Curriculum Structure & Syllabi

(As per National Education Policy 2020)

of

B. Tech.

in

Civil Engineering

(w.e.f. 2024-25)

Vision

Mission

Program Educational Objectives

Program Outcomes

Overall Credit Structure

Curriculum

Syllabus

Offered By

DEPARTMENT OF CIVIL ENGINEERING

MADAN MOHAN MALAVIYA UNIVERSITY OF TECHNOLOGY (MMMUT) GORAKHPUR-273 010, UP, INDIA

JUNE 2025

ABOUT THE DEPARTMENT

The Civil Engineering was established in 1962, since the inception of erstwhile Madan Mohan Malaviya Engineering College, Gorakhpur. The department has, over the years, established its status as a centre for imparting high quality technical education to Undergraduate and Postgraduate students and extending consultancy services to industries and various government departments located in Eastern UP. Besides undergraduate course of (B.Tech.-Civil Engineering), the department offers 4 regular M. Tech. courses in Civil Engineering respectively in Hill Area Development Engineering, Environmental Engineering, Structural Engineering, and Seismic Design and Earthquake Engineering domains. The facilities of doctoral research are also available in the department under QIP/ TEQIP/ University schemes.

The department has experienced and highly qualified faculty members. Further, the strength of the department also lies in the strong linkages, it has with its alumni and various governments/private organizations located in the region. The alumni of the department are well placed in various government/private organizations and are in close contact with the department. The department is continuously interacting with the various government and private organization in the form of consultancy work, expert advice, design projects etc.

VISION:

To become a premier centre of learning and research in Civil Engineering, nurturing sustainable development by the year 2025.

MISSION:

1. To provide the quality education in the area of civil engineering to transform students into graduates with high professional values.
2. To share and disseminate expertise for use in the solution of problems faced by Civil engineering industry and by society.
3. To insure the continuous improvement in the quality of life of people in the society.
4. To conduct need based research base projects giving priority to the needs of industry.

Program Educational Objectives (PEO) of B. Tech in Civil Engineering

PEO-1	To enrich the students with state-of-the-art knowledge in the field of Civil Engineering.
PEO-2	To keep abreast the students with the use of modern tools, equipment and software and inculcating the habit of life-long learning.
PEO-3	To foster teamwork and professional ethics among students towards devising feasible solutions to problems and project work.

Program Outcome (POs)

PO-1	Broadening the horizon of the students in the field of Civil Engineering, increasing their ability to apply knowledge of mathematics, science, and engineering to solve real world problems.
PO-2	Increasing the ability of students to identify, formulate and solve problems in a systematic way by appropriate collection, analysis, and interpretation of data.

PO-3 Increasing their ability to design a system, component, or process to meet the desired needs in an environment friendly and socially acceptable way.

PO-4 Enhancing their skills to analyze complex Civil Engineering problems and obtain the solution by synthesizing simple components.

PO-5 Increasing their ability to use the techniques, skills and modern engineering and Information Technology based tools (such as web-based applications and open-source software etc.) to increase the creativity of students.

PO-6 Enhancing awareness of students about the impact of engineering projects in a global and societal context (social, economic, legal and/or environmental implications).

PO-7 Enhancing their ability to practice environmental concerns and related sustainable measures and be capable of carrying out environmental impact of a civil engineering projects.

PO-8 Informing students about engineering ethics and professional responsibilities.

PO-9 Increasing their decision-making skills and innovative capability not only individually but also in a multi-disciplinary team.

PO-10 Increasing the ability to communicate effectively by enhancing their drawing and report writing skills and oral presentation skills.

PO-11 Increasing awareness of students about cost, time and quality issues in construction helping them to develop social and leadership skills.

PO-12 Providing the students with knowledge on contemporary issues in the field of civil engineering and recognizing the need for an ability to engage in continuous and life- long learning.

Program Specific Outcome (PSO):

PSO -1. To identify, analyze and suggest solutions for the issues faced by the present and future generation related to Civil Engineering fields.

PSO -2. Plan, analyze, and design infrastructural projects and its components in various areas of Civil Engineering like Structural Engineering, Geotechnical Engineering, Water Resources Engineering, Environmental Engineering, and Transportation Engineering.

PSO -3. Execute the construction of buildings and other components of various projects in Civil engineering including its layout, management, and quality control.

CREDIT STRUCTURE FOR B. TECH. (CIVIL ENGINEERING)

(SESSION 2024-2025 AND ONWARDS)

OVERALL CREDIT STRUCTURE FOR B.TECH. (CIVIL ENGINEERING)

<table>
<tr><th colspan="4">Credit Courses</th></tr>
<tr><th colspan="2">Core Courses (CC)</th><th colspan="2">Electives Courses (EC)</th></tr>
<tr><th>Category</th><th>Min. Credits</th><th>Category</th><th>Min. Credits</th></tr>
<tr><td>Basic Sciences & Maths (BSM)</td><td>20</td><td rowspan="3">Professional Electives (PE)/ Open Electives (OE)</td><td rowspan="3">36</td></tr>
<tr><td>Engineering Fundamentals (EF)</td><td rowspan="2">24</td></tr>
<tr><td>Professional Skill (PS)</td></tr>
<tr><td>Professional Core (PC)</td><td>48</td><td>Humanities & Social Science Elective (HSSE)</td><td>04</td></tr>
<tr><td>Management (M)</td><td>04</td><td></td><td></td></tr>
<tr><td>Humanities & Social Science (HSS)</td><td>08</td><td></td><td></td></tr>
<tr><td>Minor Project (P)</td><td>06</td><td></td><td></td></tr>
<tr><td>Industrial Practice (IP) (In Industry)/ Major Project (MP) (In University)</td><td>10</td><td></td><td></td></tr>
<tr><td>Sub-total</td><td>120</td><td>Sub-total</td><td>40</td></tr>
<tr><td>Grand Total</td><td colspan="3">160</td></tr>
<tr><th colspan="4">Non-Credit Courses</th></tr>
<tr><td colspan="3">One Expert Lecture per semester for students (Mandatory).
(BSM-Ist year), (PC-2nd Year), (T&P-3rd Year)</td><td>Non-Credit</td></tr>
<tr><td colspan="3">Social work/Training of at least 60 hours during break after first/ second semester (Mandatory) (Dean of Extension, Field Outreach and Alumni Relations).</td><td>Non-Credit</td></tr>
<tr><td colspan="3">Industrial Training during the summer break after fourth semester (Mandatory).</td><td>Non-Credit</td></tr>
<tr><td colspan="3">One -week workshop during the winter break after fifth semester on professional/ industry/ Social/ entrepreneurial orientation (Mandatory) (Dean of Extension, Field Outreach and Alumni Relations).</td><td>Non-Credit</td></tr>
<tr><td colspan="3">Value Added Courses (VAC) / Audit Courses (AC)
Two of the Value-Added Courses / Audit Courses are compulsory.</td><td>Non-Credit</td></tr>
<tr><td colspan="3">Extracurricular Activities Courses (ECA)
Two compulsory courses from the following S. No (ii) to (v) non-credit courses:
(i) Induction Program (compulsory)
(ii) Skill development
(iii) Unity and Discipline (NCC or NSS)
(iv) Sports, Cultural and Games
(v) Personality Development</td><td>Non-Credit</td></tr>
<tr><th colspan="4">Minor Degree (MD) from any Department and Micro Specializations (MS) within the Department</th></tr>
<tr><td colspan="3">• The total number of credits for graduation will be kept to minimum 160. The additional 18-20 credits required for Minor Degree Courses.
• Micro specializations (MS) will be run by the department in order to aligned to industry careers or higher studies</td><td>Offered as a Professional Electives (PE)</td></tr>
</table>

DEPARTMENT OF CIVIL ENGINEERING
MADAN MOHAN MALAVIYA UNIVERSITY OF TECHNOLOGY (MMMUT)
GORAKHPUR-273 010, UP, INDIA

SEMESTER WISE CREDIT STRUCTURE FOR B. TECH. CIVIL ENGINEERING

Category/Semesters	I	II	III	IV	V	VI	VII	VIII	Total
Basic Sciences & Maths (BSM)	8	8	0/4	4/0					**20***
Humanities & Social Science (HSS)	4	4							**08***
Humanities & Social Science Elective (HSSE)					4				**04***
Management (M)						4			**04***
Engineering Fundamentals (EF)	4	4	8/4	0/4					**16***
Professional Skill (PS)	4	4							**08***
Professional Core (PC)			12	12	12	12			**48***
Professional Electives (PE)/ Open Electives (OE)				4-8	28-32				**36***
Minor Project (P)						0	6		**06***
Industrial Practice (IP) (in Industry)/ Major Project (MP) (In University)								10	**10***
Total Credit	**20***	**20***	**20***	**20-24***	**16*-32***	**16*-32***	**6-30***	**10-30***	**160***
	80-84*				**76-80***				
Total Courses Offered	**05***	**05***	**05***	**05*-06***	**04*-08***	**04*-08***	**00-06***	**00-05***	**36***

**Minor variation is allowed as per need of the respective disciplines.*

Curriculum for B.Tech. (Civil Engineering)

First Year, Semester I

S. N.	Category	Paper Code	Subject	L	T	P	Credit
1.	BSM	BSM-110	Engineering Mathematics I	3	1	0	4
2.	BSM	BSM-131/ BSM 181	Engineering Physics	3	0	2	4
3.	EF	BIT 103	Programming in C	3	0	2	4
4.	PS	BCE 121	Engineering Graphics	2	0	4	4
5.	HSS	BHS 101 / BHS 151	Universal Human values: understanding Harmony	3	1	0	4
			Total	**14**	**2**	**8**	**20**
1.	ECA-I		**Induction Program**	**-**	**-**	**-**	**0**

 # Group-1: CSE, IT, CH, CE; Group-2: ECE, ECE(IOT), ME, EE.

First Year, Semester II

S. N.	Category	Paper Code	Subject	L	T	P	Credit
1.	BSM	BSM-160	Engineering Mathematics II	3	1	0	4
2.	BSM	BSM-140 /BSM-190	Environmental Science and Green Chemistry	3	0	2	4
3.	EF	BEE- 107 / BEE-157	Basic Electrical Engineering	3	0	2	4
4.	PS	BCE 161	Building Planning and Drawing	2	0	4	4
5.	HSS	BHS-102 /BHS-152	Technical Writing and Professional Communication	3	1	0	4
			Total	**14**	**2**	**8**	**20**
	VAC/AC	BCE-162	AC-1 (Design Thinking in Civil Engineering)	0	0	2	0
1.	ECA-II			-	-	-	**0**

Second Year, Semester III

S. N.	Category	Paper Code	Subject	L	T	P	Credit
1.	EF	BCE 210	Civil Engineering material, Evaluation and testing	3	0	2	4
2.	EF	BCE 211	Soil Mechanics	3	0	2	4
3.	PC	BCE 212	Structural Mechanics	3	0	2	4
4.	PC	BCE 213	Basic Surveying	3	1	0	4
5.	PC	BCE 214	Fluid Mechanics	3	0	2	4
			Total	**15**	**1**	**8**	**20**
6.	VAC/AC	AUC-101	Constitution of India	2	0	0	0
7.	ECA-III			-	-	-	0

Second Year, Semester IV

S. N.	Category	Paper Code	Subject	L	T	P	Credit
1.	BSM	BSM-264	Numerical Methods	3	0	2	4
2.	PC	BCE 261	Hydraulics and Hydraulic Machines	3	0	2	4
3.	PC	BCE 262	Structural Analysis	3	1	0	4
4.	PC	BCE 263	Highway Engineering	3	0	2	4
5.	PE 1	ECE 101	Matrix Method of Analysis	3	1	0	4
		ECE 102	Geotechnical Investigations and Field Testing of Soil	3	1	0	4
		ECE 103	Global Warming and Climate Change	3	1	0	4
		ECE 104	Principles of Highway Engineering	3	1	0	4
		ECE 105	Engineering Hydrology	3	1	0	4

		ECE 106	Global Positioning System	3	1	0	4
6.	PE 2	ECE 201	Prestressed Concrete	3	1	0	4
		ECE 202	Rock Mechanics	3	1	0	4
		ECE 203	Environmental Chemistry and Microbiology	3	1	0	4
		ECE 204	Traffic Engineering	3	1	0	4
			Total	**15**	**2**	**6**	**20**
7.	VAC/AC	AUC-102 to AUC-115		2	0	**0**	0
8.	ECA-IV			**-**	**-**	**-**	0

List of Extra Curricular Activity (ECA) Courses

ECA-II						
S. No.	Branch	Category	Subject Name	Subject Code	Hours/ Week	Credit
1.	Open to all Branches	ECA	Skill Development-I	ECA-151	2	0
2.	Open to all Branches	ECA	Unity and Discipline (NCC)-I	ECA-171	2	0
3.	Open to all Branches	ECA	Unity and Discipline (NSS)-I	ECA-172	2	0
4.	Open to all Branches	ECA	Games & Sports-I	ECA-181	2	0
5.	Open to all Branches	ECA	Cultural, Art & Literary-I	ECA-182	2	0

List of Value-Added Courses (VAC)/Audit Courses (AC)

S. No.	**Subjects**	**Codes**
1.	Constitution of India	AUC 101
2.	Indian Culture and Heritage	AUC 102
3.	Indian Architecture	AUC 103
4.	Indian Festivals	AUC 104
5.	Vaidic Mathematics	AUC 105
6.	Astronomy	AUC 106
7.	Arts of India	AUC 107
8.	Intellectual Property Right	AUC 108
9.	Human Rights	AUC 109
10.	Logical Research	AUC 110
11.	Professional Ethics	AUC 111
12.	Environmental Law	AUC 112
13.	Health Law	AUC 113
14.	National Cadet Corps	AUC 114
15.	Basics of Human Health and preventive medicines	AUC 115

SKILLS-ENHANCEMENT COURSES FOR EXIT (CIVIL ENGINEERING):

2-Months internship for 6-Credits **OR** Two courses mentioned below of 4 to 6 credits.

A. **After First Year: UG Certificate (Engg.).**

The candidate should pass the following two additional courses (ITI Level) **OR** any two suitable skill-based courses to qualify for **UG Certificate (Engg.).**

S. N.	Category	Paper Code	Subject	L	T	P	Credit
1.	Skill Enhancement	BCE-163	Plumbing and Sanitation	2	0	2	3
2.	Skill Enhancement	BCE-164	Computer aided drafting	2	0	2	3
3.	Skill Enhancement	BCE-165	Carpentry and fabrication	2	0	2	3

OR

Equivalent skills-enhancement courses from MOOC/SWAYAM.

B. After Second Year: UG Diploma (Engg.).

The candidate should pass the following two additional courses **OR** any two suitable skill-based courses to qualify for **UG Diploma (Engg.).**

S. N.	Category	Paper Code	Subject	L	T	P	Credit
1.	Skill Enhancement	BCE-264	Introduction to Remote Sensing and GIS	2	0	2	3
2.	Skill Enhancement	BCE-265	Analysis and Design of Water Distribution Systems	2	0	2	3
3.	Skill Enhancement	BCE-266	Geotechnical Exploration and Instrumentation	2	0	2	3

SYLLABI

Semester-I

BSM-110 Engineering Mathematics I

Course category : Basic Sciences & Maths (BSM)

Pre-requisite Subject : NIL

Contact hours/week : Lecture: 3, Tutorial: 1, Practical: 0

Number of Credits : 4

Course Assessment methods : Continuous assessment through tutorials, attendance, home assignments, quizzes and Two Minor tests and One Major Theory Examination

Course Objectives : The course is aimed to develop the basic mathematical skills of engineering students that are imperative for effective understanding of engineering subjects.

Course Outcomes : The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1. Use of basic differential operators in various engineering problems.
2. Understand the concepts of limit theory and nth order differential equations and their applications to our daily life
3. Solve linear system of equations using matrix algebra.
4. Know about qualitative applications of Gauss , Stoke's and Green's theorem.
5. To know the applications of double and triple integration in finding the area and volume.
6. To inculcate the habit of mathematical thinking and lifelong learning.

Topics Covered

UNIT-I 9

Differential Calculus: Limit, Continuity and Differentiability, Mean value theorems. Leibnitz theorem, Partial derivatives, Euler's theorem for homogenous function, Total derivative, Change of variable. Taylor's and Maclaurin's theorem. Expansion of function of two variables, Jacobian, Extrema of function of several variables.

UNIT-II 9

Linear Algebra: Symmetric, Skew-symmetric matrices, Hermitian, Skew Hermitian Matrices, orthogonal and unitary matrices and basic properties, linear independence and dependence of vectors, Rank of Matrix, Inverse of a Matrix, Elementary transformation, Consistency of linear system of equations and their solution, Characteristic equation, Eigenvalues, Eigen-vectors, Cayley-Hamilton theorem, Diagonalization of matrices.

UNIT-III 9

Multiple Integrals: Double and triple integrals, change of order of integration, change of variables. Application of multiple integral to surface area and volume. Beta and Gamma functions, Dirichlet integral.

UNIT-IV 9

Vector Calculus: Gradient, Divergence and Curl. Directional derivatives, line, surface and volume integrals. Applications of Green's, Stoke's and Gauss divergence theorems (without Proofs).

Books & References

1. B.S. Grewal: Higher Engineering Mathematics; Khanna Publishers
2. Erwin kreyszig: Advanced Engineering Mathematics, John Wiley & Sons.
3. R. K. Jain and Iyenger: Advanced Engineering Mathematics, Narosa Publications.
4. B.V. Ramana: Higher Engineering Mathematics, Tata Mc. Graw Hill Education Pvt. Ltd.,

BSM -131/181 ENGINEERING PHYSICS

Course category	:	Basic Sciences and Maths (BSM)
Pre-requisite Subject	:	Physics at 12thStandard
Contact hours/week	:	Lecture: 3, Tutorial: 0, Practical: 2
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes and Two Minor tests and One Major Theory Examination
Course Objectives	:	Understanding of the principles and concept of Optics, Quantum Mechanics, Fiber Optics, Electrodynamics and Physics of Advanced Materials.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills, and attributes after completing this course.

1. Understand the basics principles of Optics and its applications in Engineering and Technology.
2. Compare and understand the uses of various lasers in different fields of Engineering.
3. Know the knowledge of Optical Fibre and their applications in Photonics.
4. Understand the principles of Quantum Mechanics and their applications in Engineering and Technology.
5. Know the principles of Electrodynamics and their applications in Engineering and Technology.
6. Understand the basic properties of advanced materials and their engineering applications.

UNIT-I: Optics: **9**

Interference: Interference of light, Interference in thin films, Newton's rings. Refractive index and wavelength determination.

Diffraction: Fresnel and Fraunhofer class of diffraction. Resultant of n-hormonic waves, single, double and N- slit diffraction, Diffraction grating, Grating spectra, Dispersive power.

Polarization: Phenomena of double refraction, Nicol prism, Production and analysis of plane, circular and elliptical polarized light, Retardation Plate, Polarimeter.

Laser: Spontaneous and stimulated emission of radiation, Population inversion, Concept of 3 and 4 level Laser, Construction and working of Ruby, He-Ne lasers, and laser applications.

UNIT-II : Quantum Mechanics and Fiber Optics: 9

Quantum Mechanics: de Broglie waves, Davisson-Germer experiment, Concept of Phase and Group velocities, Uncertainty principle and its applications, Derivation of time independent and time dependent Schrodinger wave equations. Postulates of quantum mechanics, Significance of wave function, Application of Schrodinger wave equation for a particle in one dimensional infinite potential well.

Fiber Optics: Fundamentals of optical fiber, Acceptance angle and cone, Numerical aperture, Single and Multi-Mode Fibers, Step index and graded index fiber, Propagation Mechanism in optical fibers.

UNIT-III: Electrodynamics: 9

Scalar and Vector fields, Gradient, Divergence and curl, Concept of displacement current, Maxwell's equation in differential and integral forms, Physical significance of each equation.

Maxwell's equation in free space, Velocity of electromagnetic wave, Transverse nature of the electromagnetic wave, Poynting vector, Maxwell's equations in dielectric and conducting medium, and skin depth.

UNIT-IV: Physics of Advanced Materials: 9

Concept of energy bands in solids, Semiconducting materials**,** Concept of direct and indirect band gap in semiconductors, Carrier concentration and conductivity in semiconductors, Optoelectronic Materials, Superconducting Materials**,** Temperature dependence of resistivity in superconducting materials, Effect of magnetic field (Meissner effect), Type I and Type II superconductors, London Equations, BCS theory (Qualitative), Introduction of nanoscience, Nanotechnology and its applications.

EXPERIMENTS

1. To determine the specific resistance of a given wire using Carrey Foster's Bridge.
2. To determine the wavelength of sodium light using Newton's Ring experiment.
3. To determine the wavelength of spectral lines of white light using plane diffraction grating.
4. To determine the specific rotation of cane sugar solution using polarimeter.
5. To study the variation of magnetic field along the axis of current carrying circular coil.
6. To study the Hall's effect and to determine Hall coefficient in n type Germanium.
7. To study the energy band gap of Germanium using four probe method.
8. To determine the height of Tower by Sextant.

Books & References

1. Optics- Ajoy Ghatak, Tata McGraw-Hill
2. Optics- N. Subrahmanyam, Brij Lal, M.N. Avadhanulu, S. Chand
3. Quantum Mechanics: Theory and Applications- Ajoy Ghatak, Tata McGraw-Hill
4. Fiber optics and laser Principles and Applications-Anuradha De, New Age International

5. Optical Fibers and its application as sensors by R. K. Shukla, New Age International.
6. Introduction to Electrodynamics by David J. Griffiths, Pearson
7. Physics of Semiconductor Devices, by S. M. Sze, Wiley
8. Concepts of Modern Physics by Arthur Beiser, Tata MCGraw Hill.
9. Introduction to Solid State Physics by C. Kittel, Wiley.
10. Engineering Physics by B. K. Pandey and S. Chaturvedi, 3e Cengage Learning Pvt. Limited, India.
11. Engineering Physics by H. K. Malik and A. Singh Tata MCGraw Hill.
12. Advanced Practical Physics Vol. I and Vol. II by D. K. Dwivedi, Victorius Publishers, New Delhi.

BIT-103 PROGRAMMING IN C

Course category : Engineering Fundamentals (EF)
Pre-requisite Subject : NIL
Contact hours/week : Lecture: 3, Tutorial: 0, Practical:2
Number of Credits : 4
Course Assessment Methods :Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voce, Minor test and Major Theory Examination

Course Objective: Students will gain an understanding of the fundamentals of computers and programming. The objective is to prepare them for various dimensions of C Programming language.

Course Outcomes: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Describing the basics of terminologies used in computer programming.
2. Practicing C language programming by writing, compiling and debugging the code.
3. Designing programs involving simple statements, conditional statements, iterative statements, array, strings, functions, recursion and structure.
4. Discussing the dynamic memory allocations and use of the pointers.
5. Applying basic operations on files through programs.
6. Studying and implementing the codes using macros, pre-processor directives and command line arguments

UNIT-I **09**

Basics of Computers and Programming: Functional diagram of computer; Language Processors; Approaches to problem solving, Concept of algorithm and flow charts. **Simple Statements:** Data types; Tokens and its types; Variable declaration and initialization; User defined type declaration: type def, enum; Comments; Format specifiers; Standard I/O: taking input and displaying output; **Operators:** types, precedence and associativity; Expressions; Type conversion, Cshort-hands.

UNIT-II **09**

Conditional Statements: Simple if, if-else, nested if-else, else-if ladder, switch statements, nested switch, advantages of switch over nested if, restrictions on switch values. **Iterative Statements:** Concepts of entry and exit controlled loops; Uses of for, while and do while loops; Nested Loops; Printing various patterns using nested loops; Using break, continue and goto statements.

UNIT-III **09**

Arrays: Single-dimensional, multi-dimensional array and their applications; declaration and manipulation of arrays; strings and string handling functions. **Pointers:** Pointer and address arithmetic; dereferencing; pointers and arrays; dynamic memory allocation and de-allocation. **Functions:** Function prototype; Arguments and its types: actual, formal and default arguments; Scope of a variable; Argument passing methods; Passing pointer as the function argument; Recursion: types, advantages and disadvantages; Storage class specifies; Character test functions.

UNIT-IV **09**

Structure: Declaring and defining structures; Array within structure; Array of structure; Defining and using some data structures: Stack, Queue, and Linked lists. **File Handling:** Types of files; Text files and different operations on text

files, opening a file, closing a file; Data structure of a file; EOF; I/O operations on files; Random access to the files. **Standard C Pre-processors & C Library:** Pre-processor, Directives, Macro, Macro substitution; Conditional Compilation; Command Line Arguments; Standard C Library.

EXPERIMENTS

Implementing programs in following categories using programming language 'C':

1. Programs of simple statements, conditional statements, and iterative statements with the applications.
2. Programs of single and multi-dimensional arrays and their applications.
3. Programs of strings and the applications
4. Programs of pointer and the applications
5. Programs of function and the applications
6. Programs of structure and the applications
7. Codes of file handling and management
8. Codes with Pre-processor, Macro, Conditional Compilation and Command Line Arguments

Textbooks

1. Brian W. Kernighan and Dennis M. Ritchie, "The C programming language", Pearson
2. E. Balagurusamy, "Programming in ANSI C", McGraw Hill Education
3. Yashavant Kanetkar, "Let Us C", bpb publication
4. Jeri R. Hanly, Elliot B. Koffman, "Problem Solving and Program Design in C", Pearson
5. Herbert Schildt,"C: The Complete Reference", McGraw Hill Education

BCE 121 ENGINEERING GRAPHICS

Course category	:	Professional Skill (PS)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture : 2, Tutorial : 0 , Practical: 4
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through attendance, home assignments, quizzes, practical work, record, viva voce, Two minor tests, One Major Theory Exam and major Practical Examination
Course Objectives	:	This course aims at the following educational objectives: Comprehend general projection theory, with emphasis on orthographic projection to represent three-dimensional objects in two-dimensional views (principal, auxiliary, sections). Dimension and annotate two-dimensional engineering drawings.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course 1.How Engineering Drawing helps to sketch the imagination? 2.Able to effectively practice the different scales for drawings. 3.Effectively analyze the geometrical shapes and to be able to draw. 4.Know about out solids and discuss about their classification. 5.How to implement the different views for a solid placed in 3dspace. 6.Construction of the object from different perspective.

Topics Covered

UNIT-I **6**

Conic Sections and Orthographic Projections Introduction

Introduction to Engineering Drawing covering, Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only);Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales.

Orthographic Projections

Orthographic Projections covering Principles of Orthographic Projections- Conventions Projections of Pointsand lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Plane

UNIT-II **6**

Projection of Regular Solids

Projections of Regular Solids covering those inclined to both the Planes- Auxiliary Views

UNIT-III **6**

Sections and Sectional Views of Right Angular Solids

Sections and Sectional Views of Right Angular Solids covering, Prism, Cylinder, Pyramid, Cone – AuxiliaryViews; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone

UNIT-IV **6**

Isometric Projections

Isometric Projections covering, Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions. Overview of computer graphics, demonstrating knowledge of the theory of CAD software.

Textbooks

1. Engineering Drawing-Bhat, N.D.& M. Panchal, Charotar Publishing House, 2008

Reference Books

1. Engineering Drawing and Computer Graphics- Shah, M.B. & B.C. Rana, Pearson Education, 2008
2. A Text Book of Engineering Drawing-Dhawan, R.K., S. Chand Publications,2007
3. Text book on Engineering Drawing-Narayana, K.L. & P Kannaiah, Scitech Publishers, 2008

Semester-II

BSM-160	**Engineering Mathematics II**	
Course category	:	Basic Sciences & Maths (BSM)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture : 3, Tutorial : 1 , Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes and Two Minor tests and One Major Theory Examination

Course Objectives	:	The course is aimed to develop the basic mathematical skills of engineering students that are imperative for effective understanding of engineering subjects.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. To solve the ordinary differential equations.
2. To solve the partial differential equations using Lagrange and charpit's method.
3. To solve and understand the properties of Bessel`s and Legendre`s differential equation.
4. Application of partial differential equation in real life problems
5. To solve ODE and PDE with the help of Laplace transform
6. To inculcate the habit of mathematical thinking and lifelong learning.

Topics Covered

UNIT-I 9

Ordinary Differential Equations I: Linear differential equations with constant coefficients ($n^{th} order$), complementary function and particular integral. Simultaneous linear differential equations, solution of second order differential equations by changing dependent and independent variables, Method of variation of parameters, Applications of differential equations to engineering problems

UNIT-II 9

Ordinary Differential Equations II: Series solution of second order differential equations with variable coefficient (Frobeneous method). Bessel and Legendre equations and their series solutions, Properties of Bessel function and Legendre polynomials.

UNIT-III 9

Partial Differential equations: Partial differential equations of the first order, Lagrange's solution, Charpit's general method of solution, Partial differential equations of the second order: Constant coefficient and reducible to constant coefficient, Classification of linear partial differential equations of second order.

UNIT-IV 9

Laplace Transform: Laplace Transform, Laplace transform of derivatives and integrals. Unit step function, Laplace transform of Periodic function. Inverse Laplace transform, Convolution theorem, Applications to solve simple linear and simultaneous differential equations and Partial Differential Equations.

Books & References

1. B.S. Grewal: Higher Engineering Mathematics; Khanna Publishers
2. Erwin kreyszig: Advanced Engineering Mathematics, John Wiley & Sons.
3. R. K. Jain and Iyenger: Advanced Engineering Mathematics, Narosa Publications.
4. B.V. Ramana: Higher Engineering Mathematics, Tata Mc. Graw Hill Education Pvt. Ltd.
5. M.D. Raisinghania, Ordinary and Partial Differential Equations. S Chand Publications.

BSM-140/BSM-190	**Environmental Science and Green Chemistry**
Course category:	Basic Sciences & Maths (BSM)
Pre-requisite Subject:	NIL
Contact hours/week	Lecture : 3, Tutorial : 0 , Practical: 2
Number of Credits:	4
Course Assessment methods:	Continuous assessment through home assignments, quizzes, minor tests, practical work, viva-voce, practical exam and major theory Examination

Course Objectives Understanding the principles and concepts of Chemistry viz. Chemical Bonding, acidity and basicity, Atmospheric Chemistry & Water Chemistry, Spectroscopic analytical methods and Green Chemistry and solving industrial problems using solid foundation in Chemistry.

Course Outcomes: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. To develop the concepts of basic chemistry.
2. To make the students aware of global environmental issues e.g. global warming & Green house effect, Ozone depletion, pollution and its prevention and understand various aspects of atmospheric chemistry.
3. To understand the analytical and conceptual skills required for environmental chemistry research.
4. To understand water treatment for all types of uses and need to protect environment.
5. To understand the specifications of pure water and its purification techniques.
6. To develop the knowledge about Green Chemistry and Green Technology.

Unit 1: **9**

Basic Chemical Concepts

Periodic properties of elements, Ionization potential, electron affinity and electronegativity; mole concept, molarity and normality, Chemical Bonding – MO Theory, MO diagram of diatomic molecules, hydrogen bonding, electrophiles, nucleophiles, inductive effect and mesomeric effect. Reaction Mechanism. Acidity and basicity - Concept of pH.

Unit 2: **9**

Atmospheric chemistry & Water Chemistry

The atmosphere of Earth, layers of atmosphere and temperature inversion, Air pollution, Global warming and Greenhouse effect. Acid rain and Ozone layer depletion. Chemical and photochemical Smog.

Sources of water, conservation of water, impurities in water and their effects. WHO guideline and BIS guideline for drinking water. Hardness of water, Softening of water by Zeolite process, Lime Soda process, Ion exchange process and Reverse osmosis.

Unit 3: **9**

Spectroscopic analytical methods

Absorbance, Transmittance and Beer-lamberts Law. Basic principles of UV-Visible spectroscopy, Fluorescence spectroscopy, Infrared spectroscopy, NMR Spectroscopy. Use of these instrumental techniques for monitoring of environmental pollution.

Environmental problems posed by the use of non-biodegradable polymers widely used in day-to-day life. Incineration as the key method for disposal of polymeric waste. Bio-degradable polymers.

Unit 4: **9**

Green Chemistry

Green Chemistry and Green Technology: New trends in Green chemistry; Green Chemistry Methodologies- Microwave heating, ultrasound technique. Green Chemical Synthesis Pathways; Green reagents, Green solvents.

Experiments:

1. Determination of temporary and permanent hardness in water sample using EDTA as standard solution.
2. Determination of alkalinity in the given water sample.
3. Determination of chloride content in the given water sample by Mohr’s method.

4. Determination of percentage of available chlorine in bleaching powder sample.
5. Determination of iron content in the given sample using $K_3[Fe(CN)_6]$ as an external indicator.
6. Determination of Electrical conductivity/TDS of a given water sample using conductivity meter.
7. Determination of dissolved Carbon Dioxide of given water sample.
8. Determination of the biochemical oxygen demand of sewage influent.
9. To calculate the lambda max of the given compound by using UV-Visible spectrophotometer.
10. Determination of nickel / cobalt / copper solutions by UV–visible spectrometry.
11. Examples of Green Synthesis /Reactions.
12. Determination of Turbidity of Water
13. Iodoform test
14. Synthesis of a polymer Bakelite or Polyacrylic acid.

Books & References

1. A Text Book of Environment and Ecology, Shashi Chawla, Tata McGraw Hill
2. Environmental Studies, Raj Kumar Singh, Tata McGraw Hill
3. Engineering Chemistry, Wiley India
4. Engineering Chemistry, Tata McGraw Hill
5. Organic Chemistry, Morrison & Boyd, 6th edition, Pearson Education
6. Fundamentals of Environmental Chemistry, Manahan, Stanley E., Boca Raton: CRC Press LLC.
7. Environment and Ecology, R K Khandal, Wiley India
8. An Introductory Text on Green Chemistry: For Undergraduate Students, lndu Tucker Sidhwani, Rakesh K. Sharma, Wiley
9. A text book of Green Chemistry, Shankar Prasad Deo and Nayim Sepay, Techno World Publication.
10. Introduction to Green Chemistry, John Andraos, Albert S. Matlack, CRC Press

BEE-107/ 157 Basic Electrical Engineering

Course category	:	Engineering Fundamentals (EF)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 3, Tutorial: 0, Practical: 2
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through attendance, home assignments, quizzes, practical work, record, viva voce, Minor tests and One Major Theory & Practical Examination.
Course Objectives	:	**1.** To demonstrate and understand the basic knowledge of electrical quantities such as current, voltage, power, energy, and frequency to understand the impact of technology in a global and societal context. **2.** To demonstrate and understand the basic concepts of analysis of simple DC and AC circuits used in electrical engineering and apply the basic concepts in Electrical engineering for multi-disciplinary tasks.

Course Outcomes: The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course:

1. Understand the basic properties of electrical elements, and solve problem based on basic electrical circuits & DC network theorems.
2. Understand the fundamental behaviour of AC circuits and solve AC circuit problems.

3. Apply the knowledge gained to explain the behaviour of the circuit at series & parallel resonance of circuit & the effect of resonance.
4. Classify different electrical measuring equipment's and understanding their principles.
5. Understand the basic concepts of magnetic circuits.
6. Explain construction and working principle of transformer.

UNIT I

D C Circuit Analysis and Network Theorems:

Circuit Concepts: Concepts of network, Active and passive elements, Voltage and current sources, Concept of linearity and linear network, Unilateral and bilateral elements, R, L and C as linear elements, Source transformation, Kirchhoff's laws, Loop and nodal methods of analysis, Star-delta transformation, Network theorems: Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum Power Transfer theorem. **9**

UNIT II **9**

Steady- State Analysis of Single-Phase AC Circuits:

AC fundamentals: Sinusoidal, square, and triangular waveforms – Average and effective values, Form and peak factors, Concept of phasor, phasor representation of sinusoidally varying voltage and current, Analysis of series, parallel and series-parallel RLC Circuits, Resonance in series and Parallel circuit

Three Phase AC Circuits: Three phase system-its necessity and advantages, Star and delta connections, Balanced supply and balanced load, Line and phase voltage/current relations, three-phase power, and its measurement

UNIT III

Measuring Instruments & Magnetic Circuit: **9**

Types of instruments, Construction and working principles of PMMC and Moving Iron type voltmeters & ammeters, Use of shunts and multipliers.

Magnetic circuit, concepts, analogy between electric & magnetic circuits, B-H curve, Hysteresis, and eddy current losses.

UNIT IV **9**

Single-Phase Transformers:

Single Phase Transformer: Principle of operation, Construction, EMF equation, Power losses, Efficiency, O.C & S.C Test and Introduction to auto transformer.

EXPERIMENTS

1. Verification of Kirchhoff's Law.
2. Verification of Norton's Theorem.
3. Verification of Thevenin's Theorem.
4. Verification of Superposition Theorem.
5. Verification of Maximum Power Transfer Theorem.
6. Verification of Series R-L-C circuit.
7. Verification of Parallel R-L-C circuit.
8. Measurement of Power and Power factor of three phase inductive load by two wattmeter method.
9. To perform O.C. and S.C. test of a single-phase transformer.

Textbooks:

1. Fundamentals of Electric Circuits, C.K. Alexander and M.N.O. Sadiku; TATA McGraw-Hill.
2. Principles of Electrical Engineering, V. Del Toro; Prentice Hall International.

3. Electrical and Electronics Technology, Edward Hughes; Pearson.
4. Basic Electrical Engineering, D P Kothari, I.J. Nagarath; Tata McGraw Hill
5. Electrical Technology, B. L. Thareja and A. K. Thareja; S. Chand.

BHS- 102/152 TECHNICAL WRITING AND PROFESSIONAL COMMUNICATION (TW&PC)

Course Category	: HSS
Prerequisite subject	: None
Number of Credits	: 4
Contact Hours/Week	: Lectures: 2, Tutorial: 1, Practical: 2
Course Assessment Methods	: Continuous assessment through One test, teacher's assessment (quiz, tutorial, assignment, attendance), and One Major Theory Examination.
Course Objectives	: The objectives of this course are to: - The course aims- 1. To sensitize the students to understand the role and importance of communication for personal and professional success. 2. To enable the learners to enhance their writing skills in techno-cultural and professional echo-system. 3. To equip learners to differentiate technical writing from general writing. 4. To equip them with technical writing skills. 5. To enable learners to exhibit knowledge, skills, attitude and judgment in and around human communication that facilitate their ability to work collaboratively with others in an interpersonal environment.
Course Outcomes	: The students will be able to demonstrate the following knowledge, skills, and attitudes upon completion of the course: - 1. Overcome the problems she/he shall faces in oral and written communication. 2. Acquire knowledge of and methods for using technical communication, such as reports, proposals, technical letters, etc. 3. Use and Practice compositions correctly. 4. Give presentations in different sessions and make self-appraisal. 5. Learn and understand the various facets of Communication Skills, such as (LSRW) Listening, Speaking, Reading, and writing, and identify, formulate, and solve real-life problems with a positive attitude; also inculcate, the habit of learning and developing communication and soft skills.

Unit 1: Language and Communication **6**

Language Vs communication: Communication as coding and decoding – signs, symbols & pictograph – verbal and non–verbal symbols – Language & communication; Types ofCommunication- functional, situational, verbal, and non-verbal, interpersonal, group, interactive, public, Mass Communication. Thinking and Articulation, critical, creative aspects of articulation.

Skills of Language Acquisition: Natural Language Acquisition Skills: Listening, Speaking, Reading & Writing {LSRW}; Language Acquisition Through Training: Listening, Speaking, Reading, Writing,Grammar & Vocabulary {LSRWGV}

Phrase, Clause & Sentence in Professional Drafting-Simplicity, Clarity and Conciseness of a Presentation, Differentiating between Professional and Creative Writing, Blending of Artistic/Professional Writing, Avoiding gender, racial, and other forms of bias in Professional Writing.Pre-writing, Drafting, and Re-writing.

Unit 2: Towards Technical Writing **6**

Technical Paper Writing: Professional Paper Elements-Front Matter of a Paper, Main Text of a Paper, End Matter of a Paper: Organizing References and Bibliography, Order of a thesis and Paper Elements, Concluding Remarks. **Methods of Research Paper Writing:** Identification of Author and His Writing-Author's name and Affiliation, Joint Authorship of a Paper, Identification of Writing- Title, Keywords, Synopsis, Preface and Abstract. Drafting Research Article & Methodology.

Thesis/Dissertation Writing: Thesis Elements-Front Matter of a Thesis, Main Text of a Thesis, End Matter of a Thesis, Specimen—Thesis and Research Paper, Chapters and Sections-Introductory
Chapters and Sections, Statement of the Problems, Plan and Scope, Core Chapters and Sections- Theoretical Analysis and Synthesis, Basic Assumption and Hypothesis.

Professional Presentation & Seminar Delivery Tools: Designing the Presentation; Establishing the Objectives. Making Professional PowerPoint Presentations, Signaling Structure of Presentation through Sentences and Crisp Phrases, Preparing Notes for Professional/Technical Presentation, Text Animation, White Board, Flip Charts, Diagrams, Preparing Cards. Seminar Presentations: Purpose modes and methods. Nascent Emerging Platforms for On-line Presentations viz. Zoom, Webex, Team& Meet etc.

Unit 3: Drafting Skills & Career Correspondence **6**

Professional Drafting: Letters vs. e-mails, Formal and Informal emails, Parts of e-mails, Types of e-mails, Managing tone of E-mails and business Letters, Examples of Letters and E-mail, Professional Correspondence through E-mail, Job Applications and cover Letters. Introduction to DOs (Demi- Official Letters)

Career & Correspondence: Developing a Professional C.V, Bio Data & Resume. Report Writing, Kinds of Reports, Length of Report, Parts of a Report, Terms of Reference, Collection of Facts, Outlines of Report, Examples of Report, Technical Proposal, Elements of Proposal, Examples of Proposal, drafting of proposal.

Unit 4: Professional Practices with ICT Interface **6**

Conducting Professional Meeting: Pre-meeting Preparation, During Meeting: Action Taken Report (ATR) & New Agenda Points, Post Meeting Follow ups. Notice, Circular, Agenda & Meeting Minutes.

Introduction to Generation–Z, Cyber Identity & Professional Netiquettes for Netizens: DraftingE-mails, Blogs on social media, Videoconferencing. Managing Profiles on social media. What to Write and Share on social media. Telephone Etiquettes & Phubbing.

List of Practical:

1. Introduction to Vowel and Consonant Sounds
2. Monophthongs and Diphthongs
3. Syllable, Word Stress & Intonation
4. Harnessing Non-verbal Communication Skills in Cross-Cultural Environment for the establishment of an ideal Ecosystem to ensure Professional Success
5. Developing Speech, and Proofreading the Same
6. Argumentative Skills & Group Dynamics
7. Preparing CV, Biodata & Resume
8. Types of Interview and Interview Skills
9. GD, PI & Telephonic Interview
10. Presentation Skills, Extempore, Debate and Video Conferencing
11. Netiquettes while Writing Blogs on social media.
12. Ethical Usages of Generative AI

Text / Reference Books

1. Acharya Anita. (2012) Interview Skills- Tips & Techniques. Yking Books, Jaipur.
2. Basu, B. N., (2008) Technical Writing. PHI Learning Pvt. Ltd.., New Delhi.

3. Chauhan, N. K & Singh, S. N. (2013) Formal Letters, Pankaj Publication International, New Delhi.
4. Chhabra T.N. (2018) Business Communication. Sun India Publication New Delhi.
5. Dubey Arjun et.al. (2016) Communication for Professionals. Alfa Publications, Delhi.
6. Gibaldi, Joseph (2021). The MLA Handbook for Writers of Research Papers. Ed. IXth, ModernLanguage Association of America, NY, US.
7. Gurumani, N. (2010) Scientific Thesis Writing and Paper Presentation, MJP Publishers, Chennai.
8. Hamilton Richard. (2009) Managing Writers. Penguin, India.
9. Mc Graw S. J. (2008) Basic Managerial Skills for All. Ed. 08th, Prentice Hall of India, New Delhi.
10. Murphy & Hildebrandt. (2008) Effective Business Communication. Tata McGraw Hill NewDelhi.
11. Pandey, S.P., Singh, S. N. & Kumar, Raman, (2023) Exploring Digital Humanities: Challenges & Opportunities, MacBrain Publishing House, New Delhi.

BCE 161 **BUILDING PLANNING AND DRAWING**

Course category : Professional Skill (PS)

Pre-requisite Subject : NIL

Contact hours/week : Lecture : 2, Tutorial : 0 , Practical: 4

Number of Credits : 4

Course Assessmentmethods : Continuous assessment through attendance, home assignments, quizzes, practical work, record, viva voce two Minor tests, one Major theory exam and Practical Examination.

Course Objectives : This course aims at the following educational objectives:

1. To understand the fundamental principles and concepts of planning and architecture for buildings.
2. To study about different views of layout.
3. To learn the development controls covered by building bye laws and national building code for buildings.

Course Outcomes : The students are expected to be able to demonstrate the followingknowledge, skills, and attitudes after completing this course

1. Apply the concepts of building planning considering climatic parameters, building bye laws, classification of buildings and design buildings.
2. Draw site plan, plans, elevations and sectional views of residential, commercial and public buildings, showing maximum details of various building components using the available construction area effectively according to codal provisions and standard units Effectively analyse the geometrical shapes and to be able to draw.
3. Prepare building services drawings How to implement the different views for a solid placed in 3dspace.
4. Apply his knowledge to evaluate existing projects, suggest economical modifications for sustainable development and strengthen his professional skills through self-employability and lifelong learning.
5. Able to prepare a water supply line diagram.
6. Able to prepare a firefighting layout for buildings.

UNIT-I 6

Introduction

Building Planning- Factors Shape size and topography of site, Climatic conditions of the site, Functional requirements of the building, Local Bye laws requirements of size of different components, setbacks, neighborhood, Owner :– Status-Choices-Preferences, Economy. Building Planning- Principles Aspects, Prospects, roominess, furniture requirements, groupings, circulation, privacy, elegance, lighting & ventilation, sanitation, flexibility, economy, practical considerations.

UNIT-II 6

Building Bye Laws

Building Bye Laws Means of access, internal and external open spaces, floor area ratio, height of building, safety precautions. Building Sanction procedures, key plan (layout plan), site plan, building plan, working plan, validity of sanction, completion certificate.

UNIT-III 6

Site Plan &Planning of Buildings

Drawing of site plan showing setbacks, Floor Area Ratio, Height of Building, and Minimum Distance from Power line, as per National Building Code (NBC).

Given the floor area or carpet areas of rooms, plan the building and draw a Single line diagram of building. a) Residential building b) School Buildings c) Hostel Buildings d) Primary Health Centre Draw the Plan, Elevation and Sectional views for the following types of buildings. a) Residential buildings. b) School Buildings c) Hostel Buildings d) Primary Health Centre e) Canteen Building f) Two storied residential building g)Small workshop Building.

UNIT-IV 6

Building Basic Services

Preparation of water supply Layout for residential building.
Preparation of Electrical Layout for residential building.
Preparation of Sanitary Layout for residential building.
Preparation of Shallow Well Rain Water Harvesting Method for Building.

Preparation of Fire Fighting layout for buildings.

Reference Books:

1. Civil Engg: Drawing Balagopal and RS Prabhu – Spades.
2. Time Savers standards for Building types – Joseph Deciara and john Callender Tata Mc Graw hill

BCE 162		**Design Thinking in Civil Engineering**
Course category	**:**	VAC/AC
Pre-requisite Subject	**:**	NIL
Contact hours/week	**:**	Lecture : 0, Tutorial : 0 , Practical: 2
Number of Credits	**:**	0
Course Assessment methods	**:**	Continuous assessment through attendance, home assignments, quizzes, practical work, record, viva voce and One Major Practical Examination
Course Objectives	**:**	The objective of this Course is to provide the new ways of creative thinking and Learn the innovation cycle of Design Thinking process for developing innovative products which are useful for a student in preparing for an engineering career.
Course Outcomes	**:**	The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course.

1. Compare and classify the various learning styles and memory techniques and Apply them in their engineering education.
2. Analyze emotional experience and Inspect emotional expressions to better understand users while designing innovative products
3. Develop new ways of creative thinking and Learn the innovation cycle of Design Thinking process for developing innovative products
4. Identification of real-time civil engineering problems and their innovative solutions.
5. Perceive individual differences and its impact on everyday civil engineering project decisions and further create a better project execution.

Topics Covered

UNIT-I

An Insight to Learning: Understanding the Learning Process, Kolb's Learning Styles, Assessing and Interpreting
Remembering Memory: Understanding the Memory process, Problems in retention, Memory enhancement techniques
Emotions: Experience & Expression: Understanding Emotions: Experience & Expression, Assessing Empathy, Application with Peers

UNIT-II

Basics of Design Thinking: Definition of Design Thinking, Need for Design Thinking, Objective of Design Thinking, Concepts & Brainstorming, Stages of Design Thinking Process (explain with examples) - Empathize, Define, Ideate, Prototype, Test
Being Ingenious & Fixing Problem: Understanding Creative thinking process, Understanding Problem Solving, Testing Creative Problem Solving

UNIT-III

Infrastructure Design Concepts: Introduction to infrastructure design approaches for different projects, Various IRC and IS codes guidelines for design of various infrastructure components. General Principles of Design, Drawing, Importance of Safety, Case study of best infrastructures projects in current scenario, Introduction to ethical construction practices, application of project management tools, Standards and Quality practices in production, construction, maintenance, and services.

UNIT-IV

Prototyping & Testing: Concept of Prototype, Prototyping – Virtual and Physical. Rapid Prototype Development process, Testing Methodology, Testing and Sampling process in civil engineering.
Energy and Environment: Conservation, environmental pollution, and degradation, Climate change, Environmental impact assessment.
Information and Communication Technologies (ICT) based tools and their applications in Engineering include networking, e-governance, and technology-based education, Ethics and values in the Engineering profession**.**

Textbooks

1. E Balaguruswamy (2022), Developing Thinking Skills (The way to Success), Khanna Book Publishing Company.

2. Change by Design, Tim Brown, Harper Bollins (2009)

3. Design Thinking in the Classroom by David Lee, Ulysses Press

Reference Books

1. Design the Future, Shrrutin N Shetty, Norton Press
2. Universal principles of design- William lidwell, kritina holden, Jill butter.
3. The era of open innovation – Chesbrough.H

Skill-Based Courses to Qualify for UG Certificate (Engg.) in Civil Engineering

BCE-163	**Plumbing and Sanitation**
Course category	: Skill-based courses
Pre-requisite Subject	: NIL
Contact hours/week	: Lecture: 2, Tutorial:0, Practical: 2
Number of credits	3
Course Assessment methods	: Continuous assessment through tutorials, attendance, home assignments, quizzes, record, two Minor tests and One Major Theory Examination.
Course Objectives	: The objective of this course is to provide a student with basic knowledge in home–hold plumbing so that he/she should be able to design and analyse plumbing system for an individual residential/commercial/industrial building.
Course Outcomes	: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Coordinate plumbing works from inception to completion with Owners, Architects, other consultants and contractors.
2. Select proper plumbing materials and systems.
3. Read and interpret plumbing drawings.
4. Supervise code based plumbing installations.
5. Understand methods to conserve water and energy.
6. Protect health and safety of end users.

Topics Covered

UNIT-I 6

Plumbing Terminology.

Plumbing Fixtures: accessible, readily accessible, aerated fittings, AHJ, bathroom group, carrier, flood level rim, floor sink, flushometer valve, flush tanks, lavatories, macerating toilet, plumbing appliances, plumber.

Traps: indirect waste, vent, blow off, developed length, dirty arm, FOG, indirect waste, receptors, slip joints, trap, and vent.

Drainage: adapter fitting, adjusted roof area, AAV, air break, air gap, area drain, base, bell and spigot joint, building drain, branch, DFU, grease interceptor, joints, roof drain, smoke test, stack.

Water supply: angle valve, anti-scald valve, backflow, bypass, check valve, cross connection, ferrule, gate valve, gray water, joints, PRV.

UNIT-II 6

Definitions of plumbing fixtures, fittings, appliances and appurtenances; maximum flow rates, water closets, bidets, urinals, flushing devices, washbasins, bath/shower, toilets for differently abled, kitchen sinks, water coolers, drinking fountain, clothes washer, dish washer, mop sink, overflows, strainers, prohibited fixtures, floor drains, floor slopes, location of valves, hot water temperature controls, installation standard dimensions in plan and elevation.

UNIT-III 6

Discharge for indirect waste piping, nature of contents or systems, proper methods to install indirect waste piping, air gap and air break, sink traps, dish washers, drinking fountains, waste receptors, sterile equipment, appliances, condensers, point of discharge, venting.

Vent requirement, purpose of venting, trap seal protection, materials, vent connections, flood rim level, termination, vent stacks, water curtain and hydraulic jump, cleanouts, venting of interceptors, introduction to vent sizing.

UNIT-IV 6

Rain Water Harvesting (RWH) definition, need, catchment, conduits, settlement tanks, treatment, possible uses, recharging pits, NBC requirements, MOEF&CC requirements, and advantages of RWH.

Hot water systems, individual and centralized systems, geysers, heaters, heat pumps, energy sources, solar hot water systems, types, boilers, hot water generators, hot water consumption pattern, introduction to sizing of systems.

Definition of gray water, approvals, specifications and drawings, safety, total gray water discharge, holding tanks, valves and piping. Reclaimed water systems, definition of reclaimed water, pipe identification, installation, safety signs, valves, cross connection, approved uses.

Textbooks

1. Uniform Illustrated Plumbing Code-India (UIPC-I) published by IPA and IAPMO (India)
2 National Building Code (NBC) of India
3 IS 17650 Part 1 and Part 2 for Water Efficient Plumbing Products
4 Water Efficient Products-India (WEP-I) published by IPA and IAPMO (India)

Reference books

1. Water Efficiency and Sanitation Standard (WE.Stand) published by IPA and IAPMO (India)
2. Water Pollution, Berry, CBS Publishers.
3. 'A Guide to Good Plumbing Practices', a book published by IPA
4. Elements of Water Pollution Control Engineering, O.P. Gupta, Khanna Book Publishing, New Delhi.
5. Ram Babn Sao, perfect knowledge of plumbing Handbook.
6. Plumbing Book , by Chand Kumawat.

BCE-164	**Computer Aided Drafting.**
Course category	: Skill-based courses
Pre-requisite Subject	: NIL
Contact hours/week	: Lecture: 2, Tutorial:0, Practical: 2
Number of credits	3
Course Assessment methods	: Continuous assessment through tutorials, attendance, home assignments, quizzes, record, two Minor tests and One Major Theory Examination.
Course Objectives	: 1. The objective of this lab is to teach the student usage of Auto cad, basic drawing fundamentals in various civil engineering applications, especially in building drawing. 2. The objective of this course is to teach students the basic commands and tools necessary for professional 2D drawing, 3D drawing and drafting using AutoCAD 3. Students able to learn to sketch and take field dimensions.

4. Students able to learn to take data and transform it into graphic drawings. Students able to learn basic engineering drawing formats

Course Outcomes : The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Understand CAD software and basic functions
2. Evaluate plans of Single storied building & multistoried buildings
3. Develop different sections at different elevations
4. Detailing of building components like doors, windows roof trusses
5. Develop section and elevation for single and multistoried buildings using CAD software.
6 Exposure to creating working drawings

Topics Covered

UNIT-I 6

Overview of Computer Graphics covering, listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids];

UNIT-II 6

Customisation & CAD Drawing consisting of set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;

UNIT-III 6

Annotations, layering & other functions covering applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer-aided design (CAD) software modelling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, Multiview, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling;

UNIT-IV 6

Demonstration of a simple team design project that illustrates Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerancing; Use of solid-modelling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying colour coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modelling (BIM).

Textbooks

1.Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House

2. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education

Reference books

1. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication

2. Narayana, K.L. & P Kannaiah (2008), Textbook on Engineering Drawing, Scitech Publishers
3. (Corresponding set of) CAD Software Theory and User Manuals

BCE-165	**Carpentry And Fabrication**
Course Category	Skilled Based Course
Contact hours/week	Lecture – 2; Tutorial – 0; Practical – 2
Number of credits	3
Course assessment methods	Continuous assessment through attendance, home assignments, quizzes, two minor practical exam and One Major Practical Examination

Course Objectives

To familiarize a student with basic skills in carpentry and fabrication so that he/she can work with wood and metals.

Course Outcomes

At the end of the course student will be able to:

1. Identify and select the right type of wood for various applications.
2. Acquire required knowledge and practical skills in wood cutting, joining and other allied operations.
3. Acquire required knowledge and practical skills in engineering measurements.
4. Acquire experience in preventive and corrective maintenance of various cutting tools, machine tools and equipment.
5. Acquire required knowledge and practical skills in fabrication techniques
6. Finish various jobs within specified time and resource limits, with proper measurements and evaluate them by appropriate methods and tools.

Topics Covered

Unit – I 6

Introduction to Carpentry: Need for the work, training, relationship between timber, tools and carpentry. Carpentry tools: classification of tools; measuring & making; holding; cutting; grooving; planning; striking; boring and miscellaneous tools; care and maintenance of tools; wood working machines; wood working lathe; wood sawing machine.

Unit – II 6

Types of work and working procedure: Marking, sawing, planning, chiselling, boring, striking, checking, sharpening; joints in carpentry work; nails, screws and other materials; finishing work.

Unit – III 6

General Fabrication Concepts: Introduction to fabrication; material properties: metals, semi-conductors and polymers; design and planning: principles of design, blueprint reading, and creating fabrication plans; safety and standards.

Unit – IV 6

Fabrication Processes: Cutting: various cutting methods like, laser, plasma, water jet, and mechanical shears; forming: techniques for shaping metal, bending, rolling, and stamping; welding and joining: different welding methods, soldering, brazing and adhesive bonding; finishing: surface treatments like painting, plating and polishing.

List of Experiments – Carpentry

1. To prepare Half Lap Joint.
2. To make a simple Mortise and Tenon joint.
3. To make a Mortise Tenon joint 45 Deg.
4. To make a Habed or Lap DoveTail Joint.
5. To make a Common Multiple Joint.

List of Experiments – Fabrication

1. Manual Metal Arc Welding/ Shielded Metal Arc Welding
2. Gas Metal Arc Welding

3. Friction Stir Welding
4. Mold Preparation, Melting and Casting

Textbooks

1. S. N. Pophale and A. K. Goel, Carpentry and woodwork, Railway Engineering Technical Society, Pune, 2008.
2. Willis H Wagner, Howard Bud Smith, and Mark W Huth, Modern Carpentry, Goodheart-Wilcox Publications, 12th Edn., 2015.
3. R L Agarwal and Tahil Manghnani, Welding Engineering, Khanna Publishers, Fifht Edn., 1991.

Semester-III

BCE 210 Civil Engineering Materials, Evaluation and Testing

Course category	:	Engineering Fundamental (EF)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture : 3, Tutorial : 0 , Practical: 2
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor tests and One Major Theory & Practical Examination
Course Objectives	:	The objective of this Course is to deal with an experimental determination and evaluation of mechanical characteristics and advanced behavior of construction materials.
Course Outcomes	:	The students are expected to be able to demonstrate the followingknowledge, skills and attitudes after completing this course

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

Topics Covered

UNIT-I 9

Building Stones and Stone Aggregates

Introduction Classification of Rocks Geological Classification Physical and Chemical Classification Common Building Stones and Their Uses, Quarrying of St Quarrying Methods, Criteria for Selection of Stones, Characteristics to be Considered in Selection of Stones. Deterioration and Preservation of Stones, Artificial Stones, Stone Veneering

Aggregates: Requirement of stone for aggregates, Physical and Chemical characteristics of aggregates, Gradation and Gradation Zones of aggregates

Clay Bricks

Genera, Brick clay, Preparation of Bricks, Types of Clay Bricks. Chemical Changes in Burning of Bricks, Dimensions of Bricks, Bricks for Special Use Conventional and Specially Shaped Bricks, light Weight Clay Bricks, Brick Substitute, Test on Bricks

Cement and Concrete Blocks

Introduction, Manufacturing of Concrete Blocks, Dimensions and Tolerance, Classification of Concrete Blocks, Storage of Blocks, Autoclaved Aerated Concrete Blocks, Use of Block Masonry in Buildings, Testing of Blocks (IS 2185)

UNIT-II 9

Cement: Raw materials used, Process of Manufacturing, Chemical composition, compounds formed and their effect on strength, Types of cement Grades of Cement produced in India, Sampling and Testing of cement properties, Uses of cement, Storage of Cement, Adulteration of Cement

Lime:

Cementing Action of Lime, Classification of Lime, Slaking of Quicklime to Prepare Slaked Lime, Tank Slaking of Quicklime to Prepare Lime Putty Storing Lime, Precautions in Handling Lime, Tests for Lime, Field and Laboratory Tests for Building Lime
Mortars: Classification, Uses, Characteristics of good mortar, Ingredients. Cement mortar, Lime mortar, Lime cement mortar, special mortars

Pozzolanic Materials, Advantages of Addition of Pozzolanas, Storing of Pozzolanas Required Chemical and Physical Characteristics of Fly ash

UNIT-III 9

Concrete: Production, Properties of Fresh, Gradation of Concrete, Transportation and placement of concrete, Concrete Additives Admixtures Different Types of Concrete Special Structural Concretes

Cast Iron and Steel
Introduction, Manufacture, Iron-Carbon Alloys, Manufacture of Thermo-mechanically Treated (TMT) Bars, Equilibrium Diagram (Iron-Carbon Phase Diagram), Other Factors in Making Iron Products, Effect of Rate of Cooling Mechanical Working (Treatment) of Steel, Hot Working of Steel, Cold Working of Steel ,Heat Treatment of Steel, Mild Steel and Other Steels,Wrought Iron, Cast Iron, Malleable Cast Iron, Spheroidal Graphite Iron (Ductile Iron), Corrosion Resistance of Cast Iron, Rolled Steel Structural Sections and other market forms of steel

Allumum and its alloy

Manufacture, Description of the Process, Processing of Aluminium Metal, Conversion into Different Products, Improving Surface Appearance, Improving Appearance by Anodizing of Aluminium , Improving Appearance by Powder Coating of Aluminium, Comparison of Colouring Processes, Characteristics and Advantages of Aluminium as a Construction Material, Available Forms of Aluminium and Their Uses, Aluminium Alloys Important Alloys for Industrial Use, Uses of Aluminium in Building Construction

Other Metals and Their Alloys

Copper and Its Alloys, Alloys of Copper, Zinc and Its Alloys, Use of Zinc for Manufacturing of GI Sheets, Other Metals

UNIT-IV 9

Plastic and Plastic Pipes

Short History of Plastics, Polymerization of Plastics, Classification of Plastics Classification According to Mechanical Property, Properties of Plastics, Fabrication of Plastic Articles , Moulding Compounds, Fabrication Methods Used for Making Plastic ArticlesSome Plastics in Common Use, Vinyls—Polyvinyl Chloride (PVC), Acrylics—Polymethyl Methacrylate (PMMA). Perspex, Polycarbonate (PC) ,Polyethylene (PE),Nylo, Terylene (Polyester) ,Amino Plastics—Formaldehydes,Casin, Epoxy Resins,Reinforced Plastics , Glass Fibre Reinforced Polyesters (GFRP), Carbon Fibre Reinforced Plastic (CFRP), Thermocol , PVC Floor Sheets/Tiles, Laminated Plastics—Formica , Use of Plastics for Doors and Windows,Use of Plastics for Roofing, Polyethylene (Polythene) Water Tanks ,Compounding Plastics with Rubber

Rubber:

Natural Rubber, Synthetic (Polymer) Rubber, Vulcanization of Rubber, Uses of Rubber in Building Construction , Rubber in Cement Mortar and Concrete, Rubber Floors,

Materials for Flooring

Ceramic Tiles,Terrazo (Mosaic) Tiles, Materials for Terrazo Tiles, Manufacture of Terrazo Tiles , Test Requirement of Precast Cement-Concrete Terrazo Tiles, Terrazo Laid In Situ, Stone Flooring, Marble Stone Flooring, Resilient Floor Materials, Rubber Flooring (IS 809-1970), Linoleum Flooring (IS 653-1962), PVC Sheet and Tile Flooring (IS 3492-1966) ,Selection of Type of Floor

Geo-synthetic and WPC, ACP and other New Materials

Pipes Used in Building Construction

Cast Iron Pipes, Plastic Pipes, Galvanized Steel (GI) Pipes, Stoneware Pipes Asbestos Cement (AC) Pipes, Concrete Pipes

Practical's:

Bricks: Water absorption, Dimension Tolerances, Compressive strength, Efflorescence

Cement: Normal Consistency of cement, Initial & final setting time of cement, Compressive strength of cement, Fineness of cement, Soundness of cement, Tensile strength

Coarse Aggregate: water absorption of aggregate, Sieve Analysis of Aggregate, Grading of aggregates. Fine Aggregate: Sieve analysis of sand, Silt content of sand, Bulking of sand

Cement concrete: Workability tests, compressive strength, Tensile strength

Textbooks

1. Building Materials and Construction – Arora & Bindra, Dhanpat Roy Publications.
2. Building Materials and Construction by G C Sahu, Joygopal Jena McGraw hill Pvt Ltd 2015.
3. Building Construction by B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain - Laxmi Publications (P) ltd., New Delhi.

Reference books

1. Building Materials by Duggal, New Age International.
2. Building Materials by P. C. Varghese, PHI.
3. Building Construction by PC Varghese PHI.
4. Construction Technology – Vol – I & II by R. Chubby, Longman UK.
5. Alternate Building Materials and Technology, Jagadish, Venkatarama Reddy and others; New Age Publications.

BCE 211	**SOIL MECHANICS**
Course category	Program Core (PC)
Pre-requisite Subject	NIL
Contact hours/week	Lecture: 3, Tutorial : 0 , Practical: 2
Number of Credits	4
Course Assessment methods	Continuous assessment through attendance, home assignments, quizzes, practical work, record, viva voce and One Minor test and

	One Major Theory & Practical Examination
Course Objectives	The objectives of the course are as follows: 1. To develop an appreciation of soil as a vital construction material, so that it may subsequently be used in the design and construction of foundation for civil engineering structures. 2. To develop an understanding of the relationships between physical characteristics and mechanical properties of soils. 3. To inculcate the basic knowledge of classification and engineering properties of soil and its suitability as a foundation/subgrade material. 4. To understand the experimental methods for physical and mechanical soil properties
Course Outcomes	After completion of this course the students to demonstrate following knowledge, skills and attitudes. 1. Fundamental differences in engineering behavior between cohesive and cohesionless soils. 2. Compute the groundwater seepage and distribution of ground water pressure. 3. Compute the applied stress beneath the ground surface. 4. Demonstrate the fundamental difference in the strength and deformation characteristics of cohesive and cohesionless soils. 5. Analyze field and laboratory data to determine the strength and deformation properties of cohesive and cohesionless soils. 6. Compute settlements due to consolidation of soil.

Topics Covered

UNIT-I **9**

Geological Characteristics of Soils: Origin of soils and rocks; composition of soils: soil formation, types, clay minerals, and soil fabric; soil structure; coarse-grained and fine-grained soil for engineering use.

Physical Soil Parameters: Basic three phase relationships; index properties of soil; dry unit weight-water content relationship; Atterberg's limits; soil classification schemes.

UNIT-II **9**

Soil Compaction: Laboratory compaction; Standard and Modified Proctor compaction tests; zero air void curve; factors affecting soil compaction; field compaction; compaction quality control: Proctor Needle Test, Purpose and Phases of Soil Investigation.

One-dimensional flow of water through soils: concept of permeability, Darcy's law, flow parallel/normal to soil layers; determination of hydraulic conductivity; equivalent hydraulic conductivity; quicksand condition; seepage and flow nets, flow through dams and design of filters

UNIT-III **9**

Stresses, Strains, and Elastic Deformation of Soil: Stresses in soil from surface loads; Boussinesq's theory and Westergaard theory under point loading, circular area loading; Newmark's Influence chart.

Consolidation of Soils: Compressibility and consolidation characteristics Terzaghi's One-dimensional consolidation theory; settlement of compressible soil layers; calculation of primary consolidation settlement. determination of coefficient of consolidation and secondary consolidation (creep), Over Consolidation Ratio and Effective stress principles

UNIT-IV **9**

Shear Strength of Soils: Mohr circle of stress; Mohr-Coulomb failure criterion; estimation of shear strength parameters for soil; laboratory tests to determine the shear strength parameters of soils: direct shear test, triaxial tests (UU, CU, and CD), and vane shear test; Concept of pore water pressure, Skempton's pore pressure parameters.

Stability of Slopes: Infinite and finite slope; two-dimensional slope stability analysis; methods of slices: Bishop's method, Taylor's method, and Bishop-Morgenstern method; concept of factor of safety.

Geotechnical Engineering Lab Experiments

1. Classification of soil using Particle Size analysis.
2. Determination of specific gravity of soil grains.
3. Determination of liquid and plastic limits, and shrinkage limit.
4. Proctor compaction test.
5. Determination of relative density.
6. In-situ density – core cutter method and sand replacement method.
7. Permeability test – falling head and constant head methods.
8. Determination of coefficient of consolidation using oedometer test.
9. Determination of shear strength parameters using direct shear test.
10. Determination of shear strength parameters using triaxial test.

Textbooks

- Alam Singh – Modern Geotechnical Engineering, Asia Publishing House, New Delhi.
- Gopal Ranjan and A.S.R. Rao – Basic and Applied Soil Mechanics, New Age International (P) Ltd.
- B.C. Punamia – Soil Mechanics and Foundations, Laxmi Publications (P) Ltd.

Reference Books

- Brij Mohan Das – Geotechnical Engineering, CENGAGE Learning.
- I.H. Khan – Textbook of Geotechnical Engineering, Prentice-Hall of India Ltd., New Delhi.
- C. Venkataramaiah – Geotechnical Engineering, New Age International (P) Ltd., New Delhi.
- Shashi Gulati & Manoj Datta – Geotechnical Engineering, Tata McGraw Hill, New Delhi.
- J.E. Bowles – Foundation Analysis & Design, McGraw Hill, New Delhi.
- K.R. Arora – Soil Mechanics & Foundation Engineering, Standard Publishers & Distributors, Delhi.
- V.N.S. Murthy – Soil Mechanics and Foundation Engineering, CBS Publication.
- Muni Budhu- Soil Mechanics and Foundations, Wiley India Pvt. Ltd.

BCE 212		**STRUCTURAL MECHANICS**
Course category	:	Program Core (PC)
Pre-requisite Subject	:	Mechanics of structures
Contact hours/week	:	Lecture : 3, Tutorial : 0 , Practical: 2
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, assignments, quizzes and one Minor tests and One Major Theory & Practical Examination.
Course Objectives	:	The objective of this course is: 1. To learn the fundamental concepts of stress, strain, and deformation of solids with applications to bars, beams, and columns. 2. Detailed study of engineering properties of materials is also introduced. 3. Fundamentals of applying equilibrium, compatibility, theories of failure and energy methods and force deformation relationships to structural elements are also emphasized. 4. To introduce the concepts for calculating the deflection of beams with various loading conditions. And builds the fundamental concepts of unsymmetrical bending and curved beams.

Course Outcomes : The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Identify the basic concepts of structural mechanics including static equilibrium, geometry of deformation, and material constitutive behavior.
2. Executing the fundamental concepts of stress, strain, and elastic behaviour of materials to analyze structural members subjected to tension, compression, torsion.
3. Analyze the bending and shear stress on different types of sections.
4. Formulate an appropriate theoretical basis for the analysis of combined axial and bending stresses.
5. Understand the behavior of columns and struts under axial loading.
6. Demonstrate the use of critical thinking and problem-solving techniques as applied to structural systems.

Topics Covered

UNIT-I 9

Simple Stress and Strain, Poisson's ratio, Different Moduli of elasticity and their relations. Compound stresses and strains: Introduction: normal stress and strain, shear stress and strain, stresses on inclined plane, strain energy, impact loads and stresses, state of plane stress, principal stress and strain, maximum shear stress, Mohr‟s stress circle three-dimensional state of stress & strain, equilibrium equation, generalized Hook‟s law, theories of failure, composite bars, Temperature stresses

UNIT-II 9

Bending Moment, Shear Force Diagram for beams and determinate structural members.

Bending Stresses: Derivation of formula, bending stress distribution across various beam sections like rectangular, circular, triangular, I, T angle sections, composite beam

Shear Stresses: Derivation of formula, Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T angle sections, composite beam.

UNIT-III 9

Deflection of beam: Equation of elastic curve, cantilever and simply supported beam, Macaulay‟s method, Moment Area method, Unit Load Method. Strain Energy Methods and Strain Energy theorems.

Torsion- 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.

UNIT-IV 9

Combined bending and direct stress, middle third and quarter fourth rules. Columns and struts: Buckling and Stability, slenderness ratio, Euler‟s Crippling Load, Buckling Loads for columns with various end conditions. Empirical formulae for evaluation of Buckling Load.

Curved Beams: Bending of beams with initial curvature. Unsymmetrical Bending. Shear Centre

List of Experiments: Following experiments to be carried out:

1. Flexural Rigidity of Beam
2. Unsymmetrical Bending
3. Buckling Load of Struts
4. Deflection of curved members
5. Verification of Maxwell Betti's Reciprocal theorems

Textbooks

1.Hibbeler, R. C. Mechanics of Materials. 6th ed. East Rutherford, NJ: Pearson Prentice Hall, 2004
2.Timoshenko, S. and Young, D. H., "Elements of Strength of Materials", DVNC, New York, USA.
3.Jain, O.P. and Jain, B.K., "Theory & Analysis of Structures. Vol. I & II Nem Chand.
4. James M. Gere, Barry J. Goodno, "Mechanics of Materials" Cengage Learning

Reference Books

1. Coates, Coates, R.C., Coutie, M.G. & Kong, F.K., "Structural Analysis", English Language Book Society & Nelson,1980.
2. Ghali, A. & Neville, M., "Structural Analysis", Chapman & Hall Publications, 1974. 25
3. Jain, A.K. "Advanced Structural Analysis", Nem Chand & Bros, Roorkee, India, 1996.
4. Kazmi, S. M. A., "Solid Mechanics" TMH, Delhi, India.

BCE 213 BASIC SURVEYING

Course category	:	Basic Science and Mathematics (BSM)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture:3 ; Tutorial: 0 ; Practical:2
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance home assignments, quizzes, practical work, record, viva voce and one Minor tests and One Major Theory & Practical Examination
Course Objectives	:	The objective of this course is to develop an understanding of the basic principles of surveying including the traditional measurements and representations and thereby preparation of maps and plans showing the relative position of existing features by which areas, volumes and other related quantities can be determined.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course 1. To understand the importance of surveying in the field of civil engineering 2. To be able to use conventional surveying tools such as chain/tape, compass, plane table, in the field of civil engineering applications 3. To know the basics of levelling and theodolite/ Tacheometer in elevation and angular measurements 4. To understand traversing and numerical aspects of traversing 5. To take accurate measurements, and carry out field booking, plotting and adjustment of errors in a traverse 6. Students learn to work with others, respect the contributions of others, resolve difficulties, andunderstand responsibility

Topics Covered

UNIT-I 9

Introduction and Principles of surveying, Plane and Geodetic Surveying, Control Points, Classification ofsurveys, Horizontal and Vertical Control Measurement by chain and tape. Sources of errors and precautions, Corrections to tape measurements,

Compass surveying, Instruments, Surveyors and Prismatic compass, Bearing of survey lines, systems and conversions, Local attraction,

Traversing, Latitude and departure, Traverse adjustment of closing errors, Computation of coordinates.

Maps, their scales, referencing system and uses, plotting accuracy; Map coordinate system; projections and their types.

UNIT-II 9

Different methods of determining elevation; Spirit levelling: Definition of terms, Principle, Construction, Temporary adjustments of levels. Automatic levels, Digital Level, Levelling staves, Methods of spiritlevelling, Booking and reduction of fields notes, Curvature and refraction, Reciprocal leveling, Trigonometric leveling - simple and reciprocal observations, Sources of errors and precision of leveling procedures.

Contouring: Definition and characteristics of contours, contour interval, horizontal equivalent, Direct and Indirect methods of contouring, Use of contour maps, Digital Elevation Model.

UNIT-III 9

Theodolite surveying, Vernier theodolite, Temporary adjustments, Measurement of horizontal and vertical angles, Methods of repetition and reiteration, errors in theodolite surveying, elimination of errors, working of Electronic Theodolites

Tacheometric surveying, Principles, Methods – Stadia system – Fixed hair methods, Methods with staff held vertical and normal, Analytic lens, Subtense bar, Tangential method.

UNIT-IV 9

Plane Table surveying, instruments and accessories, advantages and disadvantages of plane table surveying, methods – radiation, intersection, traversing, resection – Two- and three-point problems, errors in plane table surveying. Map preparation with plane table.

Area and volume computation: area from latitude and departure, Simpson's rule and Trapezoidal rule. Volume of level and two level sections, Trapezoidal and prismoidal formulae with corrections

Basic Survey Lab/ Field Work

Minimum Eight experiments are to be conducted from the following:

1. To study instruments used in chain surveying and to measure distance between two points byranging.
2. To determine the bearing of sides of a given traverse using Prismatic Compass, and plotting of the traverse.
3. To find out the reduced levels of given points using level. (Reduction by Height of Collimationmethod and Rise and Fall Method).
4. To determine and draw the longitudinal and cross-section profiles along a given route.
5. Practice for temporary adjustments of a Vernier Theodolite and taking horizontal (by Repetition and Reiteration methods) and Vertical angular measurements.

Textbooks

1. K.R. Arora, "Surveying", Vol. I & II Standard Book House, Delhi,
2. B.C Punmia, "Surveying", Vol. I, II & III Laxmi Publication
3. S.K. Duggal., Surveying Vol. I & II Tata McGraw Hill
4. A.M. Chandra,. "Plane Surveying", New Age International Publishers, Delhi
5. R. Subramanian Surveying and Levelling Oxford University Press
6. W. Schofield Engineering Surveying Elsevier
7. Charles D Ghilani and Paul R Wolf Elementary Surveying Pearson

Reference books

1. W. Schofield Engineering Surveying Elsevier
2. Charles D Ghilani and Paul R Wolf Elementary Surveying Pearson

BCE-214 FLUID MECHANICS

Course category	:	Program Core (PC)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture : 3, Tutorial : 0 , Practical: 2
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voce, One Minortests, and One Major Theory & Practical Examination
Course Objective	:	1. Conceptualize of basic fluid properties including behavior of Newtonian fluid at rest and motion. 2. Apply mass, momentum, and energy equation in open channel flow. Estimate velocity distribution, Shear stress distribution and head loss in laminar and turbulent flow in pipes. 3. Analyze pipes in series and parallels, and water distribution networks. 4. Measure flow through pipes using various flow measuring devices.
Course Outcomes	:	The students are expected to be able to demonstrate the followingknowledge, skills, and attitudes after completing this course 1. Understand how to make measurements of flow. 2. Understand the type and nature of the flow. 3. Apply the principle of momentum, energy, and mass conservationin various fluid flows. 4. Explain and describe the difference between smooth and roughsurface. 5. Figure out the problems in different pipe flows. 6. To understand the concept of boundary layer theory and flowseparation.

Topics Covered

UNIT-I **9**

Introduction: Fluids and continuum, Fluid Statics, Dimensional Analysis and Model Studies Introduction: Fluids and continuum; Physical properties of fluids: Viscosity, Compressibility, SurfaceTension, Capillarity, Vapor Pressure; Cavitation's; Classification of fluids including rheological classification.

Fluid Statics: Pressure-density-height relationship; Measurement of pressure by Manometers and mechanical gauges; Pressure on plane and curved surfaces; The Hydrostatic law; Total Pressure and Centre of pressure; Buoyancy; Stability of immersed and floating bodies.

Dimensional Analysis: Units and Dimensions, Rayleigh's method, Buckingham's Π theorem,Important dimensionless numbers used in fluid mechanics and their significance. Hydraulic Similitudeand Model Studies: Model and prototype; Similitude; Geometric, Kinematic and Dynamic similarity;Model Laws; Un-distorted model studies.

UNIT-II **9**

Fluid Kinematics and Fluid Dynamics-I

Fluid Kinematics: Description of Fluid flow: Lagrangian and Eulerian approach; Types of fluid Flows: Steady and unsteady, Uniform and non-uniform, Laminar and turbulent flows, 1, 2 and 3-D flows; Streamlines, Path lines and Streak lines; Stream tube; Acceleration of a fluid particle alonga straight and curved path; Differential and Integral form of Continuity equation; Rotation, Vorticity and Circulation; Elementary explanation of Stream function and Velocity potential; Flownet characteristics, uses and experimental and graphical methods of drawing.

Fluid Dynamics-I: Concept of control volume and control surface, Reynolds Transport Theorem,Introduction to Naiver-Stokes Equations, Euler's equation of motion along a streamline and its integration, Bernoulli's equation and its applications – Pitot tube, Flow through orifices, Mouthpieces, Nozzles, Notches, Weirs, Sluice gates under free and submerged flow conditions.
Free and Forced vortex motion.

UNIT-III **9**

Fluid Dynamics-II, Flow Through Pipes and Boundary Layer Analysis

Fluid Dynamics-II: Impulse-Momentum Principle; Moment of momentum equation; Momentumequation application to stationary and moving vanes, pipe bends, Problems related to, combined application of energy and momentum equations, flow measurements, determination of coefficientsof discharge, velocity and contraction, and energy loss.
Laminar Flow: Reynolds Experiment; Equation of motion for laminar flow through pipes; Flow between parallel plates; Kinetic energy and Momentum correction factors; Stokes law; Flow through porous media; Darcy's Law; Measurement of viscosity.
Turbulent Flow: Turbulence; Equation for turbulent flow; Reynolds stresses; Eddy viscosity; Mixing length concept and velocity distribution in turbulent flow; Boundary Layer Analysis: Boundary layer thicknesses; Boundary layer over a flat plate; Laminar boundary layer**;** Applicationof Von-Karman Integral Momentum Equation; Turbulent boundary layer; Laminar sub-layer; Hydro-dynamically Smooth and rough boundaries; Local and average friction coefficient; Total
drag; Boundary layer separation and its control.

UNIT-IV 9

Flow Through Pipes: Nature of turbulent flow in pipes; Major and Minor energy losses; Hydraulic gradient and total energy lines; Flow in sudden expansion, contraction, bends, valves and siph**9**ons; Concept of equivalent length; Branched pipes; Pipes in series and parallel; Simple pipe networks and its analysis.
Compressibility Effects in Pipe Flow: Transmission of pressure waves in rigid and elastic pipes; Waterha **Flow Past Submerged Bodies:** Drag and lift, Types of drag force, Drag on sphere, Cylinder and air foil;Circulation and Lift on a cylinder and air foil; Magnus effect.mmer; Analysis of simple surge tank excluding friction.

EXPERIMENTS

1. To measure the surface tension of a liquid.
2. To determine the metacentric height of a ship model experimentally.
3. To study the transition from laminar to turbulent flow and to determine the lower critical Reynolds number.
4. To determine the coefficients of velocity, contraction, and discharge of an orifice (or a mouthpiece) of a given shape.
5. To plot the flow-net for a given model using the concept of electrical analogy.
6. To calibrate an orifice meter and venturi meter and to study the variation of the coefficient of discharge with the Reynolds number.
7. To calibrate and determine the coefficient of discharge for rectangular and triangular notches.
8. To verify Darcy's law and to find out the coefficient of permeability of the given medium.
9. To verify the momentum equation.
10. To determine the loss coefficients for the various pipe fittings.

Textbooks

1. R J Fox: Introduction to Fluid Mechanics
2. Hunter Rouse: Elementary Mechanics of Fluids, John Wiley and sons, Omc/ 1946.
3. L H Shames: Mechanics of Fluids, McGraw Hill, International student edition.
4. Garde, R J and A G Mirajgaonkar: Engineering Fluid Mechanics (including Hydraulic machines),second ed., Nemchand and Bros, Roorkee, 1983.
5. K L Kumar: Engineering Fluid Mechanics
6. Munson, Bruce R, Donald F Young and T H Okishi, Fundamentals of Fluid Mechanics, 2nd Ed,Wiley Eastern.
7. V Gupta and S K Gupta, Fluid Mechanics and its Applications, Wiley Eastern Ltd.
8. Som and Biswas: Introduction to Fluid Mechanics and Machines, TMH.

Reference Books

1. Hydraulics and Fluid Mechanics by Dr. P. N. Modi and Dr. S.M Seth.

BSM-214/264 Numerical Methods

Course category : Basic Sciences & Maths (BSM)

Pre-requisite Subject : NIL

Contact hours/week : Lecture: 3, Tutorial : 0 , Practical: 2

Number of Credits : 4

Course Assessment methods : Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor tests and One Major Theory & Practical Examination.

Course Objectives The objective of this course is to introduce a broad range of numerical methods for solving mathematical problems that arise in science and engineering.

Course Outcomes : The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions to otherwise intractable mathematical problems.
2. To find the root of a function using Bisection, Regula falsi, Newton's Method, Aitken's method.
3. To interpolate a curve using Gauss, Newton's interpolation formula.
4. To solve the first order boundary value problem.

5. To develop an understanding of the fundamentals in finding the numerical solutions of the system of equations and to find the eigen value of the matrix.
6. Demonstrate the concepts of numerical methods used for different applications.

Topics Covered

UNIT-I 9

Roots of equation: Bisection method, Regula Falsi Method, Secant Method, Fixed point Iteration Method, Newton Raphson Method, Modified Newton Raphson Method for Multiple roots, derivation of rate of convergence, Aitken Method.

UNIT-II 9

Solutions of system of Linear equations and Eigen Value problem: Linear equations: Direct method for solving systems of linear equations (Gauss elimination, Gauss Jordan, LU Decomposition, Cholesky Decomposition), Iterative methods (Jacobi, Gauss Seidel, Relaxation method). Algebraic Eigen value problem: Power method, Jacobi's method, Given's method.

UNIT-III 9

Interpolations, and Numerical Integration: Relationship in various difference operators, Newton`s Forward and Backward Interpolation, Lagrange and Newton divided difference interpolation, Newton`s Cotes Formula, Trapezoidal Rule, Simpson's 1/3 and 3/8 rule, Gauss Quadrature Formula, Chebyshev's Formula, Piecewise Linear Interpolation, Cubic Spline Interpolation.

UNIT-IV 9

Numerical solution of Ordinary differential equations, and Difference Equation: Single Step Methods: Taylor, Picard, Euler, Modified Euler, and Runge-Kutta Fourth Order Methods. Multistep methods: Milne's and Adam's predictor and corrector methods. Difference equations and their solutions, Rules for finding the particular integral.

EXPERIMENTS

1. To implement Regula-Falsi method to find root of algebraic equation.
2. To implement Newton-Raphson method to find root of algebraic equation.
3. To implement Newton's Divided Difference formula to find value of a function at a point.
4. To implement Numerical Integration by using Simpson's one-third rule.
5. To implement numerical solution of differential equation by Picard's method.
6. To implement numerical solution of differential equation by using Euler's method.
7. To implement numerical solution of differential equation by using Runge – Kutta Method.

Books & References

1. M.K. Jain, S.R.K. Iyenger and R.K. Jain, Numerical Methods:, New Age Publishers.
2. P. *Kandasamy*, K.Thilagavathi, K.Gunavathi *, Numerical Methods*., S. Chand & Company.
3. B.S. Grewal; Higher Engineering Mathematics, Khanna Publishers, Delhi.
4. B.V. Ramana; Higher Engineering Mathematics, Tata Mc. Graw Hill Education Pvt. Ltd., New Delhi.
5. Brian Bradie, A Friendly Introduction to Numerical Analysis, Pearson Education, Asia, New Delhi

Semester-IV

BCE-261 **HYDRAULIC AND HYDRAULIC MACHINES**

Course category	:	Engineering Fundamental (EF)
Pre-requisite Subject	:	Fluid Mechanics (BCE-214)
Contact hours/week	:	Lecture : 3, Tutorial : 0 , Practical: 2
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voce, One Minor tests, and One Major Theory & Practical Examination
Course Objective	:	1. Classify open channel flow and compute velocity distribution andpressure distribution in open channel flow. 2. Compute normal and critical depth and design of efficient channel. 3. Identify and compute backwater and drawdown profiles in openchannel encountered in water resources project. 4. Study of characteristics and types of hydraulic jumps. 5. Locate the hydraulic jump encountered in design of hydraulicstructures in an open channel. 6. Select and design hydraulic machines such as pumps and Turbinesbased on the system requirements.
Course Outcomes	:	The students are expected to be able to demonstrate the followingknowledge, skills, and attitudes after completing this Course. 1. To identify the different types of flow in Open Channel. 2. To understand the concept of Hydraulic Jump. 3. To classify the various types of flow profiles 4. To study the characteristics of rotodynamic Pumps. 5. To understand the working of Turbines. 6. To have throughout knowledge on selection of turbines and pumps forpractical purposes.

Topics Covered

UNIT-I **9**

Introduction: Difference between open channel flow and pipe flow, geometrical parameters of a channel, continuity equation. Critical depth, concepts of specific energy and specific force, application of specific energy principles for the interpretation of open channel phenomena, flowthrough vertical and horizontal contractions.

Uniform Flow: Chazy's and Manning's equations for uniform flow in an open channel, factorsaffecting Manning's coefficient "n", Velocity distribution, Velocity distribution coefficients, most efficient channel section

UNIT-II **9**

Gradually Varied Flow: Equation of gradually varied flow and its limitations, flow classification andsurface profiles, integration of varied flow equation by graphical and numerical method and analytical and analysis of water surface profiles.

UNIT-III **9**

Rapidly Varied Flow: Classical hydraulic jump, evaluation of the jump elements in rectangular andnon-rectangular channels on horizontal and sloping beds, open channel surge, celerity of the gravity wave.

Hydraulic Pumps: Rotodynamic pumps, classification on different basis, basic equations, Velocity triangles, manometric head, efficiencies, cavitation in pumps, characteristics curves.

UNIT-IV **9**

Hydraulic turbines: Introduction, Rotodynamic Machines, Impulse turbines, Pelton Turbine,equations for jet and rotor size, efficiency, spear valve, reaction turbines, Francis and Kaplan type, Head on reaction turbine, unit quantities, similarity laws and specific speed, cavitation, characteristic curves

EXPERIMENTS

1. To determine the Manning's roughness coefficient "n" for the given flume.
2. To determine the Chezy's coefficient "C" for the given flume.
3. To study the flow characteristics over a hump placed in an open channel.
4. To study the flow through a horizontal contraction in a rectangular channel.
5. To calibrate a broad-crested weir.
6. To study the characteristics of free hydraulic jump.
7. To study rotodynamic pumps and their characteristics
8. To study characteristics of reaction turbines (Francis/ Kaplan / Pelton)

Textbooks

1. Jain A.K., Fluid Mechanics including Hydraulic Machine, Khanna publisher, 8th edition.
2. Modi P.N and S. M Seth, Hydraulics and Fluid Mechanics including Hydraulic machines,Standard BookPub; New Delhi.

Reference Books

1. Garde, R.J., "Fluid Mechanics through Problems", New Age International
2. Streeter, V.L. and White, E.B., "Fluid Mechanics", McGraw Hill, New York, 8th
3. Asawa, G.L., "Experimental Fluid Mechanics", Vol.1, Nem Chand and Bros.,
4. Ranga Raju, K.G., Flow through open channels, T.M.H. 2nd edition
5. Rajesh Srivastava, Flow through Open Channels, Oxford University Press.
6. K. Subramanya, Flow through Open Channels, TMH
7. Vasundani, Hydraulic Machines

BCE 262 **STRUCTURAL ANALYSIS**

Course category	:	Program Core (PC)
Pre-requisite Subject	:	Structural Mechanics
Contact hours/week	:	Lecture: 3, Tutorial : 1 , Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, assignments, quizzes and one Minor tests and One Major Theory Examination.
Course Objectives	:	The main objectives of the course are: 1. To impart the principles of elastic structural analysis and behaviour of indeterminate structures and to get a feeling of how real-life structures behaves 2. To enable the student to get the knowledge about various methods involved in the analysis of indeterminate structures and apply those methods to evaluate the response of structures.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course 1. Understand the concept of structural systems, loads, supports and displacements, statically determinate and indeterminate structural systems. 2. Apply a suitable analysis technique for statically indeterminate structures. 3. Analyze the beams and frames using the Classical Methods of analysis. 4. Develop and use the concept of influence line diagram for calculating maximum values of different structural quantities in a statically determinate structure, like BM, SF and displacement. 5. Compute reactive forces in the two hinged and three hinged arches using Conventional Methods of analysis of structures. 6. Evaluate the plastic behaviour of structural system based on the plastic theory

Topics Covered

UNIT-I 9

Indeterminacy: static and Kinematic, Analysis of Indeterminate structures: Analysis of fixed beams, Continuous beams, and simple frames with and without translation of joint, Method of Consistent Deformation, Slope-Deflection method, Moment Distribution method, Strain Energy method.

UNIT-II 9

Moving loads for determinate beams: Different load cases, Influence lines for forces for determinate beams; Influence lines for indeterminate beams using Muller Breslau principle. Absolute maximum bending moment.

UNIT-III 9

Analysis of Arches, Linear arch, Eddy‟s theorem, three hinged parabolic and circular arch, two hinged arch, spandrel braced arch, Influence lines for Arches and stiffening girders, Influence line diagrams for maximum bending moment, Shear force and thrust.

UNIT-IV 9

Basics of Plastic Analysis, Plastic moment of resistance, Plastic section modulus, Shape factor, Load factor, Plastic hinge and mechanism, Plastic analysis of indeterminate beams and frames – Upper and lower bound theorems.

Textbooks

1. Theory and Analysis of Structures, Vol. I & II - O. P. Jain & B. K. Jain, Nem Chand & Bros., Roorkee.
2. Wang, C.K., Intermediate Structural Analysis, McGraw Hill.
3. Analyse Devadas Menon, “Structural Analysis”, Narosa Publishing House, 2008.
4. Hibbeler, R.C., Structural Analysis, 7th ed. East Rutherford, NJ: Pearson Prentice Hall, 2008.

Reference Books

1. Theory of Structures - S. P. Timoshenko and D. Young, McGraw Hill Book Publishing Company Ltd., New Delhi
2. Reddy. C.S., "Basic Structural Analysis", Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2013.
3. Introduction to Matrix Methods of Structural Analysis by H. C. Martin, McGraw Hill Book Publishing Company Ltd.
4. Matrix Analysis of Framed Structures - Weaver and Gere.
5. Theory of Structures Vol. II - Vazirani & Ratwani. 4. Influence Line Diagrams - Dhavilkar.
6. Analysis of Statically Indeterminate Structures - P. Dayaratnam, Affiliated East- West Press.
7. Norris, C.H., Wilbur, J.B., and Utku, S., Elementary Structural Analysis, TMH,2003,1983

BCE 263 **Highway Engineering**

Course category	:	Program Core (PC)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture:3, Tutorial: 0, Practical:2
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through attendance, home assignments, quizzes, practical work, record, viva voce and one Minor tests and One Major Theory & Practical Examination
Course Objectives	:	1. To introduce the students with the principles and practice of transportation engineering which focuses on Traffic and Transportation Engineering and Highway Engineering. 2. To enable the students to have a strong analytical and practical knowledge of Planning, Designing, and solving the transportation problems. 3. To introduce the recent advancements in the field of Sustainable Urban Development, Traffic Engineering and Management, Systems Dynamics Approach to Transport Planning, Highway Design and Construction, Economic and Environment Evaluation of Transport Projects.

4. To strength the students' knowledge and technical know-how to be efficient Transport Engineers.

Course Outcomes : The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course

1. Understanding the types of pavements and their components.
2. Materials used for highway construction.
3. Methods of design of flexible and rigid pavement including IRC method.
4. Construction and maintenance of different types of pavements
5. Basic concept about highway engineering
6. Various types of intersection and their suitability.

Topics Covered

UNIT-I 9

Introduction: Role of transportation, Mode of transportation, History of road development, Nagpur Road plan, Bombay Road plan & 3rd 20-Year-Old Road Plan, Road Types and Pattern. Geometric design: cross-sectional elements, camber, shoulder, sight distance, horizontal curves, super elevation, extra widening, transition curves and gradient, vehicle curves, summit, and valley curves

UNIT-II 9

Traffic Engineering: Traffic characteristic, volume studies, speed study, capacity, density, traffic control devices, signs, signals, design of signals, Island, Intersection at grade and grade separated intersections, design of rotary intersection.

UNIT-III 9

Design of Highway Pavement: Types of pavements, Design factors, Design of flexible pavements by CBR method (IRC: 37-2001, 2012 and 2018), Design of rigid pavement, Westergaard theory, load and temperature stresses, joints, IRC method of rigid pavement design. (IRC 58-2002, 2011 and 2015).

UNIT-IV 9

Road Construction Methods: WBM, WMM, Surface Dressing, Bituminous carpeting, Bituminous Bound Macadam and Asphaltic Concrete, Cement Concrete Road construction.

List of EXPERIMENTS

1. Impact value test of Aggregate
2. Shape test (Flakiness, Index, Elongation Index) of Aggregate
3. Crushing value test of Aggregates
4. Los Angeles Abrasion Value test for Aggregate
5. Stripping test of Bituminous Sample.
6. Ductility test of Bituminous Sample
7. Penetration test of Bituminous Sample
8. Softening point test of Bituminous sample
9. Flash and Fire Test of Bituminous Sample
10. Classified Both directional Traffic Volume study
11. Traffic speed study (using radar speedometer).
12. Determination of Marshall Stability Value
13. CBT Test for soil

14. Proctor Test for soil

Textbooks

1. Highway Engineering by S. K. Khanna and C.E.G. Justo, Nem Chand & brothers, Roorkee.
2. Traffic Engineering by L. R. Kadiyali, Khanna Publishers, New Delhi.
3. Principles of Transportation and Highway Engineering by G.V. Rao, Tata McGraw Hill, New Delhi.
4. Highway and Traffic Engineering by Subhash C. Saxena, CSB Publishers and Distributers Ltd. New Delhi.

Reference books

1. Transportation Engineering by James S. Banks Tata McGraw Hill, New Delhi.
2. Transportation Engg. by Papakosta and P.D. Prevedouros, Prentice Hall India, New Delhi.
3. Principles of Transportation Engineering by P. Chakraborti and A. Das, Prentice Hall India, New Delhi.
4. Highway Material Testing S.K. Khanna and C.E.G. Justo. 5. Highway Material Testing by A.K. Duggal.

ECE 101	**Matrix Method of Analysis**
Course category	: Professional Elective-1 (PE1)
Pre-requisite Subject	: NIL
Contact hours/week	: Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits	: 4
Course Assessmentmethods	: Continuous assessment through tutorials, attendance, home assignments, quizzes, record, One Minor tests and One Major Theory Examination.
Course Objectives	: The main objective is to expand the student knowledge of the stiffness and flexibility methods studied in the basic structural analysis courses. This course is also expected to enable a good understanding of how standard software packages and students will be able to implement the method developing their own computer program to analyze structures.
Course Outcomes	: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. To understand the basic concepts of structural analysis and matrix algebra.
2. To understand the matrix methods can be applied to plane and space trusses; beams and grids; plane and spaceframes.
3. To identify a suitable system of releases (flexibility method) or an appropriate set of degrees of freedom (stiffness method).
4. To formulate and solve the equilibrium equations (stiffness method) or boundary conditions (flexibility method).
5. Ability to use modern structural analysis software.
6. Able to understand and analysis complex structures.

Topics Covered

UNIT-I 9

Introduction to Flexibility and stiffness method. Hand computation of problems on beam.

UNIT-II 9

Hand computation of problems on trusses, frames and grids.

UNIT-III 9

Generalized computer-oriented treatment of stiffness method, Method of assembling the stiffness matrix, substructure technique for solving very large structures.

UNIT-IV 9

Analysis for imposed deformation, temperature, support settlement, etc. Transfer matrix method of analyzing framed structure.

Textbooks

1.H.C. Matrix, Introduction to Matrix Methods, of structural Analysis, McGraw Hill, New York.

Reference books

1.Weaver & Gere, Matrix Analysis of Framed structures.

ECE 102	**Geotechnical Investigations and Field Testing of Soil**
Course category	Professional Elective (PE)
Pre-requisite Subject	NIL
Contact hours/week	Lecture: 3, Tutorial : 1 , Practical: 0
Number of Credits	4
Course Assessment methods	Continuous assessment through attendance, home assignments, quizzes, practical work, record, viva voce and One Minor test and One Major Theory Examination
Course Objectives	The objectives of the course are as follows: 1. To Understand the types of soil and develop various applications of soil as a construction material for civil engineering structures. 2. To Evaluate the soil quality to understand the basic relationships between physical and mechanical properties of soils. 3. To understand the soil testing methods as the basic knowledge of classification and engineering properties of soil 4. To understand the different ground modification methods and the experimental methods for laboratory as well as field investigations.
Course Outcomes	After completion of this course the students to demonstrate following knowledge, skills and attitudes. 1. Comprehend the basics of site investigation methods and field tests and its extent for variety of structures including preliminary investigations. 2. Identify and suitable investigation method for soil exploration. 3. Illustrate different specialized exploration methods based on condition and requirement. 4. Appraise different codal provisions for field tests 5. Basic knowledge about soil explorations and field investigations.

Topics Covered

UNIT-I 9

Soil Formation, types of soils, physical and biological weathering, soil transport, deposition and stratification phenomena and Soil Classification. Clay minerals; coarse-grained and fine-grained soil for engineering use. Interpretations And Codal Provisions: Soil profiling, interpretation of exploration data and report preparation, various standards for soil investigations. Purpose and Phases of Soil Investigation.

UNIT-II 9

Exploration Methods: Methods of Boring, Augering and Drilling. Machinery used for drilling, types of augers and their usage for various projects. Soil Sampling: sampling methods, types of samples, storage of samples and their

transport. Sample preparation, sample sizes, types of samplers specifications for soil testing. Trial pits, disturbed and undisturbed sampling

Detailed bore hole investigations: types of borings and types of samplers. Compaction: Standard and Modified Proctor compaction tests; field compaction; compaction quality control: Proctor Needle Test,

UNIT-III 9

Field testing of soils: methods and specifications – visual identification tests, vane shear test, penetration tests, analysis of test results. Report writing: Soil exploration Reports- identification, calculations and preparation. Field Instrumentation: Rollers, Pressure meters, Piezometer, Pressure cells, Sensors, Inclinometers, Strain gauges etc, Collection of geological data, Resistivity and Seismic Refraction methods.

UNIT-IV 9

Field Tests: Plate load test, pile load test, SPT test, CPT test, flat dilatometer test, DCPT test, Vane shear test, pressure meter test, field CBR test, core cutter, sand replacement test, nuclear probe method, block shear test. Introduction to Ground Modification: Need and objectives of Ground Improvement, Classification of Ground Modification Techniques – suitability and feasibility, Emerging Trends in ground improvement.

Textbooks

- Alam Singh – Modern Geotechnical Engineering, Asia Publishing House, New Delhi.
- Gopal Ranjan and A.S.R. Rao – Basic and Applied Soil Mechanics, New Age International (P) Ltd.
- B.C. Punamia – Soil Mechanics and Foundations, Laxmi Publications (P) Ltd.
- C. Venkataramaiah – Geotechnical Engineering, New Age International (P) Ltd., New Delhi.

Reference Books

- Schnaid, F. (2009) In Situ Testing in Geomechanics : The Main Tests. Taylor & Francis.
- J. E. Bowles, “Foundation Analysis and Design”, McGraw Hill Companies, 1997.
- M. D., Desai, “Ground Property Characterization from In-Situ Testing”, Published by IGS-Surat Chapter,2005.
- M. J., Hvorslev, “Sub-Surface Exploration and Sampling of Soils for Civil Engineering Purposes”, US Waterways Experiment Station, Vicksburg, 1949.
- Robert M. Koerner “Construction and Geotechnical methods in Foundation Engineering”, Mc.Graw-Hill Pub. Co., New York, 1985.
- Manfred R. Haussmann, “Engineering principles of ground modification”, Pearson Education Inc. New Delhi, 2008.
- F. G., Bell, “Engineering Treatment of Soils”, E& FN Spon, New York, 2006.
- P. Purushothama Raj, “Ground Improvement Techniques” Laxmi Publications (P) Limited, 2006.
- Jie Han et. al., “Advances in ground Improvement” Allied Pub., 2009.
- Hunt Roy E , Geotechnical Investigation Methods, A Field Guide for Geotechnical Engineers, Taylor & Francis Ltd.

ECE -103	**Global Warming and Climate Change**
Course category	: Program Elective- 1
Pre-requisite Subject	: NIL
Contact hours/week	: Lecture: 3, Tutorial:1, Practical: 0
Number of credits	4

Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, record, two Minor tests and One Major Theory Examination.
Course Objectives	:	The main objective is to expand the student knowledge of the climate change, its causes, impacts, and global responses such as the Kyoto Protocol and Clean Development Mechanisms.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. To make the students understand about the sources of energy
2. To understand about the effects of greenhouse gases.
3. To have adequate knowledge on impacts of climate change.
4. To acquire knowledge on modelling on climate change.
5. To have adequate knowledge on carbon credit.
6. To understand rules and protocols on global trading related to global warming.

Topics Covered

UNIT-I 9

Energy Sources: Global Warming Potential, Energy Issues and Climate Change, Alternate Energy Sources. Greenhouse Effect: Green house as natural phenomenon, Greenhouse Gases (GHGs) and their Emission, Sources. Quantification of CO2 Emission, Global Warming Potential of GHGs.

UNIT-II 9

Impacts of Climate Change: Effects on climatic and related changes, Global and Indian, scenario. Temperature Rise. Sea Level rise, Coastal Erosion and landslides, Coastal Flooding. Wetlands and Estuaries loss. Modelling on Climate Change: Case studies on climate change, Data analysis, Interpretation, Ozone layer depletion and its control.

UNIT-III 9

Kyoto Protocol: Importance. Significance and its role in Climate Change. Carbon Credit and Trading: Mechanisms, Various Models Global and Indian Scenario.

UNIT-IV 9

Cleaner Development Mechanisms: Various Projects related to CO2 Emission Reduction.
Alternatives of Carbon Sequestration - Conventional and non-conventional techniques, Role of Countries and Citizens in Containing Global Warming.

Textbooks

1. Francis D., (2000), "Global Warming: The Science and Climate Change", 1st Edition, Oxford University Press.

Reference books

1. Barry R.G., and Chorley R.L., (2017), "Atmosphere, Weather and Climate", 4th Edition, ELBS Publication.
2. Bolin B., (Ed.), (1981), "Carbon Cycle Modelling, John Wiley and Sons Publications.
3. Corell R.W., and Andenon P.A., (Eds). (1991), "Global Environmental Change", Springer Vetlog Publishers.

ECE -104	**Principle of Highway Engineering**
Course category	Program Elective -1
Pre-requisite subject	NIL
Contact hours/week	Lecture: 3; Tutorial: 1; Practical: 0
No. of credits	4

Course assessment methods Continuous assessment through tutorials, attendance home assignments, : quizzes, practical work, record, viva voce and one Minor tests and One Major Theory

Course Objective Followings are the course objectives of this course:

1. To introduce the fundamental principles and scope of highway and transportation engineering
2. To develop skills for planning and conducting highway alignment surveys and preparing related documentation.
3. To familiarize with the various materials used in highway construction
4. To enable application of economic evaluation methods for assessing highway projects and making informed decisions.

Course outcomes The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course:

1. Understand the fundamental concepts and scope of highway and transportation engineering.
2. Aware basic road classification and the road authorities in india
3. Plan and carry out highway alignment surveys
4. Identify different types of Materials used in highway construction
5. Perform and interpret basic laboratory tests on highway materials to assess their suitability for pavement construction.
6. Evaluate highway projects using economic analysis methods

Topic covered

UNIT-I 9

Highway Introduction, Scope, Planning & Development Highway planning in India, Development, Rural and urban roads, Road departments in India, Road classification, Road authorities i.e. IRC, CRRI, NHAI, NHDP etc

UNIT-II 9

Highway Alignment & Surveys: Reconnaissance, Aerial surveys, Location surveys, Location of bridges, Problems in rural and urban areas. Highway drawings & reports Highway project preparation

UNIT-III 9

Highway Materials and construction Aggregates and their types, physical and engineering properties, Fillers, Bitumen, Characteristics, Emulsions and cutbacks, Basic tests on all materials: construction of flexible and rigid pavement.

UNIT-IV 9

Highway Economics & Finance Financing of road projects, administration of roads, PPP models, Road safety audit, Methods of economic evaluation of highway projects

Text Books/Reference books:

1. Khanna, S. K. and Justo, C. e. G., Manual for Highway testing manuals, Enchant Bros., Roorkee.
2. Das A and Chakraborty P, Principles of Transportation Engineering, PHI Pvt. Ltd. New Delhi
3. Kadiyali, L.R. & Lal, N.B., Principles & Practices of Highway Engineering, Khanna Publishers, New Delhi.
4. Wright, P. H., Highway Engineering, John Wiley and Sons, New York
5. Indian standards, ASTM Codes, IRC codes, MoRTH Specifications

ECE-105	**ENGINEERING HYDROLOGY**
Course Category	PE-1
Contact hours/week	Lecture – 3; Tutorial – 1; Practical – 0
Number of credits	4
Course assessment methods	Continuous assessment through attendance, home assignments, quizzes, two minor practical exam and One Major Practical Examination

Course Objectives

1. To study occurrence movement and distribution of water that is a prime resource for development of a civilization.
2. To know diverse methods of collecting the hydrological information, which is essential, to understand surface and ground water hydrology.
3. To know the basic principles of streamflow measurement
4. To understand the principles of watershed management and flood routing

Course Outcomes

The students are expected to be able to demonstrate the following knowledge, skills, and abilities after completing this course:

1. A background in the theory of hydrological processes and their measurement
2. Apply science and engineering fundamentals to solve current problems and to anticipate, mitigate and prevent future problems in water resources management
3. An ability to manipulate hydrological data and undertake widely used data analysis.
4. A systematic understanding of the nature of hydrological stores and fluxes and a critical awareness of the methods used to measure, analyse and forecast their variability; and the appropriate contexts for their application.
5. An understanding in principles of watershed management
6. An ability to apply momentum, energy and mass balance equations for routing flood through rivers and reservoirs

Topics Covered

Unit – I 9

Introduction: Hydrologic cycle, processes and budget; Fundamentals of hydrometeorology, Indian monsoon system

Frequency Analysis: Random variables, Probability distribution functions: normal, log-normal, Gumbel, Pearson type-3 uniform distributions; Frequency analysis; Goodness of fit measures.

Unit – II 9

Precipitation Measurement and Analysis: Precipitation variability, rainfall and snow measurement techniques, design of precipitation gauging network, consistency of rain record, filling up of missing record, estimation of mean areal rainfall, IDF and DAD analysis, Snow measurement and estimation of snow melt.

Hydrologic Abstractions: Interception and depression storage; Evaporation: factors affecting, measurement and estimation; Evapotranspiration: measurement and estimation; Infiltration, factors affecting infiltration, measurement of infiltration, empirical and analytical models of infiltration; Rain harvesting: procedures and design.

Unit – III 9

Stream Flow: Runoff process: measurement of stream flow, factors affecting stream flow; Stage-discharge relationship; Peak discharge estimation; hydrograph analysis, base flow separation, unit hydrograph for stream flow estimation, synthetic unit hydrograph, hydrological modeling

Unit – IV 9

Watershed Management: Watershed and its characteristics; Curve number method; Soil erosion and estimates; Watershed management techniques, Erosion control.

Flood Routing: Governing equations, Reservoir flood routing, Hydrologic routing: Muskingum method.

Textbooks

1. Chow, V.T., Maidment, D.R. and Mays, L.W.: Applied Hydrology, Mc Graw Hill 1998
2. Mays, L.W.: Water resources Engineering, John Wiley and Sons 2001
3. Singh V.P., Elementary Hydrology, Prentice Hall of India 1994
4. Subramanya, K., Engineering Hydrology, 4th Edition, Tata Mc Graw Hill 2013
5. C.W. Fetter, Applied Hydrogeology, Fourth Edition, CBS Publishers and Distributors, New Delhi, 2001 2001
6. H.M. Raghunath, Hydrology: Principles, Analysis and Design, 2nd edition, New Age International Publishers.

ECE-106	**Geographic Information System**	
Course category	:	PE-1
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture:3,Tutorial: 1, Practical:0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, two Minor tests, and One Major Theory Examination
Course Objectives	:	This course aspires to: Introduce basic concepts in GIS, provide exposure to basic tools and techniques in GIS software and Introduce applications of GIS in relevant areas of civil engineering.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course 1. Define what GIS is and know different types of spatial and non spatial data 2. Understand the GIS and its Data models 3. Know what are the questions that GIS can answer 4. Differentiate between Raster and Vector Models 5. Create maps and overlay features/raster data for basic analyses 6. Understand the applications of GIS in the fields of environmental, geotechnical, transportation and water resources engineering

Topics Covered

UNIT-I 9

Definition of GIS, Cartography and GIS, GIS database: spatial and attribute data; Spatial models: Semantics, spatial information, temporal information, conceptual models of spatial information, Computer representation of geographic information: Regular tessellations, irregular tessellations, Vector representations, Topology and Spatial relationships, Scale and Resolution, Representation of Geographic fields, Representation of Geographic objects

UNIT-II 9

Raster and vector data input, raster to vector data conversion, map projection, analytical transformation, rubber sheet transformation, manual digitizing and semi-automatic line following digitizer; Remote sensing data as an input to GIS data

Direct and indirect spatial data capture Accuracy and Precision, Positional accuracy, Attribute accuracy, temporal accuracy, Lineage, Completeness, Logical consistency

UNIT-III 9

GIS database Concepts and management systems, Types of Database management Systems, hierarchical, network, relational models, Object oriented DBMS, GIS functionality; data storage and data retrieval through query, generalization, classification, containment search within a spatial region

UNIT-IV 9

Overlay: arithmetical, logical and conditional overlay, buffers, inter visibility, aggregation; Network analysis; Applications of GIS in planning and management of utility lines and in the field of environmental engineering, geotechnical engineering, transportation engineering and water resources engineering

Textbooks

1. Stan Arnoff Geographic Information Systems: A Management Perspective, WDL Publications.
2. C.P. Lo and Albert K. W. Yeung, Concepts and Techniques of Geographical Information Systems, Prentice- Hall India
3. Reddy, M. Anji, Remote sensing and Geographic Information System BS Publications Hyderabad
4. B. Bhatta, Remote Sensing and GIS, Oxford University Press

Reference books

1. Robert Laurini and Derek Thompson Fundamentals of Spatial Information Systems, Academic Press.
2. Tor Bernhardsen Geographic Information Systems: An Introduction, Wiley
3. Burrough P.A. and Rachel A. McDonell, Principles of Geographical Information Systems, Oxford Publication
4. Michael N. DeMers, Fundamentals of Geographic Information Systems, Wiley

ECE- 201 **Prestressed Concrete**

Course category	:	Professional Elective-2 (PE2)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor test/s and One Major Theory Examination
Course Objectives	:	The course objectives are given below: 1. Understand the concepts of pre-stressing in concrete structures and identify the materials for pre-stressing. 2. Insight into the Pre-Tensioning and Post- Tensioning Processes to solve engineering problems.

3. Techniques for construction for prestressed concrete.
4. Design pre-tensioned and post tensioned girders for flexure and shear.
5. Design continuous pre-tensioned and post tensioned beams.

Course Outcomes : The students are expected to demonstrate the following knowledge, skills and attitudes after completing this course.

1. To learn the principles, materials, methods and systems of prestressing.
2. To know the different types of losses and deflection of prestressed members.
3. To learn the design of prestressed concrete beams for flexural, shear and tension and to calculate ultimate flexural strength of beam.
4. To learn the design of anchorage zones, composite beams, analysis and design of continuous beam.
5. Analyse a Pre-stressed Concrete section.
6. Able to estimate the losses during the prestressing

Topics Covered

UNIT-I 9

Fundamentals of prestressing - Classification and types of prestressing Concrete Strength and strain characteristics - Steel mechanical properties - Auxiliary Materials like duct formers. Prestressing Systems: Principles of pre-tensioning and post tensioning - study of common systems of prestressing for wires strands and bars.

UNIT-II 9

Advantages of prestressing, methods of prestressing, Losses in prestress, analysis of simple prestressed rectangular and T-sections. Introduction to design of elements, load balancing concept, profile of cable.

UNIT-III 9

Analysis of Sections: In flexure, simple sections in flexure, Design of rectangular, T, I beam under flexure and shear using IS 1343, kern distance - cable profile - limiting zones - composite sections cracking moment of rectangular sections.

UNIT-IV 9

Design of Simply Supported Beams: Allowable stress as per I.S. 1343 - elastic design of rectangular and I-sections. Shear and Bond: Shear and bond is prestressed concrete beams - conventional design of shear reinforcement - Ultimate shear strength of a section - Prestress transfer in pretensioned beams-Principles of end block design.

Textbooks

1. Krishna Raju. N., “Prestressed Concrete”, Tata Mc Graw Hill.,6th Edition.
2. Lin.T.Y, “Prestressed concrete”, Wiley India, 2010.

Reference Books

1. Nawy, E. G., Prestressed concrete a fundamental approach 4th edition, Pearson Education, Inc. New Jersery, US., 2003.
2. IS 1343:2012. Prestressed concrete - code of practice, Bureau of Indian Standards (BIS), New Delhi, India., 2012.
3. Rajagopalan, “Prestressed concrete”, Narosa Publishing House, 2017, 2nd Edition.

ECE- 202 **ROCK MECHANICS**

Course category : Professional Elective-2 (PE 2)

Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor test/s and One Major Theory Examination
Course Objectives	:	The course objectives are given below: 1. Concepts of rock mass properties governed by deformation of rocks and development of discontinuity features. 2. Insight to presence of in-situ and forced stresses in rock mass, their measurement will be able to solve engineering problems. 3. Safe excavation techniques for construction of underground structures. 4. Knowledge of Ground conditions in tunnelling with special reference to rock mass.
Course Outcomes	:	The students are expected to demonstrate the following knowledge, skills and attitudes after completing this course. 1. Identification of the different types of rocks. 2. Laboratory experiments to be done for the rock mass properties. 3. Index properties of rock and rock mass. 4. Determination of the strength of the rock by various failure criteria. 5. Stress-strain behaviour of a rock mass. 6. Foundations on weak rocks.

Topics Covered

UNIT-I 9

Rock Formation: rock forming minerals, identification, geological classification of rock, geological structures, faults, folds, joints. Laboratory Testing of Rocks for the determination of physical properties, uniaxial compressive strength, tensile strength, oblique shear stress. Triaxial test, slake durability test, stress-strain responses of rocks.

UNIT-II 9

Engineering Classification of Rocks & Rock Masses: Deere and Miller classification, rock quality designation, rock mass rating, rock mass quality, geological strength index and their applications. Strength Criteria for Rocks & Rock Mass: Mohr-Coulomb criterion, Hoek and Brown criterion, Barton's theory.

UNIT-III 9

Tunneling: Ground conditions in tunneling, elastic analysis under uniaxial, biaxial and hydrostatic conditions, Concrete lining: elastic analysis, elasto-plastic analysis: Tresca criterion, rock mass-tunnel support interaction analysis, design of support system.

UNIT-IV 9

Rock Slope Stability Analysis: Modes of failure, limit equilibrium approaches, application of stereographic projections, remedial measures.

Foundations of Weak Rocks: Bell's approach, bearing capacity based on classification approaches, UCS, plate load test, special considerations

ECE- 203 **ENVIRONMENTAL CHEMISTRYAND MICROBIOLOGY**

Course category	:	Professional Elective-2 (PE 2)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor test/s and One Major Theory Examination
Course Objectives	:	The course objectives are given below:
Course Outcomes	:	The students are expected to demonstrate the following knowledge, skills and attitudes after completing this course.

1. Synthesize and apply concepts from multiple sub-disciplines in environmental chemistry and toxicology.
2. Use technical and analytical skills to quantify the level and effects of xenobiotics in environmental compartments (air, water, soil, biota).
3. Identify relationships between chemical exposure and effects on physiological systems and design strategies for study of dose-response relationships.
4. Effectively understand and convey scientific material from peer-reviewed sources.
5. Conduct an individual research project within the university of other appropriate setting.

Topics Covered

UNIT-I 9

Introduction, basic Concept from General Chemistry, Colloidal Chemistry

UNIT-II 9

Environmental Biochemistry, Physico-Chemical and Biological examination of Water and Wastewater

UNIT-III 9

Thermodynamic of Microbiological systems

UNIT-IV 9

Mass and energy Balance of Microbial Process, Aerobic and Anaerobic Microbial growth

ECE- 204 **Traffic Engineering**

Course category	:	Professional Elective-2 (PE2)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits	:	4

Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes and One Minor test/s and One Major Theory Examination
Course Objectives	:	The course objectives are given below: 1. An ability to design the road with existing traffic capacity of the town /city. 2. Ability to calculate the traffic flow, traffic volume of the town/city. 3. Idea about the traffic signs.
Course Outcomes	:	The students are expected to demonstrate the following knowledge, skills and attitudes after completing this course. 1. Knowledge of achieving efficient, free and rapid flow of traffic. 2. Knowledge of having fewer accidents and pedestrians should also be given importance. 3. Knowledge about the various types of signals and their uses. 4. Knowledge about deciding the signal timing for different traffic situations. 5. Knowledge of having different type of parking techniques and lighting 6. Knowledge of having various methods of travel demand forecasting.

Topics Covered

UNIT-I 9

Introduction to traffic analysis, operation and control including traffic capacity analysis, components and characteristics traffic system, statistical application in traffic operation, Design of Intersections

UNIT-II 9

Basics of traffic signal design and phase timing, analysis and design of pre-timed and phase timing, traffic modelling including computer applications. Signal coordination for arterials and networks, Arterial analysis planning and Design,

UNIT-III 9

Analysis of unsignalized intersections, Design of parking facility, Highway Lighting, Traffic planning and administration studies and their uses, traffic flow characteristics.

UNIT-IV 9

Traffic control devices, intersections, traffic planning, Trip generation models, trip distribution models, modal split analysis. Advanced methods for travel demand forecasting.

Textbooks

1. Roess R.P., Prassas S.E, Mc- Shane W.R., Traffic Engineering, Prentice Hall, 2011.
2. Khanna K S., Justo C E G., Veeragavan A., Highway Engineering, Nem Chand & Bros, 2020.
3. Traffic Engineering by. L. R. Kadiyali Khanna publication, 2016.

Reference Books

1. Papacostas S C., Prevedouros D P., Transportation Engineering, PHI publishers, 2016.
2. Chakroborty P., Principles of Transportation Engineering, PHI publishers, 2020.

Skill-Based Courses to Qualify for UG Diploma (Engg.) in Civil Engineering

BCE-264	**INTRODUCTION TO REMOTE SENSING AND GIS**
Course Category	Minor
Contact hours/week	Lecture – 3; Tutorial – 0; Practical – 2
Number of credits	4
Course assessment methods	Continuous assessment through attendance, home assignments, quizzes, two minor practical exam and One Major Practical Examination

Course Objectives

1. To introduce the student to the physical principles of Remote Sensing and image interpretation as a tool for mapping.
2. To provide exposure to fundamental data models and data structures in GIS
3. To introduced principle of GPS, It's components, signal structure, and working procedure.

Course Outcomes

At the end of the course student will be able to:

1. Select the type of remote sensing data for mapping earth surface features
2. Identify the earth surface features from satellite images
3. Analyse the basic components of GIS
4. Classify the maps, coordinate systems and projections
5. Process spatial and attribute data and prepare thematic maps
6. Apply remote sensing & GIS techniques for natural resources evaluation

Topics Covered

Unit – I 9

Fundamentals of GIS: Information Systems, Modelling Real World Features Data, Data Models – Spatial and Non-spatial, Components, Data Collection and Input, Data Conversion, Metadata

Database Management: Database Structures, Files; Standard Data Formats, Compression Techniques, Hardware and Software.

Unit – II 9

Principles of Remote Sensing: Concept of remote sensing; principles of electromagnetic radiation; characteristics of remotely sensed data; remote sensing data interpretation and analysis

Geo-referencing: Place names; linear referencing systems; cadasters; measuring the earth latitude and longitude; projections and coordinates; measuring latitude, longitude and elevation using GPS; converting geo-references

Unit – III 9

GIS data collection: Primary geographic data capture; secondary geographic data capture; obtaining data from external sources; capturing attribute data.

Cartography and map production: maps and cartography; principles of map design; map series; applications

Unit – IV 9

Different map projections; spatial interpolation techniques; DEM and different types of resolutions; quality assessment of freely available DEMs; overlaying operations; buffer analysis; classification methods; errors in GIS; key elements of maps; limitations of GIS

List of Practical exercises for **Remote sensing and GIS** course

1. Introduction to GIS and QGIS- Downloading and installing QGIS, Introduction to QGIS interface and layers, and Plugin management in QGIS (e.g., OpenLayers, QuickMapServices)
2. Introduction to handheld GPS devices, Field data collection, Exporting GPS data to GIS, Coordinate systems overview, and UTM conversion using QGIS.
3. Remote Sensing Data: Introduction and Acquisition, Basics of remote sensing, Types of satellite data (Landsat, Sentinel, etc.) and downloading satellite data from: USGS Earth Explorer and Bhuvan Portal.
4. Data Conversion- Vector and raster data types, and Conversion between data formats.
5. To carry out image rectification and Geo-referencing using QGIS and geo-referenced layers
6. To create new vector layers, digitizing features (points, lines, and polygons), Using snapping and topology tools and Attribute data entry during digitization.
7. To editing attribute tables, using field calculator, Selection by location and attributes
8. To learn DEM elevation data, Downloading DEMs (SRTM), Slope, aspect, and hill shade generation, Contour extraction and watershed analysis.
9. To carry out raster data analysis, Raster calculator for map algebra, and Vegetation indices (NDVI).
10. Supervised classification using Semi-Automatic Classification Plugin (SCP).
11. Unsupervised classification using Semi-Automatic Classification Plugin (SCP).

Textbooks

1. Introduction to Remote Sensing, James B. Campbell & Randolph H. Wynne., The Guilford Press, 2011.
2. Introduction to the physics and techniques of Remote Sensing, Charles Elach& Jakob van Zyl., John Wiley & Sons publications, 2006.
3. Remote Sensing and Image Interpretation, Lillesand T.M & Kiefer R.W., John Wiely and Sons, 2015
4. Geographic Information systems and Science, Paul Longley., John Wiley & Sons, 4th Edition,2015.
5. Introduction to Geographic Information Systems, 9th Edition, Kang Tsung Chang., Tata Mc Graw Hill Publishing Company Ltd, New Delhi, 2018.

BCE:265	**Analysis and Design of Water Distribution Systems**
Course Category	Skill-based courses
Contact hours/week	Lecture – 3; Tutorial – 0; Practical – 2
Number of credits	4
Course assessment methods	Continuous assessment through attendance, home assignments, quizzes, two minor practical exam and One Major Practical Examination

Course Objective

To provide a thorough theoretical and practical knowledge in water distribution systems using which a student can solve real world problems concerning with design and analysis of pipe network distributions.

Course Outcomes

1. Develop water distribution systems with a thorough understanding of hydraulic principles and system components.

2. Perform calculations and solve problems commonly encountered in water distribution systems, such as volumes, flow rates, velocities, pressures, and chemical dosage
3. Evaluate existing systems to identify inefficiencies and implement effective solutions.
4. Apply industry-standard design standards to create efficient and reliable water distribution networks.
5. Use EPANET2 software to model, analyze, and optimize water distribution systems.
6. Design comprehensive water systems at the sub-division level, addressing both hydraulic and quality considerations.

Topics Covered

Unit – I 9

Introduction to pipe networks: Types of networks: serial, branching, and looped; parameters; labelling network elements: branching and looped networks; parameters interrelationships: pipe head loss relationship, node flow continuity relationship, loop head loss relationship; rules for solvability of pipe networks: rules proposed by Shamir and Howard; rules proposed by Goffman and Rodeh; rules proposed by Bhave; comparison of rules

Unit – II 9

Formulation of equations: states of parameters; basic unknown parameters; single source and multi-source networks with known pipe resistances: branching and looped networks; networks with unknown pipe resistances: branched and looped; inclusion of pumps: supply and booster; inclusion of check valves: in an external pipe, in an internal pipe, in several pipes; inclusion of pressure reducing valves

Unit – III 9

Hardy-Cross Method: Method of balancing heads; method of balancing flows; modified Hardy-Cross method; selection of initial values; convergence problems

Newton-Raphson Method: Basic concepts; head equations; loop equations; labelling network elements

Linear theory method: pipe discharge equations; nodal head equations; relationship between Newton-Raphson and linear theory method

Unit – IV 9

Dynamic Analysis: Iterative method; direct method. Node flow analysis: two node serial network; node classification; NFA theory. Calibration: data collection and preparation; calibration methods; practical considerations

Textbooks

1. Pramod R Bhave, Analysis of flow in water distribution networks, Technomic Publications, 2004.
2. Lewis A Rossman, EPANET 2 User Manual, 2000

List of Practical Experiments

1. Quick start tutorial
2. Preparing physical and non-physical components of network models
3. Understanding EPANET's workspace
4. Working with projects
5. Working with objects
6. Working with the map
7. Analyzing a network
8. Viewing results
9. Printing and copying
10. Importing and exporting files

BCE:266	**Geotechnical Exploration and Instrumentation**
Course category	Skill-based courses
Pre-requisite Subject	NIL
Contact hours/week	Lecture: 3, Tutorial: 0 , Practical: 2
Number of Credits	4
Course Assessment Methods	Continuous assessment through attendance, home assignments, quizzes, practical work, record, viva voce and One Minor test and One Major Theory Examination and Practical Examination
Course Objectives	The objectives of the course are as follows: 1. To Understand the types of soil and develop various applications of soil as a construction material for civil engineering structures. 2. To Evaluate the soil quality to understand the basic relationships between physical and mechanical properties of soils. 3. To understand the soil testing methods as the basic knowledge of classification and engineering properties of soil 4. To understand the different ground modification methods and the experimental methods for laboratory as well as field investigations.
Course Outcomes	After completion of this course the students to demonstrate following knowledge, skills and attitudes. 1. Comprehend the basics of site investigation methods and field tests and its extent for variety of structures including preliminary investigations. 2. Identify and suitable investigation method for soil exploration. 3. Illustrate different specialized exploration methods based on condition and requirement. 4. Appraise different codal provisions for field tests. 5. Basic knowledge about soil explorations and field investigations. 6. Learn to prepare soil investigation report.

Topics Covered

UNIT-I **9**

Interpretations and Codal Provisions: Soil profiling, interpretation of exploration data and report preparation, various standards for soil investigations. direct, semi-direct, and indirect methods of soil investigations, Purpose and Phases of Soil Investigation.

Report writing: Soil exploration Reports- identification, calculations and preparation.

UNIT-II **9**

Exploration Methods: Methods of Boring, Augering and Drilling. Machinery used for drilling, types of augers and their usage for various projects.

Soil Sampling: sampling methods, types of samples, storage of samples and their transport. Sample preparation, sample sizes, types of samplers specifications for soil testing. Trial pits, disturbed and undisturbed sampling

Detailed bore hole investigations: types of borings and types of samplers. Compaction: Standard and Modified Proctor compaction tests; field compaction; Proctor Needle Test. Consolidation test.

UNIT-III **9**

Geophysical Investigations: Introduction to geophysical methods, Seismic Refraction Test: Principles and applications, MASW (Multichannel Analysis of Surface Waves) and SASW (Spectral

Analysis of Surface Waves) methods, Electrical resistivity test: Principles, methods, and applications, Ground-penetrating radar (GPR) and magnetic surveys, Seismic Refraction methods.

UNIT-IV 9

Field Tests: Methods and specifications – visual identification tests, vane shear test, penetration tests, analysis of test results.

Field Instrumentation: Rollers, Pressure meters, Piezometer, Pressure cells, Sensors, Inclinometers, Strain gauges etc.

Plate load test, pile load test, SPT test, CPT test, flat dilatometer test, DCPT test, Vane shear test, pressure meter test, field CBR test, core cutter, sand replacement test.

List of Experiments

1. (i) Insitu Density by Core Cutter Method
   (ii) Insitu Density by Sand Replacement Method
2. Methods of Boring and Field Sampling
3. Standard Penetration Test (SPT)
4. Static Cone Penetration Test (SCPT)
5. Dynamic Cone Penetration Test (DCPT)
6. Plate Load Test
7. Pile Load Test
8. Vane Shear Test
9. Field CBR
10. Geophysical Exploration Methods

Textbooks

- Alam Singh – Modern Geotechnical Engineering, Asia Publishing House, New Delhi.
- Gopal Ranjan and A.S.R. Rao – Basic and Applied Soil Mechanics, New Age International (P) Ltd.
- B.C. Punamia – Soil Mechanics and Foundations, Laxmi Publications (P) Ltd.
- C. Venkataramaiah – Geotechnical Engineering, New Age International (P) Ltd., New Delhi.

Reference Books

- Schnaid, F. (2009) In Situ Testing in Geomechanics : The Main Tests. Taylor & Francis.
- J. E. Bowles, “Foundation Analysis and Design”, McGraw Hill Companies, 1997.
- M. D., Desai, “Ground Property Characterization from In-Situ Testing”, Published by IGS-Surat Chapter,2005.
- M. J., Hvorslev, “Sub-Surface Exploration and Sampling of Soils for Civil Engineering Purposes”, US Waterways Experiment Station, Vicksburg, 1949.
- Robert M. Koerner “Construction and Geotechnical methods in Foundation Engineering”, Mc.Graw-Hill Pub. Co., New York, 1985.
- Manfred R. Haussmann, “Engineering principles of ground modification”, Pearson Education Inc. New Delhi, 2008.
- F. G., Bell, “Engineering Treatment of Soils”, E& FN Spon, New York, 2006.
- P. Purushothama Raj, “Ground Improvement Techniques” Laxmi Publications (P) Limited, 2006.
- Jie Han et. al., “Advances in ground Improvement” Allied Pub., 2009.
- Hunt Roy E , Geotechnical Investigation Methods, A Field Guide for Geotechnical Engineers, Taylor & Francis Ltd.