strong desire to acquire modern scientific knowledge by pursuing higher studies, which will lead them to identify problems in the civil engineering domains and thereby become entrepreneur to propose solution

**[PSO.4]. Communication:** Communicate effectively on complex engineering activities with the engineering community & with society at large, such as, being able to comprehend & write effective reports & design documentation, make effective presentations & give & receive clear instructions

# Subject: Materials, Testing & Evaluation

Code: BTE24280

3 Credits | Semester IV

Total Lecture: 45 Total Tutorial: 9

**A. Introduction:**

- Make measurements of behavior of various materials used in Civil Engineering.
- Provide physical observations to complement concepts learnt
- Introduce experimental procedures and common measurement instruments, equipment, devices.
- Exposure to a variety of established material testing procedures and techniques.
- Different methods of evaluation and inferences drawn from observations

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

**[CO1]** Understand the different materials used in civil engineering applications.

**[CO2]** Plan an experimental program, selecting the test configuration, selecting the test specimens and collecting raw data.

**[CO3]** Document the experimental program including the test procedures, collected data, method of interpretation and results.

**[CO4]** Analyze various modes of failure in compression, tension, and shear.

**[CO5]** Analyze various types of material behavior under similar loading conditions.

**C. Assessment Plan:**

| Criteria | Description | Maximum Marks |
|---|---|---|
| **Continuous Internal Assessment (CIA)** | Internal Examination | 20 |
| | Attendance | 5 |
| | Assignment | 5 |
| **End Semester Examination(ESE)** | End Semester Examination | 70 |
| **Total** | | 100 |
| **Attendance** | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

**INTRODUCTION TO ENGINEERING MATERIALS :** Cements, M-Sand, Concrete (plain, reinforced and steel fibre/ glass fibre-reinforced, light-weight concrete, High Performance Concrete Polymer Concrete) Ceramics, and Refractories, Bitumen and asphaltic materials, Timbers, Glass and Plastics, Structural Steel and other Metals, Paints and Varnishes Acoustical material and geotextiles, rubber and asbestos, laminates and adhesives, Graphene, Carbon composites and other engineering materials including properties and uses of these

**INTRODUCTION TO MATERIAL TESTING:** What is the "Material Engineering"; Mechanical behavior and mechanical characteristics; Elasticity – principle and characteristics; Plastic deformation of metals; tensile test – standards for different material (brittle, quasi-brittle, elastic and so on) True stress – strain interpretation of tensile test; hardness tests; Bending and torsion test

**FAILURE CONCEPT IN MATERIALS:** strength of ceramic; Internal friction, creep – fundaments and characteristics; Brittle fracture of steel – temperature transition approach; Background of fracture mechanics; Discussion of fracture toughness testing – different materials; concept of fatigue of materials; Structural integrity assessment procedure and fracture mechanics

**STANDARD TESTING & EVALUATION PROCEDURES:** Laboratory for mechanical testing; Discussion about mechanical testing; Naming systems for various irons, steels and nonferrous metals; Discussion about elastic deformation; Plastic deformation; Impact test and transition temperatures; Fracture mechanics – background; Fracture toughness – different materials; Fatigue of material; Creep. Naming systems for various irons, steels and nonferrous metals; Discussion about elastic deformation; Plastic deformation; Impact test and transition temperatures; Fracture mechanics – background; Fracture toughness – different materials; Fatigue of material; Creep.

**TESTING PROCEDURE OF DIFFERENT MATERIALS:** Tests & testing of bricks, Tests & testing of sand, Tests & testing of concrete, Tests & testing of soils Tests & testing of bitumen & bituminous mixes, Tests & testing of polymers and polymer based materials Tests & testing of metals & Tests & testing of other special materials, composites and cementitious materials Explanation of mechanical behavior of these materials.

**E. TEXT BOOKS**

T1. E.N. Dowling (1993), Mechanical Behaviour of Materials,Prentice Hall International Edition
T2. American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards (post 2000)
T3. Related papers published in international journals

**F. REFERENCE BOOKS**

R1. Chudley, R., Greeno (2006), 'Building Construction Handbook' (6th ed.),R. ButterworthHeinemann
R2. Khanna, S.K., Justo, C.E.G and Veeraragavan, A, ' Highway Materials and Pavement Testing', Nem Chand& Bros, Fifth Edition
R3. Various related updated & recent standards of BIS, IRC, ASTM, RILEM, AASHTO, etc. corresponding to materialsused for Civil Engineering applications
R4. KyriakosKomvopoulos (2011), Mechanical Testing of Engineering Materials, Cognella

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| [CO1] | Understand the different materials used in civil engineering applications. | 3 | - | 1 | 1 | 1 | - | - | - | - | - | - | 2 | 3 | 1 | 3 | - |
| [CO2] | Plan an experimental program, selecting the test configuration, selecting the test specimens and collecting raw data. | 3 | 2 | 2 | - | 2 | - | - | 1 | - | - | - | 2 | 3 | 1 | 3 | - |
| [CO3] | Document the experimental program including the test procedures, collected data, method of interpretation and results. | 3 | 2 | 1 | - | 1 | - | 1 | - | - | 1 | - | 2 | 3 | 1 | 2 | |
| [CO4] | Analyze various modes of failure in compression, tension, and shear. | 3 | 2 | - | 2 | 2 | 1 | - | 1 | 2 | - | 1 | 2 | 3 | 2 | 1 | |
| [CO5] | Analyze various types of material behavior under similar loading conditions. | | | | | | | | | | | | | | | | |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Engineering Geology

Code:BTE24055

3 Credits | Semester IV

Total Lecture: 45 Total Tutorial: 9

**A. Introduction:**

- To focus on the core activities of engineering geologists – site characterization and geologic hazard identification and mitigation.
- To couple geologic expertise with the engineering properties of rock and unconsolidated materials in the characterization of geologic sites for civil work projects and
- The quantification of processes such as rock slides, soil-slope stability, settlement, and liquefaction

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

**[CO1]** Characterize Site and collect, analyse and report geologic data using standards in engineering practice

**[CO2]** Understand the fundamentals of the engineering properties of Earth materials and fluids.

**[CO3]** Understandthe Rock mass characterization and the mechanics of planar rockslides and topples.

**[CO4]** Use suitable software to examine geology, soil, geologic hazard, and NEHRP data to characterize a geologic site

**[CO5]** Understandthe mechanics of soils and fluids and their influence on settlement, liquefaction, and soil slope stability.

**C. Assessment Plan:**

| Criteria | Description | Maximum Marks |
|---|---|---|
| **Continuous Internal Assessment (CIA)** | Internal Examination | 20 |
| | Attendance | 5 |
| | Assignment | 5 |
| **End Semester Examination(ESE)** | End Semester Examination | 70 |
| **Total** | | 100 |
| **Attendance** | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

**INTRODUCTION** : Branches of geology useful to civil engineering, scope of geological studies in various civil engineering projects. Understanding the earth, internal structure and composition. Physical properties of minerals, susceptibility of minerals to alteration, Rock forming minerals, megascopic identification of common primary & secondary minerals. Basic of optical ineralogy, SEM, XRD.

**PETROLOGY** : Formation, Classification and Engineering Properties of : Igneous rocks- Types of Granite, Dolerite, Basalt, Pumice, Granite Porphyry. Sedimentary Rocks- Sandstone, Limestone, Shale, Laterite, Conglomerate. Metamorphic Rocks- Gneiss, Slate, Muscovite &Biotite schist, Marble, Quartzite. Rock weathering: types and their effects on Civil Engineering Projects. Landforms, Drainage pattern and types. Soil formation and soil profile. The apprehension of Index properties of rocks: Porosity, Density, Permeability, and Durability. Selection of rocks as materials for construction, as a foundation, Decorative, Flooring, and Roofing, Concrete Aggregate, Road Metal, Railway Ballast with examples.

**STRUCTURAL GEOLOGY & ROCK MECHANICS**: Dip and Strike. Outcrop and width of outcrop. Inliers and Outliers. Main types of discontinuities according to size. Fold- Types and nomenclature, Criteria for their recognition in field. Faults: Classification, recognition in field, effects on outcrops. Joints & Unconformity Sub surface Investigations in rocks and engineering characteristics or rocks masses; Structural geology of rocks. Classification of rocks, Field & laboratory tests on rocks, Stress deformation of rocks, Failure theories and shear strength of rocks, Bearing capacity of rocks Rock Quality Determination (RQD) & Rock Structure Rating (RSR). Geological site characterization, Strength Behavior of Rocks- Stress and Strain in rocks. Concept of Rock Deformation & Tectonics. Dam foundations, rock Foundation treatment for dams and Reservoirs heavy structures by grouting, and rock reinforcement

**GEOLOGICAL HAZARDS** : Rock Instability and Slope movement: Concept of sliding blocks. Different controlling factors. Instability in vertical rock structures and measures to prevent collapse. Slope reinforcement by Rock bolting and Rock anchoring, retaining wall, Slope treatment. Case study on black clay. Earthquake: Magnitude and intensity of earthquake. Seismic sea waves. Revelation from Seismic Records of structure of earth. Case Study on Elevation and Subsidence in Himalayan region in India. Seismic Zone in India.

**GEOLOGY OF DAM AND RESERVOIR SITE**: Required geological consideration for selecting dam and reservoir site. Failure of Reservoir. Favorable & unfavorable conditions in different types of rocks in presence of various structural features. Precautions to be taken to counteract unsuitable conditions, significance of discontinuities on the dam site and treatment giving to such structures.

**E. TEXT BOOKS**

T1. Geology for Geotechnical Engineers, J.C.Harvey, Cambridge University Press (1982).

**F. REFERENCE BOOKS**

R1. Engineering and General Geology, Parbin Singh, 8th Edition (2010), S K Kataria& Sons.
R2. Text Book of Engineering Geology, N. ChennaKesavulu, 2nd Edition (2009), Macmillan Publishers India.

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| [CO1] | Characterize Site and collect, analyse and report geologic data using standards in engineering practice | 1 | 1 | 2 | 1 | 1 | 1 | - | 1 | - | 1 | - | 2 | 2 | 2 | 3 | 2 |
| [CO2] | Understand the fundamentals of the engineering properties of Earth materials and fluids. | 3 | 1 | 1 | 2 | 1 | - | - | - | 1 | - | 1 | 2 | 3 | 2 | 1 | 2 |
| [CO3] | Understandthe Rock mass characterization and the mechanics of planar rockslides and topples. | 3 | 2 | 1 | 1 | - | - | 1 | - | - | - | - | 3 | 2 | 2 | 1 | - |
| [CO4] | Use suitable software to examine geology, soil, geologic hazard, and NEHRP data to characterize a geologic site | 2 | 1 | - | - | - | 1 | - | 1 | - | 1 | - | 2 | 2 | 1 | 1 | - |
| [CO5] | Understandthe mechanics of soils and fluids and their influence on settlement, liquefaction, and soil slope stability. | 2 | 1 | 1 | 1 | 1 | - | 2 | - | - | 1 | - | 3 | 2 | 1 | - | - |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Fluid Mechanics

Code:BTE23017

3 Credits | Semester IV

Total Lecture: 45 Total Tutorial: 9

**A. Introduction:**

- To understand parameters associated with fluid flow and hydrostatic pressure.
- To know head loss and water hammer in fluid flowing through pipes.
- To learn different types of pumps and their uses.

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

**[CO1]** Measure pressure and determine total hydrostatic pressure for different conditions.
**[CO2]** Understand various parameters associated with fluid flow.
**[CO3]** Determine head loss of fluid flow through pipes.
**[CO4]** Find the fluid flow parameters in open channels.
**[CO5]** Understand the various types of flow

**C. Assessment Plan:**

| Criteria | Description | Maximum Marks |
|---|---|---|
| **Continuous Internal Assessment (CIA)** | Internal Examination | 20 |
| | Attendance | 5 |
| | Assignment | 5 |
| **End Semester Examination(ESE)** | End Semester Examination | 70 |
| **Total** | | 100 |
| **Attendance** | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

**BASIC CONCEPT & HYDROSTATICS** : Distinction between a fluid and a solid; Density, Specific weight, Specific gravity, Kinematic and dynamic viscosity; variation of viscosity with temperature, Newton law of viscosity; vapour pressure, boiling point, cavitation; surface tension, capillarity, Bulk modulus of elasticity, compressibility. Fluid Pressure: Pressure at a point, Pascals law, pressure variation with temperature, density and altitude. Piezometer, U-Tube Manometer, Single Column Manometer, U-Tube Differential Manometer, Micromanometers. Pressure gauges, Hydrostatic pressure and force: horizontal, vertical and inclined surfaces. Buoyancy and stability of floating bodies.

**FLUID KINEMATICS & DYNAMICS** : Classification of fluid flow : steady and unsteady flow; uniform and non-uniform flow; laminar and turbulent flow; rotational and irrotational flow; compressible and incompressible flow; ideal and real fluid flow; one, two and three dimensional flows; Stream line, path line, streak line and stream tube; stream function, velocity potential function. One-, two- and three -dimensional continuity equations in Cartesian coordinates Surface and body forces; Equations of motion - Euler‘s equation; Bernoulli‘s equation – derivation; Energy Principle; Practical applications of Bernoulli‘s equation: venturimeter, orifice meter and pitot tube; Momentum principle; Forces exerted by fluid flow on pipe bend; Vortex Flow – Free and Forced.

**FLOW THROUGH PIPES** : Laminar flow through: circular pipes, annulus and parallel plates. Stoke‘s law, Measurement of viscosity Flow through Pipes:Loss of head through pipes, Darcy-Wiesbatch equation, minor losses, total energy equation, hydraulic gradient line, Pipes in series, equivalent pipes, pipes in parallel, flow through laterals, flows in dead end pipes, siphon, power transmission through pipes, nozzles. Analysis of pipe networks: Hardy Cross method, water hammer in pipes and control measures, branching of pipes, three reservoir problem

**DIMENSIONAL ANALYSIS & MODEL STUDIES** : Dimensional homogeneity, Rayleigh method, Buckingham‘s Pi method and other methods. Dimensionless groups. Similitude, Model studies, Types of models. Application of dimensional analysis and model Studies to fluid flow problem. Dynamic Similitude- Definitions of Reynolds Number, Froude Number, Mach number, Weber Number and Euler Number.

**FLOW MEASUREMENTS** : Introduction, equation for discharge over triangular notch, rectangular notch, trapezoidal notch and broad crested weir Equation for discharge through inclined & horizontal venturimeter, Numerical. Measurement of velocity using Pitot tube and Pitot Static Tube, Classification of orifices, hydraulic coefficients of an orifice, Numerical on Vertical Orifice.

**E. TEXT BOOKS**

T1. Khurmi R S, Hydraulics, Fluid Mechanics, Hydraulic machines, S. Chand Publishers
T2. Rajput, R K, Fluid Mechanics, S Chand, New Delhi.
T3. Ojha, C S P, Berndtsson, R, and Chandramoulli P. N., Fluid Mechanics and Machinery, Oxford University Press, New Delhi.

**F. REFERENCE BOOKS**

R1. Modi, P. N.and Seth, S.M., Hydraulics and Fluid Mechanics, Standard book house, Delhi.
R2. Theory and Applications of Fluid Mechanics, K. Subramanya, Tata McGraw Hill.

R3. S.S. Rattan, Fluid Mechanics & Hydraulic Machines, Khanna Book Publishing Co., New Delhi

R4. Ramamrutham, and Narayan, R., Hydraulics, Fluid Mechanics and Fluid Machines, DhanpatRai Publishing Company, New Delhi.

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| [CO1] | Measure pressure and determine total hydrostatic pressure for different conditions. | 3 | 2 | 2 | 1 | 1 | - | 1 | 1 | - | - | - | 3 | 3 | 3 | 1 | 1 |
| [CO2] | Understand various parameters associated with fluid flow. | 2 | 2 | 1 | 1 | 1 | 1 | - | 1 | 1 | - | 1 | 2 | 3 | 1 | 2 | 1 |
| [CO3] | Determine head loss of fluid flow through pipes. | 3 | 2 | 2 | 2 | 2 | 2 | - | - | 1 | - | 1 | 3 | 3 | 2 | 2 | - |
| [CO4] | Find the fluid flow parameters in open channels. | 2 | 1 | 2 | 1 | - | 1 | - | - | - | 1 | 1 | 3 | 2 | 1 | 1 | - |
| [CO5] | Understand the various types of flow | 3 | 3 | 2 | 2 | - | - | - | - | - | 1 | - | 3 | 2 | 2 | 1 | 1 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Structural Analysis-I

Code:BTE24057

3 Credits | Semester IV

Total Lecture: 45 Total Tutorial: 9

**A. Introduction:**

- Ability to model loads on structures using current codes and standards Assignments
- Ability to idealize and analyze statically determinate and indeterminate structures Assignments
- Familiarity with structural analysis software Assignments: Six computer problems are assigned.
- Familiarity with professional and contemporary issues Assignments: Students must submit two reports.

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

**[CO1]** Analyze statically determinate trusses, beams, and frames and obtain internal loading
**[CO2]** Analyze cable and arch structures
**[CO3]** Determine deflections of beams and frames using classical methods.
**[CO4]** Solve statically indeterminate structures using classical method
**[CO5]** Obtain the influence lines for statically determinate and indeterminate structures

**C. Assessment Plan:**

| Criteria | Description | Maximum Marks |
|---|---|---|
| **Continuous Internal Assessment (CIA)** | Internal Examination | 20 |
| | Attendance | 5 |
| | Assignment | 5 |
| **End Semester Examination(ESE)** | End Semester Examination | 70 |
| **Total** | | 100 |
| **Attendance** | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

**INTRODUCTION AND ANALYSIS OF PLANE TRUSSES** : Structural forms, Conditions of equilibrium, 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.

**DEFLECTION OF BEAMS** : Deflection of determinate beams by Moment area and Conjugate beam methods, Strain energy due to axial force, BM and SF Principle of virtual

work and Castigliano's theorems, Maxwell's Reciprocal Theorem and Betti's Theorem Unit load and its application to deflection of determinate beams and trusses

**ARCHES AND CABLE STRUCTURES** : Three hinged and two hinged parabolic arches with supports at 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 Girders, Stiffening trusses for suspension cables

**INFLUENCE LINES AND MOVING LOADS** : Concept of influence lines, ILD for reactions, SF and BM for determinate beams Muller Bresleau Principle, ILD for axial forces in determinate trusses, BM, SF and axial forces in determinate systems using ILD Maximum BM and SF in determinate beams using rolling loads concepts, ILD for arches

**ANALYSIS OF INDETERMINATE BEAMS** : Propped cantilevers and fixed beams using method of consistent deformations Forces due to rotation and settlement of supports

**E. TEXT BOOKS**

T1. Negi, L. S., Jangid, R. S., "Theory and Problems in Structural Analysis", Tata McGraw Hill, New Delhi, 1st Edition, 1997.
T2. Jain, O.P., Jain, B.K., "Theory & Analysis of Structures", Vol. I & II, Nem Chand.

**F. REFERENCE BOOKS**

R1. Reddy, C. S., "Basic Structural Analysis", Tata McGraw Hill, New Delhi, 2011.
R2. Jain, A. K., "Elementary Structural Analysis", Nem Chand Publishers, Roorkee, 1990.
R3. Ramamrutham, S., Narayan, R., "Theory of Structure", DhanpatRai& Co. Ltd.
R4. Norris, C. H., Wilbur, J. B., "Elementary Structural Analysis", International Student Edition, Literary Licensing, LLC, 2012.

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| [CO1] | Analyze statically determinate trusses, beams, and frames and obtain internal loading | 3 | 3 | 2 | 1 | - | - | - | 1 | - | 1 | - | 3 | 3 | 3 | 1 | 1 |
| [CO2] | Analyze cable and arch structures | 3 | 3 | 1 | 2 | - | 1 | - | 1 | 1 | - | - | 3 | 3 | 2 | - | 1 |
| [CO3] | Determine deflections of beams and frames using classical methods. | 3 | 3 | 2 | 1 | - | - | 1 | 1 | 1 | 1 | - | 3 | 2 | 2 | 1 | 2 |
| [CO4] | Solve statically indeterminate structures using classical method | 3 | 2 | - | 1 | 1 | - | 1 | - | - | 1 | - | 3 | 2 | 2 | 2 | 2 |
| [CO5] | Obtain the influence lines for statically determinate and indeterminate structures | 3 | 2 | 1 | - | 1 | - | - | - | 1 | 1 | 1 | 3 | 1 | 1 | 1 | 1 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Geotechnical Engineering

Code:BTE24056

3 Credits | Semester IV

Total Lecture: 45 Total Tutorial: 9

**A. INTRODUCTION:**

- Understand the different types of soil based on their formation mechanism.
- Evaluate the stiffness of soil using shear strength parameters
- Perform various laboratory experiments to determine moisture content, specific gravity
- Perform field experiments to estimate the field density of the soil mass.

**B. COURSE OUTCOMES:** At the end of the course, students will be able to

**[CO1]** Understand the various phase diagrams and derive various phase relationships of the soil
**[CO2]** Classify any soils based on their particle size distribution and index properties
**[CO3]** **C**alculate the effective permeability of anisotropic soil mass
**[CO4]** Evaluate ground settlements against time.
**[CO5]** Understand the significance of shear strength parameters in various geotechnical analyses

**C. ASSESSMENT PLAN:**

| Criteria | Description | Maximum Marks |
|---|---|---|
| **Continuous Internal Assessment (CIA)** | Internal Examination | 20 |
| | Attendance | 5 |
| | Assignment | 5 |
| **End Semester Examination(ESE)** | End Semester Examination | 70 |
| **Total** | | 100 |
| **Attendance** | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS:**

**PROPERTIES OF SOIL** : Types of soils, their formation and deposition, Definitions: soil mechanics, soil engineering, rock mechanics, geotechnical engineering. Scope of soil engineering. Comparison and difference between soil and rock. Basic Definitions and Relationships-Soil as three-phase system in terms of weight, volume, voids ratio, and porosity. Definitions: moisture content, unit weights, degree of saturation, voids ratio, porosity, specific gravity, mass specific gravity, etc. Relationship between volume weight, voids ratio- moisture content, unit weight- percent air voids, saturation moisture content, moisture content- specific gravity etc. Determination of various parameters such as: Moisture content by oven dry method, pycnometer, sand bath method, torsional balance method,

nuclear method, alcohol method and sensors. Specific gravity by density bottle method, pycnometer method, measuring flask method. Unit weight by water displacement method, submerged weight method, core-cutter method, sand-replacement method. Introduction to definitions of: plasticity of soil, consistency limits-liquid limit, plastic limit, shrinkage limit, plasticity, liquidity and consistency indices, flow & toughness indices, definitions of activity and sensitivity. Determination of: liquid limit, plastic limit and shrinkage limit. Use of consistency limits.

**CLASIFICATION OF SOIL & SOIL STRUCTURE** : Classification of Soils-Introduction of soil classification: particle size classification, textural classification, unified soil classification system, Indian standard soil classification system. Identification: field identification of soils, general characteristics of soil in different groups Single grained, honey combed, flocculent, and dispersed structure. Common clay structures Introduction to principle of effective stress, nature of effective stress, effect of water table. Fluctuations of effective stress, effective stress in soils saturated by capillary action, seepage pressure, quick sand condition

**FLOW THROUGH SOIL &COMPACTION** : Darcy's law, validity of Darcy's law. Determination of coefficient of permeability: Laboratory method: constant-head method, falling-head method. Field method: pumping- in test, pumping- out test. Permeability aspects: permeability of stratified soils, factors affecting permeability of soil. Seepage Analysis- Introduction, stream and potential functions, characteristics of flow nets, graphical method to plot flow nets. Compaction of Soil-Introduction, theory of compaction, laboratory determination of optimum moisture content and maximum dry density. Compaction in field, compaction specifications and field control.

**CONSOLIDATION OF SOIL** : Introduction, comparison between compaction and consolidation, initial, primary & secondary consolidation, spring analogy for primary consolidation, and interpretation of consolidation test results Terzaghi's theory of consolidation, final settlement of soil deposits, computation of consolidation settlement and secondary consolidation. Determination of consolidation characteristics of soil, Proportioning of soil compression index and coefficient of consolidation, determination of consolidation by square root of time fitting method, logarithmic time fitting method.

**SHEAR STRENGTH OF SOIL** : Mohr circle and its characteristics, principal planes, relation between major and minor principal stresses, Mohr-Coulomb theory, types of shear tests: direct shear test, merits of direct shear test, triaxial compression tests, test behavior of UU, CU and CD tests, pore pressure measurement, computation of effective shear strength parameters. Unconfined compression test, vane shear test

**E. TEXT BOOKS**

T1. Soil Mechanics in Engineering Practice by Karl Terzaghi, Ralph B. Peck, and GholamrezaMesri.

T2. Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering (Civil and Environmental Engineering) by V.N.S. Murthy

**F. REFERENCE BOOKS**

R1. Soil Mechanics by Craig R.F., Chapman & Hall
R2. Fundamentals of Soil Engineering by Taylor, John Wiley & Sons
R3. An Introduction to Geotechnical Engineering, by Holtz R.D. and Kovacs, W.D., Prentice Hall, NJ
R4. Principles of Geotechnical Engineering, by Braja M. Das, Cengage Learning
R5. Principles of Foundation Engineering, by Braja M. Das, Cengage Learning
R6. Essentials of Soil Mechanics and Foundations: Basic Geotechnics by David F. McCarthy

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| [CO1] | Understand the various phase diagrams and derive various phase relationships of the soil | 3 | 2 | 2 | 1 | 1 | - | 1 | 1 | 1 | 1 | 1 | 3 | 2 | 1 | 3 | 1 |
| [CO2] | Classify any soils based on their particle size distribution and index properties | 3 | 2 | 1 | 1 | 1 | 1 | - | - | 1 | - | 1 | 3 | 2 | 1 | 2 | 1 |
| [CO3] | Calculate the effective permeability of anisotropic soil mass | 3 | 1 | 2 | 1 | 1 | - | 1 | - | 1 | - | 1 | 3 | 2 | 2 | 1 | 2 |
| [CO4] | Evaluate ground settlements against time. | 3 | 2 | 2 | 1 | - | 1 | - | 1 | - | 1 | - | 3 | 1 | 1 | 2 | 1 |
| [CO5] | Understand the significance of shear strength parameters in various geotechnical analyses | 3 | 1 | 2 | 2 | - | - | 1 | - | - | 1 | 1 | 3 | 2 | 1 | 2 | 1 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Civil Engineering- Societal & Global Impact

Code:BTE24059

3 Credits | Semester IV

Total Lecture: 45 Total Tutorial: 9

**A. INTRODUCTION:**

- To provide a better understanding of the impact which Civil Engineering has on the Society and on the global arena?
- To understand the impact on the Infrastructure, Energy consumption and generation, Sustainability of the Environment, Aesthetics of the environment, Employment creation
- To realize the impact which this field has and take appropriate precautions to ensure that the impact is not adverse but beneficial.

**B. COURSE OUTCOMES:** At the end of the course, students will be able to

**[CO1]** Understand the importance of Civil Engineering and the impact it has on the Society and at global levels.

**[CO2]** Understand the impact of Civil Engineering for the various specific fields of human endeavor.

**[CO3]** **T**hink innovatively to ensure Sustainability.

**[CO4]** Understand the new civil engineering projects & its impact on society.

**[CO5]** Understand the importance of Civil Engineering in shaping & affecting the world.

**C. ASSESSMENT PLAN:**

| **Criteria** | **Description** | **Maximum Marks** |
|---|---|---|
| **Continuous Internal Assessment (CIA)** | Internal Examination | 20 |
| | Attendance | 5 |
| | Assignment | 5 |
| **End Semester Examination(ESE)** | End Semester Examination | 70 |
| **Total** | | 100 |
| **Attendance** | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS:**

**INTRODUCTION TO COURSE AND OVERVIEW** : Understanding the past to look into the future: Pre- industrial revolution days, Agricultural revolution, first and second industrial revolutions, IT revolution; Recent major Civil Engineering breakthroughs and innovations; Present day world and future projections, Ecosystems in Society and in

Nature; the steady erosion in Sustainability; Global warming, its impact and possible causes; Evaluating future requirements for various resources; GIS and applications for monitoring systems; Human Development Index and Ecological Footprint of India Vs. other countries and analysis; Understanding the importance of Civil Engineering in shaping and impacting the world; The ancient and modern Marvels and Wonders in the field of Civil Engineering; Future Vision for Civil Engineering

**INFRASTRUCTURE** : Infrastructure - Habitats, Megacities, Smart Cities, futuristic visions; Transportation (Roads, Railways & Metros, Airports, Seaports, River ways, Sea canals, Tunnels (below ground, under water); Futuristic systems (ex, Hyper Loop)); Energy generation (Hydro, Solar (Photovoltaic, Solar Chimney), Wind, Wave, Tidal, Geothermal, Thermal energy); Water provisioning; Telecommunication needs (towers, above-ground and underground cabling); Awareness of various Codes & Standards governing Infrastructure development; Innovations and methodologies for ensuring Sustainability

**ENVIRONMENT** : Traditional & futuristic methods; Solid waste management, Water purification, Wastewater treatment & Recycling, Hazardous waste treatment; Flood control (Dams, Canals, River interlinking), Multi-purpose water projects. Atmospheric pollution; Global warming phenomena and Pollution Mitigation measures Stationary and non-stationary; Environmental Metrics & Monitoring; Other Sustainability measures; Innovations and methodologies for ensuring Sustainability

**BUILT ENVIRONMENT** : Facilities management, Climate control; Energy efficient built environments and LEED ratings, Recycling, Temperature/ Sound control in built environment, Security systems; Intelligent/ Smart Buildings, Aesthetics of built environment, Role of Urban Arts Commissions; Conservation, Repairs & Rehabilitation of Structures & Heritage structures; Innovations and methodologies for ensuring Sustainability

**CIVIL ENGINEERING PROJECTS** : Environmental Impact Analysis procedures; Waste(materials, manpower, equipment) avoidance/ Efficiency increase; Advanced construction techniques for better sustainability; Techniques for reduction of Green House Gas emissions in various aspects of Civil Engineering Projects New Project Management paradigms & Systems (Ex. Lean Construction), contribution of Civil Engineering to GDP, Contribution to employment (projects, facilities management) Quality of products, Health & Safety aspects for stakeholders; Innovations and methodologies for ensuring Sustainability during Project development

**E. TEXT BOOKS**

T1. Ashley R M., Nowell R., Gersonius B., Walker L. (2011). Surface Water Management and Urban Green Infrastructure. Review of Current Knowledge. Foundation for Water Research FR/R0014

T2. Barry M. (2003) corporate social responsibility – unworkable paradox or sustainable paradigm? Proc ICE Engineering Sustainability 156. Sept Issue ES3 paper 13550. p 129-130

T3. Blackmore J M., Plant R A J. (2008). Risk and resilience to enhance sustainability with application to urban water systems. J. Water Resources Planning and Management. ASCE. Vol. 134, No. 3, May.

T4. Bogle D. (2010) UK's engineering Council guidance on sustainability. Proc ICE Engineering Sustainability 163. June Issue ES2 p61-63

**F. REFERENCE BOOKS**

R1. ŽigaTurk (2014), Global Challenges and the Role of Civil Engineering, Chapter 3 in: Fischinger M. (eds) Performance-Based Seismic Engineering: Vision for an Earthquake Resilient Society. Geotechnical, Geological and Earthquake Engineering, Vol. 32. Springer, Dordrecht

R2. Brito, Ciampi, Vasconcelos, Amarol, Barros (2013) Engineering impacting Social, Economic and Working Environment, 120th ASEE Annual Conference and Exposition

R3. NAE Grand Challenges for Engineering (2006), Engineering for the Developing World, The Bridge, Vol 34, No.2, Summer 2004.

R4. Allen M. (2008) Cleansing the city. Ohio University Press. Athens Ohio.

R5. Ashley R., Stovin V., Moore S., Hurley L., Lewis L., Saul A. (2010). London Tideway Tunnels Programme – Thames Tunnel Project Needs Report – Potential source control and SUDS applications: Land use and retrofit options

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| [CO1] | Understand the importance of Civil Engineering and the impact it has on the Society and at global levels. | 3 | 2 | 1 | 1 | 1 | 1 | 1 | - | - | 1 | 1 | 1 | 2 | 1 | 1 | 1 |
| [CO2] | Understand the impact of Civil Engineering for the various specific fields of human endeavor. | 3 | 2 | 2 | 1 | - | 1 | - | 1 | - | 1 | - | - | 2 | 1 | 2 | 1 |
| [CO3] | Think innovatively to ensure Sustainability. | 3 | 1 | 1 | 2 | 2 | - | 1 | - | - | - | 1 | - | 2 | 2 | 2 | 1 |
| [CO4] | Understand the new civil engineering projects & its impact on society. | 3 | 2 | 1 | 1 | 1 | - | - | - | 1 | 1 | 2 | 1 | 3 | 1 | 1 | 1 |
| [CO5] | Understand the importance of Civil Engineering in shaping & affecting the world. | 3 | 2 | 1 | 1 | 1 | - | 1 | - | - | 1 | - | 1 | 2 | 1 | 2 | 2 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Material Testing & Evaluation Lab

Code: BTE24388

1 Credits | Semester IV

Total Lecture: 30

**A. Introduction:**

- To know properties of cement, aggregate and water used in concrete.
- To understand different characteristics of concrete.
- To learn about role of admixtures in concrete.

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

**[CO1]** Identify different types of cement by performing laboratory tests.
**[CO2]** Know the physical properties of fine and coarse aggregates
**[CO3]** Prepare concrete of required specification.
**[CO4]** **U**nderstand the compression & tensile loading
**[CO5]** Apply relevant admixtures for concreting.

**C. Assessment Plan:**

| **Criteria** | **Description** | **Maximum Marks** |
|---|---|---|
| Continuous Internal Assessment (CIA) | Internal Examination | 5 |
| | Attendance | 5 |
| | Assignment | 5 |
| End Semester Examination(ESE) | End Semester Examination | 35 |
| Total | | 50 |
| Attendance | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

| **Sl.No** | **Name of Practical** |
|---|---|
| 1 | To determine the Specific Gravity of cement. |
| 2 | To determine the Consistency of cement |
| 3 | To determine the initial & Final setting time of cement. |
| 4 | To determine the Soundness of cement. |
| 5 | To determine the sieve analysis of fine aggregate |
| 6 | To determine the Compressive strength of cement mortar cubes. |
| 7 | To determine the Workability of concrete by slump cone test. |
| 8 | To determine the Compressive strength of concrete cubes. |
| 9 | Determine workability of concrete by compaction factor test. |

| | |
|---|---|
| 10 | To determine the tensile strength of TMT bar |

**E. TEXT BOOKS**

T1. E.N. Dowling (1993), Mechanical Behaviour of Materials,Prentice Hall International Edition
T2. American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards (post 2000)
T3. Related papers published in international journals

**F. REFERENCE BOOKS**

R1. Chudley, R., Greeno (2006), 'Building Construction Handbook' (6th ed.),R. ButterworthHeinemann
R2. Khanna, S.K., Justo, C.E.G and Veeraragavan, A, ' Highway Materials and Pavement Testing', Nem Chand& Bros, Fifth Edition
R3. Various related updated & recent standards of BIS, IRC, ASTM, RILEM, AASHTO, etc. corresponding to materialsused for Civil Engineering applications
R4. KyriakosKomvopoulos (2011), Mechanical Testing of Engineering Materials, Cognella

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| [CO1] | Identify different types of cement by performing laboratory tests. | 3 | 2 | 2 | 2 | - | - | - | - | - | 1 | 1 | 2 | 3 | 2 | 1 | - |
| [CO2] | Know the physical properties of fine and coarse aggregates | 3 | 2 | 1 | 1 | - | - | - | 1 | - | 1 | 1 | 2 | 1 | 1 | 2 | - |
| [CO3] | Prepare concrete of required specification. | 3 | 1 | 2 | 1 | 1 | - | - | - | 1 | 1 | 1 | 2 | 1 | 1 | 2 | 1 |
| [CO4] | Understand the compression & tensile loading | 3 | 1 | 2 | 2 | - | - | 1 | 1 | - | 1 | - | 3 | 1 | 1 | - | 1 |
| [CO5] | Apply relevant admixtures for concreting. | 3 | 1 | 1 | 2 | - | 1 | - | - | - | - | - | 2 | 1 | 1 | - | 1 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Engineering Geology Lab

Code:BTE24062

1 Credits | Semester IV

Total Lecture: 30

**A. Introduction:**

- Use suitable software to examine geology, soil, geologic hazard, and NEHRP data to characterize a geologic site
- Calculate the bulk properties of rocks and unconsolidated sediments such as density, void ratio, water contents, and unit weights.
- To identity different rocks & minerals based on physical properties

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

**[CO1]** Understand the site characterization and collect, analyze, and report geologic data using standards in engineering practice

**[CO2]** Understand the fundamentals of the engineering properties of Earth materials and fluids.

**[CO3]** Understand the Rock mass characterization and the mechanics of planar rockslides and topples.

**[CO4]** Use suitable software to examine geology, soil, geologic hazard, and NEHRP data to characterize a geologic site.

**[CO5]** Understand the mechanics of soils and fluids and their influence on settlement, liquefaction, and soil slope stability

**C. Assessment Plan:**

| Criteria | Description | Maximum Marks |
|---|---|---|
| Continuous Internal Assessment (CIA) | Internal Examination | 5 |
| | Attendance | 5 |
| | Assignment | 5 |
| End Semester Examination(ESE) | End Semester Examination | 35 |
| Total | | 50 |
| Attendance | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

| Sl.No | Name of Practical |
|---|---|
| 1 | To study the Internal Structure of the earth |

| | |
|---|---|
| 2 | To study Physical properties & Identification of Minerals.(Asbestos,graphite, magnetite) |
| 3 | To study Physical properties & Identification of Minerals.(Feldspar Pink,Alabaster,Fire Clay) |
| 4 | To study Physical properties & Identification of Minerals.(Quartz Milky,ChinaClay,Calcite) |
| 5 | To study Physical Properties & identification of Rocks.(quartzite,Anthracite,RockSalt,Sandstone, Shale, Diatomite,Flint,Dolomite) |
| 6 | To study Physical Properties & identification of Rocks.(Lime stone,Basalt, Granite) |
| 7 | To study about folds,faults& joints |
| 8 | To study about earthquakes. |
| 9 | Study of physical properties of minerals. |
| 10 | Study of different group of minerals. |

**E. TEXT BOOKS**

T1. Geology for Geotechnical Engineers, J.C.Harvey, Cambridge University Press (1982).

**F. REFERENCE BOOKS**

R1. Engineering and General Geology, Parbin Singh, 8th Edition (2010), S K Kataria& Sons.
R2. Text Book of Engineering Geology, N. ChennaKesavulu, 2nd Edition (2009), Macmillan Publishers India.

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| [CO1] | Understand the site characterization and collect, analyze, and report geologic data using standards in engineering practice | 1 | 1 | 2 | 1 | 1 | 1 | - | 1 | - | 1 | - | 2 | 2 | 2 | 3 | 2 |
| [CO2] | Understand the fundamentals of the engineering properties of Earth materials and fluids. | 3 | 1 | 1 | 2 | 1 | - | - | - | 1 | - | 1 | 2 | 3 | 2 | 1 | 2 |
| [CO3] | Understand the Rock mass characterization and the mechanics of planar rockslides and topples. | 3 | 2 | 1 | 1 | - | - | 1 | - | - | - | - | 3 | 2 | 2 | 1 | - |
| [CO4] | Use suitable software to examine geology, soil, geologic hazard, and NEHRP data to characterize a geologic site. | 2 | 1 | - | - | - | 1 | - | 1 | - | 1 | - | 2 | 2 | 1 | 1 | - |
| [CO5] | Understand the mechanics of soils and fluids and their influence on settlement, liquefaction, and soil slope stability | 2 | 1 | 1 | 1 | 1 | - | 2 | - | - | 1 | - | 3 | 2 | 1 | - | - |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Geotechnical Engineering Lab

Code:BTE24063

1Credits | Semester IV

Total Lecture: 30

**A. Introduction:**

- Understand the different types of soil based on their formation mechanism.
- Evaluate the stiffness of soil using shear strength parameters
- Perform various laboratory experiments to determine moisture content, specific gravity
- Perform field experiments to estimate the field density of the soil mass.

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

**[CO1]** Understand the various phase diagrams and derive various phase relationships of the soil
**[CO2]** Classify any soils based on their particle size distribution and index properties
**[CO3]** **C**alculate the effective permeability of anisotropic soil mass
**[CO4]** Evaluate ground settlements against time.
**[CO5]** Understand the significance of shear strength parameters in various geotechnical analyses

**C. Assessment Plan:**

| Criteria | Description | Maximum Marks |
|---|---|---|
| Continuous Internal Assessment (CIA) | Internal Examination | 5 |
| | Attendance | 5 |
| | Assignment | 5 |
| End Semester Examination(ESE) | End Semester Examination | 35 |
| Total | | 50 |
| Attendance | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

| Sl.No | Name of Practical |
|---|---|
| 1 | To determine the moisture content of the soil by oven drying method. |
| 2 | To determine the insitu density of soil by core cutter method. |
| 3 | To determine the specific gravity of soil solids by Pycnometer method |

| | |
|---|---|
| 4 | To determine the partical size distribution of soil by Sieving & Hydrometer analysis |
| 5 | To determined the liquid limit & plastic limit of soil by Cassagrange apparatus & cone penetrometer apparatus |
| 6 | To determine the shear strength parameters of soil by direct shear test. |
| 7 | To determine the compressive strength parameters of soil by unconfined compression test |
| 8 | To determine the shear strength parameters of soil by Vane shear test |
| 9 | Determination of coefficient of permeability by constant head test |
| 10 | Determination of shear strength of soil using tri-axial shear test |

**E. TEXT BOOKS**

T1. Soil Mechanics in Engineering Practice by Karl Terzaghi, Ralph B. Peck, and GholamrezaMesri.

T2. Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering (Civil and Environmental Engineering) by V.N.S. Murthy

**F. REFERENCE BOOKS**

R1. Soil Mechanics by Craig R.F., Chapman & Hall

R2. Fundamentals of Soil Engineering by Taylor, John Wiley & Sons

R3. An Introduction to Geotechnical Engineering, by Holtz R.D. and Kovacs, W.D., Prentice Hall, NJ

R4. Principles of Geotechnical Engineering, by Braja M. Das, Cengage Learning

R5. Principles of Foundation Engineering, by Braja M. Das, Cengage Learning

R6. Essentials of Soil Mechanics and Foundations: Basic Geotechnics by David F. McCarthy

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| [CO1] | Understand the various phase diagrams and derive various phase relationships of the soil | 3 | 2 | 2 | 1 | 1 | - | 1 | 1 | 1 | 1 | 1 | 3 | 2 | 1 | 3 | 1 |
| [CO2] | Classify any soils based on their particle size distribution and index properties | 3 | 2 | 1 | 1 | 1 | 1 | - | - | 1 | - | 1 | 3 | 2 | 1 | 2 | 1 |
| [CO3] | Calculate the effective permeability of anisotropic soil mass | 3 | 1 | 2 | 1 | 1 | - | 1 | - | 1 | - | 1 | 3 | 2 | 2 | 1 | 2 |
| [CO4] | Evaluate ground settlements against time. | 3 | 2 | 2 | 1 | - | 1 | - | 1 | - | 1 | - | 3 | 1 | 1 | 2 | 1 |
| [CO5] | Understand the significance of shear strength parameters in various geotechnical analyses | 3 | 1 | 2 | 2 | - | - | 1 | - | - | 1 | 1 | 3 | 2 | 1 | 2 | 1 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Fluid Mechanics Lab

Code:BTE24086

1Credits | Semester IV

Total Lecture: 30

**A. Introduction:**

- To understand parameters associated with fluid flow and hydrostatic pressure.
- To know head loss and water hammer in fluid flowing through pipes.
- To learn different types of pumps and their uses.

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

**[CO1]** Measure pressure and determine total hydrostatic pressure for different conditions.
**[CO2]** Understand various parameters associated with fluid flow
**[CO3]** Determine head loss of fluid flow through pipes
**[CO4]** Find the fluid flow parameters in open channels.
**[CO5]** Understand the various types of flow

**C. Assessment Plan:**

| Criteria | Description | Maximum Marks |
|---|---|---|
| Continuous Internal Assessment (CIA) | Internal Examination | 5 |
| | Attendance | 5 |
| | Assignment | 5 |
| End Semester Examination(ESE) | End Semester Examination | 35 |
| Total | | 50 |
| Attendance | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

| Sl.No | Name of Practical |
|---|---|
| 1 | Measurement of viscosity |
| 2 | Study of Pressure Measuring Devices |
| 3 | To determine the metacentric height of a Floating Body |
| 4 | Hydrostatics Force on Flat Surfaces/Curved Surfaces |
| 5 | Verification of Bernoulli‘s Theorem |

| | |
|---|---|
| 6 | To calibrate Venturimeter and to find out discharge in a pipe |
| 7 | To calibrate orifice and to find out discharge in a pipe |
| 8 | To determine the coefficient of discharge through V notch |
| 9 | Flow Visualisation -Ideal Flow |
| 10 | Length of establishment of flow |

**E. TEXT BOOKS**

T1. Khurmi R S, Hydraulics, Fluid Mechanics, Hydraulic machines, S. Chand Publishers
T2. Rajput, R K, Fluid Mechanics, S Chand, New Delhi.
T3. Ojha, C S P, Berndtsson, R, and Chandramoulli P. N., Fluid Mechanics and Machinery, Oxford University Press, New Delhi.

**F. REFERENCE BOOKS**

R1. Modi, P. N.and Seth, S.M., Hydraulics and Fluid Mechanics, Standard book house, Delhi.
R2. Theory and Applications of Fluid Mechanics, K. Subramanya, Tata McGraw Hill.
R3. S.S. Rattan, Fluid Mechanics & Hydraulic Machines, Khanna Book Publishing Co., New Delhi
R4. Ramamrutham, and Narayan, R., Hydraulics, Fluid Mechanics and Fluid Machines, DhanpatRai Publishing Company, New Delhi.

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| [CO1] | Measure pressure and determine total hydrostatic pressure for different conditions. | 1 | 1 | 2 | 1 | 1 | 1 | - | 1 | - | 1 | - | 2 | 2 | 2 | 3 | 2 |
| [CO2] | Understand various parameters associated with fluid flow | 3 | 1 | 1 | 2 | 1 | - | - | - | 1 | - | 1 | 2 | 3 | 2 | 1 | 2 |
| [CO3] | Determine head loss of fluid flow through pipes | 3 | 2 | 1 | 1 | - | - | 1 | - | - | - | - | 3 | 2 | 2 | 1 | - |
| [CO4] | Find the fluid flow parameters in open channels. | 2 | 1 | - | - | - | 1 | - | 1 | - | 1 | - | 2 | 2 | 1 | 1 | - |
| [CO5] | Understand the various types of flow | 2 | 1 | 1 | 1 | 1 | - | 2 | - | - | 1 | - | 3 | 2 | 1 | - | - |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**


Syllabus of

**B.Tech. in Civil Engineering**

**Semester-V**

**ARKAJAIN University, Jharkhand**
School of Engineering & IT
Department of Engineering
Faculty – Bachelor of Technology in Civil Engineering
**Scheme of Study (w.e.f Batch 2020-24)**

## SEMESTER –I

| Sr. No. | Name of the Subject | Group | L-T-P | Credit |
|---|---|---|---|---|
| 1 | Engineering Mathematics–I | A & B | 3-1-0 | 4 |
| 2 | Engineering Chemistry | A | 3-0-0 | 3 |
| | Programming for Problem Solving | B | 3-0-0 | 3 |
| 3 | Basic Electrical Engineering | A | 3-1-0 | 4 |
| | Engineering physics | B | 3-1-0 | 4 |
| 4 | Engineering Mechanics | A | 3-0-0 | 3 |
| | English for Communication | B | 3-0-0 | 3 |
| 5 | Constitution of India | B | 0-0-0 | 0 |
| | **Practical** | | | |
| 6 | Engineering Chemistry Lab | A | 0-0-1 | 1 |
| | Engineering Physics Lab | B | 0-0-1 | 1 |
| 7 | Basic Electrical Engineering Lab | A | 0-0-1 | 1 |
| | Programming for Problem Solving Lab | B | 0-0-2 | 2 |
| 8 | Engineering Mechanics Lab | A | 0-0-1 | 1 |
| 9 | Engineering Graphics & Design | A | 0-0-2 | 2 |
| | Workshop Practices | B | 0-0-2 | 2 |
| | TOTAL | A or B | 12-2-5 | 19 |

# SCHEME OF THE STUDY
# SEMESTER –II

| Sr. No. | Name of the Subject | Group | L-T-P | Credit |
|---|---|---|---|---|
| 1 | Engineering Mathematics–II | A & B | 3-1-0 | 4 |
| 2 | Engineering Chemistry | B | 3-0-0 | 3 |
| | Programming for Problem Solving | A | 3-0-0 | 3 |
| 3 | Basic Electrical Engineering | B | 3-1-0 | 4 |
| | Engineering physics | A | 3-1-0 | 4 |
| 4 | Engineering Mechanics | B | 3-0-0 | 3 |
| | English for Communication | A | 3-0-0 | 3 |
| 5 | Constitution of India | A | 0-0-0 | 0 |
| | **Practical** | | | |
| 6 | Engineering Chemistry Lab | B | 0-0-1 | 1 |
| | Engineering Physics Lab | A | 0-0-1 | 1 |
| 7 | Basic Electrical Engineering Lab | B | 0-0-1 | 1 |
| | Programming for Problem Solving Lab | A | 0-0-2 | 2 |
| 8 | Engineering Mechanics Lab | B | 0-0-1 | 1 |
| | Engineering Graphics& Design | B | 0-0-2 | 2 |
| 9 | Workshop Practices | A | 0-0-2 | 2 |
| | TOTAL | A or B | 12-2-5 | 19 |

# SEMESTER –I (Group-A)

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Engineering Chemistry | BSC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 2 | Engineering Mathematics–I | BSC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 3 | Basic Electrical Engineering | ESC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 4 | Engineering Mechanics | ESC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| | **Practical** | | | | | | | | |
| 5 | Engineering Chemistry Lab | BSC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 6 | Basic Electrical Engineering Lab | ESC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 7 | Engineering Mechanics Lab | ESC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 8 | Engineering Graphics& Design | ESC | 2 | 4 | 50 | 35 | 5 | 5 | 5 |
| | **TOTAL** | | **19** | **24** | **600** | **420** | **100** | **40** | **40** |

# SEMESTER I (Group-B)

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Engineering physics | BSC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 2 | Engineering Mathematics –I | BSC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 3 | Programming for Problem Solving | ESC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | English for Communication | HSMC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 5 | Constitution of India | MC | 0 | 2 | 50 | 35 | 10 | 2.5 | 2.5 |
| | **Practical** | | | | | | | | |
| 6 | Engineering physics Lab | BSC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 7 | Programming for Problem Solving Lab | ESC | 2 | 4 | 50 | 35 | 5 | 5 | 5 |
| 8 | Workshop Practices | ESC | 2 | 4 | 50 | 35 | 5 | 5 | 5 |
| | **TOTAL** | | **19** | **26** | **600** | **420** | **105** | **37.5** | **37.5** |

# SEMESTER II (Group-A)

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Engineering physics | BSC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 2 | Engineering Mathematics –II | BSC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 3 | Programming for Problem Solving | ESC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | English for Communication | HSMC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 5 | Constitution of India | MC | 0 | 2 | 50 | 35 | 10 | 2.5 | 2.5 |
| | **Practical** | | | | | | | | |
| 6 | Engineering physics Lab | BSC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 7 | Programming for Problem Solving Lab | ESC | 2 | 4 | 50 | 35 | 5 | 5 | 5 |
| 8 | Workshop Practices | ESC | 2 | 4 | 50 | 35 | 5 | 5 | 5 |
| | **TOTAL** | | **19** | **26** | **600** | **420** | **105** | **37.5** | **37.5** |

# SEMESTER –II (Group-B)

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Engineering Chemistry | BSC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 2 | Engineering Mathematics–II | BSC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 3 | Basic Electrical Engineering | ESC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 4 | Engineering Mechanics | ESC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| | **Practical** | | | | | | | | |
| 5 | Engineering Chemistry Lab | BSC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 6 | Basic Electrical Engineering Lab | ESC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 7 | Engineering Mechanics Lab | ESC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 8 | Engineering Graphics& Design | ESC | 2 | 4 | 50 | 35 | 5 | 5 | 5 |
| | **TOTAL** | | **19** | **24** | **600** | **420** | **100** | **40** | **40** |

# SEMESTER-III

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA * | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Engineering Mathematics -III | BSC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 2 | Biology for Engineers | BSC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 3 | Surveying &Geomatics | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | Mechanics of Solid | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 5 | Introduction to Civil Engineering | HSMC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 6 | Environmental Science | MC | 0 | 2 | 50 | 35 | 10 | 2.5 | 2.5 |
| | **Practical** | | | | | | | | |
| 7 | Surveying &Geomatics Lab | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 8 | Mechanics of Solid | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 9 | Computer Aided Civil Engineering Drawing | ESC | 2 | 4 | 50 | 35 | 5 | 5 | 5 |
| | **TOTAL** | | **20** | **26** | **700** | **490** | **125** | **42.5** | **42.5** |

# SEMESTER-IV

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Material Testing & Evaluation | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 2 | Engineering Geology | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 3 | Fluid Mechanics | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | Structural Analysis - I | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 5 | Geotechnical Engineering | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 6 | Civil Engineering-Societal & Global Impact | HSMC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| | **Practical** | | | | | | | | |
| 7 | Material Testing & Evaluation | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 8 | Engineering Geology Lab | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 9 | Geotechnical Engineering Lab | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 10 | Fluid Mechanics Lab | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| | **TOTAL** | | **22** | **26** | **800** | **560** | **140** | **50** | **50** |

# SEMESTER V

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Hydraulic Engineering | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 2 | Structural Analysis II | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 3 | Hydrology & Water Resource Engineering | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | Environmental Engineering-I | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 5 | Open Elective I Humanities I<br>Professional Practice, Law & Ethics<br>Organizational Behavior | HSMC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 6 | Disaster Preparedness & Planning | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 7 | Essence of Indian Knowledge Tradition | MC | 0 | 2 | 50 | 35 | 10 | 2.5 | 2.5 |
| | PRACTICAL | | | | | | | | |
| 8 | Hydraulic Engineering Lab | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 9 | Structural Analysis II Lab | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 10 | Summer Internship –I (3-4 week) | PROJ | 2 | 0 | 50 | 35 | 15 | 0 | 0 |
| | **TOTAL** | | **22** | **24** | **800** | **560** | **155** | **42.5** | **42.5** |

# SEMESTER VI

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory / Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Construction Engineering & Management | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 2 | Transportation Engineering-I | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 6 | Engineering Economics, Estimation & Costing | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 3 | Elective I<br>Rock Mechanics<br>Foundation Engineering | PEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | Elective II<br>Environmental Engineering II<br>Rural water supply & Onsite Sanitation System | PEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 6 | Elective III<br>Design of Steel Structure<br>Earthquake Engineering | PEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 7 | Design of Concrete Structures-I | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| | **Practical** | | | | | | | | |
| 8 | Transportation Engineering I Lab | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| | **TOTAL** | | **22** | **23** | **750** | **525** | **145** | **40** | **40** |

# SEMESTER VII

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Elective IV<br>Air and Noise Pollution and Control<br>Solid and hazardous Waste Management | PEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 2 | Elective V<br>Design of Concrete Structure - II<br>Prestressed Concrete | PEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 3 | Open Elective II<br>Metro System & Engineering<br>History of Science & Engineering | OEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | River Engineering | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| | **Practical** | | | | | | | | |
| 5 | Minor Project | PROJ | 3 | 6 | 100 | 70 | 30 | 0 | 0 |
| 6 | Summer Internship –II –(4-6 Week) | PROJ | 3 | 0 | 100 | 70 | 30 | 0 | 0 |
| | **TOTAL** | | **18** | **18** | **600** | **420** | **140** | **20** | **20** |

# SEMESTER VIII

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Elective VI<br>Bridge Engineering<br>Ground Water Engineering | PEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 2 | Elective VII<br>Railway Engineering<br>Traffic Engineering and Management | PEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 3 | Open Elective III<br>Soft Skills and Interpersonal Communication<br>Human Resource Development and Organizational Behavior | OEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | Open Elective IV<br>Civil Engineering Design-I<br>Geographic Information Systems and Science | OEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| | **Practical** | | | | | | | | |
| 5 | Major Project | PROJ | 8 | 16 | 200 | 140 | 60 | 0 | 0 |
| 6 | Extra- Curricular/ Co-Curricular Activity | PROJ | 0 | 0 | 100 | 70 | 30 | 0 | 0 |
| | **TOTAL** | | **20** | **28** | **700** | **490** | **170** | **20** | **20** |

## Distribution of Credit across 8 semesters:

| Sl. No | Type of Paper | No. of Paper | Total Credit |
|---|---|---|---|
| 1 | Humanities and Social Sciences including Management courses **(HSMC)** | 4 | 12 |
| 2 | Basic Science courses**(BSC)** | 8 | 24 |
| 3 | Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc**(ESC)** | 9 | 20 |
| 4 | Professional core courses (**PCC)** | 26 | 60 |
| 5 | Professional Elective courses relevant to chosen specialization/branch**(PEC)** | 7 | 21 |
| 6 | Open subjects – Electives from other technical and /or emerging subjects (**OEC)** | 3 | 9 |
| 7 | Project work, seminar and internship in industry or elsewhere**(PROJ)** | 5 | 16 |
| 8 | Mandatory Courses [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Knowledge Tradition]**(MC)** | 3 | 0 |
| | **Total** | 65 | 162 |

**CIA – Continuous Internal Assessment – Based on Projects / Assignment during the semester**

**Note:**
**AICTE Activity Points to be earned by students admitted to Degree program (For more details refer to Chapter 6, AICTE, Activity Point Program, Model Internship Guidelines):**
**Every regular student, who is admitted to the 4 year Degree program, is required to earn 100 activity points in addition to the total credits earned for the program. Students entering 4 years Degree Program through lateral entry are required to earn 75 activity points in addition to the total credits earned for the program. The activity points earned by the student shall be reflected on the students 8th Semester grade card.**
**The activities to earn the points can be spread over the duration of the course. However, minimum prescribed duration should be fulfilled.**
**Activity Points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression.**
**Incase student fail to earn the prescribed activity points, Eight semester Grade Card shall be issued only after earning the required activity Points.**
**Students shall be eligible for the award of degree only after the release of the Eight Semester grade card.**

***There are two groups (A & B) in semester 1 & 2. The Group division will be decided by The Dean SoE& IT before commencement of classes***

**ARKAJAIN University, Jharkhand**
School of Engineering & IT
Department of Engineering
Faculty – Bachelor of Technology in Civil Engineering
**PROGRAM OUTCOMES &PROGRAM SPECIFIC OUTCOMES**

**PROGRAM OUTCOMES**

After completing this undergraduate program, a learner:

**[PO.1].Engineering knowledge:** An ability to apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to get the solution of the engineering problems.

**[PO.2].Problem analysis:** Ability to Identify, formulates, review research literature, and analyze complex engineering problems.

**[PO.3].Design/Development of Solutions:** Ability to design solutions for complex Engineering Problems by considering social, Economic and Environmental aspects.

**[PO.4].Conduct investigations of complex problems:** Use research-based knowledge to design, conduct analyses experiments to get valid conclusion.

**[PO.5]. Modern tool usage:** ability to create, select, and apply appropriate techniques, and to model complex engineering activities with an understanding of the limitations.

**[PO.6]. The engineer and society:** Ability to apply knowledge by considering social health, safety, legal and cultural issues.

**[PO.7]. Environment and sustainability:** Understanding of the impact of the adopted engineering solutions in social and environmental contexts.

**[PO.8]. Ethics:** Understanding of the ethical issues of the civil engineering and applying ethical principles in engineering practices.

**[PO.9]. Individual and teamwork:** Ability to work effectively as an individual or in team, as a member or as a leader.

**[PO.10]. Communication:** An ability to communicate clearly and effectively through different modes of communication.

**[PO.11]. Project management and finance:** Ability to handle project and to manage finance related issue.

**[PO.12]. Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning.

**PROGRAM SPECIFIC OUTCOMES**

**[PSO.1]. Professional skills** – The ability to analyze and design civil engineering structures as per the guidelines in Indian standards and other relevant codes like buildings, bridges, tunnels ,railways, airports, water and sewage treatment plants etc

**[PSO.2]. Problem solving skills** – The ability to managed large infrastructural projects by making use of latest techniques of project management for optimum utilization of resources via man, material and money.

**[PSO.3]. Successful Career and Entrepreneurship** – Strong desire to acquire modern scientific knowledge by pursuing higher studies, which will lead them to identify problems in the civil engineering domains and thereby become entrepreneur to propose solution

**[PSO.4]. Communication:** Communicate effectively on complex engineering activities with the engineering community & with society at large, such as, being able to comprehend & write effective reports & design documentation, make effective presentations & give & receive clear instructions

# Subject: Hydraulic Engineering

Code:BTE25089

3 Credits | Semester V

**A. Introduction:**

- To improve the students understanding of the principles of fluid mechanics towards its application in Hydraulic analyses.
- To make students understand the hydraulic concepts and their application in hydraulic design and engineering applications.

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

**[CO1]** Understand the principle of operation of Hydraulic machineries (Pumps and Turbines).

**[CO2]** Solve problems in uniform, gradually and rapidly varied flows in steady state conditions.

**[CO3]** Relate the theoretical and practical problems of Hydraulic Engineering.

**[CO4]** Develop dimensional analysis and similitude to present and interpret experimental data and models in fluid engineering problems.

**[CO5]** Design calculations through pipe networks and various hydraulic structures such as Weirs.

**C. Assessment Plan:**

| Criteria | Description | Maximum Marks |
|---|---|---|
| **Continuous Internal Assessment (CIA)** | Internal Examination | 20 |
| | Attendance | 5 |
| | Assignment | 5 |
| **End Semester Examination(ESE)** | End Semester Examination | 70 |
| **Total** | | 100 |
| **Attendance** | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

**LAMINAR & TURBULENT FLOW**: Laminar flow through: circular pipes, parallel plates. Stoke's law, Measurement of viscosity Turbulent Flow- Reynolds experiment, Transition from laminar to turbulent flow. Definition of turbulence, Causes of turbulence, instability, mechanism of turbulence and effect of turbulent flow in pipes. Reynolds stresses, theories of turbulence, Prandtl's mixing length theory, velocity distribution equation. Resistance to flow of fluid in smooth and rough pipes, Moody's diagram

**BOUNDARY LAYER & OPEN-CHANNEL FLOW** : Boundary Layer Analysis- Assumption and concept of boundary layer theory. Boundary-layer thickness, displacement, momentum & energy thickness, laminar and turbulent boundary layers on a flat plate; laminar sub-layer, smooth

and rough boundaries. Local and average friction coefficients. Separation and Control. Open Channel Flow-Comparison between open channel flow and pipe flow, geometrical parameters of a channel, classification of open channels, classification of open channel flow, Velocity Distribution of channel section.

**UNIFORM & NON-UNIFORM-FLOW** : Uniform Flow-Continuity Equation, Energy Equation and Momentum Equation, Characteristics of uniform flow, Chezy's formula, Manning's formula. Factors affecting Manning's Roughness Coefficient "n_. Most economical section of channel. Computation of Uniform flow, Normal depth. Non-Uniform Flow- Specific energy, Specific energy curve, critical flow, discharge curve Specific force Specific depth, and Critical depth. Channel Transitions. Measurement of Discharge and Velocity – Venturi Flume, Broad Crested Weir. Measurement of Velocity- Current meter, Floats, Gradually Varied Flow-Dynamic Equation of Gradually Varied Flow, Classification of channel bottom slopes, Classification of surface profile, Characteristics of surface profile. Computation of water surface profile by graphical, numerical and analytical approaches. Direct Step method, Graphical Integration method and direct integration method.

**HYDRAULIC JUMP & PIPE FLOW** : Hydraulic Jump- Theory of hydraulic jump, Elements and characteristics of hydraulic jump in a rectangular Channel, length and height of jump, location of jump, Types, applications of hydraulic jump. Energy dissipation, Positive and negative surges. Dynamics of Fluid Flow- Momentum principle, applications: Force on plates, pipe bends, moments of momentum equation, Flow through Pipes: Loss of head through pipes, Darcy- Wiesbatch equation, minor losses, total energy equation, hydraulic gradient line, Pipes in series, equivalent pipes, pipes in parallel, flow through laterals, flows in dead end pipes, siphon, power transmission through pipes, nozzles. Analysis of pipe networks: Hardy Cross method, water hammer in pipes and control measures, branching of pipes, three reservoir problem

**DIMENSIONAL ANALYSIS & FLUID DYNAMICS** : Dimensional Analysis and Hydraulic Similitude: Dimensional homogeneity, Rayleigh method, Buckingham's Pi method and other methods. Dimensionless groups. Similitude, Model studies, Types of models. Application of dimensional analysis and model studies to fluid flow problem.

**E. TEXT BOOKS**

T1. Hydraulics and Fluid Mechanics, P.M. Modi and S.M. Seth, Standard Book House
T2. Theory and Applications of Fluid Mechanics, K. Subramanya, Tata McGraw Hill.
T3. Open channel Flow, K. Subramanya, Tata McGraw Hill.

**B. REFERENCE BOOKS**

R1. Open Channel Hydraulics, VenTe Chow, Tata McGraw Hill.
R2. Burnside, C.D., "Electromagnetic Distance Measurement," Beekman Publishers, 1971.

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O 1 | PS O 2 | PS O 3 | PS O 4 |
| [CO1] | Understand the principle of operation of Hydraulic machineries (Pumps and Turbines). | 3 | 2 | 2 | 1 | - | - | - | - | - | - | - | 2 | 2 | 1 | 1 | - |
| [CO2] | Solve problems in uniform, gradually and rapidly varied flows in steady state conditions. | 2 | 3 | 3 | 3 | 2 | 1 | - | - | - | - | - | 2 | 2 | 3 | 1 | - |
| [CO3] | Relate the theoretical and practical problems of Hydraulic Engineering. | 2 | 3 | 3 | 2 | 2 | 2 | 2 | - | - | - | - | 1 | 2 | 3 | - | 1 |
| [CO4] | Develop dimensional analysis and similitude to present and interpret experimental data and models in fluid engineering problems. | 2 | 1 | 2 | 1 | - | - | - | - | - | - | - | 2 | - | 2 | - | - |
| [CO5] | Design calculations through pipe networks and various hydraulic structures such as Weirs. | 3 | 2 | 3 | 2 | 2 | 1 | 1 | 1 | 1 | - | - | 2 | 3 | 3 | 1 | - |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Structural Analysis-II

Code:BTE25090

3 Credits | Semester V

Total Lecture: 45 Total Tutorial: 9

**A. Introduction:**

- Apply their knowledge of structural mechanics in addressing design problems of structural engineering
- Identify and analyse Determinate and Indeterminate structures.
- Analyse structures using Slope-Deflection and Moment Distribution method
- Explain the comparative advantages of analysis using Flexibility and Stability Method
- Apply the knowledge of Plastic Analysis in addressing design problems

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

**[CO1]** Utilize the knowledge of structural mechanics in addressing design problems of Structural engineering.

**[CO2]** Apply the knowledge of Plastic Analysis in addressing Design problems.

**[CO3]** Analyze structures using Slope-Deflection and Moment-Distribution Method.

**[CO4]** Judge the comparative advantages of analysis using Flexibility and Stability Method.

**[CO5]** Develop shape factors of simple sections.

**C. Assessment Plan:**

| Criteria | Description | Maximum Marks |
|---|---|---|
| **Continuous Internal Assessment (CIA)** | Internal Examination | 20 |
| | Attendance | 5 |
| | Assignment | 5 |
| **End Semester Examination(ESE)** | End Semester Examination | 70 |
| **Total** | | 100 |
| **Attendance** | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

**SLOPE DEFLECTION METHOD:** Introduction Sign Convention, Development of Slope-Deflection equation, Analysis of continuous beams, Analysis of orthogonal rigid plane including sway frames with kinematic indeterminacy

**MOMENT DISTRIBUTION METHOD:** Introduction, Definition of terms, Development of method, Analysis of continuous beams, Analysis of orthogonal rigid plane including swat frames with kinematic indeterminacy.

**FLEXIBILITY METHOD:** Introduction, Axes and coordinates, Flexibility matrix, Analysis of continuous beams and plane trusses using system approach, Analysis of orthogonal rigid frames using system approach

**STIFFNESS METHOD:** Introduction, Stiffness matrix, Analysis of continuous beams and plane trusses using system approach, Analysis of orthogonal rigid frames using system approach

**PLASTIC ANALYSIS:** Introduction, Basic concepts of Plastic Analysis, Shape factors of simple sections, Equilibrium and mechanism method, Collapse loads for simple and continuous beams

**E. TEXT BOOKS**

T1. Negi, L., Jehangir, R.,"Structural Analysis:, Tata McGraw Hill Publications Co. Ltd.
T2. Gupta, R., Pandit, G.S., Gupta, S.P., "Theory of Structurs", Tata McGraw Hill Publications Co. Ltd.

**F. REFERENCE BOOKS**

R1. Wang, C.K., "Intermediate Structural Analysis", McGraw Hill, New Delhi, 1983.

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| [CO1] | Utilize the knowledge of structural mechanics in addressing design problems of Structural engineering. | 2 | 3 | 1 | 3 | 1 | 1 | - | - | - | - | - | 2 | 2 | 3 | 1 | - |
| [CO2] | Apply the knowledge of Plastic Analysis in addressing Design problems. | 3 | 3 | 2 | 2 | 1 | 1 | 1 | - | 1 | - | - | 2 | 2 | 3 | 1 | - |
| [CO3] | Analyze structures using Slope-Deflection and Moment-Distribution Method. | 2 | 3 | 2 | 3 | 1 | - | - | - | - | - | - | 1 | 1 | 3 | - | - |
| [CO4] | Judge the comparative advantages of analysis using Flexibility and Stability Method. | 2 | 3 | 1 | 2 | 1 | - | - | - | - | - | - | 1 | 1 | 2 | 1 | - |
| [CO5] | Develop shape factors of simple sections. | 2 | 2 | 1 | 1 | - | - | - | - | - | - | - | 1 | 1 | 2 | 1 | - |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Hydrology & Water Resource Engineering

Code:BTE25091

3 Credits | Semester V

Total Lecture: 45 Total Tutorial: 9

**A. Introduction:**

- To introduce the student to the physical processes of hydrologic cycle, the fundamentals of hydrologic analysis and elements of design hydrology.
- To give an insight on how to use engineering hydrology and its application in everyday life.
- To develop an idea about engineering hydrology that enables us to find out the relationship between a catchment's surface water and groundwater resources

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

**[CO1]** Explain the process governing transfer of water between atmosphere, land, subsurface and natural channels and the quality of water in aquifers, rivers, lakes and reservoirs.

**[CO2]** Interpret hydrological parameter measurement techniques.

**[CO3]** Examine simple hydrological models in Environmental engineering applications.

**[CO4]** Quantify the process controlling water flow and sediment transport in catchments.

**[CO5]** Design water distribution systems and Dams.

**C. Assessment Plan:**

| Criteria | Description | Maximum Marks |
|---|---|---|
| **Continuous Internal Assessment (CIA)** | Internal Examination | 20 |
| | Attendance | 5 |
| | Assignment | 5 |
| **End Semester Examination(ESE)** | End Semester Examination | 70 |
| **Total** | | 100 |
| **Attendance** | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

**Introduction** : Definitions, functions and advantages of irrigation, present status of irrigation in India, classification for agriculture, soil moisture and crop water relations, Irrigation water quality. Consumptive use of water, principal Indian crop seasons and water requirements, multiple cropping, hybrid crops, water harvesting and conservation

**Canal Irrigation** : Types of canals, parts of canal irrigation system, channel alignment, assessment of water requirements, estimation of channel losses, design of channels, regime and semi theoretical approaches (Kennedy's Theory, Lacey's Theory), cross section of channels, silt control in canals.

Water Distribution System: Rotational delivery (Warabandi, JamaBandi, KhasraBandi, SajraSheets), continuous delivery and delivery on demand, Role of command area development authority, Functions and organizational structures

**Distribution of Canal Water :** System of regulation and control, outlets, assessment of canal revenue.

**Hydraulics of Alluvial Rivers:** Critical tractive force, regimes of flow, resistance relationship for natural streams, bed load, suspended load and total equations, different stages of rivers, meandering, aggradations, and degradation, river training & bank protection works.

**Water Logging** : Causes, preventive and curative measures, drainage of irrigated lands, saline and alkaline lands, types of channels lining and design of lined channel.

**Well Irrigation:** Open wells and tube wells, types of tube wells, duty of tube well water.

**Hydrology** : Definition, Hydrologic cycle, Application to Engineering problems, measurement of rainfall, rain gauge, peak flow, flood frequency method, catchment area formulae, Flood hydrograph, Rainfall analysis, Infiltration, Run off, Unit hydrograph and its determination, Estimation of runoff.

**E. TEXT BOOKS**

T1. K Subramanian, Engineering Hydrology, Mc-Graw Hill.
T2. G L Asawa, Irrigation Engineering, Wiley Eastern
T3. L W Mays, Water Resources Engineering, Wiley.
T4. C S P Ojha, R Berndtsson and P Bhunya, Engineering Hydrology, Oxford.

**F. REFERENCE BOOKS**

R1. K N Muthreja, Applied Hydrology, Tata Mc-Graw Hill.
R2. K Subramanian, Water Resources Engineering through Objective Questions, Tata Mc-Graw Hill.
R3. J D Zimmerman, Irrigation, John Wiley & Sons

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| [CO1] | Explain the process governing transfer of water between atmosphere, land, subsurface and natural channels and the quality of water in aquifers, rivers, lakes and reservoirs. | - | - | - | 2 | 1 | 3 | 2 | - | 1 | 1 | - | 2 | 1 | - | 1 | 1 |
| [CO2] | Interpret hydrological parameter measurement techniques. | 2 | 2 | 1 | 2 | 1 | 3 | 2 | - | 1 | 1 | - | 1 | 1 | 2 | 1 | 1 |
| [CO3] | Examine simple hydrological models in Environmental engineering applications. | 2 | - | - | 1 | 1 | 3 | 2 | - | 1 | 1 | - | 2 | 2 | 1 | 1 | 1 |
| [CO4] | Quantify the process controlling water flow and sediment transport in catchments. | 3 | 2 | 1 | 2 | - | 1 | 1 | - | - | - | - | 1 | 2 | 3 | - | - |
| [CO5] | Design water distribution systems and Dams. | 3 | 3 | 3 | 2 | 1 | 1 | 1 | 1 | - | 1 | - | 2 | 3 | 3 | 1 | 1 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: ENVIRONMENTAL ENGINEERING - I

Code:BTE25092

3 Credits | Semester V

Total Lecture: 45 Total Tutorial: 9

**A. Introduction:**

- To gain knowledge on the basics of water supply technology
- To become skilled at the design and construction of surface water treatment plant, ground water well and water distribution networks.
- To get acquainted with low cost water supply options for rural communities and draught vulnerable areas

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

| | |
|---|---|
| **[CO1]** | Understand the impact of humans on environment and environment on humans |
| **[CO2]** | **C**onversant with implementation of basic environmental legislation. |
| **[CO3]** | Examine the effect of the pollutants on the environment: atmosphere, water and soil. |
| **[CO4]** | Select the most appropriate technique for the treatment of water**.** |
| **[CO5]** | Develop strategies to control, reduce and monitor pollution. |

**C. Assessment Plan:**

| **Criteria** | **Description** | **Maximum Marks** |
|---|---|---|
| **Continuous Internal Assessment (CIA)** | Internal Examination | 20 |
| | Attendance | 5 |
| | Assignment | 5 |
| **End Semester Examination(ESE)** | End Semester Examination | 70 |
| **Total** | | 100 |
| **Attendance** | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

**WATER AND ITS SUPPLY** : Water: -Sources of Water and quality issues, water quality requirement for different beneficial uses, Water quality standards, water quality indices, water safety plans, Water Supply systems, Need for planned water supply schemes, Water demand industrial and agricultural water requirements, Components of water supply system; Transmission of water, Distribution system, Various valves used in W/S systems,

service reservoirs and design. Government authorities and their roles in water supply

**WATER TREATMENT** : Water Treatment: aeration, sedimentation, coagulation flocculation, filtration, disinfection, advanced treatments like adsorption, ion exchange, membrane process

**AIR POLLUTION & CONTROL** : Air - Composition and properties of air, Quantification of air pollutants, Monitoring of air pollutants, Air pollution- Occupational hazards, Urban air pollution, automobile pollution, Chemistry of combustion, Automobile engines, quality of fuel, operating conditions and interrelationship. Air quality standards

**NOISE POLLUTION &CONTROL** : Noise- Basic concept, measurement and various control methods.

**BUILDING PLUMBING** : Building Plumbing-Introduction to various types of home plumbing systems for water supply and waste water disposal, high rise building plumbing, Pressure reducing valves, Break pressure tanks, Storage tanks, Building drainage for high rise buildings, various kinds of fixtures and fittings used

## E. TEXT BOOKS

T1. Introduction to Environmental Engineering and Science by Gilbert Masters, Prentice Hall, New Jersey.
T2. Peavy, H.S, Rowe, D.R, Tchobanoglous, G. Environmental Engineering, Mc-Graw - Hill International Editions, New York 1985.
T3. Integrated Solid Waste Management, Tchobanoglous, Theissen& Vigil. McGraw Hill Publication

## F. REFERENCE BOOKS

R1. Introduction to Environmental Engineering by P. AarneVesilind, Susan M. Morgan, Thompson /Brooks/Cole; Second Edition 2008.
R2. MetCalf and Eddy. Wastewater Engineering, Treatment, Disposal and Reuse, Tat McGraw-Hill, New Delhi.
R3. Manual on Water Supply and Treatment. Ministry of Urban Development, New Delhi.
R4. Manual on Sewerage and Sewage Treatment Systems, Part A, B and C. Central Public Health and Environmental Engineering Organization, Ministry of Urban Development.
R5. Plumbing Engineering. Theory, Design and Practice, S.M. Patil, 1999

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| [CO1] | Understand the impact of humans on environment and environment on humans | - | - | - | - | 2 | 3 | 3 | 2 | 2 | 1 | - | 1 | 2 | 1 | 1 | - |
| [CO2] | Conversant with implementation of basic environmental legislation. | 1 | - | - | 2 | 1 | 3 | 3 | 2 | - | 2 | - | 2 | 1 | - | 1 | 2 |
| [CO3] | Examine the effect of the pollutants on the environment: atmosphere, water and soil. | 1 | - | - | 1 | 2 | 3 | 2 | 2 | 1 | - | 1 | 2 | 2 | - | - | 1 |
| [CO4] | Select the most appropriate technique for the treatment of water. | 2 | 3 | 3 | 1 | 1 | 2 | 3 | 1 | - | - | - | 1 | 3 | 3 | 1 | - |
| [CO5] | Develop strategies to control, reduce and monitor pollution. | 2 | 1 | 3 | 3 | 1 | 3 | 2 | - | - | - | - | 1 | 3 | 2 | 1 | - |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Professional Practice, Law & Ethics

Code: BTE25373

3 Credits | Semester V

Total Lecture: 45 Total Tutorial: 9

**A. Introduction:**

- To make the students understand the types of roles they are expected to play in the society as practitioners of the civil engineering profession.
- To develop some ideas of the legal and practical aspects of their profession.

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

**[CO1]** Define what constitutes Professional practice and the respective roles of various stakeholders.

**[CO2]** Make the students execute the types of roles they are expected to play in the society as practitioners of Civil Engineering profession.

**[CO3]** Examine the utility of Contracts and Contract Management in Civil Engineering, Dispute Resolution mechanisms, and Laws governing Engagement of Labour.

**[CO4]** Evaluate the different Intellectual Property Rights, Patents etc.

**[CO5]** Develop good ideas of the legal and practical aspects of their profession.

**C. Assessment Plan:**

| Criteria | Description | Maximum Marks |
|---|---|---|
| **Continuous Internal Assessment (CIA)** | Internal Examination | 20 |
| | Attendance | 5 |
| | Assignment | 5 |
| **End Semester Examination(ESE)** | End Semester Examination | 70 |
| **Total** | | 100 |
| **Attendance** | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

**PROFESSIONAL PRACTICE &ETHICS:**Professional Practice - Respective roles of various stakeholders: Government (constituting regulatory bodies and standardization organizations, prescribing norms to ensure safety of the citizens); Standardization Bodies (ex. BIS, IRC)(formulating standards of practice); professional bodies (ex. Institution of Engineers(India), Indian Roads Congress, IIA/ COA, ECI, Local Bodies/ Planning Authorities) (certifying professionals and offering platforms for interaction); Clients/ owners (role governed by contracts); Developers (role governed by regulations such as RERA); Consultants (role governed by bodies such as CEAI); Contractors (role governed by contracts and regulatory Acts and

Standards); Manufacturers/ Vendors/ Service agencies (role governed by contracts and regulatory Acts and Standards).Professional Ethics- Definition of Ethics, Professional Ethics, Business Ethics, Corporate Ethics, Engineering Ethics, Personal Ethics; Code of Ethics as defined in the website of Institution of Engineers (India); Profession, Professionalism, Professional Responsibility, Professional Ethics; Conflict of Interest, Gift Vs Bribery, Environmental breaches, Negligence, Deficiencies in state-of-the-art; Vigil Mechanism, Whistle blowing, protected disclosures.

**GENERAL PRINCIPLES OF CONTRACTS MANAGEMENT:**Indian Contract Act, 1972 and amendments covering General principles of contracting; Contract Formation & Law; Privacy of contract; Various types of contract and their features; Valid & Voidable Contracts; Prime and subcontracts; Joint Ventures & Consortium; Complex contract terminology; Tenders, Request For Proposals, Bids & Proposals; Bid Evaluation; Contract Conditions & Specifications; Critical "RedFlag" conditions; Contract award & Notice To Proceed; Variations & Changes in Contracts; Differing site conditions.Cost escalation; Delays, Suspensions & Terminations; Time extensions & Force Majeure; Delay Analysis; Liquidated damages & Penalties; Insurance & Taxation; Performance and Excusable Non-performance; Contract documentation; Contract Notices; Wrong practices in contracting (Bid shopping, Bid fixing, Cartels); Reverse auction; Case Studies; Build- Own-Operate & variations; Public- Private Partnerships; International Commercial Terms.

**ARBITRATION, CONCILIATION AND ADR (ALTERNATIVE DISPUTE RESOLUTION) SYSTEM:**Arbitration – meaning, scope and types – distinction between laws of 1940 and 1996; UNCITRAL model law –Arbitration and expert determination; Extent of judicial intervention; International commercial arbitration; Arbitration agreements – essential and kinds, validity, reference and interim measures by court; Arbitration tribunal – appointment, challenge, jurisdiction of arbitral tribunal, powers, grounds of challenge, procedure and court assistance.Award including Form and content, Grounds for setting aside an award, Enforcement, Appeal and Revision; Enforcement of foreign awards – New York and Geneva Convention Awards; Distinction between conciliation, negotiation, mediation and arbitration, confidentiality, resort to judicial proceedings, costs; Dispute Resolution Boards; Look Adalats.

**ENGAGEMENTOF LABOUR AND LABOUR & OTHER CONSTRUCTION-RELATED LAWS**: Role of Labour in Civil Engineering; Methods of engaging labour- on rolls, labour sub-contract, piece rate work; Industrial Disputes Act, 1947; Collective bargaining.Industrial Employment ( Standing Orders) Act, 1946; Workmen's Compensation Act, 1923; Building & Other Construction Workers (regulation of employment and conditions of service) Act (1996) and Rules (1998); RERA Act 2017, NBC 2017.

**LAW RELATING TO INTELLECTUAL PROPERTY:** Introduction – meaning of intellectual property, main forms of IP, Copyright, Trademarks, Patents and Designs, Secrets; Law relating to Copyright in India including Historical evolution of Copy Rights Act, 1957, Meaning of copyright – computer programs, Ownership of copyrights and assignment, Criteria of infringement, Piracy in Internet –Remedies and procedures in India,Law relating to Patents under Patents Act, 1970 including Concept and historical perspective of patents law in India, Patentable inventions with special reference to biotechnology products, Patent protection for

computer programs, Process of obtaining patent – application, examination, opposition and sealing of patents, Patent cooperation treaty and grounds for opposition, Rights and obligations of patentee, Duration of patents – law and policy considerations, Infringement and related remedies.

## E. TEXT BOOKS

T1. B.S. Patil, Legal Aspects of Building and Engineering Contracts, 1974.
T2. Meena Rao (2006), Fundamental concepts in Law of Contract, 3rd Edn. Professional Offset
T3. NeelimaChandiramani (2000), The Law of Contract: An Outline, 2nd Edn. Avinash Publications Mumbai
T4. Avtarsingh (2002), Law of Contract, Eastern Book Co.
T5. Dutt (1994), Indian Contract Act, Eastern Law House
T6. Wadhera (2004), Intellectual Property Rights, Universal Law Publishing Co.
T7. T. Ramappa (2010), Intellectual Property Rights Law in India, Asia Law House
T8. O.P. Malhotra, Law of Industrial Disputes, N.M. Tripathi Publishers
T9. Rustamji R.F., Introduction to the Law of Industrial Disputes, Asia Publishing House
T10. Ethics in Engineering- M.W.Martin&R.Schinzinger, McGraw-Hill

## F. REFERENCE BOOKS

R1. The National Building Code, BIS, 2017
R2. RERA Act, 2017
R3. Anson W.R. (1979), Law of Contract, Oxford University Press
R4. Kwatra G.K. (2005), The Arbitration & Conciliation of Law in India with case law on UNCITRAL Model Law on Arbitration, Indian Council of Arbitration
R5. Bare text (2005), Right to Information Act
R6. K.M. Desai(1946), The Industrial Employment (Standing Orders) Act
R7. Vee, Charles &Skitmore, Martin (2003) Professional Ethics in the Construction Industry, Engineering Construction and Architectural management, Vol.10, Iss2,pp 117-127, MCB UP Ltd
R8. American Society of Civil Engineers (2011) ASCE Code of Ethics – Principles Study and Application

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| [CO1] | Define what constitutes Professional practice and the respective roles of various stakeholders. | - | - | - | 1 | - | 1 | 1 | 3 | 3 | 2 | 1 | 2 | - | - | 3 | 2 |
| [CO2] | Make the students execute the types of roles they are expected to play in the society as practitioners of Civil Engineering profession. | - | - | - | 1 | - | 2 | - | 3 | 3 | 3 | 1 | 2 | - | - | 2 | 3 |
| [CO3] | Examine the utility of Contracts and Contract Management in Civil Engineering, Dispute Resolution mechanisms, and Laws governing Engagement of Labour. | - | - | - | 1 | - | 2 | 1 | 3 | 3 | 3 | 1 | 2 | 1 | - | 3 | 3 |
| [CO4] | Evaluate the different Intellectual Property Rights, Patents etc. | - | - | - | 1 | 1 | 3 | 1 | 3 | 2 | 3 | 2 | 2 | 1 | - | 2 | 2 |
| [CO5] | Develop good ideas of the legal and practical aspects of their profession. | - | - | - | - | 1 | 2 | 1 | 3 | 3 | 3 | - | 2 | 1 | - | 2 | 3 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Organizational Behavior

Code:BTE24060

3 Credits | Semester V

Total Lecture: 45 Total Tutorial: 9

**A. Introduction:**

- The course aims to provide an understanding of basic concepts, theories and techniques in the fieldof human behavior at the individual, group and organizational levels in the changing global scenario

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

**[CO1]** Define the key ideas and issues in OB.

**[CO2]** Interpret the dynamics of human behavior in work context.

**[CO3]** Examine the determinants of work behavior from different levels.

**[CO4]** Judge the issues in OB that influence the way people behave in an organizational setting.

**[CO5]** Develop competencies of analyzing behavioural issues in the work environment

**C. Assessment Plan:**

| Criteria | Description | Maximum Marks |
|---|---|---|
| **Continuous Internal Assessment (CIA)** | Internal Examination | 20 |
| | Attendance | 5 |
| | Assignment | 5 |
| **End Semester Examination(ESE)** | End Semester Examination | 70 |
| **Total** | | 100 |
| **Attendance** | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

**INTRODUCTION:** Study of OB: Definition, Meaning, Why Study OB. Learning- Nature of Learning, How learning occurs, Learning and OB.

**INDIVIDUAL BEHAVIOUR & MOTIVATION:** Foundations of Individual Behaviour: Personality- Meaning and Definition, Determinants o Personality, Personality Traits, Personality and OB. Perception- Meaning and Definition, Perceptual Process, Importance of Perception in OB. Motivation- Nature and Importance, Herzberg‟s Two Factor Theory,

Maslow‟s Need Hierarchy Theory, Alderfer‟s ERG Theory, Evaluations.

**ORGANISATIONAL BEHAVIOUR PROCESSES:** Communication- Importance, Types, Gateways and Barriers to Communication, Communication as a tool for improving interpersonal effectiveness. Groups in Organisations- Nature, Types, Why do people join groups , Group cohesiveness and Group Decision making. Managerial Implications, Effective Team building.

**LEADERSHIP & CONFLICT MANAGEMENT**: Leadership & Management, Theories of leadership- Trait theory, Leader, Behaviour theory, Contingency Theory, Leadership, Leadership and Followership, How to be an effective leader**.** Conflict- Nature of Conflict and conflict resolution. An introduction to transactional analysis.

**ORGANISATION CULTURE & HRM:** Organizational Culture- Meaning & Definition, Culture and Organizational effectiveness**.** Introduction to Human Resource Management- Selection, Orientation, Training& Development, Performance Appraisal, Incentives. Organizational Changes- Importance of Change, Planned Change and OB techniques. International Organizational Behaviour- Trends in International Business, Cultural Differences and Similarities, Individual and Interpersonal Behaviour in global perspective.

## E. TEXT BOOKS

T1. K.Aswathappa, Organizational Behavior, Himalaya Publishing House
T2. Stephen P. Robbins, Organizational Behavior, Prentice Hall of India

## F. REFERENCE BOOKS

R1. Keith Davis, Organizational Behavior, McGraw Hill

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| [CO1] | Define the key ideas and issues in OB. | - | - | - | 1 | - | 3 | 1 | 3 | 2 | 3 | - | 1 | - | - | 2 | 3 |
| [CO2] | Interpret the dynamics of human behavior in work context. | - | - | - | 2 | - | 3 | - | 3 | 3 | 3 | - | 2 | - | - | 3 | 3 |
| [CO3] | Examine the determinants of work behavior from different levels. | - | - | - | 2 | - | 3 | - | 3 | 3 | 3 | - | 2 | - | - | 3 | 3 |
| [CO4] | Judge the issues in OB that influence the way people behave in an organizational setting. | - | - | - | 1 | - | 3 | - | 2 | 2 | 3 | - | 2 | - | - | 2 | 3 |
| [CO5] | Develop competencies of analyzing behavioural issues in the work environment | - | - | - | 1 | - | 3 | - | 2 | 2 | 3 | - | 2 | - | - | 2 | 3 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Disaster Preparedness & Planning

Code:BTE25298

3 Credits | Semester V

Total Lecture: 45 Total Tutorial: 9

**A. Introduction:**

- To understand basic concepts in Disaster Management.
- To understand definitions and terminologies used in Disaster Management.
- To understand types and categories of Disasters.
- To understand the challenges posed by Disasters.
- To understand Impacts of Disasters Key Skills

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

**[CO1]** Get acquainted with basic information on various types of Disasters.
**[CO2]** Apply the disaster concepts to management.
**[CO3]** Analyze the relationship between Development and Disasters.
**[CO4]** Decide the first action to be taken under various disasters.
**[CO5]** Formulate the precautions and awareness regarding various disasters and get familiarized with organization in India dealing with disasters.

**C. Assessment Plan:**

| Criteria | Description | Maximum Marks |
|---|---|---|
| **Continuous Internal Assessment (CIA)** | Internal Examination | 20 |
| | Attendance | 5 |
| | Assignment | 5 |
| **End Semester Examination(ESE)** | End Semester Examination | 70 |
| **Total** | | 100 |
| **Attendance** | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

**INTRODUCTION:** Concepts and definitions: disaster, hazard, vulnerability, risks severity frequency and details, capacity, impact, prevention, mitigation

**DISASTERS:** Disasters classification; natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.); manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation,chemical spills,

transportation accidents, terrorist strikes, etc.); hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility.

**DISASTER IMPACTS:** Disaster impacts (environmental, physical, social, ecological, economic, political, etc.); health, psychosocial issues; demographic aspects (gender, age, special needs); hazard locations. Global and national disaster trends; climate change and urban disasters.

**E. TEXT BOOKS**

T1. Ghosh, G. K., Disaster Management, A P H Publishing Corporation
T2. Murthy, D. B. N., Disaster Management: Text & Case Studies, Deep & Deep Pvt. Ltd.
T3. Alexander, David, Natural Disasters, Kluwer Academic London

**F. REFERENCE BOOKS**

R1. Publications of National Disaster Management Authority (NDMA) on Various Templates andGuidelines for Disaster Management
R2. Bhandani, R. K., An overview on natural & man-made disasters and their reduction, CSIR,New Delhi
R3. Srivastava, H. N., and Gupta G. D., Management of Natural Disasters in developing countries,Daya Publishers, Delhi

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| [CO1] | Get acquainted with basic information on various types of Disasters. | 1 | - | - | - | - | 3 | 2 | - | 1 | 2 | - | 2 | 1 | - | 1 | 2 |
| [CO2] | Apply the disaster concepts to management. | 1 | - | - | 1 | 1 | 2 | 2 | - | 2 | 1 | - | 1 | - | - | 1 | 1 |
| [CO3] | Analyze the relationship between Development and Disasters. | 2 | 1 | - | 1 | 1 | 3 | 2 | - | 1 | 1 | - | 1 | 2 | 2 | 1 | 1 |
| [CO4] | Decide the first action to be taken under various disasters. | 2 | - | - | 2 | 2 | 3 | 3 | 1 | 3 | 3 | - | 3 | 2 | 1 | 1 | 3 |
| [CO5] | Formulate the precautions and awareness regarding various disasters and get familiarized with organization in India dealing with disasters. | 2 | - | - | 1 | 1 | 2 | 3 | 2 | 3 | 3 | - | 3 | 2 | 1 | 1 | 3 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Essence of Indian Knowledge Tradition

Code:BTE25122

0 Credits | Semester V

Total Lecture: 30 Total Tutorial: 6

**A. Introduction:**

- The course aims at imparting basic principles of thought process, reasoning and inferencing. Sustainability is at the core of Indian Traditional knowledge Systems connecting society and nature. Holistic life style of yogic science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions. Part-I focuses on introduction to Indian Knowledge Systems, Indian perspective of modern scientific world-view, and basic principles of Yoga and holistic health care system.

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

**[CO1]** Understand the basic structure of Indian Knowledge System and Modern Science.

**[CO2]** Apply the basic principles of thought processes, reasoning and inferencing.

**[CO3]** Draw connection between the basic structure of Indian Knowledge and Modern science.

**[CO4]** Evaluate the Indian philosophical, linguistic and artistic tradition.

**[CO5]** Develop the knowledge of Indian Tradition using various Case Studies.

**C. Assessment Plan:**

| Criteria | Description | Maximum Marks |
|---|---|---|
| **Continuous Internal Assessment (CIA)** | Internal Examination | 20 |
| | Attendance | 5 |
| | Assignment | 5 |
| **End Semester Examination(ESE)** | End Semester Examination | 70 |
| **Total** | | 100 |
| **Attendance** | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

**BASIC STRUCTURE OF INDIAN KNOWLEDGE SYSTEM:** Basic structure of Indian Knowledge System: अष्टादशविद्या -४वेद,४उपवेद (आयुर्वेद, धनुर्वेद, गन्धर्ववेद, स्थापत्य आदि)

**BASIC STRUCTURE OF INDIAN KNOWLEDGE SYSTEM:**
६वेदांग (शिक्षा, कल्प, निरुक्त, व्याकरण, ज्योतिष, छंद) ४ उपाङ्ग , (धर्मशास्त्र,, मीमांसा, पुराण, तर्कशास्त्र)

**MODERN SCIENCE AND INDIAN KNOWLEDGE SYSTEM:** Modern Science and Indian Knowledge System

**YOGA AND HOLISTIC HEALTH CARE:** Yoga and Holistic Health care

**CASE STUDIES:** Case studies

**E. TEXT BOOKS**

T1.Sivaramakrishnan (Ed.), Cultural Heritage of India-course material, Bharatiya
T2. Swami Jitatmanand, Holistic Science and Vedant, BharatiyaVidyaBhavan
T3. Foundation, Velliarnad, Arnakulam Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkata
T4. GN Jha (Eng. Trans.), Ed. RN Jha, Yoga-darshanam with VyasaBhashya,
T5. VidyanidhiPrakashan, Delhi 2016 RN Jha, Science of Consciousness Psychotherapyand Yoga Practices, Vidyanidhi
T6. Prakashan, Delhi 2016 P B Sharma (English translation), ShodashangHridayan

**F. REFERENCE BOOKS**

R1. Fritzof Capra, Tao of Physics
R2. Fritzof Capra, The Wave of life
R3. VN Jha (Eng. Trans.), Tarkasangraha of Annam Bhatta, International Chinmay
R4. VidyaBhavan, Mumbai. 5th Edition, 2014 Swami Jitatmanand, Modern Physics and Vedant, BharatiyaVidyaBhavan

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| [CO1] | Understand the basic structure of Indian Knowledge System and Modern Science. | - | - | - | 1 | 1 | 2 | 1 | 3 | - | 3 | - | 3 | - | - | - | 3 |
| [CO2] | Apply the basic principles of thought processes, reasoning and inferencing. | - | 1 | - | 2 | - | 2 | 1 | - | - | 2 | - | 3 | 1 | 2 | - | 2 |
| [CO3] | Draw connection between the basic structure of Indian Knowledge and Modern science. | 1 | 1 | - | 1 | 1 | 2 | - | - | - | 2 | - | 2 | - | 1 | - | 2 |
| [CO4] | Evaluate the Indian philosophical, linguistic and artistic tradition. | - | 1 | - | 1 | - | 2 | - | - | 1 | 2 | - | 2 | - | - | - | 2 |
| [CO5] | Develop the knowledge of Indian Tradition using various Case Studies. | - | 1 | - | 1 | 1 | 2 | - | 2 | 3 | 3 | - | 2 | - | 1 | - | 3 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Hydraulic Engineering Lab

Code:BTE25096

1 Credits | Semester V

Total Lecture: 30

**A. Introduction:**

- Explore the fundamental principles of fluid mechanics through experimentation
- Demonstrate and analyze key hydraulic phenomena using hands-on physical devices
- Apply computer modeling as a practical tool for solving hydraulics problems
- Investigate engineering design principles for pipe networks, open channel systems, and ground water regimes

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

**[CO1]** Understand the principle of operation of Hydraulic machineries (Pumps and Turbines).

**[CO2]** Solve problems in uniform, gradually and rapidly varied flows in steady state conditions.

**[CO3]** Relate the theoretical and practical problems of Hydraulic Engineering

**[CO4]** Develop dimensional analysis and similitude to present and interpret experimental data and models in fluid engineering problems.

**[CO5]** Design calculations through pipe networks and various hydraulic structures such as Weirs.

**C. Assessment Plan:**

| Criteria | Description | Maximum Marks |
|---|---|---|
| Continuous Internal Assessment (CIA) | Internal Examination | 5 |
| | Attendance | 5 |
| | Assignment | 5 |
| End Semester Examination(ESE) | End Semester Examination | 35 |
| Total | | 50 |
| Attendance | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

| Sl.No | Name of Practical |
|---|---|
| 1 | Flow Visualization |
| 2 | Studies in Wind Tunnel |

| | |
|---|---|
| 3 | Boundary Layer |
| 4 | Flow around an Aerofoil / circular cylinder |
| 5 | Uniform Flow |
| 6 | Velocity Distribution in Open channel flow |
| 7 | Venturi Flume |
| 8 | Standing Wave Flume |
| 9 | Gradually Varied Flow |
| 10 | Hydraulic Jump |
| 11 | Flow under Sluice Gate |
| 12 | Flow through pipes |
| 13 | Turbulent flow through pipes |
| 14 | Flow visualization |
| 15 | Laminar flow through pipes |
| 16 | Major losses / Minor losses in pipe |

### E. TEXT BOOKS

T1. Hydraulics and Fluid Mechanics, P.M. Modi and S.M. Seth, Standard Book House
T2. Theory and Applications of Fluid Mechanics, K. Subramanya, Tata McGraw Hill.
T3. Open channel Flow, K. Subramanya, Tata McGraw Hill.

### F. REFERENCE BOOKS

R1. Open Channel Hydraulics, VenTe Chow, Tata McGraw Hill.
R2. Burnside, C.D., “Electromagnetic Distance Measurement,” Beekman Publishers, 1971.

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| [CO1] | Understand the principle of operation of Hydraulic machineries (Pumps and Turbines). | 3 | 2 | 2 | 1 | - | - | - | - | - | - | - | 2 | 2 | 1 | 1 | - |
| [CO2] | Solve problems in uniform, gradually and rapidly varied flows in steady state conditions. | 2 | 3 | 3 | 3 | 2 | 1 | - | - | - | - | - | 2 | 2 | 3 | 1 | - |
| [CO3] | Relate the theoretical and practical problems of Hydraulic Engineering | 2 | 3 | 3 | 2 | 2 | 2 | 2 | - | - | - | - | 1 | 2 | 3 | - | 1 |
| [CO4] | Develop dimensional analysis and similitude to present and interpret experimental data and models in fluid engineering problems. | 2 | 1 | 2 | 1 | - | - | - | - | - | - | - | 2 | - | 2 | - | - |
| [CO5] | Design calculations through pipe networks and various hydraulic structures such as Weirs. | 3 | 2 | 3 | 2 | 2 | 1 | 1 | 1 | 1 | - | - | 2 | 3 | 3 | 1 | - |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Structural Analysis-II Lab

Code:BTE25097

1 Credits | Semester V

Total Lecture: 30

**A. Introduction:**

- To understand the structural behavior before and after application of loads.
- To be able to analyze various structure.
- To be aware of various reinforced techniques to enhance Designing of structure

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

**[CO1]** Utilize the knowledge of structural mechanics in addressing design problems of Structural engineering.

**[CO2]** Apply the knowledge of Plastic Analysis in addressing Design problems.

**[CO3]** Analyze structures using Slope-Deflection and Moment-Distribution Method.

**[CO4]** Judge the comparative advantages of analysis using Flexibility and Stability Method.

**[CO5]** Develop shape factors of simple sections.

**C. Assessment Plan:**

| Criteria | Description | Maximum Marks |
|---|---|---|
| Continuous Internal Assessment (CIA) | Internal Examination | 5 |
| | Attendance | 5 |
| | Assignment | 5 |
| End Semester Examination(ESE) | End Semester Examination | 35 |
| Total | | 50 |
| Attendance | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

| S.No | List of Practical |
|---|---|
| 1 | Verification of reciprocal theorem of deflection using a simply supported beam |
| 2 | Deflection of a truss horizontal deflections & vertical deflections of various joints of a pin jointed truss. |

| | |
|---|---|
| 3 | Elatic displacements (vertical& horizontal) of curved member. |
| 4 | To determine elastic properties of beam |
| 5 | Experiment on a two hinged arch for horizontal thrust & influence line for horizontal thrust |
| 6 | Experiment and analytical study of a 3 bar pin jointed truss. |
| 7 | Experiment & analytical study of deflections for unsymmetrical bending of a cantilever beam |
| 8 | Verification of moment area theorem for slopes &deflectionof the beam |
| 9 | Experiment on a three hinged arch for horizontal thrust & influence line for horizontal thrust |
| 10 | Experimental and analytical study of behavior of struts with various end conditions. |

**E. Text Book:**

T1. Negi, L., Jehangir, R.,"Structural Analysis:, Tata McGraw Hill Publications Co. Ltd.

T2. Gupta, R., Pandit, G.S., Gupta, S.P., "Theory of Structurs", Tata McGraw Hill Publications Co. Ltd.

**F. Reference Books:**

R1. Wang, C.K., "Intermediate Structural Analysis", McGraw Hill, New Delhi, 1983.

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| [CO1] | Utilize the knowledge of structural mechanics in addressing design problems of Structural engineering. | 2 | 3 | 1 | 3 | 1 | 1 | - | - | - | - | - | 2 | 2 | 3 | 1 | - |
| [CO2] | Apply the knowledge of Plastic Analysis in addressing Design problems. | 3 | 3 | 2 | 2 | 1 | 1 | 1 | - | 1 | - | - | 2 | 2 | 3 | 1 | - |
| [CO3] | Analyze structures using Slope-Deflection and Moment-Distribution Method. | 2 | 3 | 2 | 3 | 1 | - | - | - | - | - | - | 1 | 1 | 3 | - | - |
| [CO4] | Judge the comparative advantages of analysis using Flexibility and Stability Method. | 2 | 3 | 1 | 2 | 1 | - | - | - | - | - | - | 1 | 1 | 2 | 1 | - |
| [CO5] | Develop shape factors of simple sections. | 2 | 2 | 1 | 1 | - | - | - | - | - | - | - | 1 | 1 | 2 | 1 | - |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject:Summer Internship-1(3-4 Weeks)

Code: BTE27324
2 Credits | Semester V

Total Lecture: 60

**A. Introduction:**

- Following are the intended objectives of internship training:
- Will expose Technical students to the industrial environment, which cannot be simulated in the classroom and hence creating competent professionals for the industry.
- Provide possible opportunities to learn understand and sharpen the real time technical / managerial skills required at the job.
- Exposure to the current technological developments relevant to the subject area of training.
- Experience gained from the 'Industrial Internship' in classroom will be use in classroom discussions.
- Create conditions conducive to quest for knowledge and its applicability on the job

**COURSE OUTCOMES**

***On completion of the course, students are expected:***

[CO1] Analyze reasons behind events and situations

[CO2] solve problems utilizing various concepts, solutions, etc.

[CO3] Take initiatives and responsibilities; influencing others in working for a good purpose; setting goals; motivating others to work towards goals; taking accountability

[CO4] Understand the importance of leisure and recreation; participating in leisure and recreational activities

[CO5] Maintain ethics in public life; good moral values etc.

**GUIDELINES FOR INTERNSHIP**

Summer Internship -1 should be undertaken in an industry/Govt. or Pvt. Certified Agencies which are in social sector/ Govt. Skill Centres/Institutes/Schemes.

| S.No. | Suggested Schedule | Suggested Duration (In weeks) | Activities |
|---|---|---|---|
| 1 | Summer/winter vacation after 2nd/3rd Semester | 3-4 | Inter/Intra Institutional Activities |


Syllabus of

**B.Tech. in Civil Engineering**

**Semester-VI**

**ARKAJAIN University, Jharkhand**
School of Engineering & IT
Department of Engineering
Faculty – Bachelor of Technology in Civil Engineering
**Scheme of Study (w.e.f Batch 2020-24)**

## SEMESTER –I

| Sr. No. | Name of the Subject | Group | L-T-P | Credit |
|---|---|---|---|---|
| 1 | Engineering Mathematics–I | A & B | 3-1-0 | 4 |
| 2 | Engineering Chemistry | A | 3-0-0 | 3 |
| | Programming for Problem Solving | B | 3-0-0 | 3 |
| 3 | Basic Electrical Engineering | A | 3-1-0 | 4 |
| | Engineering physics | B | 3-1-0 | 4 |
| 4 | Engineering Mechanics | A | 3-0-0 | 3 |
| | English for Communication | B | 3-0-0 | 3 |
| 5 | Constitution of India | B | 0-0-0 | 0 |
| | **Practical** | | | |
| 6 | Engineering Chemistry Lab | A | 0-0-1 | 1 |
| | Engineering Physics Lab | B | 0-0-1 | 1 |
| 7 | Basic Electrical Engineering Lab | A | 0-0-1 | 1 |
| | Programming for Problem Solving Lab | B | 0-0-2 | 2 |
| 8 | Engineering Mechanics Lab | A | 0-0-1 | 1 |
| 9 | Engineering Graphics & Design | A | 0-0-2 | 2 |
| | Workshop Practices | B | 0-0-2 | 2 |
| | TOTAL | A or B | 12-2-5 | 19 |

# SCHEME OF THE STUDY
# SEMESTER –II

| Sr. No. | Name of the Subject | Group | L-T-P | Credit |
|---|---|---|---|---|
| 1 | Engineering Mathematics–II | A & B | 3-1-0 | 4 |
| 2 | Engineering Chemistry | B | 3-0-0 | 3 |
| | Programming for Problem Solving | A | 3-0-0 | 3 |
| 3 | Basic Electrical Engineering | B | 3-1-0 | 4 |
| | Engineering physics | A | 3-1-0 | 4 |
| 4 | Engineering Mechanics | B | 3-0-0 | 3 |
| | English for Communication | A | 3-0-0 | 3 |
| 5 | Constitution of India | A | 0-0-0 | 0 |
| | **Practical** | | | |
| 6 | Engineering Chemistry Lab | B | 0-0-1 | 1 |
| | Engineering Physics Lab | A | 0-0-1 | 1 |
| 7 | Basic Electrical Engineering Lab | B | 0-0-1 | 1 |
| | Programming for Problem Solving Lab | A | 0-0-2 | 2 |
| 8 | Engineering Mechanics Lab | B | 0-0-1 | 1 |
| | Engineering Graphics& Design | B | 0-0-2 | 2 |
| 9 | Workshop Practices | A | 0-0-2 | 2 |
| | TOTAL | A or B | 12-2-5 | 19 |

# SEMESTER –I (Group-A)

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Engineering Chemistry | BSC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 2 | Engineering Mathematics–I | BSC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 3 | Basic Electrical Engineering | ESC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 4 | Engineering Mechanics | ESC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| | **Practical** | | | | | | | | |
| 5 | Engineering Chemistry Lab | BSC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 6 | Basic Electrical Engineering Lab | ESC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 7 | Engineering Mechanics Lab | ESC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 8 | Engineering Graphics& Design | ESC | 2 | 4 | 50 | 35 | 5 | 5 | 5 |
| | **TOTAL** | | **19** | **24** | **600** | **420** | **100** | **40** | **40** |

# SEMESTER I (Group-B)

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Engineering physics | BSC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 2 | Engineering Mathematics –I | BSC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 3 | Programming for Problem Solving | ESC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | English for Communication | HSMC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 5 | Constitution of India | MC | 0 | 2 | 50 | 35 | 10 | 2.5 | 2.5 |
| | **Practical** | | | | | | | | |
| 6 | Engineering physics Lab | BSC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 7 | Programming for Problem Solving Lab | ESC | 2 | 4 | 50 | 35 | 5 | 5 | 5 |
| 8 | Workshop Practices | ESC | 2 | 4 | 50 | 35 | 5 | 5 | 5 |
| | **TOTAL** | | **19** | **26** | **600** | **420** | **105** | **37.5** | **37.5** |

# SEMESTER II (Group-A)

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Engineering physics | BSC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 2 | Engineering Mathematics –II | BSC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 3 | Programming for Problem Solving | ESC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | English for Communication | HSMC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 5 | Constitution of India | MC | 0 | 2 | 50 | 35 | 10 | 2.5 | 2.5 |
| | **Practical** | | | | | | | | |
| 6 | Engineering physics Lab | BSC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 7 | Programming for Problem Solving Lab | ESC | 2 | 4 | 50 | 35 | 5 | 5 | 5 |
| 8 | Workshop Practices | ESC | 2 | 4 | 50 | 35 | 5 | 5 | 5 |
| | **TOTAL** | | **19** | **26** | **600** | **420** | **105** | **37.5** | **37.5** |

# SEMESTER –II (Group-B)

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Engineering Chemistry | BSC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 2 | Engineering Mathematics–II | BSC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 3 | Basic Electrical Engineering | ESC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 4 | Engineering Mechanics | ESC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| | **Practical** | | | | | | | | |
| 5 | Engineering Chemistry Lab | BSC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 6 | Basic Electrical Engineering Lab | ESC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 7 | Engineering Mechanics Lab | ESC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 8 | Engineering Graphics& Design | ESC | 2 | 4 | 50 | 35 | 5 | 5 | 5 |
| | **TOTAL** | | **19** | **24** | **600** | **420** | **100** | **40** | **40** |

# SEMESTER-III

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA * | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Engineering Mathematics -III | BSC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 2 | Biology for Engineers | BSC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 3 | Surveying &Geomatics | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | Mechanics of Solid | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 5 | Introduction to Civil Engineering | HSMC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 6 | Environmental Science | MC | 0 | 2 | 50 | 35 | 10 | 2.5 | 2.5 |
| | **Practical** | | | | | | | | |
| 7 | Surveying &Geomatics Lab | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 8 | Mechanics of Solid | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 9 | Computer Aided Civil Engineering Drawing | ESC | 2 | 4 | 50 | 35 | 5 | 5 | 5 |
| | **TOTAL** | | **20** | **26** | **700** | **490** | **125** | **42.5** | **42.5** |

# SEMESTER-IV

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Material Testing & Evaluation | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 2 | Engineering Geology | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 3 | Fluid Mechanics | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | Structural Analysis - I | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 5 | Geotechnical Engineering | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 6 | Civil Engineering-Societal & Global Impact | HSMC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| | **Practical** | | | | | | | | |
| 7 | Material Testing & Evaluation | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 8 | Engineering Geology Lab | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 9 | Geotechnical Engineering Lab | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 10 | Fluid Mechanics Lab | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| | **TOTAL** | | **22** | **26** | **800** | **560** | **140** | **50** | **50** |

# SEMESTER V

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Hydraulic Engineering | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 2 | Structural Analysis II | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 3 | Hydrology & Water Resource Engineering | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | Environmental Engineering-I | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 5 | Open Elective I Humanities I<br>Professional Practice, Law & Ethics<br>Organizational Behavior | HSMC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 6 | Disaster Preparedness & Planning | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 7 | Essence of Indian Knowledge Tradition | MC | 0 | 2 | 50 | 35 | 10 | 2.5 | 2.5 |
| | PRACTICAL | | | | | | | | |
| 8 | Hydraulic Engineering Lab | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 9 | Structural Analysis II Lab | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 10 | Summer Internship –I (3-4 week) | PROJ | 2 | 0 | 50 | 35 | 15 | 0 | 0 |
| | **TOTAL** | | **22** | **24** | **800** | **560** | **155** | **42.5** | **42.5** |

# SEMESTER VI

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory / Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Construction Engineering & Management | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 2 | Transportation Engineering-I | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 6 | Engineering Economics, Estimation & Costing | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 3 | Elective I<br>Rock Mechanics<br>Foundation Engineering | PEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | Elective II<br>Environmental Engineering II<br>Rural water supply & Onsite Sanitation System | PEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 6 | Elective III<br>Design of Steel Structure<br>Earthquake Engineering | PEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 7 | Design of Concrete Structures-I | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| | **Practical** | | | | | | | | |
| 8 | Transportation Engineering I Lab | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| | **TOTAL** | | **22** | **23** | **750** | **525** | **145** | **40** | **40** |

# SEMESTER VII

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Elective IV<br>Air and Noise Pollution and Control<br>Solid and hazardous Waste Management | PEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 2 | Elective V<br>Design of Concrete Structure - II<br>Prestressed Concrete | PEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 3 | Open Elective II<br>Metro System & Engineering<br>History of Science & Engineering | OEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | River Engineering | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| | **Practical** | | | | | | | | |
| 5 | Minor Project | PROJ | 3 | 6 | 100 | 70 | 30 | 0 | 0 |
| 6 | Summer Internship –II –(4-6 Week) | PROJ | 3 | 0 | 100 | 70 | 30 | 0 | 0 |
| | **TOTAL** | | **18** | **18** | **600** | **420** | **140** | **20** | **20** |

# SEMESTER VIII

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Elective VI<br>Bridge Engineering<br>Ground Water Engineering | PEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 2 | Elective VII<br>Railway Engineering<br>Traffic Engineering and Management | PEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 3 | Open Elective III<br>Soft Skills and Interpersonal Communication<br>Human Resource Development and Organizational Behavior | OEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | Open Elective IV<br>Civil Engineering Design-I<br>Geographic Information Systems and Science | OEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| | **Practical** | | | | | | | | |
| 5 | Major Project | PROJ | 8 | 16 | 200 | 140 | 60 | 0 | 0 |
| 6 | Extra- Curricular/ Co-Curricular Activity | PROJ | 0 | 0 | 100 | 70 | 30 | 0 | 0 |
| | **TOTAL** | | **20** | **28** | **700** | **490** | **170** | **20** | **20** |

## Distribution of Credit across 8 semesters:

| Sl. No | Type of Paper | No. of Paper | Total Credit |
|---|---|---|---|
| 1 | Humanities and Social Sciences including Management courses **(HSMC)** | 4 | 12 |
| 2 | Basic Science courses**(BSC)** | 8 | 24 |
| 3 | Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc**(ESC)** | 9 | 20 |
| 4 | Professional core courses (**PCC)** | 26 | 60 |
| 5 | Professional Elective courses relevant to chosen specialization/branch**(PEC)** | 7 | 21 |
| 6 | Open subjects – Electives from other technical and /or emerging subjects (**OEC)** | 3 | 9 |
| 7 | Project work, seminar and internship in industry or elsewhere**(PROJ)** | 5 | 16 |
| 8 | Mandatory Courses [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Knowledge Tradition]**(MC)** | 3 | 0 |
| | **Total** | 65 | 162 |

**CIA – Continuous Internal Assessment – Based on Projects / Assignment during the semester**

**Note:**
**AICTE Activity Points to be earned by students admitted to Degree program (For more details refer to Chapter 6, AICTE, Activity Point Program, Model Internship Guidelines):**
**Every regular student, who is admitted to the 4 year Degree program, is required to earn 100 activity points in addition to the total credits earned for the program. Students entering 4 years Degree Program through lateral entry are required to earn 75 activity points in addition to the total credits earned for the program. The activity points earned by the student shall be reflected on the students 8th Semester grade card.**
**The activities to earn the points can be spread over the duration of the course. However, minimum prescribed duration should be fulfilled.**
**Activity Points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression.**
**Incase student fail to earn the prescribed activity points, Eight semester Grade Card shall be issued only after earning the required activity Points.**
**Students shall be eligible for the award of degree only after the release of the Eight Semester grade card.**

***There are two groups (A & B) in semester 1 & 2. The Group division will be decided by The Dean SoE& IT before commencement of classes***

**ARKAJAIN University, Jharkhand**
School of Engineering & IT
Department of Engineering
Faculty – Bachelor of Technology in Civil Engineering
**PROGRAM OUTCOMES &PROGRAM SPECIFIC OUTCOMES**

**PROGRAM OUTCOMES**

After completing this undergraduate program, a learner:

**[PO.1].Engineering knowledge:** An ability to apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to get the solution of the engineering problems.

**[PO.2].Problem analysis:** Ability to Identify, formulates, review research literature, and analyze complex engineering problems.

**[PO.3].Design/Development of Solutions:** Ability to design solutions for complex Engineering Problems by considering social, Economic and Environmental aspects.

**[PO.4].Conduct investigations of complex problems:** Use research-based knowledge to design, conduct analyses experiments to get valid conclusion.

**[PO.5]. Modern tool usage:** ability to create, select, and apply appropriate techniques, and to model complex engineering activities with an understanding of the limitations.

**[PO.6]. The engineer and society:** Ability to apply knowledge by considering social health, safety, legal and cultural issues.

**[PO.7]. Environment and sustainability:** Understanding of the impact of the adopted engineering solutions in social and environmental contexts.

**[PO.8]. Ethics:** Understanding of the ethical issues of the civil engineering and applying ethical principles in engineering practices.

**[PO.9]. Individual and teamwork:** Ability to work effectively as an individual or in team, as a member or as a leader.

**[PO.10]. Communication:** An ability to communicate clearly and effectively through different modes of communication.

**[PO.11]. Project management and finance:** Ability to handle project and to manage finance related issue.

**[PO.12]. Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning.

**PROGRAM SPECIFIC OUTCOMES**

**[PSO.1]. Professional skills** – The ability to analyze and design civil engineering structures as per the guidelines in Indian standards and other relevant codes like buildings, bridges, tunnels ,railways, airports, water and sewage treatment plants etc

**[PSO.2]. Problem solving skills** – The ability to managed large infrastructural projects by making use of latest techniques of project management for optimum utilization of resources via man, material and money.

**[PSO.3]. Successful Career and Entrepreneurship** – Strong desire to acquire modern scientific knowledge by pursuing higher studies, which will lead them to identify problems in the civil engineering domains and thereby become entrepreneur to propose solution

**[PSO.4]. Communication:** Communicate effectively on complex engineering activities with the engineering community & with society at large, such as, being able to comprehend & write effective reports & design documentation, make effective presentations & give & receive clear instructions

# Subject: Construction Engineering & Management

Code: BTE26126

3 Credits | Semester VI

**A. Introduction:**

- To learn the principles for identification of sources of surface and subsurface water
- To learn calculation of population and requirement of drinking water
- To understand the plotting of water supply scheme highlighting different features
- To know evaluation of characteristics and treatment of sewage

B. **Course Outcomes:** At the end of the course, the student will able to;

**[CO1]** Understand the various kind of materials used in construction work.

**[CO2]** Understand different types of building foundation i.e. shallow and deep foundation,
their mechanisms and uses.

**[CO3]** Analyze various structural members of a building like-walls, door, window, stair, flooring, roof etc.

**[CO4]** **A**pply their knowledge at the time of decision making for application of structural member including material used.

**[CO5]** Evaluate the characteristics and suggest treatment of sewage

**C. Assessment Plan:**

| **Criteria** | **Description** | **Maximum Marks** |
|---|---|---|
| **Continuous Internal Assessment (CIA)** | Internal Examination | 20 |
| | Attendance | 5 |
| | Assignment | 5 |
| **End Semester Examination(ESE)** | End Semester Examination | 70 |
| **Total** | | 100 |
| **Attendance** | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

**HIGHWAY DEVELOPMENT AND PLANNING** : Unique features of construction, construction projects-types and features, phases of a project, agencies involved and their methods of execution; Construction project planning Stages of project planning:pre-tenderplanning, preconstruction planning,detailed construction planning ,role of clientand contractor levelofdetail.Processofdevelopmentofplansandschedules,workbreak- down structure, activity lists assessment of work content, concept of productivities, estimating durations, sequence of activities activity utility data; Techniques of planning- Bar charts, Gantt Charts Networks: basic terminology types of precedence relationships, preparation of CPM networks: activity on link and

activity on nod ere presentation, computation of float values, critical and semi critical paths calendaring networks. PERT-Assumption sunder lying PERT analysis, determining three time estimates, analysis, slack computations,

**CONSTRUCTION EQUIPMENTS AND METHOD** : Types of foundations and construction methods; Basics of Formwork and Staging Common building construction methods (conventional walls and slabs; conventional framed structure with block work walls ; Modular construction methods for repetitive works; Precast concrete construction methods; Basics of Slip Basics of Slip forming fort all structures; Basic construction methods for steel structures; Basicsof construction methods for Bridges. Conventional construction methods Vs Mechanized methods and advantages of latter; Equipment for Earthmoving, Dewatering; Concrete mixing, transporting & placing; Cranes Hoists and other equipment for lifting; Equipment for transportation of materials. Equipment Productivities

**PLANNING AND ORGANIZING CONSTRUCTION SITE AND RESOURCES** : Site: site layout including enabling structures, developing site organization, Documentation at site; Manpower: planning, organizing, staffing, motivation; Materials: concepts of planning, procurement and inventory control; Equipment: basic concepts of planning and organizing; Funds: cash flow, sources of funds; Histograms and S-Curves. Earned Value; Resource Scheduling- Bar chart, line of balance technique, resource constraints and conflicts; resource aggregation, allocation, smoothening and leveling. Common Good Practices in Construction

**PROJECT MONITORING &CONTROL** : Supervision, record keeping, periodic progress reports, periodical progress meetings. Updating of planspurpose, frequency and methods of updating. Common causes of time and cost overruns and corrective measures Basics of Modern Project management systems such as Lean Construction; Use of Building Information Modelling (BIM) in project management; Quality control: concept of quality quality of constructed structure, use of manuals and checklists for quality control, role of inspection basics of statistical quality control. Safety, Health and Environment on project sites: accidents; their causes, effects and preventive measures, costs of accidents, occupational health problems in construction, organizing for safety and health

**E. TEXT BOOKS**

T1. Varghese, P.C., ―Building Construction", Prentice Hall India, 2007.
T2. National Building Code, Bureau of Indian Standards, New Delhi, 2017.Chudley, R., Construction Technology, ELBS Publishers, 2007.
T3. Peurifoy,R.L. Construction Planning, Methods and Equipment, McGraw Hill, 20115.Nunnally, S.W. Construction Methods and Management, Prentice Hall, 2006

**F. REFERENCE BOOKS**

R1.Jha,KumarNeeraj.,ConstructionProjectmanagement,Theory&Practice,PearsonEducationIndia, 2015
R2. Punmia, B.C., Khandelwal, K.K.,ProjectPlanning with PERT and CPM, Laxmi Publications

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| [CO1] | Understand the various kind of materials used in construction work. | 3 | 2 | - | - | - | 1 | - | - | - | - | - | - | | 3 | 2 | 1 |
| [CO2] | Understand different types of building foundation i.e. shallow and deep foundation, their mechanisms and uses. | 2 | 3 | 1 | - | - | - | - | - | - | - | - | - | | 3 | 1 | 1 |
| [CO3] | Analyze various structural members of a building like-walls, door, window, stair, flooring, roof etc. | 3 | 2 | 1 | - | - | - | - | - | - | - | - | - | | 3 | 1 | 1 |
| [CO4] | **A**pply their knowledge at the time of decision making for application of structural member including material used. | 2 | 3 | 1 | - | - | - | - | - | - | - | - | - | | 3 | 1 | 1 |
| [CO5] | Evaluate the characteristics and suggest treatment of sewage | 3 | 3 | 1 | - | - | - | - | - | - | - | - | - | | 3 | 2 | 2 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Transportation Engineering -I

Code:BTE25093

3 Credits | Semester VI

Total Lecture: 45 Total Tutorial: 9

**A. Introduction:**

- To understand terminologies in contract and tender document and their significance.
- To know different types of contracts and their uses.
- To learn preparation of typical Tender documents for civil engineering work.
- To get acquainted with rent fixation and valuation of civil structures

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

**[CO1]** Understand various types of contract and when they are used
**[CO2]** Suggest the relevant type of contract for the given civil engineering work.
**[CO3]** Prepare the typical Tender document for the given civil engineering work
**[CO4]** Decide type of payment for the executed work.
**[CO5]** Justify the rent fixation and valuation of given civil structure

**C. Assessment Plan:**

| Criteria | Description | Maximum Marks |
|---|---|---|
| **Continuous Internal Assessment (CIA)** | Internal Examination | 20 |
| | Attendance | 5 |
| | Assignment | 5 |
| **End Semester Examination(ESE)** | End Semester Examination | 70 |
| **Total** | | 100 |
| **Attendance** | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

**HIGHWAY DEVELOPMENT AND PLANNING:** Classification of roads, road development in India, Current road projects in India; highway alignment and project preparation.

**GEOMETRIC DESIGN OF HIGHWAYS:** Introduction; highway cross section elements; sight distance, design of horizontal alignment; design of vertical alignment; design of inter sections, problems

**TRAFFIC ENGINEERING & CONTROL:** Traffic Characteristics, traffic engineering studies, traffic flow and capacity, traffic regulation and control; design of road intersections; design of parking facilities; highway lighting; problems

**PAVEMENT MATERIALS:** Materials used in Highway Construction- Soils, Stone aggregates, bituminous binders, bituminous paving mixes; Portland cement and cement concrete: desirable properties, tests, requirements for different types of pavements. Problems Mode of Payment to the contractor and its necessity -Interim Payment, Advance Payment Secured Advance, Petty advance, Mobilization advance, Running account bill, Final bill, Retention money, E – payment

**DESIGN OF PAVEMENTS:** Introduction; flexible pavements, factors affecting design and performance; stresses in flexible pavements; design of flexible pavements as per IRC; rigid pavements- components and functions; factors affecting design and performance of CC pavements; stresses in rigid pavements; design of concrete pavements as per IRC; problems

## E. TEXT BOOKS

T1. Khanna, S.K., Justo, C.E.G and Veeraragavan, A, 'Highway Engineering', Revised 10th Edition, Nem Chand & Bros, 2017

T2. Kadiyalai, L.R., ' Traffic Engineering and Transport Planning', Khanna Publishers.

T3. ParthaChakraborty, ' Principles of Transportation Engineering, PHI Learning,

## F. REFERENCE BOOKS

R1. Fred L. Mannering, Scott S. Washburn, Walter P. Kilareski,'Principles of Highway Engineering and Traffic Analysis', 4th Edition, John Wiley

R2. Srinivasa Kumar, R, Textbook of Highway Engineering, Universities Press, 2011,MonojitChakraborti, Kolkata.

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| [CO1] | Understand various types of contract and when they are used | 3 | 3 | 3 | 2 | 3 | 1 | - | - | - | 3 | 3 | 3 | 1 | 1 | 1 | 3 |
| [CO2] | Suggest the relevant type of contract for the given civil engineering work. | 3 | 3 | 3 | 2 | 2 | 2 | - | - | - | 2 | 3 | 2 | 2 | 1 | 1 | 3 |
| [CO3] | Prepare the typical Tender document for the given civil engineering work | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| [CO4] | Decide type of payment for the executed work. | 3 | 3 | 3 | 3 | 2 | 2 | - | - | - | 2 | 2 | 2 | 2 | 1 | 1 | 3 |
| [CO5] | Justify the rent fixation and valuation of given civil structure | 3 | 3 | 3 | 3 | 2 | 1 | - | - | - | 2 | 1 | 2 | 1 | 1 | 1 | 3 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Engineering Economics, Estimation& Costing

Code:BTE26127

3 Credits | Semester VI

Total Lecture: 45 Total Tutorial: 9

**A. Introduction:**

- To learn about types of maintenance techniques
- To understand causes of various types of damages.
- Civil Engineering Curriculum Structure 124
- To know about relevant materials for repair.
- To learn methods of retrofitting for different structures

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

**[CO1]** Identify alternative uses for limited resources and obtain appropriate data.

**[CO2]** Understand the key economic concepts and to place them in a real world context facilitating practical insights.

**[CO3]** Establish a framework of basic economic theory, which can be extended and applied at later stages of the degree program

**[CO4]** Develop an appreciation of the importance of economic forces in shaping the contemporary world.

**[CO5]** Employ critical thinking skills to analyze financial data as well as the effects of different financial accounting methods on the financial statement.

**C. Assessment Plan:**

| Criteria | Description | Maximum Marks |
|---|---|---|
| **Continuous Internal Assessment (CIA)** | Internal Examination | 20 |
| | Attendance | 5 |
| | Assignment | 5 |
| **End Semester Examination(ESE)** | End Semester Examination | 70 |
| **Total** | | 100 |
| **Attendance** | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

**BASIC PRINCIPLES AND METHODOLOGY OF ECONOMICS:** Demand/Supply – elasticity – Government Policies and Application. Theory of the Firm and Market Structure. Basic Macro-economic Concepts (including GDP/GNP/NI/Disposable Income) and Identities for both closed and open economies. Aggregate demand and Supply (IS/LM). Price Indices (WPI/CPI), Interest rates, Direct and Indirect Taxes

**PUBLIC SECTOR ECONOMICS:** Welfare, Externalities, Labour Market. Components of Monetary and Financial System, Central Bank –Monetary Aggregates; Commercial Banks &their functions; Capital and Debt Markets. Monetary and Fiscal Policy Tools & their impact on the economy – Inflation and Phillips Curve

**ELEMENTS OF BUSINESS/MANAGERIAL ECONOMICS AND FORMS OF ORGANIZATIONS AND INDIANECONOMY:** Cost & Cost Control –Techniques, Types of Costs, Lifecycle costs, Budgets, Break even Analysis, Capital Budgeting, Application of Linear Programming. Investment Analysis – NPV, ROI, IRR, Payback Period, Depreciation, Time value of money (present and future worth of cash flows). Business Forecasting – Elementary techniques. Statements – Cash flow, Financial. Case Study Method. Brief overview of post-independence period – plans. Post reform Growth, Structure of productive activity. Issues of Inclusion –Sectors, States/Regions, Groups of people (M/F), Urbanization. Employment– Informal, Organized, Unorganized, Public, Private. Challenges and Policy Debates in Monetary, Fiscal, Social, External sectors

**ESTIMATION / MEASUREMENTS FOR VARIOUS ITEMS:** Introduction to the process of Estimation; Use of relevant Indian Standard Specifications for the same, taking out quantities from the given requirements of the work, comparison of different alternatives, Bar bending schedules, Mass haul Diagrams, Estimating Earthwork and Foundations, Estimating Concrete and Masonry, Finishes, Interiors, MEP works; BIM and quantity take-offs; adding equipment costs; labour costs; rate analysis; Material survey-Thumb rules for computation of materials requirement for different materials for buildings, percentage breakup of the cost, cost sensitive index, market survey of basic materials. Use of Computers in quantity surveying

**SPECIFICATIONS, RATEANALYSIS AND TENDER:** Types, requirements and importance, detailed specifications for buildings, roads, minor bridges and industrial structures Purpose, importance and necessity of the same, factors affecting, task work, daily output from different equipment/ productivity Preparation of tender documents, importance of inviting tenders, contract types, relative merits, prequalification. general and special conditions, termination of contracts, extra work and Changes, penalty and liquidated charges, Settlement of disputes, R.A. Bill & Final Bill, Payment of advance, insurance, claims, price variation, etc. Preparing Bids-Bid Price buildup: Material, Labour, Equipment costs, Risks, Direct & Indirect Overheads, Profits; Bid conditions, alternative specifications; Alternative Bids. Bid process management

**E. TEXT BOOKS**

T1. Mankiw Gregory N. (2002), Principles of Economics, Thompson Asia
T2. V. Mote, S. Paul, G. Gupta (2004), Managerial Economics, Tata McGraw Hill Misra, S.K. andPuri (2009), Indian Economy, Himalaya
T3. PareekSaroj (2003), Textbook of Business Economics, Sunrise Publishers
T4. M Chakravarty, Estimating, Costing Specifications & Valuation

**F. REFERENCE BOOKS**

R1. Joy P K, Handbook of Construction Management, Macmillan
R2. B.S. Patil, Building &Engineering Contracts

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| [CO1] | Identify alternative uses for limited resources and obtain appropriate data. | | 3 | | | | | | | | | | 2 | 3 | 2 | 1 | 1 |
| [CO2] | Understand the key economic concepts and to place them in a real world context facilitating practical insights. | 3 | | 2 | | | | 3 | | | | | 2 | 3 | 2 | 1 | 2 |
| [CO3] | Establish a framework of basic economic theory, which can be extended and applied at later stages of the degree program | | | | 2 | 2 | 3 | | | | | | 2 | 3 | 2 | 1 | 2 |
| [CO4] | Develop an appreciation of the importance of economic forces in shaping the contemporary world. | | | | 3 | 3 | | | | | | | 2 | 3 | 1 | 1 | 2 |
| [CO5] | Employ critical thinking skills to analyze financial data as well as the effects of different financial accounting methods on the financial statement. | | | | | | | | | | | | 2 | 3 | 1 | 2 | 2 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Rock Mechanics

Code:BTE26315

3 Credits | Semester VI

Total Lecture: 45 Total Tutorial: 9

**A. Introduction:**

- The main objective is to teach engineering students: how to appreciate and identify geologic features that could have short and long-term consequences to the overall performance of various engineering structures and projects that they might encounter in their engineering careers, and how to quantify the effect of geologic features when considering rock-structure interaction

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

**[CO1]** Understand the about Properties of Rock

**[CO2]** Understand the Physic Strength and Deformability of Rock Mass and Failure.

**[CO3]** Understand the Physico-mechanical properties of soil and Ground Water

**[CO4]** Understand the engineering classification of rocks and rock masses

**C. Assessment Plan:**

| Criteria | Description | Maximum Marks |
|---|---|---|
| **Continuous Internal Assessment (CIA)** | Internal Examination | 20 |
| | Attendance | 5 |
| | Assignment | 5 |
| **End Semester Examination(ESE)** | End Semester Examination | 70 |
| **Total** | | 100 |
| **Attendance** | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

**INTRODUCTION:** Definition, History, Inherent complexities, Source of Information and field of application of rock mechanics. Concept of stress and strain in Rock.

**PROPERTIES OF ROCK:** Propagation of elastic wave in rock media; Determination of dynamic strength and elastic constants of rock. Time dependent properties of rock: Creep deformation and strength behavior; Creep test and rheological models.

**PHYSISTRENGTH AND DEFORMABILITY OF ROCK MASS AND FAILURE:** In situ shear tests; Evaluation of shear strength; In situ bearing strength test; In situ deformability tests-

Plate Loading Test, Plate Jacking Test and Borehole Jack Tests Failure criteria for rock and rockmass: Theories of rock failure; Coulomb, Mohr and Griffith criteria; Empirical criteria. Pre-mining state of stress: Sources, methods of determination including over coring, hydro-fracturing methods and other methods

**PHYSICO-MECHANICAL PROPERTIES OF SOIL AND GROUND WATER:** Origin of soils; Basic relationships; Index properties including consistency and gradation; Clay ineralogy; Classification of engineering soils; Engineering properties of soils – compressibility, consolidation, compaction and strength. Free and confined groundwater; Exploration and engineering importance of groundwater; Influence of water on rock and soil behaviour; Permeability of rocks; Measurement of permeability; Ground water flow in rockmass; Groundwater pressure in rock mass and its measurement.

**ENGINEERING CLASSIFICATION OF ROCKS AND ROCK MASSES:** Classification systems in rock engineering; Classification of intact rocks; Classification of rock masss-Terzaghi's rock load, RQD, Rock Structure Rating, Bieniawski's RMR, Barton's Q-System, Laubscher's-MRMR, Hoek's-GSI, Plastron's RMi, CMRI-ISM Rock mass classification and Recent developments; correlations between different classification systems; Applications of Rockmass Classification in rock engineering

**E. TEXT BOOKS**

T1. Fundamentals of Rock Mechanics" by J C Jaeger and N G W Cook.
T2. Rock Mechanics and Design Structures of Rock" by Obert and W I Duvall.
T3. Comprehensive Rock Mechanics" by J A Hudson.
T4. Fundamentals and Applications of Rock Mechanics" by DEB DEBASIS

**F. REFERENCE BOOKS**

R1. "Rock Mechanics: For Underground Mining" by B H G Brady
R2. "Introduction to Rock Mechanics" by Richard E Goodman

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| [CO1] | Understand the about Properties of Rock | 3 | 3 | 3 | 2 | 3 | 1 | - | - | - | - | 3 | 3 | 3 | 1 | 1 | 1 |
| [CO2] | Understand the Physic Strength and Deformability of Rock Mass and Failure. | 3 | 3 | 3 | 2 | 2 | 2 | - | - | - | | 3 | 2 | 2 | 2 | 1 | 1 |
| [CO3] | Understand the Physico-mechanical properties of soil and Ground Water | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| [CO4] | Understand the engineering classification of rocks and rock masses | 3 | 3 | 3 | 3 | 2 | 2 | - | - | - | - | 2 | 2 | 2 | 2 | 1 | 1 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Foundation Engineering

Code:BTE26316

3 Credits | Semester VI

Total Lecture: 45 Total Tutorial: 9

**A. Introduction:**

- Understand how to interpret design soil properties from a range of site investigation data
- Understand how to analyses foundations at the ultimate and serviceability limit states
- Know how to devise a numerical model of a geotechnical system

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

**[CO1]** Understand the foundation and anchoring design challenges in civil engineering
**[CO2]** Understand the soil behavior relevant to foundation and anchoring systems.
**[CO3]** Understand the techniques used to investigate and characterize the ground for design
**[CO4]** Understand the technologies used to install or construct foundation and anchoring system

**C. Assessment Plan:**

| Criteria | Description | Maximum Marks |
|---|---|---|
| **Continuous Internal Assessment (CIA)** | Internal Examination | 20 |
| | Attendance | 5 |
| | Assignment | 5 |
| **End Semester Examination(ESE)** | End Semester Examination | 70 |
| **Total** | | 100 |
| **Attendance** | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

**SHALLOW FOUNDATION** : Methods of estimation of bearing capacity, computation of bearing capacity factors, Effect of eccentric and inclined loads, effect of water table on bearing capacity, Terzaghi, Vesic, Hansen, Moyerhof's analysis, Bearing capacity of stratified soils. IS code recommendations for minimum depth, factor of safety, and design for local shear and general shear failure

**SETTLEMENT UNDER FOUNDATION** : Methods of estimation of settlement of footings. Limits of settlements for various structures, Indian Standard Code Provisions (IS: 1904, 6403, 8009). Determination of allowable bearing capacity as per IS code. Schemartman's method, Dee beer's and Mortin method of finding out settlement from static cone penetration test. Methods of finding out bearing capacity from plate load test, standard

penetration test data.

**PILE FOUNDATION** : Types of pile and their use, modes of failure. Bearing capacity and settlement of pile foundation. Types of piles, Allowable load, Pile load test, Dynamic and static formulae. Bearing Capacity factors. Pile group bearing capacity and settlement. Negative skin friction. Behavior of piles under lateral loading. Winkler's assumption. Pile resistance and deflection under lateral loads, elastic method, and Brooms method

**RAFT FOUNDATION**: Common types of raft, combined footing. Bearing capacity of raft, differential settlement of raft; semi empirical method of design of raft foundation. Well foundations: design and construction. Bearing capacity, settlement and lateral resistance. Tilts and shifts, IS and IRC codes methods.

**SOIL EXPLORATION AND SLOPE STABILITY**: Introduction, methods of site exploration and soil investigation, methods of boring, soil samplers, sampling procedures, trail pits, borings, penetrometer tests, analysis of borehole logs, geophysical and advance soil exploration methods, Introduction, types of slopes and their failure mechanisms, factor of safety, analysis of finite and infinite slopes, wedge failure Swedish circle method, friction circle method, stability numbers and charts. On completion of this module, the student must be able to

**E. TEXT BOOKS**

T1. Basic & Applied Soil Mechanics -by Ranjan& Rao, New Age International Publishers.

**F. REFERENCE BOOKS**

R1. Geotechnical Engineering by Gulhati&Dutta , Tata McGraw Hills, Delhi

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| [CO1] | Understand the foundation and anchoring design challenges in civil engineering | 2 | 2 | 2 | 2 | - | | | | | | 2 | 3 | 2 | 1 | 2 | 1 |
| [CO2] | Understand the soil behavior relevant to foundation and anchoring systems. | 2 | 2 | 2 | 3 | - | | | | | | 2 | 3 | 3 | 2 | 2 | 1 |
| [CO3] | Understand the techniques used to investigate and characterize the ground for design | 2 | 2 | 1 | 2 | - | | | | | | 1 | 2 | 3 | 1 | 1 | 1 |
| [CO4] | Understand the technologies used to install or construct foundation and anchoring system | 2 | 1 | 1 | 2 | - | | | | | | 2 | 2 | 2 | 3 | 2 | 1 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Environment Engineering-II

Code:BTE26130

3 Credits | Semester VI

Total Lecture: 45 Total Tutorial: 9

**A. Introduction:**

- Identify, formulate, analyze, and develop processes and technologies to meet desired environmental protection needs of society and formulate solutions that are technically sound, economically feasible, and socially acceptable

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

**[CO1]** Understand key current environmental problems like level of pollution

**[CO2]** Identify and value the effect of the pollutants on the environment: atmosphere, water and soil.

**[CO3]** Analyze an industrial activity and identify the environmental problems.

**[CO4]** Plan strategies to control, reduce and monitor pollution.

**[CO5]** Select the most appropriate technique to purify and/or control the emission of pollutants.

**C. Assessment Plan:**

| Criteria | Description | Maximum Marks |
|---|---|---|
| **Continuous Internal Assessment (CIA)** | Internal Examination | 20 |
| | Attendance | 5 |
| | Assignment | 5 |
| **End Semester Examination(ESE)** | End Semester Examination | 70 |
| **Total** | | 100 |
| **Attendance** | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

**SEWAGE CHARACTERISTICS** : General Terms: sewerage, domestic sewage, sewage treatment, disposal scope, Role of an Environmental engineer, historical overview. Quality parameters: BOD, COD, TOC, Solids, DO, Nitrogen, Phosphorus, Standards of disposal into natural watercourses and on land, Indian standards

**COLLECTION OF SEWAGE** : Systems of sewerage, Separate, combined, and partially separate, components of sewerage systems, systems of layout, quantity of sanitary sewage and variations, quantity of storms water, rational method, shapes of sewer, Hydraulic design of sewers: diameter self-cleansing velocity and slopes, construction and testing of sewer line,

Sewer materials, joints and appurtenances, Sewage pumping and pumping stations, maintenance of sewerage system.

**SEWAGE TREATMENT** : Various units: their purpose, sequence and efficiencies, preliminary treatment, screening and grit removal units, oil and grease removal, primary treatment, secondary treatment, activated sludge process, trickling filter, sludge digestion and drying beds, stabilization pond, septic tank, soakage systems, recent trends in sewage treatment, advanced wastewater treatment :nutrient removal, solids removal

**WASTEWATER DISPOSAL AND REUSE AND GOVERNMENT AUTHORITIES ROLE** : Disposal of sewage by dilution, self- purification of streams, sewage disposal by irrigation sewage farming, wastewaters reuse. Government authorities and their roles in water supply, sewerage disposal. Solid waste management and monitoring/control of environmental pollution

**SOLID WASTE MANAGEMENT** : Domestic and Storm water, Quantity of Sewage, Sewage flow variations. Conveyance of sewage- Sewers, shapes design parameters, operation and maintenance of sewers, Sewage pumping; Sewerage, Sewer appurtenances, Design of sewerage systems. Small bore systems, Storm Water- Quantification and design of Storm water; Sewage and Sullage, Pollution due to improper disposal of sewage, National River cleaning plans, Wastewater treatment, aerobic and anaerobic treatment systems, suspended and attached growth systems, recycling of sewage – quality requirements for various purposes

**E. TEXT BOOKS**

T1. Introduction to Environmental Engineering and Science by Gilbert Masters, Prentice Hall, New Jersey.
T2. Introduction to Environmental Engineering by P. AarneVesilind, Susan M. Morgan, Thompson /Brooks/Cole; Second Edition 2008.
T3. Peavy, H.s, Rowe, D.R, Tchobanoglous, G. Environmental Engineering, Mc-Graw Hill International Editions, New York 1985.
T4. MetCalf and Eddy. Wastewater Engineering, Treatment, Disposal and Reuse, Tata McGraw-Hill, New Delhi.

**F. REFERENCE BOOKS**

R1. Manual on Water Supply and Treatment. Ministry of Urban Development, New Delhi. Plumbing Engineering. Theory, Design and Practice, S.M. Patil, 1999
R2. Integrated Solid Waste Management, Tchobanoglous, Theissen& Vigil. McGraw Hill Publication

R3. Manual on Sewerage and Sewage Treatment Systems, Part A, B and C. Central Public Health and Environmental Engineering Organization, Ministry of Urban Development

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| [CO1] | Understand key current environmental problems like level of pollution | - | 3 | - | - | - | 1 | 2 | 1 | - | - | - | - | 3 | 2 | 1 | 2 |
| [CO2] | Identify and value the effect of the pollutants on the environment: atmosphere, water and soil. | - | - | 2 | - | 1 | 1 | - | - | - | - | - | - | 2 | 2 | 1 | 3 |
| [CO3] | Analyze an industrial activity and identify the environmental problems. | 1 | 1 | 1 | 2 | - | - | - | - | - | - | - | - | 2 | 2 | 1 | 3 |
| [CO4] | Plan strategies to control, reduce and monitor pollution. | - | - | 2 | - | 2 | - | - | - | - | - | - | - | 1 | 1 | 1 | 1 |
| [CO5] | Select the most appropriate technique to purify and/or control the emission of pollutants. | 1 | - | 1 | 2 | 2 | - | - | - | - | - | - | - | 2 | 1 | 1 | 1 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Rural Water Supply and onsite Sanitation System

Code:BTE26317

3 Credits | Semester VI

Total Lecture: 45 Total Tutorial: 9

**A. Introduction:**

- This course is design to explain the concepts behind water demand & supply and treatment of sewage.

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

**[CO1]** Identify problems pertaining to rural water supply and sanitation.
**[CO2]** Design water supply and sanitation system for rural community.
**[CO3]** Design low cost waste management systems for rural areas.
**[CO4]** Plan and design an effluent disposal mechanism

**C. Assessment Plan:**

| Criteria | Description | Maximum Marks |
|---|---|---|
| **Continuous Internal Assessment (CIA)** | Internal Examination | 20 |
| | Attendance | 5 |
| | Assignment | 5 |
| **End Semester Examination(ESE)** | End Semester Examination | 70 |
| **Total** | | 100 |
| **Attendance** | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

**IMPORTANT AND SOURCE OF WATER:** General: Importance of village community in India, Condition of Indian villages with special regard to economics, social and health aspects. Traditional sources of water in rural areas. Different types of wells, sanitary aspects in well construction, pumps used for village wells, Hand pump Technology, its operation and maintenance. Water harvesting techniques

**QUALITY OF WATER AND COMMUNICABLE DISEASES:** Estimation of total water requirement including cattle water demand, quality of water needed for village community, water quality surveillance, standards of water quality.Diseases and immunity, Source of communicable diseases, Mode of transfer, Control of communicable diseases, Guinea worm Eradication.

**WATER TREATMENT AND SCHEMES OF RURAL WATER SUPPLY:** Slow sand filter, horizontal roughing filter and their combination. Disinfection of rural water sources, Fluoride and its removal. Different Schemes of Rural water supply in Rajasthan, Their Design and project formulation including the programmes and standards laid by Govt. of India and Govt. of Rajasthan.

**MILK AND FOOD SANITATION:** Essentials of dairy farm and cattle shed sanitation, Tests for milk and dairy products, food epidemics, food poisoning, Botulism. Fly and Mosquito control: Life cycle of flies and mosquitoes, various methods of flies and mosquito control.

**RURAL SANITATION:** Village latrines, VIP latrines, pour flush latrines, materials, construction and cost of the latrines, Pollution aspects and pollution travel from latrines. Storm water and sludge problems. Septic tank, soak pit, small-bore sewer system; its design and construction. Animal waste, method of composting, Biogas, collection and disposal ofwastes. Community Awareness and user participation: Planning of communication support in rural supply and sanitation projects.

**E. TEXT BOOKS**

T1. Rural Water Supply & Sanitation Manual by Govt. of India
T2. Municipal and Rural Sanitation E.W. Steel, McGraw Hill Book Co.

**F. REFERENCE BOOKS**

R1. Reports of Rajeev Gandhi National Drinking Water Mission
R2. The Innovator's Dilemma: The Revolutionary Book That Will Change the Way Clayton M. Christensen

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| [CO1] | Identify problems pertaining to rural water supply and sanitation. | - | 3 | - | - | - | 1 | 2 | 1 | - | - | - | - | 1 | 3 | 2 | 2 |
| [CO2] | Design water supply and sanitation system for rural community. | - | - | 2 | - | 1 | 1 | - | - | - | - | - | - | 1 | 2 | 2 | 2 |
| [CO3] | Design low cost waste management systems for rural areas. | 1 | 1 | 1 | 2 | - | - | - | - | - | - | - | - | 1 | 3 | 3 | 3 |
| [CO4] | Plan and design an effluent disposal mechanism | - | - | 2 | - | 2 | - | - | - | - | - | - | - | 2 | 2 | 1 | 3 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Design of Steel Structures

Code:BTE26134

3 Credits | Semester VI

Total Lecture: 45 Total Tutorial: 9

**A. Introduction:**

- To understand the concepts involved in the design of riveted and welded connections.
- To know the provisions of BIS code for design of built up section
- To identify short and long columns and their design provisions.

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

**[CO1]** Design of riveted and welded connections.

**[CO2]** Design of built up sections.

**[CO3]** Analyze and design of simple bolted and welded connections

**[CO4]** Design steel framing system and connections of a building in a team setting

**[CO5]** Understand the structural steel fabrication process and construction through field trip and or speaker presentation

**C. Assessment Plan:**

| Criteria | Description | Maximum Marks |
|---|---|---|
| **Continuous Internal Assessment (CIA)** | Internal Examination | 20 |
| | Attendance | 5 |
| | Assignment | 5 |
| **End Semester Examination(ESE)** | End Semester Examination | 70 |
| **Total** | | 100 |
| **Attendance** | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

**INTRODUCTION**:Steel structures, material properties, Limit states and design philosophies; analysis and design methods, Loads, partial safety factors and load combinations, analysis of roof for wind loads. Codes and standards. Section Classification: Plastic, compact, semi-compact, and slender sections. Connections: Structural fasteners - Rivets, bolts and welds, strength under combined stresses, Bolted and Welded Connections -

Simple and Eccentric and Column bases

**TENSION MEMBERS**:Design based on net section including shear lag effects and block shear, lug angles. Compression members.

**DESIGN OF MEMBER**:Design for flexural and flexural-torsional buckling, Effective length factor: Sway and Non-sway frames, Local buckling, Built-up columns - Battens and lacings. Laterally Supported and Unsupported Beams

**DESIGN STRENGTH USING SHEAR-MOMENT INTERACTION** : Built-up beams, Shear buckling strength, Plate girders and design of stiffeners, Lateral torsional buckling, Effect of restraints and effective length

**BEAM-COLUMNS** : Effect of axial load on flexure behavior, P-M interaction and moment amplification, Flexural torsional buckling and Bi-axial bending

**E. TEXT BOOKS**

T1. McCormac, J.C., Nelson, J.K. Jr., Structural Steel Design. 3rd edition. Prentice Hall, N.J., 2003.
T2. Gal ambos, T.V., Lin, F.J., Johnston, B.G., Basic Steel Design with LRFD, Prentice Hall, 1996
T3. Segui, W. T., LRFD Steel Design, 2nd Ed., PWS Publishing, Boston.
T4. Salmon, C.G. and Johnson, J.E., Steel Structures: Design and Behavior, 3rd Edition, Harper & Row, Publishers, New York, 1990.
T5. Related Codes of Practice of BIS
T6 .NBC, National Building Code, BIS (2017).
T7. ASCE, Minimum Design Loads for Buildings and Other Structures, ASCE 7-02, American Society of Civil Engineers, Virginia, 2002.
T8. Subramanian, N. (2010). Steel Structures: Design and Practice, Oxford University Press.
T9 Duggal, S.K. (2014). Limit State Design of Steel Structures, McGraw Hill.

**F. REFERENCE BOOKS**

R1. ASCE, Minimum Design Loads for Buildings and Other Structures, ASCE 7-02, American Society of Civil Engineers, Virginia, 2002.
R2. Subramanian, N. (2010). Steel Structures: Design and Practice, Oxford University Press.
R3. Duggal, S.K. (2014). Limit State Design of Steel Structures, McGraw Hill.

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| [CO1] | Design of riveted and welded connections. | 3 | 2 | 2 | 2 | - | - | | | | | - | 1 | 2 | 2 | 2 | 1 |
| [CO2] | Design of built up sections. | 3 | 2 | 2 | 2 | - | | | | | | - | 1 | 2 | 2 | 2 | 1 |
| [CO3] | Analyze and design of simple bolted and welded connections | 3 | 2 | 2 | 2 | - | | | | | | - | 1 | 2 | 2 | 2 | 1 |
| [CO4] | Design steel framing system and connections of a building in a team setting | 3 | 1 | 1 | 1 | 1 | | | | | | 2 | 1 | 1 | 1 | 1 | 1 |
| [CO5] | Understand the structural steel fabrication process and construction through field trip and or speaker presentation | 3 | 3 | 3 | 1 | 1 | | | | | | 2 | 1 | 3 | 1 | 1 | 1 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Earthquake Engineering

Code:BTE26318

3 Credits | Semester VI

Total Lecture: 45 Total Tutorial: 9

**A. Introduction:**

- To provide a coherent development to the student for the courses in the sector of earthquake engineering.
- To present the foundation of many basic engineering concept related earthquake engineering.

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

**[CO1]** Understand the theoretical and practical aspects of earthquake engineering along with the planning and design aspect.

**[CO2]** Acquire the diverse knowledge of earthquake engineering practices apply to real life problems.

**[CO3]** Analyze the potential consequences of an earthquake.

**[CO4]** Understand the earthquake intensity and earthquake magnitude.

**[CO5]** Evaluate the enormous energies released by earthquakes.

**C. Assessment Plan:**

| Criteria | Description | Maximum Marks |
|---|---|---|
| **Continuous Internal Assessment (CIA)** | Internal Examination | 20 |
| | Attendance | 5 |
| | Assignment | 5 |
| **End Semester Examination(ESE)** | End Semester Examination | 70 |
| **Total** | | 100 |
| **Attendance** | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

**INTRODUCTORY SEISMOLOGY**:Various terminology related with earthquake, Causes of earthquake, plate tectonics, Tsunami. Seismic wave propagation. Magnitude, intensity & energy of earthquake, magnitude & intensity scales, classifications of earthquakes, Seismic zoning case histories of earthquakes. Seismic hazards, induced hazards

**MEASUREMENT AND CAUSE OF EARTHQUAKE**:Earthquake recording, Seismic instruments, Seismographs & Seismograms. Basic concept of liquefaction and isolation. Introduction to various IS related codes. Structural systems, Effects of earthquake on

buildings in general, structural and nonstructural failures. Dynamic characteristics of buildings, natural period of vibration, damping, stiffness etc. Seismic performance of traditionally built masonry constructions, typical failure mechanism of masonry buildings under earthquakes.

**IS CODE PROVISION** : IS 4326: 1993: Planning consideration & architectural concept, provisions for earthquake resistant construction/ seismic strengthening of masonry constructions

**SEISMIC PERFORMANCE OF REINFORCED CONCRETE BUILDINGS**:Plan, elevation & stiffness irregularities & their effects. Typical earthquake damages of RC constructions, short column effect, soft storey effect, strong column-weak beam analogy. IS 13920: 1993: Ductile detailing of reinforced concrete buildings and shear wall concept. BEAM-COLUMNS: Effect of axial load on flexure behavior, P-M interaction and moment amplification, Flexural torsional buckling and Bi-axial bending

advance, Mobilization advance, Running account bill, Final bill, Retention money, E – payment

**SEISMIC DESIGN PHILOSOPHY, IS 1893 (PART I):2002 CODALPROVISIONS**:Load combinations, Design lateral loads, response reduction factors, structural modeling of building frames, and equivalent load method for earthquake analysis of multistory frames.

**E. TEXT BOOKS**

T1. Structural Dynamics by Anil K Chopra ,PearsonEducation.
T2. Dynamics of Structures by Clough &Penzin, McGraw Hill BookCo.
T3. Earthquake Engineering by PankajAgarwal& Manish Shree Khande, Prentice Hall ofIndia.

**F. REFERENCE BOOKS**

T4. Earthquake Tips by C.V R. Murthy, IIT Kanpur.
T5. Earthquake-Resistant Design of Steel Structures by Duggal, Oxford UniversityPress

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| [CO1] | Understand the theoretical and practical aspects of earthquake engineering along with the planning and design aspect. | 3 | 2 | 3 | 3 | - | - | - | - | - | - | 1 | - | 3 | 3 | 3 | 1 |
| [CO2] | Acquire the diverse knowledge of earthquake engineering practices apply to real life problems. | 3 | 3 | 3 | 2 | 3 | - | - | - | - | 1 | 1 | - | 3 | 3 | 2 | 2 |
| [CO3] | Analyze the potential consequences of an earthquake. | 3 | 1 | 2 | 1 | 3 | - | - | 1 | - | 1 | - | - | 3 | 2 | 1 | 1 |
| [CO4] | Understand the earthquake intensity and earthquake magnitude. | 3 | - | 2 | - | 3 | - | - | - | - | - | - | - | 3 | 2 | 1 | 3 |
| [CO5] | Evaluate the enormous energies released by earthquakes. | 3 | 3 | - | 2 | 2 | - | - | - | 1 | 1 | - | - | 3 | 2 | 2 | 2 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Design of Concrete Structure-I

Code:BTE26319

3 Credits | Semester VI

Total Lecture: 45 Total Tutorial: 9

**A. Introduction:**

- This course aims at providing students with a solid background on principles of structural engineering design. Students will be exposed to the theories and concepts of both concrete and steel design and analysis both at the element and system levels. Hands-on design experience and skills will be gained and learned through problem sets and a comprehensive design project. An understanding of real-world open-ended design issues will be developed. Weekly recitations and project discussions will be held besides lectures

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

**[CO1]** Understand the basic information on various types of disasters

**[CO2]** Understand the precautions and awareness regarding various disasters

**[CO3]** Decide first action to be taken under various disasters.

**[CO4]** Familiarize with organization in India which are dealing with disasters

**[CO5]** **S**elect IT tools to help in disaster management

**C. Assessment Plan:**

| **Criteria** | **Description** | **Maximum Marks** |
|---|---|---|
| **Continuous Internal Assessment (CIA)** | Internal Examination | 20 |
| | Attendance | 5 |
| | Assignment | 5 |
| **End Semester Examination(ESE)** | End Semester Examination | 70 |
| **Total** | | 100 |
| **Attendance** | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

**INTRODUCTION:** concepts of energy principles, safety, sustainable development in performance; what makes a structure; principles of stability, equilibrium; what is a structural engineer, role of engineer, architect, user, builder; what are the functions‘ what do the engineers design, first principles of process of design

**INTRODUCTION TO REINFORCED CONCRETE STRUCTURES:** Basic material properties: stress- strain relation of concrete and reinforcing steel Planning and Design Process; Materials, Loads, and Design Safety; Behaviour and Properties of Concrete and Steel; Wind and Earthquake Loads Design philosophy: assumptions and code of practice.

**SINGLY REINFORCED MEMBERS:** Theory of singly reinforced members in bending, Design of simply supported and continuous beams with rectangular and flanged section,

**LIMIT STATE METHOD:** Limit state of collapse in shear, Design for bond, Design of one-way and two-ways lab systems

**DESIGN COLUMN:** Design of columns under uniaxial and biaxial bending, Design of footings and stair case

**E. TEXT BOOKS**

T1. Nilson, A. H.Design of ConcreteStructures.13th edition. McGraw-Hill ,2004
T2. McCormac,J.C.,Nelson,J.K.Jr.,StructuralSteelDesign.3rdedition.PrenticeHall, N.J., 2003.
T3. Galambos,T.V.,Lin,F.J.,Johnston,B.G.,BasicSteelDesignwithLRFD,PrenticeHall,1996
T4. Segui, W. T., LRFDSteel Design, 2nd Ed., PWSPublishing,Boston.

**F. REFERENCE BOOKS**

R1. Salmon, C.G. and Johnson, J.E., Steel Structures: Design and Behavior, 3rd Edition, Harper & Row, Publishers, NewYork, 1990.
R2. Mac Gregor, J.G. ,Reinforced Concrete: Mechanics and Design, 3rd Edition, Prentice Hall, NewJersey, 1997.

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| [CO1] | Understand the basic information on various types of disasters | 3 | 2 | 3 | 3 | - | - | - | - | - | - | 1 | - | 2 | 3 | 3 | 1 |
| [CO2] | Understand the precautions and awareness regarding various disasters | 3 | 3 | 3 | 2 | 3 | 1 | - | - | - | 1 | 1 | - | 3 | 3 | 2 | 2 |
| [CO3] | Decide first action to be taken under various disasters. | 3 | 1 | 2 | 1 | 3 | - | - | - | - | 1 | - | - | 1 | 2 | 1 | 2 |
| [CO4] | Familiarize with organization in India which are dealing with disasters | 3 | - | 2 | - | 3 | 2 | - | - | - | - | - | - | 1 | 2 | 1 | 3 |
| [CO5] | Select IT tools to help in disaster management | 3 | 3 | - | 2 | 2 | 2 | - | - | 1 | 1 | - | - | 3 | 2 | 2 | 2 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Transportation Engineering-I Lab

Code:BTE25098

1 Credits | Semester VI

Total Lecture: 30

**A. Introduction:**

- To understand terminologies in contract and tender document and their significance.
- To know different types of contracts and their uses.
- To learn preparation of typical Tender documents for civil engineering work.
- To get acquainted with rent fixation and valuation of civil structures

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

**[CO1]** Understand various types of contract and when they are used
**[CO2]** Suggest the relevant type of contract for the given civil engineering work
**[CO3]** Prepare the typical Tender document for the given civil engineering work
**[CO4]** Decide type of payment for the executed work
**[CO5]** Justify the rent fixation and valuation of given civil structure

**C. Assessment Plan:**

| Criteria | Description | Maximum Marks |
|---|---|---|
| Continuous Internal Assessment (CIA) | Internal Examination | 5 |
| | Attendance | 5 |
| | Assignment | 5 |
| End Semester Examination(ESE) | End Semester Examination | 35 |
| Total | | 50 |
| Attendance | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

| SR. NO. | EXCERCISE/LAB WORK | LECTURES |
|---|---|---|
| 1 | To determine the Gradation of aggregate. | 3 hours |
| 2 | To determine the Specific gravity & Water Absorption test of aggregates. | 3 hours |
| 3 | To determine the Flakiness Index of the given aggregate | 3 hours |

| | | |
|---|---|---|
| | sample. | |
| 4 | To determine the Elongation Index of the given aggregate sample. | 3 hours |
| 5 | To determine the abrasion value of the given aggregate by losangeles abrasion test. | 3 hours |
| 6 | To determine the strength of the Subgrade of soil by California Bearing Ratio test (CBR). | 3 hours |
| 7 | To determine the penetration test of bitumen. | 3 hours |
| 8 | To determine the flash & fire point of Bitumen. | 3 hours |
| 9 | Penetration test of bitumen. | 3 hours |
| 10 | Ductility test of Bitumen. | 3 hours |

**E. TEXT BOOKS**

T1. Khanna, S.K., Justo, C.E.G and Veeraragavan, A, 'Highway Engineering', Revised 10th Edition, Nem Chand & Bros, 2017

T2. Kadiyalai, L.R., ' Traffic Engineering and Transport Planning', Khanna Publishers.

T3. ParthaChakraborty, ' Principles of Transportation Engineering, PHI Learning,

**F. REFERENCE BOOKS**

R1. Fred L. Mannering, Scott S. Washburn, Walter P. Kilareski,'Principles of Highway Engineering and Traffic Analysis', 4th Edition, John Wiley

R2. Srinivasa Kumar, R, Textbook of Highway Engineering, Universities Press, 2011,MonojitChakraborti, Kolkata.

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| [CO1] | Understand various types of contract and when they are used | 3 | 3 | 3 | 2 | 3 | 1 | - | - | - | - | 3 | 1 | 1 | 1 | 1 | 3 |
| [CO2] | Suggest the relevant type of contract for the given civil engineering work | 3 | 3 | 3 | 2 | 2 | 2 | - | - | - | - | 3 | 2 | 2 | 1 | 1 | 2 |
| [CO3] | Prepare the typical Tender document for the given civil engineering work | 3 | 2 | - | - | 1 | - | - | - | - | - | - | - | - | - | - | - |
| [CO4] | Decide type of payment for the executed work | 3 | 3 | 3 | 3 | 2 | 2 | - | - | - | - | 2 | - | 2 | 1 | 1 | 3 |
| [CO5] | Justify the rent fixation and valuation of given civil structure | 3 | 3 | 3 | 3 | 2 | 1 | - | - | - | - | 1 | 2 | 1 | 1 | 1 | 1 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

ARKA JAIN University
Jharkhand

Syllabus of

**B.Tech. in Civil Engineering**

**Semester-VII**

**ARKAJAIN University, Jharkhand**
School of Engineering & IT
Department of Engineering
Faculty – Bachelor of Technology in Civil Engineering
**Scheme of Study (w.e.f Batch 2020-24)**

## SEMESTER –I

| Sr. No. | Name of the Subject | Group | L-T-P | Credit |
|---|---|---|---|---|
| 1 | Engineering Mathematics–I | A & B | 3-1-0 | 4 |
| 2 | Engineering Chemistry | A | 3-0-0 | 3 |
| | Programming for Problem Solving | B | 3-0-0 | 3 |
| 3 | Basic Electrical Engineering | A | 3-1-0 | 4 |
| | Engineering physics | B | 3-1-0 | 4 |
| 4 | Engineering Mechanics | A | 3-0-0 | 3 |
| | English for Communication | B | 3-0-0 | 3 |
| 5 | Constitution of India | B | 0-0-0 | 0 |
| | **Practical** | | | |
| 6 | Engineering Chemistry Lab | A | 0-0-1 | 1 |
| | Engineering Physics Lab | B | 0-0-1 | 1 |
| 7 | Basic Electrical Engineering Lab | A | 0-0-1 | 1 |
| | Programming for Problem Solving Lab | B | 0-0-2 | 2 |
| 8 | Engineering Mechanics Lab | A | 0-0-1 | 1 |
| 9 | Engineering Graphics & Design | A | 0-0-2 | 2 |
| | Workshop Practices | B | 0-0-2 | 2 |
| | TOTAL | A or B | 12-2-5 | 19 |

# SCHEME OF THE STUDY
# SEMESTER –II

| Sr. No. | Name of the Subject | Group | L-T-P | Credit |
|---|---|---|---|---|
| 1 | Engineering Mathematics–II | A & B | 3-1-0 | 4 |
| 2 | Engineering Chemistry | B | 3-0-0 | 3 |
| | Programming for Problem Solving | A | 3-0-0 | 3 |
| 3 | Basic Electrical Engineering | B | 3-1-0 | 4 |
| | Engineering physics | A | 3-1-0 | 4 |
| 4 | Engineering Mechanics | B | 3-0-0 | 3 |
| | English for Communication | A | 3-0-0 | 3 |
| 5 | Constitution of India | A | 0-0-0 | 0 |
| | **Practical** | | | |
| 6 | Engineering Chemistry Lab | B | 0-0-1 | 1 |
| | Engineering Physics Lab | A | 0-0-1 | 1 |
| 7 | Basic Electrical Engineering Lab | B | 0-0-1 | 1 |
| | Programming for Problem Solving Lab | A | 0-0-2 | 2 |
| 8 | Engineering Mechanics Lab | B | 0-0-1 | 1 |
| | Engineering Graphics& Design | B | 0-0-2 | 2 |
| 9 | Workshop Practices | A | 0-0-2 | 2 |
| | TOTAL | A or B | 12-2-5 | 19 |

# SEMESTER –I (Group-A)

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Engineering Chemistry | BSC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 2 | Engineering Mathematics–I | BSC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 3 | Basic Electrical Engineering | ESC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 4 | Engineering Mechanics | ESC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| | **Practical** | | | | | | | | |
| 5 | Engineering Chemistry Lab | BSC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 6 | Basic Electrical Engineering Lab | ESC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 7 | Engineering Mechanics Lab | ESC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 8 | Engineering Graphics& Design | ESC | 2 | 4 | 50 | 35 | 5 | 5 | 5 |
| | **TOTAL** | | **19** | **24** | **600** | **420** | **100** | **40** | **40** |

# SEMESTER I (Group-B)

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Engineering physics | BSC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 2 | Engineering Mathematics –I | BSC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 3 | Programming for Problem Solving | ESC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | English for Communication | HSMC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 5 | Constitution of India | MC | 0 | 2 | 50 | 35 | 10 | 2.5 | 2.5 |
| | **Practical** | | | | | | | | |
| 6 | Engineering physics Lab | BSC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 7 | Programming for Problem Solving Lab | ESC | 2 | 4 | 50 | 35 | 5 | 5 | 5 |
| 8 | Workshop Practices | ESC | 2 | 4 | 50 | 35 | 5 | 5 | 5 |
| | **TOTAL** | | **19** | **26** | **600** | **420** | **105** | **37.5** | **37.5** |

# SEMESTER II (Group-A)

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Engineering physics | BSC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 2 | Engineering Mathematics –II | BSC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 3 | Programming for Problem Solving | ESC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | English for Communication | HSMC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 5 | Constitution of India | MC | 0 | 2 | 50 | 35 | 10 | 2.5 | 2.5 |
| | **Practical** | | | | | | | | |
| 6 | Engineering physics Lab | BSC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 7 | Programming for Problem Solving Lab | ESC | 2 | 4 | 50 | 35 | 5 | 5 | 5 |
| 8 | Workshop Practices | ESC | 2 | 4 | 50 | 35 | 5 | 5 | 5 |
| | **TOTAL** | | **19** | **26** | **600** | **420** | **105** | **37.5** | **37.5** |

# SEMESTER –II (Group-B)

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Engineering Chemistry | BSC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 2 | Engineering Mathematics–II | BSC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 3 | Basic Electrical Engineering | ESC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 4 | Engineering Mechanics | ESC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| | **Practical** | | | | | | | | |
| 5 | Engineering Chemistry Lab | BSC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 6 | Basic Electrical Engineering Lab | ESC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 7 | Engineering Mechanics Lab | ESC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 8 | Engineering Graphics& Design | ESC | 2 | 4 | 50 | 35 | 5 | 5 | 5 |
| | **TOTAL** | | **19** | **24** | **600** | **420** | **100** | **40** | **40** |

# SEMESTER-III

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA * | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Engineering Mathematics -III | BSC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 2 | Biology for Engineers | BSC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 3 | Surveying &Geomatics | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | Mechanics of Solid | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 5 | Introduction to Civil Engineering | HSMC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 6 | Environmental Science | MC | 0 | 2 | 50 | 35 | 10 | 2.5 | 2.5 |
| | **Practical** | | | | | | | | |
| 7 | Surveying &Geomatics Lab | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 8 | Mechanics of Solid | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 9 | Computer Aided Civil Engineering Drawing | ESC | 2 | 4 | 50 | 35 | 5 | 5 | 5 |
| | **TOTAL** | | **20** | **26** | **700** | **490** | **125** | **42.5** | **42.5** |

# SEMESTER-IV

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Material Testing & Evaluation | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 2 | Engineering Geology | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 3 | Fluid Mechanics | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | Structural Analysis - I | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 5 | Geotechnical Engineering | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 6 | Civil Engineering-Societal & Global Impact | HSMC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| | **Practical** | | | | | | | | |
| 7 | Material Testing & Evaluation | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 8 | Engineering Geology Lab | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 9 | Geotechnical Engineering Lab | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 10 | Fluid Mechanics Lab | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| | **TOTAL** | | **22** | **26** | **800** | **560** | **140** | **50** | **50** |

# SEMESTER V

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Hydraulic Engineering | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 2 | Structural Analysis II | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 3 | Hydrology & Water Resource Engineering | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | Environmental Engineering-I | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 5 | Open Elective I Humanities I<br>Professional Practice, Law & Ethics<br>Organizational Behavior | HSMC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 6 | Disaster Preparedness & Planning | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 7 | Essence of Indian Knowledge Tradition | MC | 0 | 2 | 50 | 35 | 10 | 2.5 | 2.5 |
| | PRACTICAL | | | | | | | | |
| 8 | Hydraulic Engineering Lab | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 9 | Structural Analysis II Lab | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 10 | Summer Internship –I (3-4 week) | PROJ | 2 | 0 | 50 | 35 | 15 | 0 | 0 |
| | **TOTAL** | | **22** | **24** | **800** | **560** | **155** | **42.5** | **42.5** |

# SEMESTER VI

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory / Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Construction Engineering & Management | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 2 | Transportation Engineering-I | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 6 | Engineering Economics, Estimation & Costing | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 3 | Elective I<br>Rock Mechanics<br>Foundation Engineering | PEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | Elective II<br>Environmental Engineering II<br>Rural water supply & Onsite Sanitation System | PEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 6 | Elective III<br>Design of Steel Structure<br>Earthquake Engineering | PEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 7 | Design of Concrete Structures-I | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| | **Practical** | | | | | | | | |
| 8 | Transportation Engineering I Lab | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| | **TOTAL** | | **22** | **23** | **750** | **525** | **145** | **40** | **40** |

# SEMESTER VII

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Elective IV<br>Air and Noise Pollution and Control<br>Solid and hazardous Waste Management | PEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 2 | Elective V<br>Design of Concrete Structure - II<br>Prestressed Concrete | PEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 3 | Open Elective II<br>Metro System & Engineering<br>History of Science & Engineering | OEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | River Engineering | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| | **Practical** | | | | | | | | |
| 5 | Minor Project | PROJ | 3 | 6 | 100 | 70 | 30 | 0 | 0 |
| 6 | Summer Internship –II –(4-6 Week) | PROJ | 3 | 0 | 100 | 70 | 30 | 0 | 0 |
| | **TOTAL** | | **18** | **18** | **600** | **420** | **140** | **20** | **20** |

# SEMESTER VIII

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Elective VI<br>Bridge Engineering<br>Ground Water Engineering | PEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 2 | Elective VII<br>Railway Engineering<br>Traffic Engineering and Management | PEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 3 | Open Elective III<br>Soft Skills and Interpersonal Communication<br>Human Resource Development and Organizational Behavior | OEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | Open Elective IV<br>Civil Engineering Design-I<br>Geographic Information Systems and Science | OEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| | **Practical** | | | | | | | | |
| 5 | Major Project | PROJ | 8 | 16 | 200 | 140 | 60 | 0 | 0 |
| 6 | Extra- Curricular/ Co-Curricular Activity | PROJ | 0 | 0 | 100 | 70 | 30 | 0 | 0 |
| | **TOTAL** | | **20** | **28** | **700** | **490** | **170** | **20** | **20** |

## Distribution of Credit across 8 semesters:

| Sl. No | Type of Paper | No. of Paper | Total Credit |
|---|---|---|---|
| 1 | Humanities and Social Sciences including Management courses **(HSMC)** | 4 | 12 |
| 2 | Basic Science courses**(BSC)** | 8 | 24 |
| 3 | Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc**(ESC)** | 9 | 20 |
| 4 | Professional core courses (**PCC)** | 26 | 60 |
| 5 | Professional Elective courses relevant to chosen specialization/branch**(PEC)** | 7 | 21 |
| 6 | Open subjects – Electives from other technical and /or emerging subjects (**OEC)** | 3 | 9 |
| 7 | Project work, seminar and internship in industry or elsewhere**(PROJ)** | 5 | 16 |
| 8 | Mandatory Courses [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Knowledge Tradition]**(MC)** | 3 | 0 |
| | **Total** | 65 | 162 |

**CIA – Continuous Internal Assessment – Based on Projects / Assignment during the semester**

**Note:**
**AICTE Activity Points to be earned by students admitted to Degree program (For more details refer to Chapter 6, AICTE, Activity Point Program, Model Internship Guidelines):**
**Every regular student, who is admitted to the 4 year Degree program, is required to earn 100 activity points in addition to the total credits earned for the program. Students entering 4 years Degree Program through lateral entry are required to earn 75 activity points in addition to the total credits earned for the program. The activity points earned by the student shall be reflected on the students 8th Semester grade card.**
**The activities to earn the points can be spread over the duration of the course. However, minimum prescribed duration should be fulfilled.**
**Activity Points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression.**
**Incase student fail to earn the prescribed activity points, Eight semester Grade Card shall be issued only after earning the required activity Points.**
**Students shall be eligible for the award of degree only after the release of the Eight Semester grade card.**

***There are two groups (A & B) in semester 1 & 2. The Group division will be decided by The Dean SoE& IT before commencement of classes***

**ARKAJAIN University, Jharkhand**
School of Engineering & IT
Department of Engineering
Faculty – Bachelor of Technology in Civil Engineering
**PROGRAM OUTCOMES &PROGRAM SPECIFIC OUTCOMES**

**PROGRAM OUTCOMES**

After completing this undergraduate program, a learner:

**[PO.1].Engineering knowledge:** An ability to apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to get the solution of the engineering problems.

**[PO.2].Problem analysis:** Ability to Identify, formulates, review research literature, and analyze complex engineering problems.

**[PO.3].Design/Development of Solutions:** Ability to design solutions for complex Engineering Problems by considering social, Economic and Environmental aspects.

**[PO.4].Conduct investigations of complex problems:** Use research-based knowledge to design, conduct analyses experiments to get valid conclusion.

**[PO.5]. Modern tool usage:** ability to create, select, and apply appropriate techniques, and to model complex engineering activities with an understanding of the limitations.

**[PO.6]. The engineer and society:** Ability to apply knowledge by considering social health, safety, legal and cultural issues.

**[PO.7]. Environment and sustainability:** Understanding of the impact of the adopted engineering solutions in social and environmental contexts.

**[PO.8]. Ethics:** Understanding of the ethical issues of the civil engineering and applying ethical principles in engineering practices.

**[PO.9]. Individual and teamwork:** Ability to work effectively as an individual or in team, as a member or as a leader.

**[PO.10]. Communication:** An ability to communicate clearly and effectively through different modes of communication.

**[PO.11]. Project management and finance:** Ability to handle project and to manage finance related issue.

**[PO.12]. Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning.

**PROGRAM SPECIFIC OUTCOMES**

**[PSO.1]. Professional skills** – The ability to analyze and design civil engineering structures as per the guidelines in Indian standards and other relevant codes like buildings, bridges, tunnels ,railways, airports, water and sewage treatment plants etc

**[PSO.2]. Problem solving skills** – The ability to managed large infrastructural projects by making use of latest techniques of project management for optimum utilization of resources via man, material and money.

**[PSO.3]. Successful Career and Entrepreneurship** – Strong desire to acquire modern scientific knowledge by pursuing higher studies, which will lead them to identify problems in the civil engineering domains and thereby become entrepreneur to propose solution

**[PSO.4]. Communication:** Communicate effectively on complex engineering activities with the engineering community & with society at large, such as, being able to comprehend & write effective reports & design documentation, make effective presentations & give & receive clear instructions

# Subject: Air & Noise Pollution and Control

Code:BTE27341

3 Credits | Semester VII

Total Lecture: 45 Total Tutorial: 9

**A. Introduction:**

- An understanding of the nature and characteristics of air pollutants, noise pollution and basic concepts of air quality management
- Ability to identify, formulate and solve air and noise pollution problems
- Ability to design stacks and particulate air pollution control devices to meet applicable laws.

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

**[CO1]** Understand the different models of dispersion

**[CO2]** Understand the air quality measurement and the standards set by different organizations.

**[CO3]** Understand the sampling Methods and collection techniques

**[CO4]** Understand the measurement of Air Quality

**[CO5]** Understand the basic of Noise Pollution & its control

**C. Assessment Plan:**

| Criteria | Description | Maximum Marks |
|---|---|---|
| **Continuous Internal Assessment (CIA)** | Internal Examination | 20 |
| | Attendance | 5 |
| | Assignment | 5 |
| **End Semester Examination(ESE)** | End Semester Examination | 70 |
| **Total** | | 100 |
| **Attendance** | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

**INTRODUCTION:** Air pollution: composition and structure of atmosphere, global implications of air pollution. Classification of air pollutants: particulates, hydrocarbon, carbon monoxide, oxides of sulphur, oxides of nitrogen and photochemical oxidants. Indoor air pollution, Effects of air pollutants on humans, animals, property and plants. Dispersion and interaction of pollutants, Air quality, Mass balance approaches, Box model approaches, Air quality dispersion-modeling approaches, Water quality, Mass balance approaches, Aquatic ecosystem modeling approaches, Air and water chemistry

**MEASUREMENT OF AIR QUALITY:** Air pollution chemistry, meteorological aspects of air pollution dispersion; temperature lapse rate and stability, wind velocity and turbulence, plume behavior, dispersion of air pollutants, the Gaussian Plume Model, stack height and dispersion. Different measurement methods, Monitoring and modeling of indoor and ambient air quality, Emission inventory, Key meteorological data, Pollution of surface and ground water resources and control mechanisms, Baseline monitoring of surface waters, Ground water quality, Mitigation measures.

**AIR SAMPLING & COLLECTION:** Ambient air quality and standards, air sampling and measurements; Ambient air sampling, collection of gaseous air pollutants, collection of particulate air pollutants, stack sampling Control devices for particulate contaminants: gravitational settling chambers, cylone separators, wet collectors, fabric filters (Bag-house filter), electrostatic precipitators (ESP).

**CONTROL OF GASEOUS CONTAMINANTS:** Control of gaseous contaminants: Absorption, Adsorption, Condensation and Combustion, and Control of sulphur oxides, nitrogen oxides, carbon monoxide, and hydrocarbons. Automotive emission control, catalytic convertor, Euro-I, Euro-II and Euro-III specifications, Indian specifications.

**NOISE POLLUTION:** Basics of acoustics and specification of sound; sound power, sound intensity and sound pressure levels; plane, point and line sources, multiple sources; outdoor and indoor noise propagation Psycho-acoustics and noise criteria, effects of noise on health, annoyance rating schemes special noise environments: Infra-sound, ultrasound, impulsive sound and sonic boom; noise standards and limit values; noise instrumentation and monitoring procedure. Noise indices

**E. TEXT BOOKS**

T1. Peavy, Rowe and Tchobanoglous: Environmental Engineering.
T2. Martin Crawford: Air Pollution Control Theory.
T3. Warkand Warner: Air Pollution: Its Origin and Control.
T4. Rao and Rao: Air Pollution Control Engineering.
T5. Keshav Kant and Rajni Kant, “Air Pollution and Control Engineering”, Khanna Publishing House.

**F. REFERENCE BOOKS**

R1. C.S. Rao, Air pollutionand control
R2. Environmental Noise Pollution – PE Cunniff, McGraw Hill, New York, 1987
R3. Nevers: Air Pollution Control Engineering.
R4. M. P. Poonia and S C Sharma,” Environmental Engineering, Khanna Publishing House.

R5. My cock, Mc Kenna and Theodore: Handbook of Air Pollution Control Engineering and Technology. Suess and Crax ford: W.H.O. Manualon Urban Air Quality Management OP Gupta,Elements of Environmental Polluton Control, Khanna Publishing House.

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| [CO1] | Understand the different models of dispersion | 3 | 2 | - | 1 | 2 | 2 | 3 | 1 | - | - | - | 1 | 2 | 2 | 1 | - |
| [CO2] | Understand the air quality measurement and the standards set by different organizations. | 3 | 2 | 3 | 2 | 2 | 1 | 3 | 1 | - | 2 | - | 1 | 2 | 2 | 1 | 2 |
| [CO3] | Understand the sampling Methods and collection techniques | 3 | 2 | 2 | 2 | - | 2 | 2 | 1 | - | 1 | 1 | 1 | 2 | 2 | 1 | - |
| [CO4] | Understand the measurement of Air Quality | 2 | 2 | - | 2 | 2 | - | 2 | 1 | 1 | - | 2 | 1 | 2 | 2 | 1 | 1 |
| [CO5] | Understand the basic of Noise Pollution & its control | - | 2 | 1 | - | 2 | 2 | 3 | 1 | 2 | 1 | - | 1 | 2 | 2 | 1 | - |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Solid & Hazardous Waste Management

Code:BTE27342

3 Credits | Semester VII

Total Lecture: 45 Total Tutorial: 9

**A. Introduction:**

- To provide comprehensive overview of solid, biomedical and hazardous waste management.
- To provide knowledge on solid waste management design aspects.
- To learn about the different methods of solid waste management

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

**[CO1]** Understand the solid waste generation and its types

**[CO2]** Apply methods to dispose solid wastes depending upon hazardous level.

**[CO3]** Design of landfill sites

**[CO4]** Take measures for minimization of waste.

**[CO5]** Analyze the current site remediation facilities present in the country.

**C. Assessment Plan:**

| Criteria | Description | Maximum Marks |
|---|---|---|
| **Continuous Internal Assessment (CIA)** | Internal Examination | 20 |
| | Attendance | 5 |
| | Assignment | 5 |
| **End Semester Examination(ESE)** | End Semester Examination | 70 |
| **Total** | | 100 |
| **Attendance** | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

**INTRODUCTION**:Solid Wastes: Origin, Analysis, Composition and Characteristics. Integrated Solid Waste Management System: Collection, Storage, Segregation, Reuse and Recycling possibilities, Transportation, Treatment / Processing and Transformation Techniques, Municipal solid waste, Composition and various chemical and physical parameters of MSW, MSW management: Collection, transport, treatment and disposal of MSW. Special MSW: waste from commercial establishments and other urban areas, solid waste from construction activities, biomedical wastes, Effects of solid waste on environment: effects on air, soil water surface and ground health hazards. Disposal of solid waste-

segregation, reduction at source, recovery and recycle. Disposal methods- Integrated solid waste management

**DISPOSAL MANAGEMENT**: Final Disposal. Management of: Municipal, Biomedical, Nuclear, Electronic and Industrial Solid Wastes and the rules and regulations. Introduction to Hazardous wastes, Definition of Hazardous waste, Landfilling methods Design goals, basis, and variables Design of landfill cover and drainage/liner systems

**DESIGN OF LANDFILL SITE** : The magnitude of the problem; Hazardous waste: Risk assessment, Environmental legislation, Characterization and site assessment Status, types, principles, equipment used, application ranges, and Comparisons of different treatment facilities General design criteria and special requirements.

**WASTE MINIMIZATION** : Waste minimization and resource recovery, Transportation of hazardous waste, Physical, chemical and biological treatment, Ground water contamination, Landfill disposal, Principles and techniques of Waste minimization ;Examples of waste types and phase separation processes; Design criteria and examples

**SITE REMEDIATION FACILITIES**: Current Management Practices, Environmental audit, Pollution Prevention, Facility Development and operation, Site Remediation: Quantitative risk assessment, site and subsurface characterization, Containment, remedial alternatives. Case Studies: Sanitary Landfills, Hazardous Waste Landfill, Radioactive Waste Treatment/Landfill

**E. TEXT BOOKS**

T1. Tchobanoglous G., Theissen H., and EIiassen R.(1991), "Solid Waste Engineering - Principles and Management Issues", McGraw Hill, New York.
T2. PavoniJ.L(1973)., "Handbook of Solid Waste Disposal".
T3. Peavy, Rowe and Tchobanoglous (1985), "Environmental Engineering", McGraw Hill Co. 4th Edition
T4. Mantell C.L., (1975), "Solid Waste Management", John Wiley.

**F. REFERENCE BOOKS**

R1. CPHEEO, Manual on Municipal Solid waste management, Central Public Health and Environmental Engineering Organisation, Government of India, New Delhi, 2000.
R2. WHO Manual on Solid Waste Management.
R3. Vesiland A.(2002), "Solid Waste Engineering", Thompson Books.
R4. Hazardous waste (management and handling) rules, 2001
R5. Biomedical (Handling and Management) Rules 2008

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| [CO1] | Understand the solid waste generation and its types | 3 | 2 | - | 1 | 2 | 2 | 3 | 1 | - | - | - | 1 | 2 | 2 | 1 | - |
| [CO2] | Apply methods to dispose solid wastes depending upon hazardous level. | 3 | 2 | 3 | 2 | 2 | 1 | 3 | 1 | - | 2 | - | 1 | 2 | 2 | 1 | 2 |
| [CO3] | Design of landfill sites | 3 | 2 | 2 | 2 | - | 2 | 2 | 1 | - | 1 | 1 | 1 | 2 | 2 | 1 | - |
| [CO4] | Take measures for minimization of waste. | 2 | 2 | - | 2 | 2 | - | 2 | 1 | 1 | - | 2 | 1 | 2 | 2 | 1 | 1 |
| [CO5] | Analyze the current site remediation facilities present in the country. | - | 2 | 1 | - | 2 | 2 | 3 | 1 | 2 | 1 | - | 1 | 2 | 2 | 1 | - |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Design of Concrete Structure-II

Code:BTE27343

3 Credits | Semester VII

Total Lecture: 45 Total Tutorial: 9

**A. Introduction:**

- Ability to perform analysis and design of members of a structure
- Ability to design water tanks.
- Ability to design retaining walls

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

**[CO1]** Understand the continuous beam design

**[CO2]** Understand various parameters associated with design of water tanks

**[CO3]** Understand the different types of staircases

**[CO4]** Understand the Retaining Wall Design.

**[CO5]** Understand the design concept of framed structures.

**C. Assessment Plan:**

| Criteria | Description | Maximum Marks |
|---|---|---|
| **Continuous Internal Assessment (CIA)** | Internal Examination | 20 |
| | Attendance | 5 |
| | Assignment | 5 |
| **End Semester Examination(ESE)** | End Semester Examination | 70 |
| **Total** | | 100 |
| **Attendance** | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

**DESIGN OF CONTINUOS BEAMS** : Design of continuous beams and building frames, Moment redistribution, Estimation of wind and seismic loads Desirable features of earthquake resistant construction, Detailing for earthquake resistant construction – ductility criteria

**WATER TANKS** : Types of water tanks, Design of circular water tanks resting on ground with rigid base Design of circular water tanks resting on ground with flexible base, Design of overhead water tank (Intz type tank).

**DESIGN OF STAIR CASES** : General specifications, Types of stair cases, Loads on stair cases, Effective span of stairs, Design of dog legged stair case, Design of open well stair case

**DESIGN OF RETAINING WALL** : General specifications, Forces acting on retaining walls Stability consideration, Wall proportioning Design of cantilever type retaining walls Design of counterfort type retaining walls

**MULTI-STOREY BUILDING FRAMES** : Introduction to multi-storey building frames Analysis of multi- storey frames, Method of substitute frames.

**E. TEXT BOOKS**

T1. Pillai, S. U., Mennon, D., "Reinforced Concrete Design", Tata McGraw Hill Publications, New Delhi, 2nd Edition, 2003.
T2. Raju, N. K., "Advanced Reinforced Concrete Design", CBS Publishers, New Delhi, 2nd Edition, 2013.
T3. Sinha, S. N., "Reinforced Concrete Design", Tata McGraw Hill Publications, New Delhi, 2nd Edition, 2007.
T4. IS 456: 2000, "Plain and Reinforced Concrete - Code of Practice", 4th Revision, BIS, New Delhi.

**F. REFERENCE BOOKS**

R1. SP 16: "Design Aid for RC to IS: 456-1978", BIS, New Delhi.
R2. SP 34: "Handbook on Concrete Reinforcement and Detailing", BIS, New Delhi.

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| [CO1] | Understand the continuous beam design | 3 | 3 | 2 | 1 | - | 1 | - | - | - | - | - | 1 | 2 | - | 3 | - |
| [CO2] | Understand various parameters associated with design of water tanks | 3 | 2 | 2 | 1 | 2 | - | - | - | - | 1 | 1 | 1 | 2 | 1 | 2 | - |
| [CO3] | Understand the different types of staircases | 3 | 3 | 2 | - | 2 | - | - | 1 | - | 1 | - | 1 | 2 | 2 | 2 | 1 |
| [CO4] | Understand the Retaining Wall Design. | 3 | 2 | 2 | 1 | - | - | 2 | 1 | 2 | - | - | 2 | 3 | 1 | 3 | - |
| [CO5] | Understand the design concept of framed structures. | 3 | 3 | 3 | 2 | - | 1 | - | - | 1 | - | 2 | 2 | 2 | - | 2 | 1 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Prestressed Concrete

Code: BTE28218

3 Credits | Semester VII

Total Lecture: 45 Total Tutorial: 9

**A. Introduction:**

- This course deals with the introduction and design of prestressed concrete members.
- Ability to analyze a prestressed structure and the losses included

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

**[CO1]** Understand the behavior of prestressed concrete structure which is an advanced topic of civil engineering.

**[CO2]** Design, analysis, detailing and construction of prestressed concrete structural.

**[CO3]** Determine flecural strength

**[CO4]** Solve deflections

**[CO5]** Obtain the mechanism of transfer of prestress.

**C. Assessment Plan:**

| Criteria | Description | Maximum Marks |
|---|---|---|
| **Continuous Internal Assessment (CIA)** | Internal Examination | 20 |
| | Attendance | 5 |
| | Assignment | 5 |
| **End Semester Examination(ESE)** | End Semester Examination | 70 |
| **Total** | | 100 |
| **Attendance** | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

**INTRODUCTION TO PRESTRESSING:** Basic concepts of prestressing, High strength concrete and steel, Stress-strain characteristics and properties various prestressing systems, Pre-tensioning and Post- tensioning systems with anchorages Advantages and limitations of prestressed concrete.

**ANALYSIS OF SECTIONS FOR FLEXURE:** Basic assumptions, Analysis of stresses in concrete due to pre- stress and loads for different types of cross section Pressure line or thrust line, Cable profile, Concept of load balancing, Cracking moment.

**LOSSES OF PRESTRESS & DEFLECTION:** Nature of losses in pre-stress, Various losses encountered in pretensioning and post tensioning methods, Deflection, Factors influencing deflection, Elastic deflection under transfer loads and due to different cable profile. Deflections limits as per IS-1343. Effects of creep on deflection crack widths.

**FLEXURAL & SHEAR STRENGTH OF PRESTRESSED CONCRETE SECTIONS:** Types of flexural failure, IS code recommendations for flexure Ultimate flexural strength of section. Shear and principal stresses Ultimate shear resistance of prestressed concrete members, Shear reinforcement

**TRANSFER OF PRESTRESS:** Transmission of pre-stress in pre-tensioned members, Transmission length, Bond stresses Codal provisions for bond and transmission length, Anchorage stress in post- tensioned member. Bearing stress and bursting tensile force, IS code provisions.

**E. TEXT BOOKS**

T1. Raju, N. K., "Pre-stressed concrete", Tata McGraw Hill, New Delhi, 1st Edition, 2012.
T2. Ramamruthum, S., "Pre-stressed Concrete", DhanpatRai Publishing Company (P) Ltd., New Delhi, 2003.

**F. REFERENCE BOOKS**

R1. Lin, T. Y., Burns, N. H., "Design of pre- stressed Concrete Structures", John Wiley and Sons. New York, 3rd Edition, 1981.

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| [CO1] | Understand the behavior of prestressed concrete structure which is an advanced topic of civil engineering. | 3 | 3 | 2 | 1 | - | 1 | - | - | - | - | - | 1 | 2 | - | 3 | - |
| [CO2] | Design, analysis, detailing and construction of prestressed concrete structural. | 3 | 2 | 2 | 1 | 2 | - | - | - | - | 1 | 1 | 1 | 2 | 1 | 2 | - |
| [CO3] | Determine flecural strength | 3 | 3 | 2 | - | 2 | - | - | 1 | - | 1 | - | 1 | 2 | 2 | 2 | 1 |
| [CO4] | Solve deflections | 3 | 2 | 2 | 1 | - | - | 2 | 1 | 2 | - | - | 2 | 3 | 1 | 3 | - |
| [CO5] | Obtain the mechanism of transfer of prestress. | 3 | 3 | 3 | 2 | - | 1 | - | - | 1 | - | 2 | 2 | 2 | - | 2 | 1 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Metro Systems & Engineering

Code:BTE27345

3 Credits | Semester VII

Total Lecture: 45 Total Tutorial: 9

**A. Introduction:**

- Understand the advancement in railway engineering.
- Understand the concept of railway engineering with the perspective of other engineering branches.

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

**[CO1]** Understand the various types of metro systems

**[CO2]** Understand the role of Civil Engineering in Metro Rail Technology

**[CO3]** Understand the role of Electronics & Communication Engineering in Metro Rail Technology

**[CO4]** Understand the role of Mechanical Engineering in Metro Rail Technology

**[CO5]** Understand the role of Electrical Engineering in Metro Rail Technology

**C. Assessment Plan:**

| Criteria | Description | Maximum Marks |
|---|---|---|
| **Continuous Internal Assessment (CIA)** | Internal Examination | 20 |
| | Attendance | 5 |
| | Assignment | 5 |
| **End Semester Examination(ESE)** | End Semester Examination | 70 |
| **Total** | | 100 |
| **Attendance** | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

**INTRODUCTION:** Overview of Metro Systems; Need for Metros, Routing studies; Basic Planning and Financials

**CIVIL ENGINEERING ASPECT:** Overview and construction methods for: Elevated and underground Stations; Viaduct spans and bridges; Underground tunnels; Depots; Commercial and Service buildings Initial Surveys & Investigations; Basics of Construction Planning & Management Construction Quality & Safety Systems. Traffic integration, multimodal transfers and pedestrian facilities; Environmental and social safeguards Track systems-permanent way. Facilities Management

**ELECTRICONICS & COMMUNICATION ENGINEERING ASPECTS:** Signaling systems; Automatic fare collection, Operation Control Centre (OCC and BCC); SCADA and other control systems; Platform Screen Doors.

**MECHANICAL & TV + AC ENGINEERING ASPECTS:** Rolling stock, vehicle dynamics and structure; Tunnel Ventilation systems.Air conditioning for stations and buildings; Fire control systems; Lifts and Escalators.

**ELECTRICAL ENGINEERING ASPECTS:** OHE, Traction Power; Substations- TSS and ASS; Power SCADA; Standby and Back-up systems; Green buildings, Carbon credits and clear air mechanics.

**E. TEXT BOOKS**

T1. Practical Railway Engineering by Clifford F Bonnet, Imperial College Press.
T2. Railway Engineering by Satish Chandra & MM Agarwal, Oxford Publications.
T3. Railway Engineering by SC Saxena& SP Arora, DhanpatRai Publications.
T4. Contact Lines for Electric Railways: Planning, Design, Implementation & Maintenance by Kiessing, Puschmann, Schmieder, Schneider; Siemens Publications.

**F. REFERENCE BOOKS**

R1. Handbook of Research on Emerging Innovations in Rail Transportation Engineering by B. UmeshRai; IGI Global Publisher of Timely Knowledge.
R2. Industrial Automation with SCADA: Concept, Communications and Security by KS Manoj; Notion Press.

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| [CO1] | Understand the various types of metro systems | 3 | - | 2 | 1 | - | 1 | - | - | - | - | - | 1 | 2 | - | 3 | - |
| [CO2] | Understand the role of Civil Engineering in Metro Rail Technology | 2 | 2 | 2 | 1 | 2 | - | - | - | - | 1 | 1 | 1 | 2 | 1 | 2 | - |
| [CO3] | Understand the role of Electronics & Communication Engineering in Metro Rail Technology | 2 | 2 | 2 | - | 2 | - | - | 1 | - | 1 | - | 1 | 2 | 2 | 2 | 1 |
| [CO4] | Understand the role of Mechanical Engineering in Metro Rail Technology | 2 | 2 | 2 | 1 | - | - | 2 | 1 | 2 | - | - | 2 | 3 | 1 | 3 | - |
| [CO5] | Understand the role of Electrical Engineering in Metro Rail Technology | 2 | 2 | 3 | 2 | - | 1 | - | - | 1 | 1 | 2 | 2 | 2 | - | 2 | 1 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: History of Science & Engineering

Code:BTE27346

3 Credits | Semester VII

Total Lecture: 45 Total Tutorial: 9

**A. Introduction:**

- To provide a better understanding of the advancement in science & technology with time.
- To understand the role of various researchers and engineers in the advancement of technology

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

**[CO1]** Understand the development of science wrt different branches

**[CO2]** **[**Understand the science & Technology during Medieval India

**[CO3]** Understand the science & Technology during Coloniel India

**[CO4]** Understand the Indian Scientis & their contributions

**[CO5]** Understand the civil Engineers & their roles

**C. Assessment Plan:**

| Criteria | Description | Maximum Marks |
|---|---|---|
| **Continuous Internal Assessment (CIA)** | Internal Examination | 20 |
| | Attendance | 5 |
| | Assignment | 5 |
| **End Semester Examination(ESE)** | End Semester Examination | 70 |
| **Total** | | 100 |
| **Attendance** | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

**SCIENCE & TECHNOLOGY- THE BEGINNING:** Development in different branches of Science in Ancient India: Astronomy, Mathematics, Engineering and Medicine. Developments in metallurgy: Use of Copper, Bronze and Iron in Ancient India Development of Geography: Geography in Ancient Indian Literature

**DEVELOPMENT IN SCIENCE & TECHNOLOGY IN MEDIEVAL INDIA:** Scientific and Technological Developments in Medieval India; Influence of the Islamic world and Europe; The role of maktabs, madrasas and karkhanas set up Developments in the fields of Mathematics, Chemistry, Astronomy and Medicine Innovations in the field of agriculture - new crops introduced new techniques of irrigation etc.

**DEVELOPMENT IN SCIENCE & TECHNOLOGY IN COLONIAL INDIA:** Early European Scientists in Colonial India- Surveyors, Botanists, Doctors, under the Company's Service. Indian Response to new Scientific Knowledge, Science and Technology in Modern India: Development of research organizations like CSIR and DRDO; Establishment of Atomic Energy Commission; Launching of the space satellites.

**PROMINENT SCIENTIST OF INDIA & THEIR ACHIEVEMENT:** Mathematics and Astronomy: Baudhayan, Aryabhtatta, Brahmgupta, Bhaskaracharya, Varahamihira, Nagarjuna Medical Science of Ancient India (Ayurveda & Yoga): Susruta, Charak, Yoga &Patanjali. Scientists of Modern India: SrinivasRamanujan, C.V. Raman, Jagdish Chandra Bose, HomiJehangirBhabha and Dr. Vikram Sarabhai.

**GREAT RESEARCHERS & PROJECTS IN CIVIL ENGINEERING:** Sir M. Visvesvaraya, KanwarSen, E. Sreedharan and their contribution to Indian Civil Engineering. John Smeaton and his contribution to Civil Engineering Case Studies of ongoing mega-projects

**E. TEXT BOOKS**

T1. Landmarks in Western Science: From Prehistory to the Atomic Age by Peter Whitfield

T2. The Timetables of History: A Horizontal Linkage of People and Events by Bernard Grun, Daniel J. Boorstind

**F. REFERENCE BOOKS**

R1. Science and Technology in World History: An Introduction by J. E. I. McClellan and H. Dorn

R2. The Timetables of Science: A Chronology of the Most Important People and Events in the History of Science by Alexander Hellemans and Bryan Bunch

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| [CO1] | Understand the development of science wrt different branches | 3 | 3 | 2 | 1 | - | 1 | - | - | - | - | - | 1 | 2 | - | 3 | - |
| [CO2] | [Understand the science & Technology during Medieval India | 3 | 2 | 2 | 1 | 2 | - | - | - | - | 1 | 1 | 1 | 2 | 1 | 2 | - |
| [CO3] | Understand the science & Technology during Coloniel India | 3 | 3 | 2 | - | 2 | - | - | 1 | - | 1 | - | 1 | 2 | 2 | 2 | 1 |
| [CO4] | Understand the Indian Scientis & their contributions | 3 | 2 | 2 | 1 | - | - | 2 | 1 | 2 | - | - | 2 | 3 | 1 | 3 | - |
| [CO5] | Understand the civil Engineers & their roles | 3 | 3 | 3 | 2 | - | 1 | - | - | 1 | - | 2 | 2 | 2 | - | 2 | 1 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: River Engineering

Code:BTE27347

3 Credits | Semester VII

Total Lecture: 45 Total Tutorial: 9

**A. Introduction:**

- To provide a better understanding of river associated problems.
- To understand the river hydraulics and the sedimentation.

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

**[CO1]** Understand fluvial geomorphology

**[CO2]** **U**nderstand concept of analysis of river flow hydraulics

**[CO3]** **A**nalyses hydraulic geometry and to design stable alluvial channels

**[CO4]** Understand the fluvial design for riverbank protection

**[CO5]** **U**nderstand the environmental aspect of river engineering

**C. Assessment Plan:**

| **Criteria** | **Description** | **Maximum Marks** |
|---|---|---|
| **Continuous Internal Assessment (CIA)** | Internal Examination | 20 |
| | Attendance | 5 |
| | Assignment | 5 |
| **End Semester Examination(ESE)** | End Semester Examination | 70 |
| **Total** | | 100 |
| **Attendance** | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

**ELEMENTS OF RIVER ENGINEERING:** Origin and properties of sediments, river problems, control of vegetation and river morphology. Stable channel and their geometry, flow around river bends, braided river and meandering river

**SOIL EROSION AND SEDIMENTS YIELD:** Types of erosion, mechanism of soil erosion sediment delivery ratio, and process based modeling of soil erosion.

**HYDRAULICS OF STREAM:** Incipient motion, modes of sediment transport, bed-forms, resistance to flow in alluvial rivers bed load transport, suspended load transport Hydraulics geometry of gravel Bed Rivers, armoring, bed forms and resistance to flow in gravel Bed Rivers.

**BED LEVEL VARIATIONS IN STREAM:** Degradation, local scour, Aggradations Reservoir sedimentation, mathematical modeling for river bed variations

**RIVERS AND ENVIRONMENT:** Environmental effects of hydraulic structures, Structures, River Pollution, River action Plans, Stream restoration

**E. TEXT BOOKS**

T1. Rosgen, D., "Applied River Morphology", Wildland Hydrology books, Pagosa Springs, 1996.
T2. Graf, W. H., Altinakar, M. S., "Fluvial Hydraulics: Flow and Transport Processes in Channels of Simple Geometry", John Wiley, 1999

**F. REFERENCE BOOKS**

R1. Garde, R. J., "River Morphology", New Age International, 2006.
R2. Julin, P. Y., " Erosion and Sedimentation", Cambridge University Press, 1998.
R3. Jansen, P. P. H., " Principles of River Engineering", VSSD Publications, 1994.

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| [CO1] | Understand fluvial geomorphology | 3 | 3 | 2 | 1 | - | 1 | - | 1 | 1 | 2 | - | 1 | 2 | - | 3 | - |
| [CO2] | Understand concept of analysis of river flow hydraulics | 3 | 2 | 2 | 1 | 2 | - | 2 | - | 2 | 1 | 1 | 1 | 2 | 1 | 2 | 2 |
| [CO3] | Analyses hydraulic geometry and to design stable alluvial channels | 3 | 3 | 2 | - | 2 | 2 | - | 1 | - | 1 | - | 1 | 2 | 2 | 2 | 1 |
| [CO4] | Understand the fluvial design for riverbank protection | 3 | 2 | 2 | 1 | - | - | 2 | 1 | 2 | - | - | 2 | 3 | 1 | 3 | 2 |
| [CO5] | Understand the environmental aspect of river engineering | 3 | 3 | 3 | 2 | - | 1 | 2 | - | 1 | 2 | 2 | 2 | 2 | - | 2 | 1 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject:Summer Internship-II

Code: BTE27349

3 Credits | Semester VII

Total Lecture: 90

**A. Introduction:**

- Following are the intended objectives of internship training:
- Will expose Technical students to the industrial environment, which cannot be simulated in the classroom and hence creating competent professionals for the industry.
- Provide possible opportunities to learn understand and sharpen the real time technical / managerial skills required at the job.
- Exposure to the current technological developments relevant to the subject area of training.
- Experience gained from the 'Industrial Internship' in classroom will be use in classroom discussions.
- Create conditions conducive to quest for knowledge and its applicability on the job

**COURSE OUTCOMES**

***On completion of the course, students are able to;***

[CO1] Analyze reasons behind events and situations
[CO2] Solve problems utilizing various concepts, solutions, etc.
[CO3] Take initiatives, responsibilities, setting goals, motivating others to work towards goals and taking accountability
[CO4] Understand the importance of leisure and recreation.
[CO5] Maintain ethics in public life and good moral values etc.

**B. Assessment Plan:**

| Criteria | Description | Maximum Marks |
|---|---|---|
| Continuous Internal Assessment (CIA) | Internal Examination | 30 |
| | | |
| | | |
| End Semester Examination(ESE) | End Semester Examination | 70 |
| Total | | 100 |
| Attendance | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**GUIDELINES FOR INTERNSHIP**

Summer Internship –II should be undertaken in an industry only

| S.No. | Suggested Schedule | Suggested Duration (In weeks) | Activities |
|---|---|---|---|
| 1 | Summer/winter vacation after 4th Semester | 4-6 | Inter/Intra Institutional Activities |

**Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | PO11 | PO12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| [CO1] | Analyze reasons behind events and situations | | | | | | | 1 | 2 | | | | | | | | 2 |
| [CO2] | Solve problems utilizing various concepts, solutions, etc. | | | | | | | | | | 1 | | | 2 | | | |
| [CO3] | Take initiatives, responsibilities, setting goals, motivating others to work towards goals and taking accountability | | | | | | | | | | | 3 | | | | 2 | 1 |
| [CO4] | Understand the importance of leisure and recreation. | | | | | | | | | | | 3 | | 3 | | | |
| [CO5] | Maintain ethics in public life and good moral values etc. | | | | | | | | | | | 3 | | | | 1 | 2 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Minor Project

Code: BTE27217
3 Credits | Semester VII

Total Lecture: 90

**A. Introduction:**

The objective of this course is to prepare students to use applications of the theory and practical learned during the course. It will also help students to develop an industry or research oriented project. This course helps students how to carry out project/studies in the field of interest of the student or as given by the industry.

## COURSE OUTCOMES

***On completion of the course, students are able to:***

[CO1] Demonstrate a sound technical knowledge of their selected project topic.
[CO2] Undertake problem identification, formulation and solution.
[CO3] Design engineering solutions to complex problems utilizing a systems approach.
[CO4] Conduct an engineering project.
[CO5] Communicate with engineers and the community at large in written an oral form.

## B. Assessment Plan:

| Criteria | Description | Maximum Marks |
|---|---|---|
| Continuous Internal Assessment (CIA) | Internal Examination | 30 |
| | | |
| | | |
| End Semester Examination(ESE) | End Semester Examination | 70 |
| Total | | 100 |
| Attendance | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

## GUIDELINES FOR PROJECT

Minor Project should be based on real/ live problems of the Industry/Govt./NGO/ MSME/Rural Sector or an innovative idea having the potential of a Startup and this project to be carried over to next semester.

**Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | PO11 | PO12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| [CO1] | Demonstrate a sound technical knowledge of their selected project topic. | | | | | | | 1 | 2 | | | | | | | | 2 |
| [CO2] | Undertake problem identification, formulation and solution. | | | | | | | | | | 1 | | | 2 | | | |
| [CO3] | Design engineering solutions to complex problems utilizing a systems approach. | | | | | | | | | | | 3 | | | | 2 | 1 |
| [CO4] | Conduct an engineering project. | | | | | | | | | | | 3 | | 3 | | | |
| [CO5] | Communicate with engineers and the community at large in written an oral form. | | | | | | | | | | | 3 | | | | 1 | 2 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

ARKA JAIN University
Jharkhand

Syllabus of

# B.Tech. in Civil Engineering

## Semester-VIII

**ARKAJAIN University, Jharkhand**
School of Engineering & IT
Department of Engineering
Faculty – Bachelor of Technology in Civil Engineering
**Scheme of Study (w.e.f Batch 2020-24)**

## SEMESTER –I

| Sr. No. | Name of the Subject | Group | L-T-P | Credit |
|---|---|---|---|---|
| 1 | Engineering Mathematics–I | A & B | 3-1-0 | 4 |
| 2 | Engineering Chemistry | A | 3-0-0 | 3 |
| | Programming for Problem Solving | B | 3-0-0 | 3 |
| 3 | Basic Electrical Engineering | A | 3-1-0 | 4 |
| | Engineering physics | B | 3-1-0 | 4 |
| 4 | Engineering Mechanics | A | 3-0-0 | 3 |
| | English for Communication | B | 3-0-0 | 3 |
| 5 | Constitution of India | B | 0-0-0 | 0 |
| | **Practical** | | | |
| 6 | Engineering Chemistry Lab | A | 0-0-1 | 1 |
| | Engineering Physics Lab | B | 0-0-1 | 1 |
| 7 | Basic Electrical Engineering Lab | A | 0-0-1 | 1 |
| | Programming for Problem Solving Lab | B | 0-0-2 | 2 |
| 8 | Engineering Mechanics Lab | A | 0-0-1 | 1 |
| 9 | Engineering Graphics & Design | A | 0-0-2 | 2 |
| | Workshop Practices | B | 0-0-2 | 2 |
| | TOTAL | A or B | 12-2-5 | 19 |

## SEMESTER –II

| Sr. No. | Name of the Subject | Group | L-T-P | Credit |
|---|---|---|---|---|
| 1 | Engineering Mathematics–II | A & B | 3-1-0 | 4 |
| 2 | Engineering Chemistry | B | 3-0-0 | 3 |
| | Programming for Problem Solving | A | 3-0-0 | 3 |
| 3 | Basic Electrical Engineering | B | 3-1-0 | 4 |
| | Engineering physics | A | 3-1-0 | 4 |
| 4 | Engineering Mechanics | B | 3-0-0 | 3 |
| | English for Communication | A | 3-0-0 | 3 |
| 5 | Constitution of India | A | 0-0-0 | 0 |
| | **Practical** | | | |
| 6 | Engineering Chemistry Lab | B | 0-0-1 | 1 |
| | Engineering Physics Lab | A | 0-0-1 | 1 |
| 7 | Basic Electrical Engineering Lab | B | 0-0-1 | 1 |
| | Programming for Problem Solving Lab | A | 0-0-2 | 2 |
| 8 | Engineering Mechanics Lab | B | 0-0-1 | 1 |
| | Engineering Graphics& Design | B | 0-0-2 | 2 |
| 9 | Workshop Practices | A | 0-0-2 | 2 |
| | TOTAL | A or B | 12-2-5 | 19 |

# SEMESTER –I (Group-A)

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Engineering Chemistry | BSC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 2 | Engineering Mathematics–I | BSC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 3 | Basic Electrical Engineering | ESC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 4 | Engineering Mechanics | ESC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| | **Practical** | | | | | | | | |
| 5 | Engineering Chemistry Lab | BSC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 6 | Basic Electrical Engineering Lab | ESC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 7 | Engineering Mechanics Lab | ESC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 8 | Engineering Graphics& Design | ESC | 2 | 4 | 50 | 35 | 5 | 5 | 5 |
| | **TOTAL** | | **19** | **24** | **600** | **420** | **100** | **40** | **40** |

# SEMESTER I (Group-B)

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Engineering physics | BSC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 2 | Engineering Mathematics –I | BSC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 3 | Programming for Problem Solving | ESC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | English for Communication | HSMC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 5 | Constitution of India | MC | 0 | 2 | 50 | 35 | 10 | 2.5 | 2.5 |
| | **Practical** | | | | | | | | |
| 6 | Engineering physics Lab | BSC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 7 | Programming for Problem Solving Lab | ESC | 2 | 4 | 50 | 35 | 5 | 5 | 5 |
| 8 | Workshop Practices | ESC | 2 | 4 | 50 | 35 | 5 | 5 | 5 |
| | **TOTAL** | | **19** | **26** | **600** | **420** | **105** | **37.5** | **37.5** |

# SEMESTER II (Group-A)

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Engineering physics | BSC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 2 | Engineering Mathematics –II | BSC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 3 | Programming for Problem Solving | ESC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | English for Communication | HSMC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 5 | Constitution of India | MC | 0 | 2 | 50 | 35 | 10 | 2.5 | 2.5 |
| | **Practical** | | | | | | | | |
| 6 | Engineering physics Lab | BSC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 7 | Programming for Problem Solving Lab | ESC | 2 | 4 | 50 | 35 | 5 | 5 | 5 |
| 8 | Workshop Practices | ESC | 2 | 4 | 50 | 35 | 5 | 5 | 5 |
| | **TOTAL** | | **19** | **26** | **600** | **420** | **105** | **37.5** | **37.5** |

# SEMESTER –II (Group-B)

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Engineering Chemistry | BSC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 2 | Engineering Mathematics–II | BSC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 3 | Basic Electrical Engineering | ESC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 4 | Engineering Mechanics | ESC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| | **Practical** | | | | | | | | |
| 5 | Engineering Chemistry Lab | BSC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 6 | Basic Electrical Engineering Lab | ESC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 7 | Engineering Mechanics Lab | ESC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 8 | Engineering Graphics& Design | ESC | 2 | 4 | 50 | 35 | 5 | 5 | 5 |
| | **TOTAL** | | **19** | **24** | **600** | **420** | **100** | **40** | **40** |

# SEMESTER-III

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA * | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Engineering Mathematics -III | BSC | 4 | 4 | 100 | 70 | 20 | 5 | 5 |
| 2 | Biology for Engineers | BSC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 3 | Surveying &Geomatics | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | Mechanics of Solid | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 5 | Introduction to Civil Engineering | HSMC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 6 | Environmental Science | MC | 0 | 2 | 50 | 35 | 10 | 2.5 | 2.5 |
| | **Practical** | | | | | | | | |
| 7 | Surveying &Geomatics Lab | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 8 | Mechanics of Solid | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 9 | Computer Aided Civil Engineering Drawing | ESC | 2 | 4 | 50 | 35 | 5 | 5 | 5 |
| | **TOTAL** | | **20** | **26** | **700** | **490** | **125** | **42.5** | **42.5** |

# SEMESTER-IV

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Material Testing & Evaluation | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 2 | Engineering Geology | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 3 | Fluid Mechanics | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | Structural Analysis - I | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 5 | Geotechnical Engineering | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 6 | Civil Engineering-Societal & Global Impact | HSMC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| | **Practical** | | | | | | | | |
| 7 | Material Testing & Evaluation | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 8 | Engineering Geology Lab | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 9 | Geotechnical Engineering Lab | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 10 | Fluid Mechanics Lab | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| | **TOTAL** | | **22** | **26** | **800** | **560** | **140** | **50** | **50** |

# SEMESTER V

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Hydraulic Engineering | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 2 | Structural Analysis II | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 3 | Hydrology & Water Resource Engineering | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | Environmental Engineering-I | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 5 | Open Elective I Humanities I<br>Professional Practice, Law & Ethics<br>Organizational Behavior | HSMC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 6 | Disaster Preparedness & Planning | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 7 | Essence of Indian Knowledge Tradition | MC | 0 | 2 | 50 | 35 | 10 | 2.5 | 2.5 |
| | PRACTICAL | | | | | | | | |
| 8 | Hydraulic Engineering Lab | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 9 | Structural Analysis II Lab | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| 10 | Summer Internship –I (3-4 week) | PROJ | 2 | 0 | 50 | 35 | 15 | 0 | 0 |
| | **TOTAL** | | **22** | **24** | **800** | **560** | **155** | **42.5** | **42.5** |

# SEMESTER VI

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory / Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Construction Engineering & Management | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 2 | Transportation Engineering-I | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 6 | Engineering Economics, Estimation & Costing | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 3 | Elective I<br>Rock Mechanics<br>Foundation Engineering | PEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | Elective II<br>Environmental Engineering II<br>Rural water supply & Onsite Sanitation System | PEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 6 | Elective III<br>Design of Steel Structure<br>Earthquake Engineering | PEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 7 | Design of Concrete Structures-I | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| | **Practical** | | | | | | | | |
| 8 | Transportation Engineering I Lab | PCC | 1 | 2 | 50 | 35 | 5 | 5 | 5 |
| | **TOTAL** | | **22** | **23** | **750** | **525** | **145** | **40** | **40** |

# SEMESTER VII

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Elective IV<br>Air and Noise Pollution and Control<br>Solid and hazardous Waste Management | PEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 2 | Elective V<br>Design of Concrete Structure - II<br>Prestressed Concrete | PEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 3 | Open Elective II<br>Metro System & Engineering<br>History of Science & Engineering | OEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | River Engineering | PCC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| | **Practical** | | | | | | | | |
| 5 | Minor Project | PROJ | 3 | 6 | 100 | 70 | 30 | 0 | 0 |
| 6 | Summer Internship –II –(4-6 Week) | PROJ | 3 | 0 | 100 | 70 | 30 | 0 | 0 |
| | **TOTAL** | | **18** | **18** | **600** | **420** | **140** | **20** | **20** |

# SEMESTER VIII

| S.No | Name of the Subject | Type of Paper | Credit | Contact Hours Per Week | Total Marks | End Term Theory/ Practical Exam | Mid Term Theory/ Practical Exam | CIA* | Attendance |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Elective VI<br>Bridge Engineering<br>Ground Water Engineering | PEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 2 | Elective VII<br>Railway Engineering<br>Traffic Engineering and Management | PEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 3 | Open Elective III<br>Soft Skills and Interpersonal Communication<br>Human Resource Development and Organizational Behavior | OEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| 4 | Open Elective IV<br>Civil Engineering Design-I<br>Geographic Information Systems and Science | OEC | 3 | 3 | 100 | 70 | 20 | 5 | 5 |
| | **Practical** | | | | | | | | |
| 5 | Major Project | PROJ | 8 | 16 | 200 | 140 | 60 | 0 | 0 |
| 6 | Extra- Curricular/ Co-Curricular Activity | PROJ | 0 | 0 | 100 | 70 | 30 | 0 | 0 |
| | **TOTAL** | | **20** | **28** | **700** | **490** | **170** | **20** | **20** |

## Distribution of Credit across 8 semesters:

| Sl. No | Type of Paper | No. of Paper | Total Credit |
|---|---|---|---|
| 1 | Humanities and Social Sciences including Management courses **(HSMC)** | 4 | 12 |
| 2 | Basic Science courses**(BSC)** | 8 | 24 |
| 3 | Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc**(ESC)** | 9 | 20 |
| 4 | Professional core courses (**PCC)** | 26 | 60 |
| 5 | Professional Elective courses relevant to chosen specialization/branch**(PEC)** | 7 | 21 |
| 6 | Open subjects – Electives from other technical and /or emerging subjects (**OEC)** | 3 | 9 |
| 7 | Project work, seminar and internship in industry or elsewhere**(PROJ)** | 5 | 16 |
| 8 | Mandatory Courses [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Knowledge Tradition]**(MC)** | 3 | 0 |
| | **Total** | 65 | 162 |

**CIA – Continuous Internal Assessment – Based on Projects / Assignment during the semester**

**Note:**
**AICTE Activity Points to be earned by students admitted to Degree program (For more details refer to Chapter 6, AICTE, Activity Point Program, Model Internship Guidelines):**
**Every regular student, who is admitted to the 4 year Degree program, is required to earn 100 activity points in addition to the total credits earned for the program. Students entering 4 years Degree Program through lateral entry are required to earn 75 activity points in addition to the total credits earned for the program. The activity points earned by the student shall be reflected on the students 8th Semester grade card.**
**The activities to earn the points can be spread over the duration of the course. However, minimum prescribed duration should be fulfilled.**
**Activity Points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression.**
**Incase student fail to earn the prescribed activity points, Eight semester Grade Card shall be issued only after earning the required activity Points.**
**Students shall be eligible for the award of degree only after the release of the Eight Semester grade card.**

***There are two groups (A & B) in semester 1 & 2. The Group division will be decided by The Dean SoE& IT before commencement of classes***

**ARKAJAIN University, Jharkhand**
School of Engineering & IT
Department of Engineering
Faculty – Bachelor of Technology in Civil Engineering
**PROGRAM OUTCOMES &PROGRAM SPECIFIC OUTCOMES**

**PROGRAM OUTCOMES**

After completing this undergraduate program, a learner:

**[PO.1].Engineering knowledge:** An ability to apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to get the solution of the engineering problems.

**[PO.2].Problem analysis:** Ability to Identify, formulates, review research literature, and analyze complex engineering problems.

**[PO.3].Design/Development of Solutions:** Ability to design solutions for complex Engineering Problems by considering social, Economic and Environmental aspects.

**[PO.4].Conduct investigations of complex problems:** Use research-based knowledge to design, conduct analyses experiments to get valid conclusion.

**[PO.5]. Modern tool usage:** ability to create, select, and apply appropriate techniques, and to model complex engineering activities with an understanding of the limitations.

**[PO.6]. The engineer and society:** Ability to apply knowledge by considering social health, safety, legal and cultural issues.

**[PO.7]. Environment and sustainability:** Understanding of the impact of the adopted engineering solutions in social and environmental contexts.

**[PO.8]. Ethics:** Understanding of the ethical issues of the civil engineering and applying ethical principles in engineering practices.

**[PO.9]. Individual and teamwork:** Ability to work effectively as an individual or in team, as a member or as a leader.

**[PO.10]. Communication:** An ability to communicate clearly and effectively through different modes of communication.

**[PO.11]. Project management and finance:** Ability to handle project and to manage finance related issue.

**[PO.12]. Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning.

**PROGRAM SPECIFIC OUTCOMES**

**[PSO.1]. Professional skills** – The ability to analyze and design civil engineering structures as per the guidelines in Indian standards and other relevant codes like buildings, bridges, tunnels ,railways, airports, water and sewage treatment plants etc

**[PSO.2]. Problem solving skills** – The ability to managed large infrastructural projects by making use of latest techniques of project management for optimum utilization of resources via man, material and money.

**[PSO.3]. Successful Career and Entrepreneurship** – Strong desire to acquire modern scientific knowledge by pursuing higher studies, which will lead them to identify problems in the civil engineering domains and thereby become entrepreneur to propose solution

**[PSO.4]. Communication:** Communicate effectively on complex engineering activities with the engineering community & with society at large, such as, being able to comprehend & write effective reports & design documentation, make effective presentations & give & receive clear instructions

# Subject: Bridge Engineering

Code:BTE28365

3 Credits | Semester VIII

**A. Introduction:**

- To discuss basic definitions, types, and components of bridges.
- To understand standard specification for bride design.
- To perform design of various slab type reinforced concrete bridges.
- To perform design of bridges sub-structures, bearings and joints.
- To have knowledge of quality control and maintenance aspects of bridges.

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

**[CO1]** Understand the load-flow mechanisms and identify loads on bridges.

**[CO2]** Interpret the load-carrying capacity of various types of bridges.

**[CO3]** Execute the concepts of proportioning and design of bridges in terms of aesthetics, geographical location and functionality.

**[CO4]** Select a design of bridge starting from conceptual design, selecting suitable bridge, geometry to sizing of its elements.

**[CO5]** Design short and medium span bridges, using existing codes of practice.

**C. Assessment Plan:**

| Criteria | Description | Maximum Marks |
|---|---|---|
| **Continuous Internal Assessment (CIA)** | Internal Examination | 20 |
| | Attendance | 5 |
| | Assignment | 5 |
| **End Semester Examination(ESE)** | End Semester Examination | 70 |
| **Total** | | 100 |
| **Attendance** | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

**INTRODUCTION:** General; classification of bridges, site selection, geometric and hydraulic design consideration, loading. Standards for highway and railway bridges, general design consideration; optimum spans

**REINFORCED CONCRETE & STEEL BRIDGES:** Concrete bridges: culverts; Slab, T-beam, box girder bridges, balanced cantilever bridge, cable stayed bridge, arch bridge; Special requirements for Prestressed Concrete bridges; Steel bridges: plate girder bridge, truss bridge, suspension cable bridge, cable stayed bridge

**BRIDGE SUBSTRUCTURE:** Substructures: design of piers and abutments, pile and well foundations

**JOINTS & BEARINGS:** Bearings and expansion joints, special wearing coats; seismic design considerations;

**STABILITY AND MAINTENANCE:** Aerodynamic stability considerations; special durability Measures. Provisions for inspection and maintenance;

**E. TEXT BOOKS**

T1. Design of Bridges – N.KrishnaRaju
T2. RCC Designs- B.C. Punmia

**F. REFERENCE BOOKS**

R1. Design of Bridge Structures- T.R.Jagadeesh& M.A. Jayaram

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| [CO1] | Understand the load-flow mechanisms and identify loads on bridges. | 2 | 1 | - | 1 | 1 | 1 | 1 | - | - | - | - | 2 | 2 | 1 | - | - |
| [CO2] | Interpret the load-carrying capacity of various types of bridges. | 2 | 2 | 1 | 1 | 1 | 1 | - | - | - | - | - | 1 | 2 | 2 | 1 | - |
| [CO3] | Execute the concepts of proportioning and design of bridges in terms of aesthetics, geographical location and functionality. | 3 | 3 | 3 | 2 | 1 | - | 1 | 1 | 1 | 1 | - | 2 | 3 | 3 | 2 | 1 |
| [CO4] | Select a design of bridge starting from conceptual design, selecting suitable bridge, geometry to sizing of its elements. | 2 | 3 | 3 | 1 | 1 | - | 1 | 1 | - | - | - | 2 | 2 | 3 | 2 | - |
| [CO5] | Design short and medium span bridges, using existing codes of practice. | 2 | 2 | 3 | 1 | 1 | - | 1 | 1 | - | - | - | 1 | 3 | 3 | 2 | - |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Ground Water Engineering

Code: BTE28389

3 Credits | Semester VIII

Total Lecture: 45 Total Tutorial: 9

**A. Introduction:**

- To introduce engineers to groundwater topics
- To survey the fundamental science of hydrogeology
- To introduce the distribution and movement of water through geologic formations
- To explore the mathematical models of fluid flow and methods for solving these equations
- To address practical groundwater engineering problems

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

**[CO1]** Understand the basic concepts of Hydrogeology, Well Hydraulics and Groundwater Management.

**[CO2]** Address practical groundwater engineering problems.

**[CO3]** Characterize the subsurface using aquifer tests, transport and remediation of contaminants, and innovations in groundwater management.

**[CO4]** Select the best method of Surface and Subsurface investigation.

**[CO5]** Develop a conceptual model of an area's hydrogeology that can be used to guide a site investigation or engineering design project.

**C. Assessment Plan:**

| Criteria | Description | Maximum Marks |
|---|---|---|
| **Continuous Internal Assessment (CIA)** | Internal Examination | 20 |
| | Attendance | 5 |
| | Assignment | 5 |
| **End Semester Examination(ESE)** | End Semester Examination | 70 |
| **Total** | | 100 |
| **Attendance** | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

**GROUNDWATER RESOURCE:** Groundwater hydrology, well hydraulics and well construction, geophysical explorations, Problems and perspectives regarding groundwater in India; Groundwater quality and management of groundwater resources;

**HYDROGEOLOGY:** Hydrogeology: Darcy's Equation; flow characteristics; general flow equations; unsaturated flow;

**WELL HYDRAULICS:** Well Hydraulics: Steady and unsteady radial flows in aquifers; partially penetrating wells; multiple well systems; Characteristic well losses; specific capacity, Surface and Subsurface investigations (Geologic methods; remote sensing; geophysical explorations; electrical resistivity and seismic refraction)

**WATER WELLS:** Water Wells: Construction; completion, development, protection and rehabilitation of wells; Groundwater quality

**GROUNDWATER MANAGEMENT:** Groundwater Management: Basin management, investigations, conjunctive use, modeling, artificial recharge; Saline water intrusion

**E. TEXT BOOKS**

T1. Soil and Water conservation engineering – Dr. R. Suresh

**F. REFERENCE BOOKS**

R1. Groundwater Hydrology – M.Karamouz, A. Ahmadi, M. Akhbari
R2. Hydrogeology Groundwater Science and Engineering – Alain Dassargues

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| [CO1] | Understand the basic concepts of Hydrogeology, Well Hydraulics and Groundwater Management. | 2 | 1 | - | 1 | 1 | 3 | 1 | - | - | 1 | - | 2 | 2 | 2 | 2 | 1 |
| [CO2] | Address practical groundwater engineering problems. | 2 | 3 | 1 | 1 | 2 | 3 | 1 | 1 | - | 1 | - | 2 | 1 | 2 | 1 | - |
| [CO3] | Characterize the subsurface using aquifer tests, transport and remediation of contaminants, and innovations in groundwater management. | 2 | 2 | - | 2 | 2 | 3 | 1 | - | 1 | 1 | - | 2 | 2 | 1 | - | 1 |
| [CO4] | Select the best method of Surface and Subsurface investigation. | 2 | 1 | - | 1 | 2 | 3 | 1 | 1 | - | 1 | - | 1 | 2 | 1 | 2 | 1 |
| [CO5] | Develop a conceptual model of an area's hydrogeology that can be used to guide a site investigation or engineering design project. | 3 | 2 | 2 | 1 | 2 | 3 | 2 | 1 | 2 | 1 | - | 1 | 3 | 2 | 1 | 1 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Railway Engineering

Code:BTE28366

3 Credits | Semester VIII

Total Lecture: 45 Total Tutorial: 9

**A. Introduction:**

- To introduce the fundamental principles for railway engineering
- To develop the concepts of basic track geometry parameters
- To make the students understand the influence of railway transportations in the society
- To make the students understand the process of execution of railway projects

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

**[CO1]** Understand the basic concepts of Track components, geometric design, track and railway maintenance.

**[CO2]** Demonstrate different Interlocking and modern Signal Systems in Railways.

**[CO3]** Analyze various facets of geometric design of tracks.

**[CO4]** Select the most suitable method of track maintenance, rehabilitation and renewal of track.

**[CO5]** Develop simple track layout.

**C. Assessment Plan:**

| Criteria | Description | Maximum Marks |
|---|---|---|
| **Continuous Internal Assessment (CIA)** | Internal Examination | 20 |
| | Attendance | 5 |
| | Assignment | 5 |
| **End Semester Examination(ESE)** | End Semester Examination | 70 |
| **Total** | | 100 |
| **Attendance** | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

**INTRODUCTION** : Railway track gauge, alignment of railway lines, engineering surveys and construction of new lines, Tracks and track stresses; rails, sleepers; ballast; subgrade and formation

**GEOMETRIC DESIGN OF TRACK** : Track fittings and fastenings, creep of rails, geometric design of track, curves and super-elevation, points and crossings, Track junctions and simple track layouts; rail joints and welding of rails

**TRACK MAINTENANCE** : Track maintenance, track drainage; modern methods of track maintenance, rehabilitation and renewal of track; tractive resistance and power

**RAIL STATIONS & SIGNALLING** : Railway stations and yards; railway tunneling; signaling and interlocking

**RAILWAY MANTENANCE** : Maintenance of railways and high speed trains

**E. TEXT BOOKS**

T1. A Textbook of Railway Engineering – S.C. Saxena, S. P. Arora
T2. Railway Engineering - Rangwala

**F. REFERENCE BOOKS**

R1. . Railway Engineering – Satish Chandra, M.M. Agarwal

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| [CO1] | Understand the basic concepts of Track components, geometric design, track and railway maintenance. | 2 | - | 1 | 1 | 1 | 1 | - | - | - | - | - | 2 | 2 | 1 | 1 | - |
| [CO2] | Demonstrate different Interlocking and modern Signal Systems in Railways. | 3 | 1 | 2 | 2 | 3 | 1 | - | - | 1 | 1 | - | 1 | 2 | 1 | - | 1 |
| [CO3] | Analyze various facets of geometric design of tracks. | 2 | 1 | 3 | 1 | - | 1 | 1 | - | 2 | 2 | 1 | 3 | 3 | 2 | 1 | 2 |
| [CO4] | Select the most suitable method of track maintenance, rehabilitation and renewal of track. | 2 | 2 | - | 2 | 3 | 1 | - | - | - | - | 1 | 2 | 2 | 2 | 3 | - |
| [CO5] | Develop simple track layout. | 3 | 2 | 3 | 2 | - | - | - | - | 1 | 1 | 1 | 2 | 3 | 2 | - | 1 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Traffic Engineering & Management

Code:BTE28367

3 Credits | Semester VIII

Total Lecture: 45 Total Tutorial: 9

**A. Introduction:**

- To have an overall knowledge of the traffic components and assess the traffic characteristics and related problems
- To develop a strong knowledge base of traffic planning and its management in any transportation area.
- To provide knowledge of traffic control devices and its techniques in transportation interaction.

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

**[CO1]** Understand the traffic Forecast, Accident Analysis and Traffic Simulation.

**[CO2]** Estimate the basic characteristics of traffic stream.

**[CO3]** Conduct traffic studies and analyse traffic data.

**[CO4]** Determine the capacity of highways.

**[CO5]** Design traffic signal system.

**C. Assessment Plan:**

| Criteria | Description | Maximum Marks |
|---|---|---|
| **Continuous Internal Assessment (CIA)** | Internal Examination | 20 |
| | Attendance | 5 |
| | Assignment | 5 |
| **End Semester Examination(ESE)** | End Semester Examination | 70 |
| **Total** | | 100 |
| **Attendance** | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

**TRAFFIC FORECAST:** Traffic Forecast: General travel forecasting principles, different methods of traffic forecast - Mechanical and analytical methods, Demand relationships, methods for future projection; Design Hourly Volume for Varying Demand Conditions: Concept of Design vehicle units and determination of PCU under mixed traffic conditions, Price-volume relationships, demand functions. Determination of design hourly volume; critical hour concept;

**HIGHWAY CAPACITY:** Highway Capacity: Factors affecting capacity, level of service; Capacity studies - Capacity of different highway facilities including un-signalised and signalised intersections. Problems in Mixed Traffic flow; Case studies;

**ACCIDENT ANALYSIS:** Accident Analysis: Analysis of individual accidents and statistical data; Methods of representing accident rate; Factors in traffic accidents Influence of roadway and traffic conditions on traffic safety; accident coefficients; Driver strains due to roadway and traffic conditions;

**TRAFFIC FLOW THEORY:** Traffic Flow Theory: Fundamental flow relationship and their applications, Traffic flow theories and applications; Shock waves; Queuing theory and applications Probabilistic Aspects Of Traffic Flow: Vehicle arrivals, distribution models, gaps and headway distribution models; gap acceptance merging parameters, delay models, applications;

**CONCEPT OF TRAFFIC SIMULATION:** Simulation: Fundamental principle, application of simulation techniques in traffic engineering Formulation of simulation models, Case studies. Formulation of system models.

**E. TEXT BOOKS**

T1. Traffic Engineering and Transport Planning – Dr. L.R. Kadiyali
T2. Textbook of Highway and Traffic Engineering – Subhash C. Saxena

**F. REFERENCE BOOKS**

R1. Traffic & Highway Engineering – Nicholas J. Garber, Lester A. Hoel

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| [CO1] | Understand the traffic Forecast, Accident Analysis and Traffic Simulation. | 2 | 2 | 1 | 1 | - | 1 | - | - | 1 | 1 | - | 2 | 2 | 2 | - | 1 |
| [CO2] | Estimate the basic characteristics of traffic stream. | 2 | 3 | 2 | 2 | - | 1 | - | - | 1 | 2 | - | 2 | 2 | 3 | - | 2 |
| [CO3] | Conduct traffic studies and analyse traffic data. | 2 | 3 | 2 | 1 | 1 | 1 | - | - | - | 2 | - | 1 | 1 | 2 | - | 2 |
| [CO4] | Determine the capacity of highways. | 2 | 3 | 2 | 1 | 1 | 1 | - | - | - | - | - | 1 | 2 | 3 | 1 | - |
| [CO5] | Design traffic signal system. | 1 | 3 | 3 | 1 | - | 2 | 1 | - | 1 | - | - | 2 | 2 | 3 | 1 | 1 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

## Subject: Soft Skills and Interpersonal Communication

Code: BTE25386

3 Credits | Semester VIII

Total Lecture: 45 Total Tutorial: 9

**A. Introduction:**

- To give each student a realistic perspective of work and work expectations
- To guide students in making appropriate and responsible decisions
- To create a desire to fulfill individual goals
- To educate students about unproductive thinking, self-defeating emotional impulses, and self- defeating behaviors.

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

**[CO1]** Understand the Corporate communication culture.

**[CO2]** Implement Corporate Social Responsibility and Ethics.

**[CO3]** Acquire corporate email, mobile and telephone etiquette.

**[CO4]** Judge presentation and entrepreneurial skills of individuals.

**[CO5]** Develop business reports and proposals expected of a corporate professional.

**C. Assessment Plan:**

| Criteria | Description | Maximum Marks |
|---|---|---|
| **Continuous Internal Assessment (CIA)** | Internal Examination | 20 |
| | Attendance | 5 |
| | Assignment | 5 |
| **End Semester Examination(ESE)** | End Semester Examination | 70 |
| **Total** | | 100 |
| **Attendance** | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

**LANGUAGE ENHANCEMENTS:** English Language Enhancement: Verbs and tenses, Phrasal verbs, Synonyms, Antonyms, Homonyms - Descriptive Words, Combining Sentences, Business Idioms, Indianisms in English

**ART OF COMMUNICATION:** Art of Communication, Communication process- Non-verbal Communication- Effective Listening. Interpersonal and Intra Personal Communication Skills- Self-Awareness- Self-Esteem and Confidence- Assertiveness and Confidence- Dealing with Emotions-

**TEAM CONCEPT:** Team Concept- Elements of Teamwork- Stages of Team Formation- Effective Team-Team Player Styles-Leadership

**CAMPUS TO COMPANY:** Campus to Company- Dressing and Grooming- The Corporate Fit- Business Etiquette Communication; media etiquette

**PRESENTATION & ENTREPRENEURIAL SKILLS:** Group Discussions, Interviews, and Presentation Skills. Interview handling skills- Effective Resume-- Common Interview Mistakes- Body-language Content Aid, Visual Aids- Entrepreneurial Skills Development. Reading

**E. TEXT BOOKS**

T1. K.Alex, Soft Skills: Know Yourself & Know The world, S. Chand; 2009.

**F. REFERENCE BOOKS**

R1 Robert M. Sherfield, Developing Soft Skills, Montgomery and Moody Fourth Edn. Pearson, 2009.

R2. Robert Bramson, Coping with Difficult People, Dell, 2009

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| [CO1] | Understand the Corporate communication culture. | - | - | - | 1 | - | 2 | - | 2 | 3 | 3 | 1 | 2 | - | - | 2 | 3 |
| [CO2] | Implement Corporate Social Responsibility and Ethics. | - | - | - | 1 | - | 3 | 1 | 3 | 3 | 2 | - | 2 | - | - | 3 | 2 |
| [CO3] | Acquire corporate email, mobile and telephone etiquette. | - | - | - | 1 | 1 | 2 | - | 3 | 3 | 3 | 1 | 3 | - | - | 3 | 3 |
| [CO4] | Judge presentation and entrepreneurial skills of individuals. | - | - | - | - | 2 | 1 | 1 | 3 | 3 | 3 | 2 | 2 | - | - | 3 | 3 |
| [CO5] | Develop business reports and proposals expected of a corporate professional. | - | - | - | - | 2 | 1 | - | 2 | 3 | 3 | - | 3 | - | 1 | 3 | 3 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

## Subject: Human Resource Development & Organizational Behavior

Code: BTE26387

3 Credits | Semester VIII

Total Lecture: 45 Total Tutorial: 9

**A. Introduction:**

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

**[CO1]** Define the key ideas and issues in OB.

**[CO2]** Interpret the dynamics of human behavior in work context.

**[CO3]** Examine the determinants of work behavior from different levels.

**[CO4]** Judge the issues in OB that influence the way people behave in an organizational setting.

**[CO5]** Develop competencies of analyzing behavioural issues in the work environment

**C. Assessment Plan:**

| Criteria | Description | Maximum Marks |
|---|---|---|
| **Continuous Internal Assessment (CIA)** | Internal Examination | 20 |
| | Attendance | 5 |
| | Assignment | 5 |
| **End Semester Examination(ESE)** | End Semester Examination | 70 |
| **Total** | | 100 |
| **Attendance** | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

**INTRODUCTION:** Study of OB: Definition, Meaning, Why Study OB, Learning- Nature of Learning, How learning occurs, Learning and OB

**INDIVIDUAL BEHAVIOUR & MOTIVATION:** Foundations of Individual Behaviour: Personality- Meaning and Definition, Determinants of Personality, Personality Traits, Personality and OB Perception- Meaning and Definition, Perceptual Process, Importance of Perception in OB Motivation- Nature and Importance, Herzberg's Two Factor Theory, Maslow's Need Hierarchy Theory, Alderfer's ERG Theory, Evaluations

**ORGANISATIONAL BEHAVIOUR PROCESSES:** Communication- Importance, Types, Gateways and Barriers to Communication, Communication as a tool for improving interpersonal effectiveness. Groups in Organisations- Nature, Types, Why do people join groups , Group cohesiveness and Group Decision making. Managerial Implications, Effective Team building

**LEADERSHIP & CONFLICT MANAGEMENT:** Leadership & Management, Theories of leadership- Trait theory, Leader, Behaviour theory, Contingency Theory, Leadership, Leadership and Followership, How to be an effective leader Conflict- Nature of Conflict and conflict resolution An introduction to transactional analysis

**ORGANISATION CULTURE & HRM:** Organisational Culture- Meaning & Definition, Culture and Organisational effectiveness Introduction to Human Resource Management- Selection, Orientation, Training& Development, Performance Appraisal, Incentives Organisational Changes- Importance of Change, Planned Change and OB techniques International Organisational Behaviour- Trends in International Business, Cultural Differences and Similarities, Individual and Interpersonal Behaviour in global perspective

**E. TEXT BOOKS**

T1. Keith Davis, Organizational Behavior, McGraw Hill
T2.K.Aswathappa, Organizational Behavior, Himalaya Publishing House

**F. REFERENCE BOOKS**

R1. Stephen P. Robbins, Organizational Behavior, Prentice Hall of India

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| [CO1] | Define the key ideas and issues in OB. | - | - | - | 1 | - | 3 | 1 | 3 | 2 | 3 | - | 1 | - | - | 2 | 3 |
| [CO2] | Interpret the dynamics of human behavior in work context. | - | - | - | 2 | - | 3 | - | 3 | 3 | 3 | - | 2 | - | - | 3 | 3 |
| [CO3] | Examine the determinants of work behavior from different levels. | - | - | - | 2 | - | 3 | - | 3 | 3 | 3 | - | 2 | - | - | 3 | 3 |
| [CO4] | Judge the issues in OB that influence the way people behave in an organizational setting. | - | - | - | 1 | - | 3 | - | 2 | 2 | 3 | - | 2 | - | - | 2 | 3 |
| [CO5] | Develop competencies of analyzing behavioural issues in the work environment | - | - | - | 1 | - | 3 | - | 2 | 2 | 3 | - | 2 | - | - | 2 | 3 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Civil Engineering Design-I

Code:BTE28368

3 Credits | Semester VIII

Total Lecture: 45 Total Tutorial: 9

**A. Introduction:**

- To introduce the concept of Design.
- To explain the role of geomatics in Civil Engineering Drawing.
- To make the students understand the scientific laws in design
- To interpret the need of Site appraisal and Safety in Design
  To explain the concept of EIA

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

**[CO1]** Define the concept of Design and EIA.

**[CO2]** Demonstrate the role of Geomatics in Civil Engineering Design.

**[CO3]** Examine the importance of modern tools and software in design.

**[CO4]** Judge the relevance of Site Appraisal and Safety in Design.

**[CO5]** Develop the Plan of a Building using modern tools.

**C. Assessment Plan:**

| Criteria | Description | Maximum Marks |
|---|---|---|
| **Continuous Internal Assessment (CIA)** | Internal Examination | 20 |
| | Attendance | 5 |
| | Assignment | 5 |
| **End Semester Examination(ESE)** | End Semester Examination | 70 |
| **Total** | | 100 |
| **Attendance** | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

**INTRODUCTION:** Concept of design and its contribution to the quality of life;

**CIVIL ENGINEERING DESIGN:** Civil Engineering Design, the role of geomatics, the environment, and scientific laws in design Introduction to the design of buildings and Civil Engineering Infrastructure,

**APPRAISAL &EIA :**Site appraisal; Risk and vulnerability in design; Health and safety in Civil Engineering Design, Environmental impact assessment;

**INTRODUCTION TO CAD:** Civil Engineering drawing, CAD techniques

**GIS :**Introduction to GIS technique

**E. TEXT BOOKS**

T1. Drawing for Civil Engineering, Second Edition – Jan A van der Westhuizen

**F. REFERENCE BOOKS**

R1. Principles of Applied Civil Engineering Design – Ying-Kit Choi

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| [CO1] | Define the concept of Design and EIA. | 1 | - | 1 | - | 1 | 2 | 2 | 2 | 1 | 1 | - | 2 | 2 | - | - | 1 |
| [CO2] | Demonstrate the role of Geomatics in Civil Engineering Design. | 2 | 1 | 2 | - | 1 | - | - | 1 | 1 | 1 | - | 1 | 2 | - | 1 | 1 |
| [CO3] | Examine the importance of modern tools and software in design. | 2 | 1 | 1 | - | 2 | - | 1 | 1 | 2 | 1 | - | 3 | 2 | - | 3 | 1 |
| [CO4] | Judge the relevance of Site Appraisal and Safety in Design. | 2 | 2 | - | - | - | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 3 | 1 | 1 | 2 |
| [CO5] | Develop the Plan of a Building using modern tools. | 1 | 1 | - | - | 3 | 2 | 2 | 1 | 2 | 1 | 2 | 2 | 2 | - | 3 | 2 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Subject: Geographic Information Systems & Science

Code: BTE28369

3 Credits | Semester VIII

Total Lecture: 45 Total Tutorial: 9

**A. Introduction:**

- To comprehend fundamental concepts and practices of Geographic Information Systems (GIS) and advances in Geospatial Information Science and Technology
- To apply basic graphic and data visualization concepts
- To give examples of interdisciplinary applications of Geospatial Information Science and Technology.
- To apply GIS analysis to address geospatial problems and/or research questions

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

**[CO1]** Understand the basic concepts of GIS and list the software/hardware requirements for implementing GIS Project.

**[CO2]** Demonstrate the geospatial features in computing environment.

**[CO3]** Analyze spatial and attribute data for solving spatial problems.

**[CO4]** Judge the relationship of GIS to GPS and satellite generated data.

**[CO5]** Create GIS and cartographic outputs for presentation.

**C. Assessment Plan:**

| Criteria | Description | Maximum Marks |
|---|---|---|
| **Continuous Internal Assessment (CIA)** | Internal Examination | 20 |
| | Attendance | 5 |
| | Assignment | 5 |
| **End Semester Examination(ESE)** | End Semester Examination | 70 |
| **Total** | | 100 |
| **Attendance** | A minimum of 75% Attendance is required to be maintained by a student to be qualified for taking up the End Semester examination. The allowance of 25% includes all types of leaves including medical leaves. | |

**D. SYLLABUS**

**INTRODUCTION TO GIS:** Investigation of geographic information systems (GIS) and science (GI Science) including theory and applications areas.

**GIS SOFTWARES:** Use of a current widely-used GIS computer software system.

**GEOGRAPHIC DATA:** Aspects of geographic data entry and editing, spatial analysis, and map development and display

**GIS & GPS:** Relationship of GIS to the Global Positioning System (GPS) and satellite generated data

**E. TEXT BOOKS**

T1. Fundamentals of Geographic Information System – DebashisChakraborty, Rabi N. Sahoo
T2. Introductory Geographic Information Systems – John R. Jensen, Ryan R. Jensen

**F. REFERENCE BOOKS**

R1. Principles of Geographical Information System – Peter A. Burrough, Rachael A. McDonnell

**G. Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| [CO1] | Understand the basic concepts of GIS and list the software/hardware requirements for implementing GIS Project. | 1 | 1 | 2 | 3 | 3 | - | - | - | 2 | 2 | 1 | 1 | 2 | 1 | 1 | 2 |
| [CO2] | Demonstrate the geospatial features in computing environment. | 2 | 3 | - | 2 | 3 | 2 | - | - | 2 | 2 | - | 1 | 2 | 1 | 1 | 2 |
| [CO3] | Analyze spatial and attribute data for solving spatial problems. | 2 | 3 | - | 1 | 3 | 2 | - | - | 2 | 2 | - | - | 2 | 2 | - | 2 |
| [CO4] | Judge the relationship of GIS to GPS and satellite generated data. | 3 | 1 | - | 1 | 3 | 1 | - | - | 2 | 2 | - | 1 | 2 | 1 | 1 | 2 |
| [CO5] | Create GIS and cartographic outputs for presentation. | 3 | 2 | - | 1 | 3 | 1 | - | - | 2 | 2 | 1 | 1 | 2 | 3 | 1 | 2 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Major Project

Code: BTE28297
8 Credits | Semester VIII

Total Lecture: 240

The object of Project Work & Dissertation is to enable the student to extend further the investigative study, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include:

1. In-depth study of the topic assigned in the light of the Report;
2. Review and finalization of the Approach to the Problem relating to the assigned topic;
3. Preparing an Action Plan for conducting the investigation, including team work;
4. Detailed Analysis/Modeling/Simulation/Design/Problem Solving/Experiment as needed;
5. Final development of product/process, testing, results, conclusions and future directions;
6. Preparing a paper for Conference presentation/Publication in Journals, if possible;
7. Preparing a Dissertation in the standard format for being evaluated by the Department.
8. Final Seminar Presentation before a Departmental Committee.

***On completion of the course, students are able to:***

[CO1] Demonstrate a sound technical knowledge of their selected project topic.
[CO2] Undertake problem identification, formulation and solution.
[CO3] Design engineering solutions to complex problems utilizing a systems approach.
[CO4] Conduct an engineering project.
[CO5] Communicate with engineers and the community at large in written an oral form.

**Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| [CO1] | Demonstrate a sound technical knowledge of their selected project topic. | | | | | | | 1 | 2 | | | | | | | | 2 |
| [CO2] | Undertake problem identification, formulation and solution. | | | | | | | | | | 1 | | | 2 | | | |
| [CO3] | Design engineering solutions to complex problems utilizing a systems approach. | | | | | | | | | | | 3 | | | | 2 | 1 |
| [CO4] | Conduct an engineering project. | | | | | | | | | | | 3 | | 3 | | | |
| [CO5] | Communicate with engineers and the community at large in written an oral form. | | | | | | | | | | | 3 | | | | 1 | 2 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

# Extra-Curricular/Co-Curricular Activity

Code: BTE28390

0 Credits | Semester VIII

AICTE Activity Points to be earned by students admitted to Degree program**(For more details refer to Chapter 6, AICTE, Activity Point Program, Model Internship Guidelines):**

Every regular student, who is admitted to the 4 year Degree program, is required to earn 100 activity points in addition to the total credits earned for the program. Students entering 4 years Degree Program through lateral entry are required to earn 75 activity points in addition to the total credits earned for the program. The activity points earned by the student shall be reflected on the students 8th Semester grade card.

The activities to earn the points can be spread over the duration of the course. However, minimum prescribed duration should be fulfilled.

Activity Points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression.

Incase student fail to earn the prescribed activity points, Eight semester Grade Card shall be issued only after earning the required activity Points.

Students shall be eligible for the award of degree only after the release of the Eight Semester grade card.

## COURSE OUTCOMES

### *On completion of the course, students are able to;*

[CO1] Analyze reasons behind events and situations

[CO2] Solve problems utilizing various concepts, solutions, etc.

[CO3] Take initiatives, responsibilities, setting goals, motivating others to work towards goals and taking accountability

[CO4] Understand the importance of leisure and recreation.

[CO5] Maintain ethics in public life and good moral values etc.

**Course Articulation Matrix: (Mapping of COs with POs)**

| CO | STATEMENT | CORRELATION WITH PROGRAM OUTCOMES | | | | | | | | | | | | CORRELATION WITH PROGRAM SPECIFIC OUTCOMES | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO10 | PO11 | PO12 | PSO 1 | PSO 2 | PSO 3 | PSO 4 |
| [CO1] | Analyze reasons behind events and situations | | | | | | | 1 | 2 | | | | | | | | 2 |
| [CO2] | Solve problems utilizing various concepts, solutions, etc. | | | | | | | | | | 1 | | | 2 | | | |
| [CO3] | Take initiatives, responsibilities, setting goals, motivating others to work towards goals and taking accountability | | | | | | | | | | | 3 | | | | 2 | 1 |
| [CO4] | Understand the importance of leisure and recreation. | | | | | | | | | | | 3 | | 3 | | | |
| [CO5] | Maintain ethics in public life and good moral values etc. | | | | | | | | | | | 3 | | | | 1 | 2 |

**1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**