University Institute of Technology

(UIT)

Silver Wood Estate, H. P. University, Shimla-171005

(NAAC Accredited "A-Grade" University)

DEPARTMENT
of
CIVIL ENGINEERING

Course Structure & Syllabus

for

Bachelor of Technology

in

Civil Engineering

Semester I to VIII
Effective for the Batch 2021-2025 and onwards

Also

Semester V-VIII
Effective for the Batch 2019-2023 and 2020-2024

SCHEME OF THE SYLLABUS

B. Tech. I-year (Civil Engineering)

Semester-I

Sr. No.	Course Code	Course Title	L	T	P	Credits	Semester End Marks	
							External Exam	Internal Assessment
1.	AS-1001	Applied Mathematics-I	3	1	0	**4**	100	50
2.	IT-1011	Introduction to C Language	3	1	0	**4**	100	50
3.	HU-1001	Communication & Professional Skill in English	3	0	0	**3**	100	50
4.	EE-1001	Basic Electrical Engineering	3	1	0	**4**	100	50
5.	IT-1002	C Programming Lab	0	0	2	**1**	50	50
6.	EE-1002	Basic Electrical Engineering Lab	0	0	2	**1**	50	50
7.	CE-1001	Civil Engineering Workshop	0	0	2	**2**	50	50
TOTAL						**19**	**550**	**350**
							Total Marks = 900	

Semester-II

Sr. No	Course Code	Course Title	L	T	P	Credits	Semester End Marks	
							External Exam	Internal Assessment
1.	AS-2001	Applied Mathematics-II	3	1	0	**4**	100	50
2.	AS-2002	Applied Physics	3	1	0	**4**	100	50
3.	EC-2001	Basic Electronics	3	1	0	**4**	100	50
4.	ME-2001	Basic Mechanical Engineering	3	1	0	**4**	100	50
5.	AS-2003	Applied Physics Lab	0	0	2	**1**	50	50
6.	ME-2002	Engineering Graphics & Design Lab	0	0	4	**2**	100	50
7.	EC-2002	Basic Electronics Lab	0	0	2	**1**	50	50
TOTAL						**20**	**600**	**350**
							Total = 950	

Semester-III

Course Code	Course Title	Hours /Week			Credits	Marks	
		L	T	P	C	Ext.	Int.
ES-3001	Engineering Mechanics	3	1	0	3	100	50
ES-3002	Numerical Methods	3	1	0	3	100	50
CE-3001	Fluid Mechanics	3	1	0	3	100	50
CE-3002	Structural Analysis-I	3	1	0	3	100	50
CE-3003	Surveying	3	1	0	3	100	50
CE-3004	Strength of Material	3	1	0	3	100	50
CE-3051	Surveying Lab	0	0	2	1	50	50
CE-3052	Fluid Mechanics Lab	0	0	2	1	50	50
CE-3053	Computer-aided Civil Engineering Tools- Lab	0	0	2	2	50	50
Total		**30**			**22**	**1200**	

Semester-IV

Course Code	Course Title	Hours /Week			Credits	Marks	
		L	T	P	C	Ext.	Int.
HSMC-4001	Organizational Behaviour	2	0	0	2	100	50
CE-4001	Structural Analysis-II	3	1	0	3	100	50
IT-4020	Python Programming	3	0	0	3	100	50
CE-4002	Hydrology	3	1	0	3	100	50
CE-4003	CPM & PERT	3	1	0	3	100	50
CE-4004	Building Materials and Construction	3	0	0	3	100	50
CE-4051	Structural Lab	0	0	2	1	50	50
MC- 4001	Environmental Science	2	0	0	2	100	50
Total		**25**			**20**	**1150**	

Semester-V

Course Code	Course Title	Hours/week			Credits	Marks	
CE-5001	Soil Mechanics	3	1	0	3	100	50
CE-5002	Design of Steel Structure	4	1	0	4	100	50
CE-5003	Transportation Engineering-I	3	1	0	3	100	50
CE-5004	Irrigation and Hydraulic Structures	3	1	0	3	100	50
CE-5051	Highway Engineering Lab	0	0	2	1	50	50
MT (IT)-301	MATLAB	3	0	0	3	100	50
CE-5052	Geotechnical Engineering Lab-I	0	0	2	1	50	50
Total		**24**			**18**	**950**	

Semester-VI

Course Code	Course Title	Hours /Week			Credits	Marks	
		L	**T**	**P**	**C**	Ext.	Int.
CE-6001	Geotechnical and Foundation Engineering	3	1	0	3	100	50
CE-6002	Design of RCC structure	4	1	0	4	100	50
CE-6003	Water Supply Engineering	3	1	0	3	100	50
CE-6004	Transportation Engineering-II	3	1	0	3	100	50
CE-6005	Estimation and Costing	3	1	0	3	100	50
CE-6006	Concrete Technology	3	0	0	3	100	50
CE-6051	Environmental Engineering Lab	0	0	2	1	50	50
CE-6052	Building Material Lab	0	0	2	1	50	50
CE-6053	Geotechnical Engineering Lab-II	0	0	2	1	50	50
Total		**30**			**22**	**1200**	

Semester-VII

Course Code	Course Title	Hours/ Week			Credits	Marks	
		L	T	P	C	Ext.	Int.
CE-7001	Sewage Treatment and Disposal	3	1	0	3	100	50
CE-7002	Minor Project	0	0	8	8	100	50
CE-70XX	Elective-I	3	0	0	3	100	50
CE-70XX	Elective-II	3	0	0	3	100	50
OEC-CE	Open Elective-I	3	0	0	3	100	50
CE-7003	Seminar	0	0	2	2	100	50
	Total	**23**			**22**	**900**	

Semester-VIII

Course Code	Course Title	Hours/ Week			Credits	Marks	
		L	T	P		Ext.	Int.
CE-8001	Major Project	0	0	8	8	100	50
CE-80XX	Elective-III	3	0	0	3	100	50
HSMC-8001	Principles of Engineering Economics and management	3	0	0	3	100	50
OEC-CE-XX	Open Elective-II	3	0	0	3	100	50
Total		**17**			**17**	**600**	

ELECTIVES 1	
CE-7011	Repair and Rehabilitation of structures
CE-7012	Ground Improvement Technique
CE-7013	Earth Retaining Structures
CE-7014	GIS and Remote Sensing
ELECTIVES 2	
CE-7021	Finite Element Method
CE-7022	Environmental management and Impact Assessment
CE-7023	Engineering Geology and Rock Mechanics
CE-7024	Open Channel Flow
ELECTIVES 3	
CE-8011	Bridge Engineering
CE-8012	Dam and Reservoir Design
CE-8013	Industrial Waste Treatment
CE-8014	Solid Waste Management

OPEN- ELECTIVES

Subject Code	Course Title
OEC-CE-01	Total Quality Management
OEC-CE-02	Indian Financial System
OEC-CE-03	Energy Assessment and Auditing
OEC-CE-04	Non-Conventional Energy Resources
OEC-CE-05	Applied fuzzy Electronic System
OEC-CE-06	Cyber Law and Ethics
OEC-CE-07	Artificial Intelligence and Machine Learning
OEC-CE-08	Artificial Neural Networks
OEC-CE-09	NCC Elective Course
OEC-CE-10	Open-Source Technologies
OEC-CE-11	Data Science

Semester - I

Name of the Course	**Applied Mathematics- I**		
Course Code	**AS-1001**	Credits-4	L-3, T-1, P-0
Total Lectures	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:

The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculator is allowed to use in examinations.

Course Objectives:

- To learn operations of matrices, echelon form of matrices and system of equations
- To introduce the concept of limits, continuity and maximum and minimum behaviour of functions.
- To compute curl, divergence of vector fields and definite integrals

Section	Course Content
Section-A	Review of Matrices, Eigen values, Eigen vectors, Properties of Eigen values, Eigen values of Hermitian, skew-Hermitian and unitary matrices, Cayley Hamilton Theorem, Rank of matrix, Normal and Echelon form of matrix, Solutions of Homogeneous and Non-Homogeneous system of equations.
Section-B	Limit and Continuity of functions of two variables, Partial Differentiation and its geometrical interpretation, Homogeneous functions, Euler's theorem, Jacobian, Taylor's and Maclaurin's infinite series, Maxima and minima of functions of two variables
Section-C	Double Integrals and Triple integrals (Cartesian and Polar Forms), Change of Order of Integration, Change of Variables, Applications of Double and Triple Integrals to find area and volume, Beta and Gamma functions
Section-D	Brief review of complex numbers, complex variable, concept of limit, continuity and derivatives of analytical function, Cauchy-Riemann equations, harmonic function, complex series, some elementary functions, logarithm. .

Course Outcomes:

CO1: Perform matrix operations of addition, multiplication and solve system of linear equations.

CO2: Learn about the basic principle of calculus.

CO3: Calculate directional derivatives, gradient of vectors and understand their geometrical significance.

Text Books:

1. Higher Engineering Mathematics: B.S. Grewal: Khanna Publishers.
2. Engineering Mathematics (2^{nd}Ed.): Vol-I & Vol-II, S. S. Shastri, Prentice Hall of India.

Reference Books:

1. Advanced Engineering Mathematics: E. Kreyszig, John Wiley & Sons.
2. Differential and Integral Calculus: N. Piskunov, CBS Publishers.
3. Advanced Engineering Mathematics: R. K. Jain & S. R. K. Iyengar, Narosa Publication House.
4. Advanced Engineering Mathematics: Michael D. Greenberg: Pearson Education.

Name of the Course	Introduction to C Language		
Course Code	**IT-1011**	**Credits-4**	**L-3, T-1, P-0**
Total Lectures	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:

The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculator is allowed to use in examinations.

Course Objectives:

- To introduce the concept of computer fundamentals and computer programming
- To enable the student to design algorithms
- To enable the students to understand "C" language and its application in problem solving.

Section	Course Content
Section-A	Problem solving with Computers: Algorithms, pseudo codes and Flowcharts. Overview of C Programming: Structure of C program, character set, keywords & identifiers, Data types, Constants, variables, expressions (arithmetic and logical), typedef, enum Operators: Arithmetic, relational, logical, bitwise, conditional and modulus operator, operator's precedence & associativity, pre-processors statements, data inputs and output functions, assignments statements.
Section-B	Conditional statements: If-else, nested if-else, switch case statement Control statements: for loop, while loop, do-while, nested loops, jump control statements: break, continue, goto, exit, return. Functions: Declaration of functions, definition of functions, calling of functions, call by value and call by reference
Section-C	Arrays: One dimensional arrays,–Declaration of 1D arrays –Initialization of 1D arrays –Accessing element of 1D arrays –Reading and displaying elements – Two dimensional arrays –Declaration of 2D arrays –Initialization of 2D arrays –Accessing element of 2D arrays –Reading and displaying elements. Storage classes, recursion. Strings versus character arrays:–Initializing strings, Reading strings, displaying string, String-handling functions.
Section-D	Pointer Concepts: Need of Pointers, Integer & Character pointers, array and functions, Array & pointers, function & pointers, Parameter passing by reference.

	Structure & Union: Definition of Structure & union, Structure & Pointers, Nesting of Structures, Structure and arrays, Arrays of pointer to structures. Files Concepts in C: Using files in C, Buffer and streams, working with text files and Binary Files, file operations using standard library and system calls, File management I/O functions, Random Access Files Reading, Writing text and binary files.

Course Outcomes:

CO1: Know the basic components of the computer and working of each device.
CO2: Design algorithms and flowcharts.
CO3: Understand the fundamentals of C programming.
CO4: Use suitable data structure for problem solving.

Text Books:

1. Kanetkar, "Let us C", BPB Publications
2. E. Balaguruswamy, "Programming in C", Tata McGraw Hill

Reference Books:

1. V Rajaraman "Fundamentals of Computers"
2. D.Dromey, "How to Solve it by Computers" (Prentice Hall)
3. Richie and Kerningham, "C Programming"

Name of the Course	**Communication & Professional Skills in English**		
Course Code	**HU-1001**	Credits-3	L-3, T-1, P-0
Total Lectures	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:

The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculator is allowed to use in examinations.

Course Objectives:

- To develop independent perspective through critical thinking.
- To communicate their perspective in clear and correctly articulated language through LSRW skills.
- To instil a lifelong habit of language learning.

Section	Course Content
Section-A	**Reading Skills:** The skill of effective reading – eye movements, fixations, regression and visual wandering, the right approach to reading; Factors affecting the style of reading – reader, related material related and environmental; Memory, retention, association of reading material. **Kinds of Reading:** Introduction to phonetics – familiarization with speech sounds and their symbols– articulation of speech sounds – stress and intonation. **Grammar:** Word building use of punctuation marks, articles, tenses, abbreviations, prepositions, idioms & phrases, transformation of sentences, incorrect to correct English, single word for a group of words.
Section-B	**Writing Skills:** Business letters: principles, structure and style of writing business i.e., sales letters, claim and adjustment letters, inviting quotations/tenders, writing a memo, job application letters, preparing a personal resume; Effective Meetings: Qualities i.e. planning, processing the discussion, conducting a meeting, use of different type of questions, summaries, handling problem situations and problem people, writing notices, agenda and minutes of meetings; Report writing: Characteristics, types of reports, structure of technical/research reports, preparatory steps to report writing; Elements of style: Definition of style, characteristics of a good technical style – practical hints to improve the style of writing; précis writing; Comprehension of passages.

Section-C	**Listening Skills:** Barriers to listening, effective listening and feedback skills, Telephone techniques. Considerations of listening and voice, developing telephone skills – preparing for the call, controlling the call, follow up action. Handling difficult calls and difficult callers.
Section-D	**Speaking And Discussion Skills:** Effective speaking: Preparation i.e., deciding the objective, preparing the environments, organizing the material selection of words, voice modulation, speed, expression, body language, dealing with questions, dealing with nervousness, presentation of audio-visual aids; Group Discussions: The art of participating in group discussion i.e., initiative, cooperation with group members, analysis of the issue, putting one's views effectively, establishing leadership. Assignments / Seminars / discussions may be given for following skill development. a) Word processing a (b) Report writing c) Preparing agenda for (d) Preparing minutes of the e) Press Releases (f) Preparing a Brochure g) Advertisements (h) Preparing a power point slide

Course Outcomes:

CO1. Identify the importance of Communication Skills.
CO2: Apply Critical Thinking to what they read, listen to and observe.
CO3: Apply principles of effective LSRW skills in professional & Social Communication.
CO4: Assess the verbal and non-verbal messages effectively.

Text Books:

1	An Approach to Communication Skills	: I. Bhatacharya	:Dhanpat Rai & Co.
2	Business Correspondence and Report writing	: R.C.Sharma & Krishna Mohan	:Tata McGraw Hill
3	Business Communication	: K.K.Sinha	: Galgotia Publishing

Name of the Course	**Basic Electrical Engineering**		
Course Code	**EE-1001**	Credits-3	L-3, T-1, P-0
Total Lectures	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:

The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non- programmable calculators is allowed.

Course Objectives:

- To impart knowledge about the electrical quantities and to understand the impact of electricity in a global and societal context.
- To introduce the fundamental concepts relevant to DC and AC circuits and network theorems.
- Highlight the importance of electromagnetism and transformers in transmission and distribution of electric power.
- To explain the working principle, construction, applications of DC machines, AC machines & measuring instruments.

Section	Course Content
Section-A	**D.C. circuits**: V- I characteristics of ideal voltage and ideal current sources, various types of controlled sources, passive circuit components, V-I characteristics and ratings of different types of R, L, C elements. Ohm's law, Kirchoff's Laws, delta-star transformation, Nodal and Mesh analysis, Thevenin's, Norton's, superposition theorem, Maximum power transfer theorem, Reciprocity, Compensation, Millman and Tellegan's Theorem.
Section-B	**A.C. Circuits,** Sinusoidal signal, instantaneous and peak values, RMS and average values, phase angle, polar and rectangular, exponential and trigonometric representations RL and C components, Concept of complex power, power factor. Series and Parallel A.C. circuit, Series and Parallel resonance. Q factor, cut off frequency and bandwidth. **Three Phase Circuits**: Phase and line voltages and currents, balanced star and delta circuits, power equation, measurement of power by 2-wattmeter method.
Section-C	**Magnetic Circuits:** Amperes circuital law, B-H curve, concept of reluctance, flux and mmf, analogies between electrical and magnetic quantities, solution of magnetic circuits, hysteresis and eddy current losses, mutual inductance and dot convention.

Section-D	**Electromagnetic Theory of Electric Machines: Electrical Machines:** Basic concepts including principle, construction and working of transformers and D.C. Machines.

Course Outcomes:

Upon successful completion of the course, the students will be able to:

CO1: Identify and predict the behaviour of any electrical and magnetic circuit.

CO2: Formulate and solve complex AC and DC circuits.

CO3: Realize the requirement of transformers in transmission and distribution of electric power and other applications.

CO4: Identify the type of electrical machines used for that particular application.

Text Books and Reference Books:

1. Fundamental of Electric Circuits by Charles K Alexander and Matthew N. O. Sadiku, MH Publication.
2. Electrical Engineering Fundamentals by Vincent Del Toro, PHI Publication.
3. Basic Electrical Engineering by V N Mittal & Arvind Mittal, TMH Publication.
4. Basic Electrical Technology by A.E. Fitzgerald, McGraw Hill Publication.
5. Electrical Estimating and Costing by N Alagappan and B Ekambaram, TMH Publication

Name of the Course	**C Programming Lab.**		
Course Code	**IT -1002**	Credits-1	L-0, T-0, P-2
Total Practical Sessions	15 (2 Hr Each)		
Semester End Examination	Max Marks: 50	Min. Pass Marks: 20	Max. Time: 3 Hrs.
Internal Assessment: (based on Continuous Lab Work Assessment: 20%, Experiment Performance: 30%, Attendance 10%, Viva: 40%)			Max Marks: 50 Min. Pass Marks: 25

List of Experiments

Sr. No.	Name of the Experiment
1	Write a program to find the largest of three numbers (if-then-else).
2	Write a program to find the largest number out of ten numbers (for statement).
3	Write a program to find the average male height & average female heights in the class (input is in form of sex code, height).
4	Write a program to find roots of quadratic equation using functions and switch statement.
5	Write a program using arrays to find the largest and second largest no.
6	Write a program to multiply two matrices.
7	Write a program to read a string and write it in reverse order
8	Write a program to concatenate two strings.
9	Write a program to sort numbers using the Quick sort Algorithm. Represent a deck of playing cards using arrays.
10	Write a program to compute the Fibonacci series.
11	Write a program to find weather the number is palindrome or not.

Course Outcomes:

CO1: Identify and abstract the programming task involved for a given problem.
CO2: Design and develop modular programming skills.
CO3: Trace and debug a program.

Text Books:

1. Let us C: Yashwant Kanetkar: BPB Publication
2. Programming in C: E. Balaguruswamy: Tata McGraw Hill

Name of the Course	**Basic Electrical Engineering Lab**		
Course Code	**EE – 1002**	Credits-1	L-0, T-0, P-2
Total Practical Sessions	15 (2 Hr Each)		
Semester End Examination	Max Marks: 50	Min. Pass Marks: 20	Max. Time: 3 Hrs.
Internal Assessment: (based on Continuous Lab Work Assessment: 20%, Experiment Performance: 30%, Attendance 10%, Viva: 40%)			Max Marks: 50 Min. Pass Marks: 25

List of Experiments

Sr. No.	Name of the Experiment
1	To verify KCL and KVL.
2	To study frequency response of series RLC circuit and determine resonance frequency and power factor for various values of R,L,C.
3	To study frequency response of parallel RLC circuit and determine resonance frequency and Q factor for various values of R,L,C
4	To perform direct load test of transformer and plot efficiency v/s load characteristics.
5	To perform direct load test of the DC shunt generator and plot load v/s current curve
6	To study and verify Thevenins, Norton's, superposition, Milliman's, maximum power, reciprocity theorems.
7	To perform O.C and S.C test of transformer.
8	To study various types of meters.
9	Measurement of power by 3 voltmeter/ 3 ammeter method.
10	Measurement of power in 3-phase system by 2-wattmeter method.

Course Outcomes:

CO1: Verify fundamental laws like Ohm's Law, KCL, KVL, etc.

CO2: Use different meters and instruments for the measurement of common electrical quantities

CO3: Understand the importance of various theorems and transformer tests

Text Books:

1. Experiment in Basic Electrical Engineering: S. K. Bhattachrya & K. M. Rastogi: New Age International Pub.
2. Experiment and Viva – Voce on Electrical Machines: V. N. Mittal & A. Mittal: Standard Publishers.

Name of the Course	**Civil Engineering Workshop**		
Course Code	**CE-1001**	Credits-2	L-0, T-0, P-2
Total Practical Sessions	15 (2 Hr Each)		
Semester End Examination	Max Marks: 50	Min. Pass Marks: 20	Max. Time: 3 Hrs.
Internal Assessment: (based on Continuous Lab Work Assessment: 20%, Experiment Performance: 30%, Attendance 10%, Viva: 40%)			Max Marks: 50 Min. Pass Marks: 25

Sr. No.	Name of the Experiment
	List of Experiments (Fitting)
1	To make a square piece of mild steel.
2	To make V-matching joint of mild steel..
3	To make a V-notch.
	List of Experiments (Machine)
1	Facing and turning on mild steel rod on Lathe Machine
2	To make a groove on lathe machine.
3	Taper turning operation on Lathe Machine
	List of Experiments (Carpentry and Pattern making)
1	To make the 'T' lap joint.
2	To make 'T' Dove-tail joint.
3	To make Mortise & Tennon joint.
	List of Experiments (Welding)
1	To make a lap joint.
2	To make a T joint
3	To make a V-butt joint.
	List of Experiments (Smithy and Forging)
1	To make a ring of mild steel by cold forging process
2	To make S-hook by hot forging process
3	To make chisel by hot forging process.
	List of Experiments (Foundry)
1	Make a single piece pattern mould
2	To make spilt pattern mould
3	To make mould and core and assemble it
	List of Experiments (Electrical and Electronics)
1	Introduction to electric wiring
2	Exercises preparation of PCBs, involving soldering of electrical & electronic application.

Course Outcomes:

CO1: Learn the basics of metal machining, welding, fitting, forging, carpentry and foundry related operations.

CO2: Apply basic concepts related to plumbing, building materials and construction.

CO3: Execute the basic house hold wiring, electrical circuits and basic electronics appliances

CO4: Identify and understand the functioning of common electrical appliances and their safe handling.

CO5: Develop the skill for soldering and de-soldering of electronic circuits.

Text Books:

1. Workshop Technology: S. K. Garg: Luxmi Publication.
2. A Course in Workshop Technology Vol. 1: B. S. Raghuwanshi: Dhanpat Rai & Comp.

Semester - II

Name of the Course	**Applied Mathematics – II**		
Course Code	**AS – 2001**	**Credits-4**	**L-3, T-1, P-0**
Total Lectures	**52 (1 Hr Each) (L = 39, T = 13 for each semester)**		
Semester End Examination	**Max Marks: 100**	**Min. Pass Marks: 40**	**Max. Time: 3 Hrs.**
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			**Max Marks: 50**

Instructions

For Paper Setters:

The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non- programmable calculators is allowed.

Course Objectives:

- To explain the basics of linear algebra including matrix theory, system of linear equations, eigenvalues and eigenvectors.
- To elaborate the basic concepts of complex algebra and analysis for applications in engineering subjects.
- To demonstrate the basics of numerical methods for different kind of interpolations; finding roots of algebraic and transcendental equations etc.
- To demonstrate the basics of numerical differentiation and integrations and their applications.
- To display the theories of Laplace, Fourier transformations and their applications in differential equations.
- To impart competence to the students for solving problems of the standards pertaining to standards of the various national level competitive examinations like GATE, UPSC, PSUs etc.

Section	Course Content
Section-A	**Vector Calculus**: Tangent, curvature and torsion, Directional derivative, Gradient of a scalar field, divergence and curl of a vector field. Line, surface and volume integrals, theorem of gauss and Stoke's (proofs not needed).
Section-B	**Integral Transforms**: Fourier series, Euler's formula, even and odd functions, half range expansions. Fourier and Laplace transform, Inverse transform of derivatives and integrals, shifting theorem, application to periodic functions, unit step function.
Section-C	**Second order Differential Equations**: Solution by: Power series method and its basis, Solution of Bessel and Legendre differential equations, properties of Bessel and Legendre functions.

Section-D	**Partial Differential Equations (PDE)**: Formulation and classification. Solution of wave equation heat equation in one dimension and Laplace equation in two dimensions by the method of separation of variables.

Course Outcomes:

CO1: Gain the knowledge to develop the concepts of surface Z= f (x, y) its partial derivatives, Euler Theorem & modified Euler Theorem for homogenous function & deduction develops ability to solve problems related to partial derivatives.

CO2: Learn to expand any functions of two variables in the ascending power of variables and also develops error and approximation, extremum value of a given function related to engineering application.

CO3: Develops the ability to solve higher order & first degree linear non homogenous differential equation arising in various branch of engineering and related mathematical model develops arising to form mathematical modelling of Real-World Problem with its physical interpretation.

CO4: Solve some differential equation which is not solvable in ordinary case but its series solution gives an idea of developing special function which has important role in some physical phenomena arising in engineering problems.

Text Books:

1. Higher Engineering Mathematics: B. S. Grewal: Khanna Publishers.
2. Advanced Engineering, Mathematics: R. K. Jain and. S. R. K Iyengar: Narosa Publishing House.

Reference Books:

1. Advanced Engineering Mathematics: E. Kreyszig: John Wiley & Sons (Asia) Pvt. Ltd.
2. Engineering Mathematics (2nd edition):S. S. Shastri: Prentice Hall of India Pvt. Ltd. Vol-I and Vol-II.
3. Differential and Integral Calculus: N. Piskunov: CBS Publishers and Distributors.
4. Advanced Engineering Mathematics: Michael D Greenberg: Pearson Education Asia.

Name of the Course	**Applied Physics**		
Course Code	**AS – 2002**	Credits-4	L-3, T-1, P-0
Total Lectures	**52 (1 Hr Each) (L = 39, T = 13 for each semester)**		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:

The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculator is allowed.

Course Objectives:

- To develop understanding of Quantum Mechanics and its applications.
- To understand various free electron gas models.
- To know the fundamental concept of theory of relativity and Electromagnetic waves.
- To understand principle and design of various Laser systems, optical fiber and their applications in upcoming technologies like photonics.

Section	Course Content
Section-A	**Optics:** Methods of interference-division of wave front, division of amplitude, interference through thin films (qualitative only), Newton rings. Diffraction of light, diffraction through single slit, double slit and diffraction grating. **Theory of Relativity:** Galilean transformations. Postulates of Einstein's special theory of relativity, Lorentz transformations. Length contraction, time dilation, Variation of mass with velocity, mass-energy equivalence. **Electromagnetic Wave Theory:** Maxwell's equations and their significance, Electromagnetic waves, Poynting vector, Electromagnetic wave equation.
Section-B	**Quantum Mechanics:** Introduction to quantum mechanics, concept of de Broglie Waves, Davisson-Germer experiment, wave packet, Phase and Group Velocities (qualitative only), wave function and its properties, operators in quantum mechanics, expectation values, eigen values and eigen functions. Postulates of quantum mechanics, time dependent and time independent Schrodinger wave equation, Application: Particle in a box, Tunnel Effect.

Section-C	**Band Theory of Solids**: Free electron theory: Quantum theory of free electrons, Fermi Dirac distribution function and its variation with temperature. Periodic potential and Bloch theorem, Kronig Penney Model (qualitative), E-K diagrams, Brillouin Zones. **Superconductivity:** Superconductivity, effect of magnetic field, Meissner effect, types of superconductors, BCS theory (qualitative only), Josephson effect, applications of superconductivity.
Section-D	**LASER**: Spontaneous and stimulated emission, LASER action schemes, characteristics of LASER beam, ruby LASER, He-Ne LASER, semiconductor LASER (simple Ideas), applications of LASERs. **Fibre Optics**: Principle, structure, acceptance angle and acceptance cone, numerical aperture, single mode and multi-mode fibres, step index and graded index fibres, optical fibre communications, losses in optical fibres.

Course Outcomes:

After successful completion of this course, students will be able to:

CO1: understand new methods of interference and diffraction.
CO2: understand the fundamentals of relativistic mechanics, Maxwell's equations and their relevance in the modern technology and the concept of electromagnetic waves.
CO3: explain fundamentals of quantum mechanics and its applications in microscopic systems.
CO4: understand the various models of free electron theories and basics of superconductivity.
CO5: understand various laser systems and theory of fiber optics.

Text Books:

1. Modern Engineering Physics: A. S. Vasudeva: S. Chand Publications.
2. A text book of Engineering Physics: M. B. Avadhanulu, P. G. Kshirsagar: S. Chand Publications.

Reference Books:

1.	Solid state Physics	: Gupta & Saxena	: Pragati Publications
2.	Concepts of Modern Physics	: Arthur Beiser	: Tata McGraw Hill
3.	Modern Engineering Physics	: Bhattacharya Tando	: Oxford
4.	Modern Engineering Physics	: Sharma & Sharma	: Pearson

Name of the Course	**Basic Electronics**		
Course Code	**EC– 2001**	Credits-4	L-3, T-1, P-0
Total Lectures	52 (1 Hr Each) (L = 39, T = 13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:

The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non- programmable calculators is allowed.

Course Objectives:

- To understand operation of semiconductor devices.
- To understand DC analysis and AC models of semiconductor devices.
- To apply concepts for the design of Regulators and Amplifiers
- To verify the theoretical concepts through laboratory and simulation experiments.
- To implement mini projects based on concept of electronics circuit concepts.

Section	Course Content
Section-A	Brief review of Band Theory, transport phenomenon in semiconductors, Electrons and holes in Intrinsic semiconductor, Donor and acceptor Impurities, charge densities in semiconductor. PN Junction, Reverse and Forward bias conditions, Diode Characteristic and parameter, Ideal vs. Practical diode. Equivalent circuits and frequency response. Rectification-half and full wave, Zener and Avalanche diode, its role as regulator, photodiode.
Section-B	Bipolar junction transistor (BJT) and their characteristics as circuit and gain elements. Two port network analysis, h-parameters and trans-conductance. Equivalent circuits for JFET and MOSFET, enhancement mode and depletion mode MOSFETS. Uni-junction transistor (UJT), UJT characteristics, parameters and circuit operation.
Section-C	Bias for transistor amplifier: fixed bias, emitter feedback bias. Feedback principles. Types of feedback, Stabilization of gain, reduction of non-linear distortion, change of inputs and output resistance by negative feedback in amplifier. Amplifiers coupling, types of coupling, Amplifier pass band, Eq circuits for BJT at high frequency response of CE, RC-Coupled amplifiers at mid, low and high frequencies.
Section-D	Semiconductor processing, active and passive elements, Integrated circuits, bias for integrated circuits. Basic operational amplifier, applications of operational amplifier – adder, subtractor, Integrator, differentiator and comparator, Photo transistor: its characteristics and applications.

Course Outcomes:

CO1: Understand the current voltage characteristics of semiconductor devices.
CO2: Analyse dc circuits and relate ac models of semiconductor devices with their physical Operation.
CO3: Design and analyse of electronic circuits.
CO4: Evaluate frequency response to understand behaviour of Electronics circuits.

Reference Books: -

1	Electronic Principles	: A. P. Malvino	: TMH
2	Electronic Fundamentals and Applications: J. D. Ryder		: PHI
3	Electronic Circuits & Devices : J. Millman and C. C. Halkias		: TMH
4	Integrated Circuits & Devices: J. Millman & C. C. Halkias		: TMH
5	Basic Electronic & Linear Circuits: N. N. Bhargava & Kulshrestha		: TMH

Name of the Course	**Basic Mechanical Engineering**		
Course Code	**ME– 2001**	Credits-4	L-4, T-1, P-0
Total Lectures	52 (1 Hr Each) (L = 39, T = 13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:

The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non- programmable calculators is allowed.

Course Objectives:

- To understand the concept of stress and strain, Pure Bending and Torsion.
- To understand the concept of shear force and bending moments of beams and analysis of trusses.

Section	Course Content
Section-A	**Simple Stresses & Strains:** Concept & types of Stresses and strains, Poisson's ratio, stresses and strain in simple and compound bars under axial loading, stress strain diagrams, Hooks law, Elastic constants and their relationships., Numerical problems.
Section-B	**Automobile engineering-** components, basic structure (frame, axels, suspension, wheel-overview), transmission system (layout & brief description).
Section-C	**Shear Force and Bending Moments:** Definitions, SF & BM diagrams for cantilevers, simply supported beams with or without over-hang and calculation of maximum BM and SF and the point of contraflexure under (i) concentrated loads, (ii) uniformly distributed loads over whole span or a part of it, (iii) combination of concentrated loads and uniformly distributed loads. Numerical Problems.
Section-D	**Bending Stresses in Beams:** Bending Stresses, neutral axis, moment of area, section modulus, bending equation and its application to beams of circular, rectangular I & T Section, flexural strength, Composite beams, Torsions.

Course Outcomes:

Upon successful completion of the course, the students will be able to:

CO1: Understand the basics of elasticity and elastic constants.

CO2: Understand the basics of automobiles.

CO3: Determine the shear force, Bending moment of beams and analyse the trusses and solve related numerical problems.

CO4: Determine the stresses in beam for pure bending and effect of torsion in shafts.

Text Books: -

1. Strength of Material: R. S. Khurmi: S. Chand Publications.
2. Thermal Science and Engineering: Yadav, R: Central Publishing House, Allahabad.
3. Strength of Materials: G. H. Ryder: Macmillan India Third Edition in S I units 1969.
4. Mechanics of Materials: Dr. Kirpal Singh: Standard Publishers Distributors, New Delhi.

Name of the Course	**Applied Physics Lab**		
Course Code	**AS-2003**	Credits-1	L-0, T-0, P-2
Total Practical Sessions	15 (2 Hr Each)		
Semester End Examination	Max Marks: 50	Min. Pass Marks: 20	Max. Time: 3 Hrs.
Internal Assessment: (based on Continuous Lab Work Assessment: 20%, Experiment Performance: 30%, Attendance 10%, Viva: 40%)			Max Marks: 50 Min. Pass Marks: 25

List of Experiments

Sr. No.	Name of the Experiment
1	To find the wavelength of sodium light by Newton's rings experiment.
2	To find the wavelength of sodium light by Fresnel's bi-prism experiment
3	To find the wavelength of various colours of white light using plane transmission diffraction rating.
4	To find the wavelength of sodium light by Michelson interferometer
5	To find the refractive index and Cauchy's constant of a prism by using spectrometer
6	To find the resolving power of a telescope
7	To study the beam parameters of a helium-neon laser
8	To find flashing & quenching potentials of argon & hence to find the capacitance of unknown capacitor.
9	To find the value of high resistance by Substitution method
10	To convert a galvanometer into an ammeter of a given range
11	To study the variation of magnetic field with distance for Stewart and Gee's apparatus
12	To find the reduction factor of two turn coil tangent galvanometer using copper voltammeter
13	To find the value of e/m for electrons by Helical method.
14	To determine the charge of an electron by Millikan's oil drop method
15	To find the value of Planck's constant by using a photoelectric cell
16	To calculate the hysteresis loss by tracing a B-H curve for a given sample
17	To determine the band gap of an intrinsic semiconductor by four probe method
18	To determine the resistivity of a semi-conductor by four probe method at different temperatures
19	To determine the Hall co-efficient
20	To study the photovoltaic cell & hence to verify the inverse square law

Course Outcomes:

CO1: After performing the experiments related to optics, students shall be able to visualise fringe patterns and use them in determination of wavelength of light used.

CO2: Students shall be able to perform experiments based on electricity and magnetism.

CO3: Students shall be able to determine various properties of semiconducting materials.

CO4: Students shall be able to perform experiments based on bridges to determine the characteristic values of various circuit components.

Text Books:

1. Practical Physics: S. L. Gupta & V. Kumar: PRAGATI Publications.
2. Practical Physics for B.Sc. I, II and III: S. L. Arora: S. Chand Publications.

Name of the Course	Engineering Graphics and Design Lab		
Course Code	**ME-2002**	Credits-2	L-0, T-0, P-2
Total Practical Sessions	15 (2 Hr Each)		
Semester End Examination	Max Marks: 50	Min. Pass Marks: 20	Max. Time: 3 Hrs.
Internal Assessment: (based on Continuous Lab Work Assessment: 20%, Experiment Performance: 30%, Attendance 10%, Viva: 40%)			Max Marks: 50 Min. Pass Marks: 25

List of Experiments

Sr. No.	Name of the Experiment
1	Drawing Techniques: Various type of lines, principal of dimensioning, size & location as per IS code of practice (SP-46) for general engineering drawing. Practice of drawing, various types of lines & dimensioning exercises. Drawing exercises pertaining to symbols. Conventions & Exercise of lettering techniques. Free hand printing of letters & numerals in 3, 5, 8 & 12-mm sizes, vertical & inclined at 75^{o}. Instrumental lettering in single stroke. Linear Scale, Diagonal scale & vernier scale. Projection of Points, Lines and Planes: Concept of horizontal and vertical planes. First and third angle projections: projections of point & lines, true length of lines and their horizontal & vertical traces, projection of planes & their traces.
2	Projections of Solids: Right regular solids of revolution & polyhedrons etc. and their auxiliary views. Sectioning of Solids: Principal of sanctioning, types of sanctioning & their practice on projection of solids.
3	Practice In: Orthographic projections of individual blocks/ parts. Isometric Projection: Concept of isometric views: isometric scale and exercise on isometric views.
4	Development of Surfaces: Development of surfaces of cylinders, cones, pyramid, prism etc. exercises involving development of unique surfaces like Y-piece, hopper, tray, truncated pieces etc. Intersection of Surfaces: Intersection of cylinders, cones & prisms with their axes being vertical, horizontal or inclines. Exercise on intersection of solids-cylinder & cylinder, cylinder & cone, prism & prism.

Course Outcomes:

CO1: Student's ability to hand letter will improve.
CO2: Student's ability to perform basic sketching techniques will improve
CO3: Students will be able to draw orthographic projections and sections
CO4: Student's ability to use architectural and engineering scales will increase

Text Books:

1. Elementary Engineering Drawing: N. D. Bhatt: Charotar Pub. House.
2. Engineering Drawing & Engg. Graphics. P. S. Gill: S. K. Kataria & sons
3. Engineering Graphics: L.V. Lakshminarayan & R. S. Vaish
4. Engineering Drawing Plane and Solid Geometry: N. D. Bhatt V. M. Panchal: Charotar Pub. House, 2002.

Reference Books:

1. Engineering Graphics with AutoCAD 2002: James D. Bethune: Pearson Education
2. Engineering Graphics and Drawing: P. S. Gill: S. K. Kataria.
3. Engineering Graphics using AUTOCAD 2000: T. Jeyapoovan: Vikas Publishing House.
4. Engineering Drawing and Graphics + AutoCAD 4th Edition: K. Venugopal: NewAge International
5. Engg. Drawing: Harwinder Singh: Dhanpat Rai Publications.
6. Engg. Drawing: R. K. Dhawan : S. Chand Publications.

Name of the Course	**Basic Electronics Lab**		
Course Code	**EC-2002**	Credits-1	L-0, T-0, P-2
Total Practical Sessions	15 (2 Hr Each)		
Semester End Examination	Max Marks: 50	Min. Pass Marks: 20	Max. Time: 3 Hrs.
Internal Assessment: (based on Continuous Lab Work Assessment: 20%, Experiment Performance: 30%, Attendance 10%, Viva: 40%)			Max Marks: 50 Min. Pass Marks: 25

List of Experiments

Sr. No.	Name of the Experiment
1	To study the use and scope of using an oscilloscope as a measuring device in an electronic laboratory
2	To study the use and scope of using a millimetre (digital and analog) as a measuring device in an electronics laboratory
3	To study the use and scope of function generator as a signal source in an electronics laboratory.
4	Draw forward bias and reverse bias characteristics of a p-n junction diode and use it as a half wave and full wave rectifier
5	Draw the characteristics of a zener diode and use it as a voltage regulator
6	Draw characteristics of common base configuration of p-n-p transistor
7	Draw characteristics of common emitter configuration of an npn transistor
8	Draw characteristics of common drain configuration of a MOSFET
9	Find the voltage and current gain of single stage common emitter amplifier.
10	Draw the characteristics curve of UJT.
11	Find the voltage gain of single stage voltage series feedback amplifier
12	Use operational amplifier as: a) Inverting amplifier , b) Non-inverting amplifier, c) Comparator, d) Integrator e) Differentiator, f) Adder, g) Precision amplifier

Course Outcomes:

CO1: To study basics of semiconductor & devices and their applications in different areas

CO2: To study different biasing techniques to operate transistor, FET, MOSFET and operational amplifier in different modes.

CO3: Analyse output in different operating modes of different semiconductor devices

Text Books:

1. Basic Electronic & Linear Circuits : N. N. Bhargava & Kulshrestha: TMH
2. Electronic Devices & Circuit Theory: Robert L. Boylestad, Louis Nashelsky: Pearson Edu.

Semester-III

Name of the Course	Engineering Mechanics		
Course Code	ES – 3001	Credits-3	L-2, T-1, P-0
Total Lectures	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:

The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculator is allowed to use in examinations.

Course Objectives:

- Learn to beams under different loading conditions and to find out the shear force and bending moment diagram
- Learn to find the centroid and moment of inertia of different types of cross sections.
- Learn to calculate the types of motion applied to a body and its characteristics.
- To prepare the students for higher level courses such as courses in Mechanics of Solids, Mechanical Design and Structural Analysis.

Section	Course Content
Section-A	Introduction to Engineering Mechanics covering: Force Systems Basic concepts, Particle equilibriumin 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems, Types of supports.
Section-B	Friction covering: Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack.
Section-C	Centroid and Moment of Inertia: Centroid of plane, curve, area, volume and composite bodies, Moment of inertia of plane area, Parallel Axes Theorem, Perpendicular axes theorems, Principal Moment Inertia, Mass Moment of Inertia of Circular Ring, Cylinder, Sphere and Cone about their Axis of Symmetry Virtual Work Method: Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies.
Section-D	Kinematics of Rigid body: Introduction, Basic terms, general principles in dynamics; Types of motion; Linear motion Relative Velocity; Problems. Kinetics of Rigid Bodies: D'Alembert's principle and its applications in plane motion and connected bodies; Work energy principle and its application in plane motion of connected bodies; Impulse and Momentum, Problems.

Course Outcomes:

CO1: Use scalar and vector analytical techniques for analyzing forces in statically determinate structures.
CO2: Apply fundamental concepts of kinematics and kinetics of particles to the analysis of simple, practical problems.
CO3: Apply basic knowledge of mathematics and physics to solve real-world problems
CO4: Determine the resultant force and moment for a given system of forces; Determine the centroid and second moment of area.

Text Books:

1. S.S Bhavikatti, Engineering Mechanics, 5th Edition, New Age International Publishers.
2. Khurmi R. S. (2010), Engineering Mechanics, S. Chand & Co.
3. Irving H. Shames (2006), Engineering Mechanics, 4th Edition, Prentice Hall.
4. Hibler and Gupta (2010), Engineering Mechanics (Statics, Dynamics) by Pearson Education.
5. Tayal A. K. (2010), Engineering Mechanics, Umesh Publications.

Reference Books:

1. R. C. Hibbler (2006), Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press.
2. Andy Ruina & Rudra Pratap (2011), Introduction to Statics and Dynamics, Oxford University Press.
3. Shanes and Rao (2006), Engineering Mechanics, Pearson Education.

Name of the Course	Numerical Methods		
Course Code	**ES – 3002**	Credits-3	L-2, T-1, P-0
Total Lectures	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time:3Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:
The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:
Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculator is allowed to use in examinations.

Course Objectives:
- To introduce the field of numerical analysis.
- To introduce numerical methods for finding roots of algebraic and transcendental equations.
- To introduce numerical methods for solving interpolation problems.

Section	Course Content
Section-A	Solution of algebraic and transcendental equations: Bisection method, Method of false position, Secant method, Iteration method Newton-Raphson method. Solution of Simultaneous Algebraic Equations: Gauss elimination method, Jacobi's method, Gauss-Seidal method.
Section-B	Finite Differences & Interpolation: Forward and Backward difference operators, Newton's Forward and Backward interpolation formulae, Central Difference Interpolation formulae, Gauss's forward and Backward Interpolation formulae, Lagrange's interpolation formulae and Newton's Divided Difference formulae.
Section-C	Numerical Methods to Solve Differential Equations: Solution of first order differential equations using Taylor's Series, Euler's, Picard's and Runge - Kutta method up to 4^{th} order, Predictor- Corrector methods, Simultaneous differential equations of first order, Differential equations of second order.
Section-D	Numerical Integration: Numerical integration using Trapezoidal rule, Simpson's 1/3rd and 3/8th rules, Two point and three-point Gauss quadrature method.

Course Outcomes:
CO1: Understand and analyze the concept of Numerical Solution of Linear and Non-Linear Equations, Ordinary Differential Equations.
CO2: Identify an appropriate technique to solve the linear, non-linear equations, ordinary differential equations
CO3 Formulate the problems on related topics and solve analytically
CO4: Demonstrate the concepts through examples and applications

Text Books:

1. Numerical Methods by B. S. Grewal, Khanna Publishers.
2. Introductory Methods of Numerical Analysis by S.S. Sastry, Prentice Hall of India.

Reference Books:

1. Numerical Methods for Engineers by S. C. Chapra and R. P. Canale: McGraw Hill Book Company.
2. Computer Oriented Numerical Methods: V. Rajaraman: PHI Learning Pvt. Ltd.

Name of the Course	Fluid Mechanics		
Course Code	**CE – 3001**	Credits-3	L-2, T-1, P-0
Total Lectures	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max.Marks:100	Min.Pass Marks:40	Max. Time:3Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:

The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculator is allowed to use in examinations.

Course Objectives:

- To familiarize with the properties of fluids and the applications of fluid mechanics.
- To formulate and analyse problems related to calculation of forces in fluid structure interaction.
- To understand the concept of fluid measurement, types of flows and dimensional analysis

Section	Course Content
Section-A	Basic Concepts and Definitions – Distinction between a fluid and a solid; Density, Specific weight, Specific gravity, Kinematic and dynamic viscosity; variation of viscosity with temperature, Newton law of viscosity; vapour pressure, boiling point, cavitation; surface tension, capillarity, Bulk modulus of elasticity, compressibility.
Section-B	Fluid Statics - Fluid Pressure: Pressure at a point, Pascals law, pressure variation with temperature, density and altitude. Piezometer, U-Tube Manometer, Single Column Manometer, U-Tube Differential Manometer, Micromanometers. pressure gauges, Hydrostatic pressure and force: horizontal, vertical and inclined surfaces. Buoyancy and stability of floating bodies.
Section-C	Fluid Kinematics- Classification of fluid flow: steady and unsteady flow; uniform and non-uniform flow; laminar and turbulent flow; rotational and irrotational flow; compressible and incompressible flow; ideal and real fluid flow; one, two- and three-dimensional flows; Stream line, path line, streak line and stream tube; stream function, velocity potential function. One-, two- and three -dimensional continuity equations in Cartesian coordinates.
Section-D	Fluid Dynamics- Surface and body forces; Equations of motion-Euler's equation; Bernoulli's equation–derivation; Energy Principle; Practical applications of Bernoulli's equation: venturimeter, orifice meter & pitot tube; Momentum principle; Forces exerted by fluid flow on pipe bend; Vortex Flow–Free and Forced; Dimensional analysis & Dynamic Similitude-Definitions of Reynolds number, Froude number, Mach number, Weber number & Euler number; Buckingham's π-Theorem.

Course Outcomes:

CO1: Identify and obtain the values of fluid properties and relationship between them and understand the principles of continuity, momentum, and energy as applied to fluid motions.
CO2: Recognize these principles written in form of mathematical equations.
CO3: Apply dimensional analysis to predict physical parameters that influence the flow in fluid mechanics.
CO4: Describe the problems involving fluid properties, continuity and bernoulli's equations, energy losses through pipes, turbulent flows, dimensional analysis, and flow through open channels.

Text Books:

1. Fluid Mechanics and Machinery, C. S. P. Ojha, R. Berndtsson and P. N. Chadramouli, Oxford University Press, 2010
2. Hydraulics and Fluid Mechanics, P M Modi and S M Seth, Standard Book House.
3. Theory and Applications of Fluid Mechanics, K. Subramanya, Tata McGraw Hill.
4. Fluid Mechanics with Engineering Applications, R. L. Daugherty, J. B. Franzini and E. J. Finnemore, International Student Edition, McGraw Hill.

Reference Book:

1. Fluid Mechanics by Wiley and Streeter, Publisher McGraw Hill Education
2. Fluid Mechanics by F.M. White, Publisher McGraw Hill Education
3. Flow in open Channels by K. Subramanya , Publisher McGraw Hill Education
4. Open Channel Flow by K.G. Rangaraju. Publisher McGraw Hill Education

Name of the Course	**Structure Analysis-I**		
Course Code	**CE – 3002**	Credits-3	L-2, T-1, P-0
Total Lectures	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max.Time:3Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:

The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculator is allowed to use in examinations.

Course Objectives:

- The course runs through a number of techniques which are used for the analysis of civil engineering structures.
- Introduction to structural mechanics, with respect to previous courses of engineering.
- To understand the principle of virtual work and the application of influence line diagrams in structural analysis problems.

Section	Course Content
Section-A	Introduction: Structure, Loads, Response, and Method of analysis. Pin jointed Frames: Analysis Using Method of Joints, Method of Section, Graphical Method, and Tension co-efficient Methods. Cables and Arches: Analysis of three hinged, two hinged and fixed arches, analysis of cables and two hinged suspension bridges, unsymmetrical bending and shear centre.
Section-B	Energy Methods: Strain Energy due to Axial Force, Bending Moment, Shear Force and Torsion, Principle of Virtual Work, Betti's Law, Castigliano's Theorem I & II, and Dummy\Unit Load Method, Application of these Methods to Beams, Frames &Trusses.
Section-C	Slope and Deflection in beams: Double integration method, Macaulay's method, Moment area Method, Conjugate beam Method and Strain energy method.
Section-D	Rolling/Moving loads and Influence lines diagrams for Determinate structures Rolling loads, ILD for determinate beams, Gantry girders, Trusses.

Course Outcomes:

CO1: Formulate Equilibrium and compatibility equations for structural members.

CO2: Analyse one dimensional and two-dimensional problems using classical methods.

CO3: Analyse structures for gravity loads, moving loads and lateral loads.

CO4: Assess the response of structure to the different types of loads.

CO5: Apply principles of basic structural analysis

Text Books:

1. Structural Analysis I & II by S. S. Bhavikatti, Vikas.
2. Structural Analysis by R.C. Hibbeler, Pearson.
3. Theory of Structures by S. Ramamrutham & R. Narayan, Dhanpat Rai & Son.

Reference Books:

1. Fundamentals of Structural Analysis by K. M. Leet, C. Ming Uan, G &A. M. Gilbert, Tata McGraw Hill Education.
2. Structural Analysis by Devdas Menon, Narsoa.
3. Theory of Structures Vol-I & II by G. S. Pandit,S. P. Gupta & R. Gupta, Tata McGraw Hill Education.
4. Structural Analysis by L.S. Negi & R.S. Jangid, TATA McGraw Hill education.
5. Basic Structural Analysis by C. S. Reddy TATA McGraw Hill education.
6. Theory of Structures by B. C. Punmia. Ashok Kumar Jain & Arun Kumar Jain, Laxmi Publication.

Name of the Course	Surveying		
Course Code	CE – 3003	Credits-3	L-2, T-1, P-0
Total Lectures	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:

The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculator is allowed to use in examinations.

Course Objectives:

- To produce up-to-date Engineering Plans of the areas in which the work will be carried out.
- To determine the required areas and volumes of land and materials needed during construction.
- To ensure that the construction takes place in the correct relative and absolute position on the ground.

Section	Course Content
Section-A	Basics of surveying: Introduction, Classification Uses and principle of surveying, Method of linear measurement, Accessories of linear measurement, Ranging, Method of chaining on level and sloping ground, Obstacle in chaining, Conception of magnetic bearing, Error and mistakes in chaining, Precaution against Error and mistakes, Chain and tape correction, sloping ground, Scales and its problems, Direct and indirect methods of distance measurements.
Section-B	Compass traversing: Introduction, Principle, Traversing, method of traversing, check on close traverse and open traverse, Types of compass, whole circle bearing and quadrant bearing, Fore bearing back bearing, Magnetic Declination, local attraction, calculation of angles, adjustment of closing error. Plane Table Survey: Principle, Accessories of a plane table, orientation, setting of a plane table over station, Method of plane tabling, resection, error & precaution.
Section-C	Levelling: Object and use of levelling, Different type of levels, Type of levelling operation, Back sight and fore sight, Auto levelling, Reciprocal levelling, curvature, refraction combined, visible horizon distance correction, reciprocal levelling & its merits, sensitivity of bubble tube. Contouring: Introduction, Contour interval, Contour gradient, preparing contour map, use of contour map, characteristics, method of contouring, interpolation of contour, Calculation of areas and volumes.

Section-D	Theodolite & Tacheometry: Introduction, temporary & permanent adjustments, measurements of horizontal & vertical angles, methods of repetitions & reiteration, sources of errors, checks in traversing, adjustments of traverse, degree of accuracy, omitted measurements. Principles of stadia system, fixed and movable hair methods, inclined sights with staff vertical, inclined sight with statt normal to the line of sight. Determination of tacheometric constants, analytic lens, subtense bar method, auto reduction tacheometer. Curves: Introduction, Types of horizontal curve, properties of simple circular curve, Notation used with circular curve, Horizontal curve setting by chain and tape method, Vertical curve.

Course Outcomes:

CO1: Calculate angles, distances and levels.
CO2: Identify data collection methods and prepare field notes.
CO3: Understand the working principles of survey instruments.
CO4: Estimate measurement errors and apply corrections.

Text Books:

1. Surveying–Vol 1 & 2 by K. R. Arora, Standard book house.
2. Plane Surveying by A. M. Chandra, New Age International Publisher.
3. Arora, K.R., Surveying, Vol-I, II and III, Standard Book House, 2015.
4. Surveying: Principle and Applications by Barry F. Kavanagh, Pearson.
5. Bhavikatti, S.S., Surveying and Levelling, Vol. I and II, I.K. International, 2010.

Reference Book:

1. Surveying: Theory and Practice by J.M. Anderson and E.M. Mikhail, Mc Graw Hill.
2. Chandra, A.M., Higher Surveying, Third Edition, New Age International (P) Limited, 2002.
3. Madhu N. Sathikumar, R & S. Gobi, Advanced Surveying: Total Station, GIS & Remote Sensing, Pearson India,2006.

Name of the Course	Strength of Material		
Course Code	CE – 3004	Credits-3	L-2, T-1, P-0
Total Lectures	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:

The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculator is allowed to use in examinations.

Course Objectives:

- To impart the knowledge of mechanics of deformable bodies under static loads including temperature variation
- To teach students the development of strains & stresses in solids and their relationships
- To develop knowledge of behaviour of structural members (beams, columns, shafts, etc.) under loading and draw bending moment and shear forces diagram of members for different loading.
- To impart knowledge of methods used to compute slope and deflections in beams under transverse loads.

Section	Course Content
Section-A	Mechanics of Deformable Solids: Definition of stress and strain. Hooke´s law. Constants of elasticity: Young's modulus, shear modulus, Poisson's ratio. Mechanical Properties, Stress-Strain Relationships. Axial load: Calculation of stress and strain, design of bars for axial load. Statically indeterminate structures. Thermal effects on axial deformation and geometric. Shear stress and shear strain. Bars of uniform, varying and tapering cross sections, composite bars.
Section-B	Torsion of circular bars: Computation of shear stress, Hooke's law for shear; design of circular bars. Stress distributions in beams. Complex Stresses: Stresses on inclined planes, principal stresses and strains, Mohr's circle of stresses, theories of elastic failure. Generalized Hooke's law for isotropic materials.
Section-C	Shear Force and Bending Moment Diagram: Relationships between loads, shear force and bending moment. Shear force and bending moment diagram for different beams and their application. Bending Stress: Flexural stress in linearly elastic beams; design of beams for strength; differential equations of the deflection curve; computation of slope and deflection; unsymmetrical bending.
Section-D	Slope and deflection of beams: Differential equation of the deflection curve, double integration method, Macaulay's method, moment area method

	and conjugate beam method. Buckling of columns: The ideal pin-ended column; Euler buckling load; the effect of end conditions on column buckling.

Course Outcomes:

CO1: At the end of the course students will have knowledge of various stress and strain systems, their relationships and behaviour of materials under loads.

CO2: Understanding of concept of complex stresses and their treatment to find maximum value of a stress.

CO3: Understanding of how various forcing functions (shear force, bending moment and torque) vary along a structural element and be able to plot the same.

CO4: Analyzing a structural member (beams, columns, shafts, etc.) in depth with determination of crucial stresses, strains and deformation characteristics.

Text Books:

1. Beer, Johnston, Dewolf, Mazurek, Sanghi: Mechanics of Materials, 7th Edition, McGraw Hill Education IndiaPrivate Limited, 2017
2. B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain: Mechanics of Materials, Laxmi Publications; Revised edition(2017)
3. Russell C. Hibbeler: Static and Mechanics of Materials, 5th Edition, Pearson, 2018.

Reference Book:

1. Shames Irving H: Introduction to Solid Mechanics, 3rd Edition, Prentice Hall India Learning Private Limited, 2002.
2. William Nash: Schaum‘s Outline of Strength of Materials, 6th Edition, McGraw Hill Education India Private Limited, 2013.

Name of the Course	**Surveying Lab**		
Course Code	**CE-3051**	Credits-1	L-0, T-0, P-2
Total Practical Sessions	15 (2 Hours Each)		
Semester End Examination	Max Marks: 50	Min. Pass Marks: 20	Max. Time: 3 Hrs.
Internal Assessment: (based on Continuous Lab Work Assessment: 20%, Experiment Performance: 30%, Attendance 10%, Viva: 40%)			Max Marks: 50 Min. Pass Marks:25

List of Experiments

Sr. No.	Name of the Experiment
1	To determine the difference in elevation of two given points.
2	Profile levelling and cross sectioning of a given route.
3	To measure the horizontal angle by the method of reiteration and repetition, theodolite traversing and error adjustment.
4	To prepare the contour map of an area by the method of radial lines.
5	Determination of tacheometric constant and determination of height and distance using Stadia tacheometry
6	Plane tabling by the method of radiation and intersection.
7	Solution of Three-point problem in plane tabling.
8	Setting out of simple circular curve by offsets from long chord and by successive bisection of long chord.
9	Setting out of simple circular curve by radial and perpendicular offsets.
10	Setting out of simple circular curve by one theodolite and by two theodolite method.
11	Topographic survey using total station.

Course Outcomes:

CO1: Conduct survey and collect field data.
CO2: Prepare field notes from survey data.
CO3: Able to perform different types of levelling operation to be performed at site.
CO4: Interpret survey data and compute areas.

Name of the Course	Fluid Mechanics Lab		
Course Code	**CE-3052**	Credits-1	L-0, T-0, P-2
Total Practical Sessions	15 (2 Hr Each)		
Semester End Examination	Max Marks: 50	Min. Pass Marks: 20	Max. Time: 3 Hrs.
Internal Assessment: (based on Continuous Lab Work Assessment: 20%, Experiment Performance: 30%, Attendance 10%, Viva: 40%)			Max Marks: 50 Min. Pass Marks: 25

List of Experiments

Sr. No.	Name of the Experiment
1	Determination of viscosity using Ostwald Viscometer.
2	Study of Pressure Measuring Devices.
3	To determine the Stability of Floating Body.
4	To determine Hydrostatics Force on Flat Surfaces/Curved Surfaces.
5	To verify the Bernoulli's Theorem.
6	To find out venturi meter coefficient.
7	To determine the coefficient of discharge (C_d) by orifice meter.
8	To verify the moments equation experimentally through impacts of jet experiment.
9	Flow Visualisation -Ideal Flow.
10	Length of establishment of flow.
11	To perform Reynold's experiments (for determining critical velocity of a liquid flowing through a pipe).
12	To determine Laminar Flow in the inlet length of a smooth pipe.

Course Outcomes:

CO1: Estimate the friction and measure the frictional losses in fluid flow.
CO2: Experiment with flow measurement devices like venturimeter and orifice meter.
CO3: Predict the coefficient of discharge for flow through pipes.
CO4: Gaining knowledge to calculate and design engineering applications involving fluid.

Name of the course	Computer-aided Civil Engineering Tools- Lab		
Course Code	**CE-3053**	Credits: 2	L-0, T-0, P-2
Lectures to be delivered	15 (2 Hrs Each)		
Semester End Examination	Max. Time: 3 hrs.	Max. Marks: 50	Min. Pass Marks: 20
Internal Assessment (based on Lab work 30%, Lab record 30%, Viva 30%, Attendance 10%)		Max. Marks: 50	Min. Pass Marks: 25

Content

***Introduction*:** Introduction to concept of drawings, Interpretation of typical drawings, Planning drawings to show information concisely and comprehensively; optimal layout of drawings and Scales; Introduction to computer aided drawing, co- ordinate systems, reference planes.
Commands: Initial settings, drawing aids, drawing basic entities, Modify commands, Layers, Text and Dimensioning, Blocks. Drawing presentation norms and standards.

***Symbols and Sign Conventions*:** Materials, Architectural, Structural, Electrical and Plumbing symbols. Rebar drawings and structural steel fabrication and connections drawing symbols, welding symbols; dimensioning standards

Masonry Bonds: English Bond and Flemish Bond – Corner wall and Cross walls – One brick wall and one and half brick wall

***Building Drawing*:** Terms, Elements of planning building drawing, Methods of making line drawing and detailed drawing. Site plan, floor plan, elevation and section drawing of small residential buildings. Foundation plan. Roof drainage plans. Depicting joinery, standard fittings & fixtures, finishes. Use of Notes to improve clarity**.**

***Pictorial View*:** Principles of isometrics and perspective drawing. Perspective view of building. Fundamentals of Building Information Modeling (BIM)

List of Drawing Experiments:

1. Buildings with load bearing walls including details of doors and windows.
2. Taking standard drawings of a typical two storied building including all MEP, joinery, rebars, finishing and other details and writing out a description of the Facility in about 500 -700 words. RCC framed structures
3. Reinforcement drawings for typical slabs, beams, columns and spread footings.
4. Industrial buildings - North light roof structures – Trusses.
5. Design of structural components of building under static and seismic condition using STAAD.PRO
6. Building analysis and design using STAAD.PRO

Course Outcomes

CO1: Identify and discuss the role of CAD and STAAD.PRO in Civil Engineering.
CO2: Identify and discuss different types bonds and their diagrams.
CO3: Identify and discuss different drawing related to buildings.
CO4: Design of structural components of building as well as building as a whole under static and seismic condition using STAAD.PRO

Text Books/References Books:

1. Subhash C Sharma & Gurucharan Singh (2005), "Civil Engineering Drawing", Standard Publishers
2. Ajeet Singh (2002), "Working with AUTOCAD 2000 with updates on AUTOCAD 200I", Tata- Mc Graw-Hill Company Limited, New Delhi
3. Venugopal (2007), "Engineering Drawing and Graphics +AUTOCAD", New Age International Pvt. Ltd.,
4. Malik R. S., Meo, G. S. (2009) Civil Engineering Drawing, Computech Publication LtdNew Asian.
5. Sikka, V. B. (2013), A Course in Civil Engineering Drawing, S. K. Kataria &Sons
6. STAAD.Pro : Reference Guide
7. Design of R C C Buildings using Staad Pro V8i (2017) by TS Sharma

Semester-IV

Name of the Course	**Python Programming**		
Course Code	**IT-4020**	Credits-4	L-3, T-1, P-0
Total Lectures	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examintion	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:

The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non-programmable calculator is allowed to use in examinations.

Course Objectives:

- To develop an understanding of programming
- To develop an ability to carry out programming in Python
- To be updated in the knowhow of the latest programming language

Section	Course Content
Section-A	Parts of Python Programming Language, Identifiers, Keywords, Statements Expressions, Variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions, The type() Function and Is Operator, Dynamic and Strongly Typed Language, Control Flow Statements, The if Decision Control Flow Statement, The if…else Decision Control Flow Statement, The if…elif…else Decision Control Statement, Nested if Statement, The while Loop, The for Loop, The continue and break Statements, Catching Exceptions Using try and except Statement, Functions, Built-In Functions, Commonly Used Modules, Function Definition and Calling the Function, The return Statement and void Function, Scope and Lifetime of Variables, Default Parameters, Keyword Arguments, *args and **kwargs,
Section-B	Strings, Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings, Lists, Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions Used on Lists, List Methods, The del Statement. Dictionaries, Creating Dictionary, Accessing and Modifying key value Pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, The del Statement, Tuples and Sets, Creating Tuples, Basic Tuple Operations, Indexing and Slicing in Tuples, Built-In Functions Used on Tuples, Relation between Tuples and Lists, Relation between Tuples and Dictionaries, Tuple Methods, Using zip() Function, Sets, Set Methods, Traversing of Sets, Frozen set.

Section-C	Files, Types of Files, Creating and Reading Text Data File Methods to Read and Write Data, Reading and Writing Binary Files, The Pickle Module, Reading and Writing CSV Files, Python os and os.path Modules, Regular Expression Operations, Using Special Characters, Regular Expression Methods, Named Groups in Python Regular Expressions, Regular Expression with glob Module.
Section-D	Object-Oriented Programming, Classes and Objects, Creating Classes in Python, Creating Objects in Python, The Constructor Method, Classes with Multiple Objects, Class Attributes versus Data Attributes, Encapsulation, Inheritance, The Polymorphism

Course Outcomes:

CO1: To practically apply python programming in applications.
CO2: To know the fundamentals of python programming.
CO3: To practically apply files and types of files.
CO4: To know the fundamentals of Object-Oriented Programming

Text Books:

1. Gowrishankar S, Veena A, **"Introduction to Python Programming",** 1st Edition, CRC Press/Taylor &Francis, 2018.

Reference Books:

1. Jake VanderPlas, "Python Data Science Handbook: Essential Tools for Working with Data", 1st Edition, O'Reilly Media.
2. AurelienGeron, Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems".
3. Wesley J Chun, "Core Python Applications Programming", 3rd Edition,Pearson Education India.
4. Miguel Grinberg, "Flask Web Development: Developing Web Applications with Python

Name of the Course	**Organizational Behaviour**		
Course Code	**HSMC – 4001**	Credits - 3	L-3, T-0, P-0
Lectures to be Delivered	L = 39, for each semester		
Semester End Examination	Max Marks: 100	Min Pass Marks: 40	Max.Time:3Hrs
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks:50

Instructions

For Paper Setters:
The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For candidates:
Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

Course Objectives

- To familiarize the students with planning and management techniques at work places.
- To familiarize the students with different strategies at work place.

Section	Course Content
Section-A	OB: Learning objectives, Definition & Meaning, Why to study OB, An OB model, New challenges for OB Manager LEARNING: Nature of learning, How learning occurs, Learning & OB
Section-B	PERSONALITY: Meaning & Definition, Determinants of Personality, Personality Traits, Personality & OB PERCEPTION: Meaning & Definition, Perceptual process, Importance of Perception in OB MOTIVATION: Nature & Importance, Herzberg's Two Factor theory and Maslow's Need Hierarchy theory
Section-C	GROUPS IN ORGANISATION: Nature, Types, Why do people join groups, Group Cohesiveness & Group Decision Making- managerial Implications, Effective Team Building LEADERSHIP: Leadership & management, Theories of leadership- Trait theory, Behavioral Theory Contingency Theory, Leadership & Followership, How to be an Effective Leader CONFLICT: Nature of Conflict & Conflict Resolution
Section-D	ORGANIZATIONAL CULTURE AND CLIMATE: Factors affecting organizational climate, Importance JOB SATISFACTION: Determinants, Measurements, Influence on behaviour, STRESS: Work Stressors, Prevention and Management of stress, Balancing work and Life

Course Outcomes

CO1: Identify and discuss the role and importance of management at professional level.
CO2: Identify and discuss the different approaches pertaining to the professional career.

CO3: Identify and discuss issues related to working in organisation.
CO4: Identify and discuss the complex issues related to management.

Text Books:

1. Organizational Behaviour by Robbins, S.P., Prentice Hall of India.
2. Organizational Behavior by Luthans F., McGraw-Hill.

Reference Books:

1. Human Behaviour at Work: Organizational Behaviour by Davis K., Tata McGraw-

Name of the Course	**Structures Analysis – II**		
Course Code	**CE-4001**	Credits-3	L-2, T-1, P-0
Lectures to be Delivered	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min Pass Marks: 40	Max. Time: 3 Hrs
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:

The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed

Course Objectives

- To understand the basic concept of structural analysis.
- To familiarize the students with structural analysis in software.

Section	Course Content
Section-A	Introduction: Determinacy and indeterminacy of structures, Static and kinematic indeterminacy. Plastic Theory: Statically indeterminate structures – Plastic moment of resistance, Plastic modulus, Static and kinematic methods, Upper and lower bound theorems, Plastic analysis of indeterminate beams and frames.
Section-B	Statically indeterminate structures: Force methods, Three-moment equation, Method of consistent deformation, Approximate method of analysis (Portal Frame, Cantilever, Substitute Frame Method)
Section-C	Kinematically Indeterminate Structures: Displacement Methods- slope deflection method, moment distribution method, Kani's Method.
Section-D	Influence lines for In-determinate structures: Muller-Breslau Principle for Influence lines diagram of indeterminate structures: Beams, frame, trusses and two hinged & fixed arches. Computer Applications in Structural Analysis: Introduction to software and its applications to 2Dtrusses and building frames.

Course Outcomes

CO1: Identify and discuss the role and importance of plastic theory in structure.

CO2: Identify and discuss the issues and concepts salient to the different structures.

CO3: Identify the load displacement response of the indeterminate structures

CO4: Describe the bending moment, shear force and axial force variations along with the curvature, Slope and deflection of the indeterminate structures.

Text Books:

1. Structural Analysis by R.C. Hibbeler, Pearson.
2. Fundamentals of Structural Analysis by K. M. Leet, C. Ming Uan, G&A. M. Gilbert, Tata McGraw Hill Education.
3. Structural Analysis by Devdas Menon, Narsoa.
4. Theory of Structures Vol-I&II by G. S.Pandit,S. P.Gupta & R.Gupta, Tata McGraw Hill Education.
5. Structural Analysis by L. S. Negi & R. S.Jangid, TATA McGraw Hill education.

Reference Books:

1. Theory of Structures by S. Ramamrutham & R.Narayan, Dhanpat Rai & Son.
2. Basic Structural Analysis by C. S. Reddy TATA McGraw Hill education.
3. Theory of Structures by B. C. Punmia. Ashok Kumar Jain & Arun Kumar Jain, Laxmi
4. Structural Analysis I&II by S . S. Bhavikatti,Vikas.

Name of the Course	Hydrology		
Course Code	CE-4002	Credits-3	L-2, T-1, P-0
Lectures to be Delivered	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min Pass Marks: 40	Max. Time: 3 Hrs
Internal Assessment (based on sessional test (2) 50%, Tutorials/Assignments30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:

The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-Programmable calculators is allowed.

Course Objective:

- To familiarize students with the basics of water cycle, understanding various aspects of hydrographs, importance of different concepts involved in groundwater hydrology.

Section	Course Content
Section-A	Introduction: Hydrological cycle, Water budget equation, Watershed, history of hydrology, world water balance, applications in engineering. Abstractions: Precipitation- Types, Measurement, Computation of average rainfall over a basin, Evaporation, transpiration, infiltration, Φ-index, weather systems.
Section-B	Runoff: Factors affecting, runoff computation, rainfall-runoff correlation, flow mass curve, flow duration curve
Section-C	Hydrographs: Flood hydrograph, base flow separation, Unit and S-hydrograph, Unit Hydrograph from simple and complex storms, synthetic and instantaneous unit hydrograph. Floods: Flood control, Flood frequency analysis, flood estimation, flood routing through a reservoir, channel flow routing methods.
Section-D	Groundwater Hydrology: Darcy's Law – concept and applications, Well Hydraulics – Steady and unsteady state. Specific yield, storage coefficient, coefficient of permeability, confined and unconfined aquifers, aquitards, radial flow into a well under confined and unconfined conditions, tube wells, pumpingand recuperation tests, ground water potential.

Course Outcomes:

CO1: Identify and discuss the role and importance of engineering in water cycle.
CO2: Identify and discuss the issues and concepts salient to the prediction of rain, floods etc.
CO3: Apply principles, theory and equations to solve problems mentioned in CO2.
CO4: Assess the results obtained by solving above problems.

Text Books:

1. Engineering Hydrology by K. Subramanya, Mc Graw Hill.
2. Engineering Hydrology by Ojha, Berndtssson and Bhunia,
3. Water Resources Engineering by R.K. Linsley and J.B. Franzini, McGraw-Hill Inc, 2000.
4. S.K. Sharma by Design of Irrigation Structures, S. Chand

Reference Books:

1. Groundwater by H.M Raghunath, New Age International publishers.
2. Groundwater Hydrology by B.R. Chahar, Mc Graw Hill.

Name of the Course	**CPM & PERT**		
Course Code	**CE-4003**	Credits-3	L-2, T-1, P-0
Lectures to be Delivered	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min Pass Marks: 40	Maximum Time: 3 hrs
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:

The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

Course Objective:

- Understanding the issues related to construction industry.
- Understanding the contract management and work execution.

Section	Course Content
Section-A	Construction Management: Significance, objectives and functions, resources for construction industry, stages in construction, Civil Engineering drawings, work breakdown structure, pre-tender stage planning, contract stage planning, scheduling, bar charts, limitations of bar charts, milestone charts, preparation of material, equipment, labour, and finance schedule.
Section- B	Construction Contracts & Specifications: Types of contracts, contract document, specifications, important conditions of contract, arbitration. Construction Organization: Principles of organization, communication in organization, types of organizations, temporary services, job layout
Section- C	Critical Path Method: Network techniques, element of a network, rules for developing networks, development logics, numbering events, time computations, activity floats, network updating. Resources profile, resources smoothing and resources leveling
Section- D	Cost-Time Analysis: Cost versus time, direct cost, indirect cost, total project cost, optimum duration, contracting network for cost optimization. Programme Evaluation and Review Technique: Probability concept in network, optimistic time, pessimistic time, most likely time, variance, standard deviation, slack, central limit theorem, probability of achieving completion time.

Course Outcomes:

CO1: Identify and discuss the role and importance of different construction management techniques.
CO2: Identify and discuss the concept related to time management in construction.
CO3: Develop critical path method based network and estimate various times and floats, and
CO4: Develop PERT network and find probability of completion of a project in specified duration.

Text Book(s):

1. Construction Planning and Management by P.S. Gehlot and B.M. Dhir,New Age International Publisher.
2. Project Planning and Control with PERT and CPM by B.C. Punmia and K.K. Khandelwal, Laxmi Publication.
3. PERT and CPM -Principles and Applications by L.S. Srinath, New Delhi, Affiliated East West Press.
4. Construction Project Management: Planning, Scheduling and Control by K.K. Chitkara, Mc Graw Hill.
5. Project Management Technique in Planning and Controlling Construction Projects by H.N. Ahuja, John Wiley & Sons.

Reference Book(s):

1. Construction Planning Equipment and Methods by R.L. Peurify, Mc Graw Hill.
2. Project Management with CPM, PERT and Precedence Diagramming byJ. Moder, C. Phillips and E. Davis, New York : Van Nostrand Reinhold.

Name of the Course	**Building Material and Construction**		
Course Code	**CE-4004**	Credits-3	L-3, T-0, P-0
Lectures to be Delivered	52 (L = 39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min.Pass Marks: 40	Max. Time: 3Hrs
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:

The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

Course Objective:

- Understanding the basic concept of building construction techniques.
- To familiarize students with different building materials.

Section	Course content
Section-A	Basic Structural Building Materials - Bricks: Classification, properties and selection criteria of bricks, burning of bricks, tests for bricks. Cement: Composition, types, properties, manufacturing of Ordinary Portland Cement. Stones: Stone classification, characteristics of good building stone, Limestone, common building stones in India. Timber: Characteristics of good timber, defects in timber, Seasoning of timber, plywood.
Section-B	Masonry: Brick Masonry: Technical terms, types of bonds, strength of brick masonry, defects in brick masonry, reinforced brickwork. Stone Masonry: joints in stone masonry, classification of stone masonry, selection of stone for masonry, Composite masonry, Dressing of stones. Metals: Types: Ferrous and Non-Ferrous, Manufacturing processes. Paints, Distemper & Varnishing: Basic constituents, types, composition, defects, application, Plastics: Classification, composition, raw material, characteristics and uses, polymerization, classification, special varieties.
Section-C	Walls: Types: load bearing, partition walls, cavity walls, advantages, position of cavity, Constructional details. Roofs & Floors: Types & construction of roofs, roof trusses: king post truss, queen post truss, features, necessity, arches, lintels, types & construction of ground floor, upper floor, floor finishes. Doors &Windows: Location, Technical terms of door & window, door frame, size, designation of door& window, types of door & window.

Section-D	Damp Proofing & Termite Proofing: Causes, effects, various methods and material used for damp proofing and termite proofing, water proofing treatment to roof including pitched roofs. Sound & Fire proof construction: Sound Insulation, Insulation values for different type of walls, sound proof materials. Fire: Causes, fire hazards, fire load, grading of building according to fire resistance, characteristics of fire resisting materials, fire alarms, fire extinguishing equipment.

Course Outcomes:

Upon successful completion of the course, the students will be able to

CO1: Identify and Describe construction material, structural and non-structural components

CO2: Apply principles of compatibility of material and construction methods

CO3: Assess the suitability and functional aspect of the materials and construction methodology

CO4: Understand new and safe construction practices in industry.

CO5: Identify cost optimization related to materials, equipment, etc

Text Books:

1. R. K. Rajput, S. Chand Publishers.
2. Building Materials by S. K. Duggal, New Age Int. Publishers.
3. Building Materials by P. C.Varghese, PHI.

Reference Books:

1. Engineering Materials by Kulkarni, C. J., "A text book of Engineering Materials", Ahmedabad book Depot,Ahmedabad, 1968.
2. Kumar Sushil, "Engineering Materials, "Standard Publishers Distributors, Delhi, 1994.

Name of the Course	Environmental Science		
Course Code	**MC-4001**	Credits-2	L-2, T-0, P-0
Total Lectures	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:

The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculator is allowed to use in examinations.

Course Objectives:

- Understanding the social issues, their impact on environment and recognizing the major concepts of environmental studies for public awareness.
- Understanding the pollution impact and finding its solution

Section	Course Content
Section-A	Multidisciplinary nature of Environmental Studies: Definition, scope and importance, public awareness, Ecosystem, types and its functioning. Natural Resources: Water, Forest, mineral, Land, Energy (Renewable and Non-Renewable), Equitable Use of resources, Conservation and protection of natural resources.
Section-B	Environmental Standards and Quality: Water, Air and Soil Quality, pollution control system, green chemistry and its benefits. Environmental Pollution: Air, Water and Land Pollution: sources and causes, effects and control measures, role of individual for pollution control, Critical issues concerning global environment, Pollution case studies..
Section-C	Biodiversity and its conservation: Introduction, ecosystem diversity- diversity of flora and fauna, threats to biodiversity
Section-D	Social Issues and the Environment: Wasteland reclamation, water conservation, rain water harvesting, watershed management, Environmental ethics: issues and solutions, Environment Protection act, Air (prevention and control of population) act; Water (prevention and control of pollution) act, Wildlife protection act, Forest conservation act, Issues involved in enforcement of environmental legislation National Environmental Policy; Function of pollution control boards (SPCB and CPCB), their roles and responsibilities.

Course Outcomes:

CO1: Identify and discuss the role and importance of environmental engineering
CO2 : Identify and discuss the issues salient to the pollution industry.
CO3: Identify and discuss the social and issues
CO4: Identify and discuss the environmental issues and solution

Text Books:

1. Environmental Studies by M.P. Punia and S.C. Sharma, Khanna Publishers.
2. Environmental Studies- Suresh K. Dhameja, S. K. Kataria & Sons, 2009.

Reference Books:

1. Text Book of Environmental Studies for UG courses- Erach Barucha, University Press
2. David Laurance. 2003. Environment Impact assessment, Wiley publications.
3. Nebel, B.J. & Wright, R.T., 1993, Environmental Science, 8th Edition, Prentice Hall, USA

Name of the Course	**Structural Lab**		
Course Code	**CE- 4051**	Credits-1	L-0, T-0, P-2
Total Practical Sessions	26 hours		
Semester End Examination	Max Marks: 50	Min. Pass Marks: 20	Max. Time: 3 Hrs.
Internal Assessment: (based on Continuous Lab Work Assessment: 20%, Experiment Performance: 30%, Attendance 10%, Viva: 40%)			Max Marks: 50 Min. Pass Marks: 25

List of Experiments

Sr. No.	Name of the Experiment
1	To verify the Betti's Law& Maxwell law of reciprocal displacements.
2	Study of a three hinged arch experimentally for a given set of loading and compare with analytical results.
3	To obtain experimental influence line diagram for horizontal thrust in a three hinged arch and compare with theoretical value.
4	To determine the flexural rigidity of a given beam.
5	To study the behaviour of different type of struts.
6	To verify moment area theorem for slopes and deflections of a beams
7	To find the deflection of a pin-connected truss and to verify the results by calculation and graphically.
8	To determine the carry over factors for beam with rigid connections.
9	To determine the rotational stiffness of a beam when far end is (a) fixed (b) pinned.
10	Determine experimentally the horizontal displacement of the roller end of a two hinged arch for a given set of loading and to compare the results with those obtained analytically.
11	To obtain experimental influence line diagram for horizontal thrust in a two hinged arch and compare with theoretical value.
12	To study tensile stress and strain on different materials.

Course Outcomes:

CO1: Understand the role and importance of different theories in structure.
CO2: Identify and discuss the issues and concepts salient to different structural models.
CO3: Apply principles and algorithms for analysis of structure.
CO4: Assess the results obtained by solving theoretical problems and validation it experimentally.

Semester-V

Name of the Course	**Soil Mechanics**		
Course Code	**CE-5001**	Credits-3	L-2, T-1, P-0
Lectures to be Delivered	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min Pass Marks: 40	Maximum Time: 3 hrs
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:

The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B,C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

Course Objectives

- To understand fundamental aspects of soil mechanics
- To understand the effect of rate of stress on shear parameters

Section	Course Content
Section- A	Soil Formation: Definition of soil, origin of soil Soil Properties: Basic definitions, phase diagram, water content, specific gravity, void ratio, porosity, unit weight, weight volume relationships, index properties of soil and their determination, classification of soils, degree of saturation, density index.
Section- B	Permeability and seepage: Darcy's law and its validity, seepage velocity, discharge velocity, constant and variable head permea-meter, pumping in and out tests, permeability of stratified soils, factors affecting permeability, Laplace's equation, flow potential flow net and its properties, different methods of drawing flownets, seepage pressure, quick sand, exit gradient, piping, filter, principle of total and effective stresses, capillarity conditions in soil, effective and pore pressures. Stresses in soils: Need for finding stress distribution in soil, assumptions in elastic theories, Boussinesq's equation for point, line, circular and rectangular loads, Westergaad's formula for point load, comparison of Boussinesq's and Westergaard's equation, concept & use of pressure bulbs, principle & use of New mark's influence chart.
Section- C	Compaction : Mechanism of compaction, objective of compaction, measurement of compaction, factors affecting compaction, optimum moisture content, Standarad Proctor test, Modified Proctor test, effect of moisture content and compactive effort on dry density, zero air void curve, compaction of cohesionless soils, field compaction, field control of compaction. Consolidation: Mechanism of consolidation, e-logp curves, basic definitions, estimation of preconsolidation pressure, normally consolidation and over consolidation ratio, Terzaghi's theory of one dimensional consolidation, assumptions, governing equation, standard solution, laboratory determination of consolidation properties of soil, magnitude and rate of consolidation, settlements, secondary consolidation, compression characteristics of clays and settlement analysis.

Section- D	Shear Strength of Soil: Normal, shear and principal stresses, Columb's equation, Mohr's stress circle, Mohr-Coulomb failure criterion, laboratory determination of shear parameters of soil by direct shear tests, triaxial test, unconfined compression test, Vane shear test, Consolidated drained, consolidated undrained and unconsolidated undrained shear test, stress path, pore pressure parameters.

Course Outcomes:

CO1: Identify index properties of soil and to classify the soils

CO2: Describe the behaviour of the soils

CO3: Apply principles of soil mechanics to civil engineering problem

CO4: Build knowledge on principle of stress and stress distribution in soil

CO5: Develop theoretical background for design of foundation system with economy

Text Book(s) :

1. Gopal Ranjan and A.S. Rao "Basic and Applied Soil Mechanics", New Age International Publishers, 2007.
2. Soil Mechanics and Foundation Engineering (Geotechnical Engineering) Dr. K. R. Arora, seventh edition, Standard Publishers Distributors.
3. Couduto D.P., "Geotechnical Engineering – Principles and Practices", Prentice Hall of India, 2002.
4. Murthy, V.N.S., "Text Book of Soil Mechanics and Foundation Engineering", CBS Publishers, 2007.

Reference Book(s):

1. Holtz, R.D. and Kovacs, W.D., "An Introduction to Geotechnical Engineering", Prentice Hall, 1981.
2. Lambe, T.W. and Whitman, R.V., "Soil Mechanics", John Wiley and Sons, 2000.
3. Indian Standards Codes.

Name of the Course	Design of Steel Structures		
Course Code	CE-5002	Credits-4	L-3, T-1, P-0
Total Lectures	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:

The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculator is allowed to use in examinations.

Course Objectives:

- To impart knowledge of design of basic structural steel elements as per relevant codal practices.
- To provide basic understanding of mechanical properties and types of steel used in civil structures, design of tension and compression members

Section	Course Content
Section-A	Introduction: General, Types of steel, properties of structural steel and Structural steel sections. Basic Concepts of Steel Design: Working Stress and Limit State Method. Basis of Structural Design: Structural systems, Loads and load combinations, Codes and specifications, Design Philosophies, Failure criteria for steel.
Section-B	Design of connections in steel structures: Bolted and welded connections, assumptions, Different types of joints, design of various types of bolted and welded connections subjected to direct loads and Eccentric Loads, Design examples. Design of Beams: Laterally Supported, Unsupported and Built-up Beams
Section-C	Design of tension members: Types of tension members, Slenderness ratio, behavior, modes of failure, Angle under tension, other sections, design of axially loaded tension members, design of lug angle, splices and gussets. Design of compression members: Theory of buckling: Euler's theory, effective length, slenderness ratio, Design formula: IS code formula, design of column, cross section (single and built up sections), design of angle struts, eccentrically loaded columns, column splices, lacings and battens.
Section-D	Design of Plate Girder and Gantry Girder: Component of plate girder, Optimum depth, Bending strength, Shear Strength, Shear Buckling, Design of section, stiffeners, splices, design of built up Gantry Girder, Plastic Analysis.

Course Outcomes:

CO1: Identify and discuss the role and importance of steel designing
CO2 Identify and discuss the issues and concepts related to selection of steel
CO3: Apply principles and algorithms for steel structures design
CO4: Assess the results obtained by solving above problems
CO5: Design the various components of steel structures like beam column, beam, truss etc.

Text Books:

1. Subramanian, N - Design of steel structures, Oxford University Press, New Delhi.
2. Duggal, S. K., Design of steel structures, Tata McGraw-Hill, New Delhi.
3. IS 801-1995. Use of cold deformed light gauge steel structural members in general BC.
4. Design of Steel Structures by K.S. Sai Ram, Pearson.
5. IS CODES: IS 800 – 2007, Code of Practice for general construction in steel, Bureau of Indian Standards, 2007.
6. IS CODES: IS 875,1987 Code of Practice for different types of loading.

Reference Books:

1. Design of Steel Structures Edwin H. Gaylord, Jr. Charles N. Gaylord and James Stallmeyer. Tata McGraw-Hill Education Pvt. Ltd.
2. Design of Steel Structures Vol. 1 & 2 – Ramchandra, Standard Publications.
3. Design of steel structures, Structures, S.S. Bhavikatti, IK int Publication House, New Delhi, 2010.

Link to NPTEL course contents: https://nptel.ac.in/courses/105106112/

Name of the Course	Transportation Engineering-I		
Course Code	CE-5003	Credits-3	L-2, T-1, P-0
Total Lectures	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:

The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculator is allowed to use in examinations.

Course Objectives:

- To impart knowledge about the Roadway.
- To introduce the fundamental of traffic, roadways, maintenance etc.
- To enable the students to understand the factors considered in pavement design, Signal Design etc.

Section	Course Content
Section-A	Road Development and Planning: Necessity of transportation planning, Classification of roads, Road patterns, Planning surveys, Highway planning and development in India, PMGSY. Highway Location and Alignment: Ideal alignment and factors controlling, Engineering survey for highway location, Drawing and reports, Highway projects
Section-B	Highway Materials and Testing: Subgrade soil, sub base and base course materials, bituminous materials, testing of soil, stone aggregates and bitumen. Highway Geometric Design: Highway cross-section elements, Sight distances, Design of horizontal alignment, Transition curves and vertical alignment.
Section-C	Traffic Engineering: Traffic characteristics, Traffic operation, Traffic studies and data collection, Design of intersections & rotaries, Signalling, Road markings and parking facilities, road user & vehicular characteristics, traffic operations, traffic control devices, intelligent transport systems. Pavement Design: Design factors, Pavement materials and their characteristics, Design of flexible pavement by CBR method, Group index and Burmister methods, Design of rigid pavements
Section-D	Construction of Roads: Construction of water-bound macadam roads, Bituminous pavements, Cement concrete roads, Constructions of joints in cement concrete pavement Highway Maintenance: Pavement failures, maintenance techniques, evaluation and strengthening of existing pavements.

Course Outcomes:

CO1: Identify and discuss the role and importance of Highway engineering

CO2: Identify & discuss the issues & concepts salient to design of pavement & road

CO3: Estimate the roadway capacity
CO4: Design pavement layers.

Text Books:

1. Highway Engineering by Khanna, S. K. & Justo, C. E. G., Nem Chand & Bros,2004.
2. Traffic Engineering and Transport Planning by Kadiyali, L. R., Khanna Publishers ,2002.
3. Highway and Traffic Engineering, Saxena, S. C., CBS Publishers and Distributors, 2008.
4. Highway Material Testing Manual" Khanna, S.K. and Justo, C.E.G., ", Nem Chand & Bros, 2004.

Reference Books:

1. Transportation Engineering and Planning Papacostas, C.S. and Prevedouros, P.D., Prentice Hall., 2002.
2. Quality Assurance Handbook for Rural Roads, Volume 1 and 2, Published by National Rural Roads Development Agency, 2007.
3. Highway Engineering IES Master's Publication,4th Edition-2020

Name of the Course	Irrigation and Hydraulic Structures		
Course Code	CE-5004	Credits-3	L-2, T-1, P-0
Total Lectures	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:

The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculator is allowed to use in examinations.

Course Objectives:

- To introduce the concepts of irrigation and channel hydraulics, used in design of inland waterways for irrigation and navigation

Section	Course Content
Section-A	Introduction- Irrigation, water resources in India, need of irrigation in India, development of irrigation in India, impact of irrigation on human environment, irrigation systems: minor and major, command area development. Water requirement of crops- Crops and crop seasons in India, cropping pattern, duty and delta; Quality of irrigation water; Soil-water relationships- soil characteristics significant from irrigation considerations, root zone soil water, infiltration, consumptive use, irrigation requirement, frequency of irrigation; Methods of applying water to the fields: surface, sub-surface, sprinkler and trickle / drip irrigation.
Section-B	Distribution system- Canal systems, alignment of canals, canal losses, estimation of design discharge. Design of channels- rigid boundary channels carrying clear and sediment laden water, alluvial channels carrying clear and sediment laden water, Kennedy's and Lacey's theory of regime channels. Canal outlets: non-modular, semi- modular and modular outlets. Water logging: causes, effects and remedial measures. Lining of canals, economics of lining, types of lining. Drainage of irrigated lands: necessity, methods..
Section-C	Canal structures- Surface and sub-surface flow considerations for design of canal structures: hydraulic jump, seepage forces, uplift forces. Canal falls, cross regulator, distributary head regulator, canal escapes: types, components and design considerations, Cross drainage works: need, types, design considerations. Canal head works- Weir and barrage, different units of head works, types of weirs, sediment control in canals, river training for canal head works. Theories of seepage for design of weirs: Bligh"s creep theory, Lane's weighted creep theory, Khosal's method of independent variables.

Section-D	Dams and spillways-Embankment dams: Classification, selection of site for dam, design considerations, estimation and control of seepage, slope protection. Gravity dams: forces, causes of failure, stress analysis, elementary and practical profile, structural joints, keys and water seals, galleries, outlets. Arch and buttress dams types. Spillways: components of spillways, types, terminal structures, types of gates for spillway crests; Reservoirs- Types, capacity of reservoirs, yield of reservoir, reservoir regulation, sedimentation, economic height of dam, selection of suitable site, flood routing.

Course Outcomes:

CO1: Identify and discuss the role and importance of engineering in irrigation.

CO2: Identify and discuss the issues and concepts salient to the design of hydraulic structures.

CO3: Identify different problems related to irrigation engineering.

CO4: Assess the results obtained by solving above problems

Text Books:

1. G L Asawa, Irrigation Engineering, Wiley Eastern
2. S K Garg, Irrigation Engineering & Hydraulic Structures, Khanna Publishers
3. P N Modi, Irrigation Engineering & Hydraulic Structures.

Reference Books:

1. J D Zimmerman, Irrigation, John Wiley & Sons.
2. Varshney, Gupta & Gupta, Theory and Design of Irrigation Structures, Nem Chand & Bros.
3. Punmia B C & Pande B B Lal, Irrigation Engineering and Water Power Engineering, Laxmi Publications

Name of the Course	MATLAB		
Course Code	**MT (IT)-301**	Credits-4	L-3, T-1, P-0
Total Lectures	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:
The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:
Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Non- programmable calculators allowed using in examinations.

Course Objectives:

- The aim of this module is to study, learn, and understand the main *concepts* of MATLAB

Section	Course Content
Section-A	MATLAB Usage and Computational Errors: Introduction to MATLAB, Types of Computer Errors, IEEE 64- bit Floating-Point Number Representation, Vectors in MATLAB, Efficient programming techniques System of Linear Equations: Solution for a System of Linear Equations, Solving a System of Linear Equations, Inverse Matrix, Decomposition (Factorization), Iterative Methods to Solve Equations
Section-B	Interpolation and Curve Fitting: Interpolation by Lagrange, Newton, and Chebyshev Polynomial, Hermite Interpolating Polynomial, Cubic Spline interpolation, Straight Line, Polynomial Curve, and Exponential Curve Fit, Fourier transform Nonlinear Equations: Bisection Method, Regula-Falsi Method, Newton Raphson Method, Secant Method, Newton Method for a System of Nonlinear Equations
Section-C	Numerical Differentiation/Integration: Difference Approximation for First Derivative, Approximation Error of First Derivative, Numerical Integration and Quadrature, Trapezoidal Method and Simpson Method, Romberg Integration, Adaptive and Gauss Quadrature. Ordinary Differential Equations: Euler's Method, Runge–Kutta Method, PredME or–Corrector Method, Vector Differential Equations, Boundary Value Problem (BVP)
Section-D	Optimization: Unconstrained Optimization, Constrained Optimization, MATLAB Built-In Routines for Optimization, Matrices and Eigenvalues: Eigenvalues and Eigenvectors, Power Method, Jacobi Method Partial Differential Equations: Elliptic, Hyperbolic, and Parabolic PDE, Finite Element Method (FEM) for solving PDE

Course Outcomes:

Upon successful completion of the course, the students will be able to

CO1 Use Computational techniques are to be learnt and executed using Matlab.

CO2 : Use MATLAB effectively to analyze and visualize data.

CO3 : Apply numeric techniques and computer simulations to solve engineering-related problems.

CO4 : Apply a top-down, modular, and systematic approach to design, write, test, and debug sequential MATLAB programs to achieve computational objectives.

Text Books:

1. "Applied Numerical methods using MATLAB", By W. Y. Yang, Wiley Publications, 2005 2. "Applied Numerical Methods with MATLAB," Steven C. Chapra, McGraw-Hill, 2005

Reference Books:

1. "Numerical Methods using MATLAB", John H. Mathews, Prentice Hall 2. "Introduction to MATLAB® for Engineers", W.J Palm, McGraw-Hill

Name of the Course	**Highway Engineering Lab**		
Course Code	**CE-5051**	Credits-1	L-0, T-0, P-2
Total Practical Sessions	15 (2 Hr Each)		
Semester End Examination	Max Marks: 50	Min. Pass Marks: 20	Max. Time: 3 Hrs.
Internal Assessment: (based on Continuous Lab Work Assessment: 20%, Experiment Performance: 30%, Attendance 10%, Viva: 40%)			Max Marks: 50 Min. Pass Marks: 25

List of Experiments

Sr. No.	Name of the Experiment
1	Determination of toughness (Impact value) of aggregate sample
2	Crushing value of road aggregate.
3	Flakiness and elongation index of given aggregate sample
4	Hardness of aggregate by Los Angeles Abrasion test
5	Grain size analysis of coarse and fine aggregates
6	Specific gravity and water absorption of aggregate
7	CBR value of a given soil sample.
8	Penetration test on bitumen
9	Softening point of bitumen sample.
10	Determination of fire and flash point of given sample of bitumen.
11	Bituminous content in a bituminous mix.
12	Ductility value of a bitumen sample.
13	Demonstration of rebound deflection of pavement by Benkelman Beam
14	Traffic survey on a road stretch.

Course Outcomes:

CO1: Identify and discuss the role and importance of different tests on pavement

CO2: : Identify and discuss the issues and concepts related to different tests in-situ and in laboratory

CO3: Student will learn regarding various test performed on bitumen

CO4: Student will learn how to perform traffic data collection

Text Books:

1. Quality Assurance Handbook for Rural Roads, Volume 1 and 2. Published by National Rural Roads Development Agency, 2007.
2. Highway Material Testing Manual" Khanna, S.K. and Justo, C.E.G., ", Nem Chand & Bros, 2004.
3. IRC codes and Manuals.

Name of the Course	Geotechnical Engineering Lab -I		
Course Code	**CE-5052**	Credits-1	L-0, T-0, P-2
Total Practical Sessions	26 hours		
Semester End Examination	Max Marks: 50	Min. Pass Marks: 20	Max. Time: 3 Hrs.
Internal Assessment: (based on Continuous Lab Work Assessment: 20%, Experiment Performance: 30%, Attendance 10%, Viva: 40%)			Max Marks: 50 Min. Pass Marks: 25

List of Experiments

Sr. No.	Name of the Experiment
1	Determination of moisture content of the given soil sample using oven method.
2	Determination of specific gravity of soil.
3	Particle size distribution of the given soil sample by Sieve analysis for coarse grained soil and Hydrometer analysis for fine grained soil.
4	Determination of Atterberg's limit (consistency limit) of the given soil sample.
5	Determination of field density by Sand replacement method.
6	Determination of field density by Core cutter method.
7	Standard Proctor`s compaction test.
8	Determination of coefficient of permeability of the given soils by constant head method.
9	Determination of coefficient of permeability of the given soils by falling head method.

Course Outcomes:

CO1: To classify soil on the basis of index properties and engineering characteristics of soil.
CO2: To analyze the difference between lab tests and in- situ testing conditions.

CO3: Evaluate the index properties of soil.

CO4: Evaluate the engineering properties of soil and interpret field data with respect to specifications given in IS codes.

CO5: Apply the concept of MDD and OMC to control compaction in the field

Text Books :

1. S. Prakash, P.K. Jain, Soil Testing for Engineers, Nem Chand & Bros, Roorkee.
2. Lambi, Engineering Soil Testing, Wiley Eastern.
3. J. P. Bowles, Engineering Properties of Soils and their Measurement, McGraw Hill.
4. Alam Singh, Soil Engineering in Theory and Practice, Vol. II, Geotechnical Testing and Instrumentation, CBSPub.
5. Soil Mechanics and Foundation Engineering (Geotechnical Engineering) By Dr. K. R. Arora, seventh edition.

Semester - VI

Name of the Course	Geotechnical and Foundation Engineering		
Course Code	CE-6001	Credits-3	L-2, T-1, P-0
Total Lectures	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:

The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculator is allowed to use in examinations.

Course Objectives:

- To provide knowledge base on the current practices in foundation engineering to carry out the job of selection, design and construction of foundation.
- Impart knowledge of determining shear strength parameters and stress changes in soil due to foundation loads, earth pressure theory and slope stability

Section	Course Content
Section-A	Earth pressure: Different types of earth pressures, states of plastic equilibrium Rankine's theory and Coulomb's theory, influence water table, surcharge, wall friction and deformation on the earth pressure, application of Rankine's and Coulomb's theory to cohesionless and cohesive soils, Culmann's graphical method, , retaining walls, stability analysis of retaining walls, Design of retaining walls.
Section-B	Stability of slopes: Stability of finite and infinite slopes, types of failures, different factors of safety, determination of factor of safety by method of slices, Swedish circle, friction circle, Bishop's method, Tylor's stability number, location of critical circle, stability analysis of earth dam slopes for different conditions. Soil Exploration: Methods of soil exploration; boring, sampling, penetration tests, correlations between penetration resistance and soil design parameters.
Section-C	Foundations: Different types of loads on foundations, types of foundations,selection of foundation type. Shallow Foundations: Bearing capacity, Terzaghi's theory, effect of foundation size, shape, ground water table, determination bearing capacity from building codes, plate load test, penetration test, static and dynamic cone tests, bearing capacity of sands and clays, settlement analysis of foundation, permissible settlements, design principles, depth of foundation, principles of floating raft, foundations on non-uniform soils.
Section-D	Pile Foundations: Necessity of pile foundation, classification of pile, materials and methods of construction, friction and end bearing piles, static formulae, Engineering News and Hiley's formula, group action, settlement of pile groups

	in sand and clays, pile load test, negative skin friction, under-reamed piles. Well foundation: Elements, forces acting on well, lateral stability analysis, problems in sinking of wells and remedial measures.

Course Outcomes:

Upon successful completion of the course, the students will be able to

CO1: To learn slope stability analysis and different methods of determining the factor of safety.

CO2: To assess the stability of retaining wall with respect to sliding,overturning and its design considering lateral earth pressure.

CO3: To know different types of foundations, their general requirements and loads imposed.

CO4: To estimate the ultimate bearing capacity of shallow foundations and their settlement Behavior as well as design shallow foundations.

Text Books:

1. Ranjan, G. and Rao, A.S.R., "Basic and Applied Soil Mechanics", New age, 2000.
2. Das, B.M., "Principles of Foundation Engineering", PWS, 2004
3. Som, N.N. and Das, S.C., "Theory and Practice of Foundation Design", Prentice-Hall, 2003.

Reference Books:

1. Couduto, Donald P., "Geotechnical Engineering – Principles and Practices", Prentice-Hall, 1999.
2. Peck, R.B., Hanson, W.E. and Thornburn, T.H., "Foundation Engineering", John Wiley, 1974.
3. Indian Standards Codes

Name of the Course	Design of RCC Structure		
Course Code	**CE-6002**	Credits: 4	L-3, T-1, P-0
Lectures to be delivered	52 (L = 39 T=13 for each semester)		
Semester End Examination	Max. Time: 3 hrs.	Max. Marks: 100	Min. Pass Marks:40
Internal Assessment (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%		Max. Marks: 50	

Instructions

For Paper Setters:

The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non- programmable calculators is allowed.

Course Objectives

- To understand fundamental properties of Concrete
- To understand the various design methods
- To understand design of various elements of building

Section	Course Content
Section-A	Properties of Concrete: Compressive strength, tensile strength, stress-strain behavior, modulus of elasticity, shrinkage, creep, characteristic strength, grades of concrete, design stress-strain curve of concrete, reinforcing steel, types and grades, stress-strain behavior, design stress-strain curve, basic properties of concrete constituent materials and fresh concrete, design of concrete mix.
Section-B	Basic Concepts of Reinforced Concrete Design: Working stress and limit state design methods. Design and detailing of R.C. Beams in Flexure: Singly and doubly reinforced rectangular/flanged sections, design for shear, bond and anchorage of reinforcement, limit states of deflection and cracking. Design for Torsion: Design of RC beams subjected to torsion and detailing.
Section-C	Design of Slabs: One way and two-way slabs. Design of Columns: Subjected to eccentric and axial loading, Using S.P. 16.
Section-D	Design of footings: Individual and combined footing and raft foundation. Design of retaining walls: Various types of retaining walls, design of cantilever and counterfortretaining walls

Course Outcomes

CO1: Identify and discuss the role and importance of theory related to Concrete.
CO2: Identify and discuss the issues and concepts salient to design of slabs.
CO3: Identify and discuss the design of retaining walls.
CO4: Read and execute the drawings and detailing of reinforcement for the designed structures in the field.
CO5: Design large structures integrating the principles of design and become familiar with professional and contemporary issues in design and detailing of reinforcement.

Text Books

1. IS 456 2000: Code of Practice for Plain and Reinforced Concrete
2. B. C. Punmia: Reinforced Concrete Structures, Luxmi Publications
3. Limit state design of reinforced concrete by Varghese, P. C. Prentice-Hall, New Delhi
4. Reinforced concrete design by Pillai, S, Unnikrishna, Menon Devdas: Tata McGraw-Hill, New Delhi
5. Fundamentals of Reinforced Concrete Design by M.L. Gambhir, Prentice-Hall, New Delhi.

Reference Books

1. Shah, V.L. and Karve, S.R., "Limit State Theory and Design of Reinforced Concrete", Structures Publication.
2. Design of reinforced Concrete Structures by N Subramanian, Oxford university Press
3. Limit State Design of Concrete Structures by Ram Chandra and Virendra Gehlot, SP.

Name of the Course	Water Supply Engineering		
Course Code	CE-6003	Credits: 3	L-2, T-1, P-0
Lectures to be delivered	52 (L = 39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min.Pass Marks: 40	Max. Time:3Hrs.
Internal Assessment (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%			Max. Marks: 50

Instructions

For Paper Setters:

The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non- programmable calculators is allowed.

Course Objectives

- To understand fundamental aspects of basics of water quality
- To understand concepts of water quality and its treatment methods
- To understand importance of planning and execution of modern water supply schemes

Section	Course Content
Section-A	Introduction: Environmental pollution, water pollutants and impact on human beings. Source of water supply, selection of water sources. Water Demand: Types of demand: per capita demand, variation in demand, design period, estimation of demand, population forecast. Water Quality: Water quality requirements, physical, chemical and biological characteristics, significant water quality parameter for municipal water supplies, Standard and guidelines for water quality parameters.
Section-B	Water Treatment: Types and screening, Design of treatment units: aeration, sedimentation, sedimentation tank and types, coagulation-flocculation, filtration and disinfection. Advanced treatment-activated carbon adsorption and ozonation.
Section-C	Collection and Distribution System: Intakes and their design for rivers, lakes; capacity of distribution reservoir, Design of distribution system, analysis of pipe network- hardy cross method, equivalent pipe method, Newton-Raphson method, method of section. Distribution methods: layout, construction and maintenance.
Section-D	Pipes-joints-fittings: Conduits types, testing, inspection, joints in pipe, Design consideration for water piping system. Pumps and pumping: Necessity, types of pumps, selection criteria, economical diameter of pumping, pump testing, water hammer: control measures. Rural Water Supply and Treatment: Water demand and treatment techniques for rural area, water problems and remedial measures

Course Outcomes

CO1: Identify and discuss the different sources of raw water and the associated water demands from such sources.

CO2: Identify and discuss the different treatment processes associated for supplying treated water for different uses.

CO3: Identify and discuss the importance of the disinfection process (purification) of treated water supply for domestic purposes.

CO4: Understand the importance of environment and its application in our day to day life.

Text Books:

1. S.K. Garg, Environmental Engineering (Volume -1) Water Supply Engineering-Khanna Publishers
2. J. S Birdie, G S Birdie: Water Supply and Sanitation Engineering, 9th Edition, Dhanpat Rai Publications, India,2014.
3. B.C. Punmia, A.K. Jain, A.K. Jain: Water Supply Engineering, 2ndEdition, Laxmi Publications. India,2016

Reference Books:

1. Water Supply & Pollution Control byWarren Viessman Jr, Mark J. Hammer &Elizabeth Perez, PHI.
2. Water Supply and Sewerage by McGhee T.J., McGraw Hill, 1991.
3. H. Peavy, D. Rowe, G. Techobanoglous "Environmental Engineering", Ist Edition, McGraw Higher Education Publications, India, 2017.

Name of the Course	Transportation Engineering-II		
Course Code	**CE-6004**	Credits: 3	L-3, T-1, P-0
Lectures to be delivered	52 (L = 39, T=13 for each semester)		
Semester End Examination	Max. Time: 3 hrs.	Max. Marks: 100	Min. Pass Marks:40
Internal Assessment (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%			Max. Marks: 50

For Paper Setters: The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For candidates: Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non- programmable calculators is allowed.

Course Objectives

- To understand fundamental concepts of airport and railways
- To understand the design parameters of railways
- To understand the design concepts of airports

Section	Course Content
Section-A	Railway Transportation and its development: Advantages, Classification of Railways, historical development of railways in India, Track alignment, Surveying, subgrade and embankment, Railway stations and yards
Section-B	Railway Design: Elements of permanent way Rails, Sleepers, Ballast, rail fixtures and fastenings, Track Stress, coning of wheels, creep in rails, signalling and Control System, Geometric design of railways: gradient, super elevation, Points and Crossings ; Principles and classification of signals, control of movement of trains, track drainage and maintenance Railway track, component parts, gauges, , resistances to traction and stresses in track, various resistances and their evaluation, hauling capacity and tractive effort, stress in rail, sleepers, ballast and foundation.
Section-C	Airport Planning: Air transport characteristics-airport classification-airport planning: objectives, components, layout characteristics, criteria for airport site selection and ICAO stipulations, Typical airport layouts, Parking and circulation area, Airport Zones, Passenger Facilities and Services. Airport Design: Runway Design: Orientation, Wind Rose Diagram, Runway length, Geometric design of runways, Configuration and Pavement Design Principles, Elements of Taxiway Design, Runway and Taxiway Markings and lighting. Airport obstructions: Zoning, classification of obstructions, imaginary surfaces, approach zone and turning zones
Section-D	Tunneling: Necessity, shape, size, alignment, shafts, pilot tunnel, tunneling through soft ground, through rocks, drilling, safety measures, ventilation, lightening, drainage and tunneling machinery.

Course Outcomes:

CO1: Identify factors affecting airports and railways design

CO2: Describe the process of planning railways and airports

CO3: Apply principles of railways and airport planning

CO4: Assess the effect of proper airport and railways planning

Text Books:

1. "A Course in Railway Engineering" by Saxena Subhash C and Satyapal Arora, Dhanpat Rai and Sons, Delhi, 2003.
2. "Airport Planning and Design" by Khanna S K, Arora M G and Jain S S, Nem Chand and Brothers, Roorkee, 2012
3. Irrigation Engineering & Hydraulic Structures by S.R. Sahasrabudhe, S K Kataria & Sons.
4. Transportation Engineering by Vazirani and Chandola, S.P., Khanna Publishers

Reference Books:

1. Planning & Design of airports'" by Horonjeff, Robert and McKelvey, Francis X , 4th Ed., McGraw Hill
2. Airport Engineering – Planning and Design by Saxena, S.C, CBS Publishers.

Name of the Course	**Estimation and Costing**		
Course Code	**CE-6005**	Credits: 3	L-3, T-1, P-0
Lectures to be delivered	52 (L = 39 T=13 for each semester)		
Semester End Examination	Max.Time:3hrs.	Max. Marks: 100	Min. Pass Marks:40
Internal Assessment (based on sessional tests 50%,Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%			Max. Marks: 50

For Paper Setters: The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For candidates: Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non- programmable calculators is allowed.

Course Objectives

- To understand fundamental estimation and costing
- To understand various estimation methods for specific type of work
- To understand how maintain public works accounts

Section	Course Content
Section-A	Estimate: Principles of estimation, units, items of work, different kinds of estimates, different methods of estimation, estimation of materials in single room building, two roomed building with different sections of walls for foundation, floors and roofs, R.B. and R.C.C. works, plastering, white-washing, distempering, painting, doors and windows, and lump sum items, estimates of canals and roads.
Section-B	Specification of Works: Necessity of specifications, types of specifications, general specifications, specification for bricks, cement, sand, water, lime, reinforcement; detailed specifications for earthwork, cement, concrete, brick work, floorings, D.P.C., R.C.C, cement plastering, white and colour washing, distempering, painting.
Section-C	Rate Analysis: Purpose, preparation of rate analysis, procedure of rate analysis for items:- Earthwork, concrete works, R.C.C. works, reinforced brick work, plastering, painting, white-washing and distempering. Valuation: Gross income, net income, outgoings, scrap values, salvage value, obsolescence, annuity, sinking fund, depreciation, valuations of buildings.
Section-D	Public Works Account: Regular and work charge establishment, earnest money, security money, retention money, muster roll, measurement book, cash book, examination and payment of bills, first and final bills, administrative sanction, technical sanction

Course Outcomes

CO1: Identify and discuss the role and importance of estimation and costing in civil engineering
CO2: Identify and discuss the issues regarding estimation of specific type of work
CO3: Identify and discuss the method of maintaining various public work accounts.
CO4 : Prepare quantity estimates for Buildings, roads & rails and canal structures as per specifications.

Text Books:

1. Estimating& Costing in Civil Engineering: Theory and Practice by B.N. Dutta.
2. Estimating and Costing for Building & Civil Engineering Works by P.L. Bhasin.
3. Costing & Specification in Civil Engineering by M. Chakarborty, Estimating.
4. Building Construction Estimating by George H. Cooper.

Reference Books:

1. Estimation, Costing, Specifications and Valuation in Civil Engineering, Chakraborti, M, National Halftone Co. Calcutta.

2. Building Construction Estimating by George H.Cooper.

3. Estimating and Costing for Building & Civil Engg.Works by P.L.Bhasin.

4. Standard Schedule of rates and standard data book by Public Works Department.

Name of the Course	Concrete Technology		
Course Code	**CE-6006**	Credits: 3	L-3, T-0, P-0
Lectures to be delivered	52 (L = 39, , T=13 for each semester)		
Semester End Examination	Max. Time: 3 hrs.	Max. Marks: 100	Min. Pass Marks:40
Internal Assessment (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%		Max. Marks: 50	

Instructions

For Paper Setters:

The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

Course Objectives

- To understand concrete making materials including supplementary cementations materials
- To understand concrete production process
- To understand concrete production process and properties and uses of concrete as a modern material of construction

Section	Course Content
Section-A	Cement: Composition, types, manufacturing of ordinary Portland cement, rate of hydration, Special types. Aggregates: Classification of aggregate, mechanical properties of aggregate, bulking of Aggregate, soundness, alkali aggregate reaction, thermal properties, sieve analysis, grading of fine & coarse aggregates.
Section-B	Admixtures- Additives and admixtures, types, necessity and benefit, Mineral admixture- fly ash, silica fume, blast furnace slag and other pozzolanic materials. Chemical admixtures- Accelerator, retarder, water reducing elements, plasticizer and super-plasticizer, their functions and dosage.
Section-C	Fresh concrete: Quality of mixing water, workability of concrete, factors affecting workability, measurement of workability, setting times of concrete, segregation and bleeding, mixing and vibration of concrete, steps in manufacture of concrete, curing necessity and various methods. Strength of concrete: Water/cement ratio, permeability of concrete, durability of concrete. Testing of hardened concrete: Compression and tension tests, factors affecting strength, flexure test, non-destructive testing methods.

Section-D	Elasticity, creep and shrinkage: Modulus of elasticity, dynamic modulus of elasticity, Poisson's ratio, creep of concrete, factors influencing creep, relation between creep and time, nature and effect of creep, shrinkage of concrete, types of shrinkage. Mix design: Factors considered in the choice of mix proportions, quality control of concrete, proportioning of concrete mixes by various methods, IS code method of mix design, Special concrete: Self-compacting, fibre-reinforced concrete, ready mix concrete.

Course Outcomes:

CO1: Identify and discuss the behaviour of fresh and hardened concrete.

CO2: Identify and discuss the influence of chemical and mineral admixture.

CO3: Identify and discuss the need for special concretes.

CO4: Follow standard practices in the production of quality concrete.

Text Books:

1. Concrete Technology: Theory and Practice, By M.L. Gambhir, Fifth edition, Tata McGraw Hill publication.
2. Concrete Technology by A R Shanta Kumar, oxford universitypress.
3. Concrete Technology Theory and Practice, M.S. Shetty, S. Chand and companyLtd.
4. I.S. codes.

Reference Books:

1. Mindess, S., and Young, J. F. Concrete. Prentice Hall, Inc., NJ, 1981. J. Newman and B. S. Choo, Eds.,Advanced Concrete Technology. Four Volume Set, Elsevier, 2003
2. A. M. Neville, ―Properties of Concrete‖, English Language Book Society/Longman Pub, 1988

Name of the Course	Environmental Engineering Lab		
Course Code	**CE-6051**	Credits-1	L-0, T-0, P-2
Total Practical Sessions	15 (2 Hr. Each)		
Semester End Examination	Max Marks: 50	Min. Pass Marks: 20	Max. Time: 3 Hrs.
Internal Assessment: (based on Continuous Lab Work Assessment: 20%, Experiment Performance: 30%, Attendance 10%, Viva: 40%)			Max Marks: 50 Min. Pass Marks: 25

List of Experiments

Sr. No.	Name of the Experiment
1	Determination of pH of given water and wastewater sample.
2	Determination of total solids, suspended solids and dissolve solids of water and waste water sample
3	Determination of conductivity of water and wastewater sample.
4	Determination of turbidity.
5	Determination of concentration of chlorides of water and wastewater sample.
6	Determination of type and extent of alkalinity of water and wastewater sample.
7	Determination of acidity of water and wastewater sample.
8	Determination of temporary and permanent hardness by standard EDTA method.
9	Determination of Sulphates of water and wastewater sample.
10	Determination of dissolved oxygen.
11	Determination of residual chlorine in a given sample of water and wastewater.
12	Determination of Biological oxygen demand (BOD).
13	Determination of Chemical oxygen demand (COD).

Course Outcomes:

CO1: Identify and discuss the role and importance of various test on water.
CO2: Identify and discuss different types of test on wastewater.
CO3: Identify and discuss various type of instruments used on site.
CO4: Demonstrate the ability to write clear technical laboratorial reports

Text Books:

1. Methods of Sampling and Test (Physical and Chemical) for Water and Wastewater (IS:3025).
2. Standard Methods for the Examination of Water and Wastewater (2012) APHA, AWWA.
3. Chemistry for Environmental Engineering and Science: C.N. Sawyer, P.L. McCarty & G.F. Parkin.
4. Mathur, R.P., Water and Wastewater testing: A laboratory Manual (2013**).**

Name of the Course	**Building Materials Lab**		
Course Code	**CE-6052**	Credits-1	L-0, T-0, P-2
Total Practical Sessions	15 (2 Hr. Each)		
Semester End Examination	Max Marks: 50	Min. Pass Marks: 20	Max. Time: 3 Hrs.
Internal Assessment: (based on Continuous Lab Work Assessment: 20%, Experiment Performance: 30%, Attendance 10%, Viva: 40%)			Max Marks: 50 Min. Pass Marks: 25

List of Experiments

Sr. No.	Name of the Experiment
1	Test for Cement: i. Fines of Cement - a) Sieve Analysis Air b) Permeability Test ii. Standard Consistency iii. Initial and Final Setting Time iv. Soundness v. Compressive Strength vi. Specific Gravity
2	Test for Fine Aggregate: i. Specific Gravity (FA) ii. Bulking of Fine Aggregate iii. Fineness Modulus, gradation.
3	Test for Course Aggregate: i. Specific Gravity and Water Absorption ii. Fineness Modulus and Gradation.
4	Test for Fresh & Hard Concrete: i. Workability Test a) Compaction Factor Test b) Vee Bee Test ii. Cube and Cylinder Strength of Concrete iii. Flexural Tensile Strength
5	Test for Brick & Stone: i. Water Absorption/Efflorescence ii. Compressive Strength

Course Outcomes:

Upon successful completion of the course, the students will be able to:

CO1: Identify the various test procedures carried out for a building materials

CO2: Design and develop the materials for construction

CO3: Determine appropriateness of the material

CO4 : Outline the importance of testing of cement and its properties

Text Books:

1. Methods of Sampling and Test (Physical and Chemical) for Water and Wastewater (IS: 3025).
2. Standard Methods for the Examination of Water and Wastewater (2012) APHA, AWWA.
3. Chemistry for Environmental Engineering and Science: C.N. Sawyer, P.L. McCarty & G.F. Parkin.
4. Mathur, R.P., Water and Wastewater testing: A laboratory Manual (2013**).**

Name of the Course	**Geotechnical Engineering Lab -II**		
Course Code	**CE-6053**	Credits-1	L-0, T-0, P-2
Total Practical Sessions	15 (2 Hr Each)		
Semester End Examination	Max Marks: 50	Min. Pass Marks: 20	Max. Time: 3 Hrs.
Internal Assessment: (based on Continuous Lab Work Assessment: 20%, Experiment Performance: 30%, Attendance 10%, Viva: 40%)			Max Marks: 50 Min. Pass Marks: 25

List of Experiments

Sr. No.	Name of the Experiment
1	Determination of shear strength parameters of cohesionless soils by Direct Shear Test.
2	Determination of shear strength parameters of soil by Unconfined Compressive Strength Test
3	Determination of shear strength parameters by Triaxial Test
4	Determination of Free Swelling Index of given expansive soil
5	Oedometer test for consolidation of soils.
6	Determination of shear strength of cohesive soils by Vane Shear Test.
7	.Determination of in–situ shear strength by Standard Penetration test (Demonstration).

Course Outcomes:

The students will

CO1: have thorough knowledge about the procedures of laboratory tests used for determination of physical, index and engineering properties of soils

CO2: have the capability to classify soils based on test results and interpret engineering behavior based on test results

CO3: be able to evaluate the permeability and shear strength of soils

CO4: be able to evaluate settlement characteristics of soils

CO5: be able to evaluate compaction characteristics required for field application

Text Books:

1. Soil Mechanics laboratory manual by Braja M Das; Publisher: Oxford university press
2. Manual of Soil laboratory Testing (Vol. 1 and Vol. 2) by K. H. Head; Publisher: Pentech Press, London

Semester – VII

Name of the Course	**Sewage Treatment and Disposal**		
Course Code	**CE-7001**	Credits: 3	L-2, T-1, P-0
Lectures to be delivered	**52** (L = 39, T=13 for each semester)		
Semester End Examination	Max. Time: 3hrs.	Max. Marks: 100	Min. Pass Marks:40
Internal Assessment (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%		Max. Marks: 50	

Instructions

For Paper Setters: The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For candidates: Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non- programmable calculators is allowed.

Course Objectives

- To understand fundamental aspects of sewage treatment
- To understand the characteristic of sewage
- To understand how to do secondary treatment of sewage

	Course Content
Section A	Sewage Generation, Collection: Classification, Sewerage system-separate, combined and partially separate, quantity and variation, sewer shapes- egg and circular, Design and layout of sewerage system, self-cleansing velocity, characteristics and maintenance
Section B	Sewage Characterization: Constituents, Quality parameters: physical, chemical and biological Characteristics. Indian Standards for disposal of effluents into inland surface sources and on land. Primary Treatment of Sewage: Objectives, efficiency of conventional treatment unit, Preliminary treatment-screening and grit removal unit. Design aspects of primary treatment system.
Section C	Secondary Treatment of Sewage: Secondary treatment- Activated sludge process, conventional and extended aeration, sludge digestion and drying beds. Stabilization ponds, UASB process and post treatment.
Section D	Disposal of Sewage: Disposal of sewage by dilution, waste water disposal on land and water bodies, disposal of sludge

Course Outcomes:

CO1: Identify and discuss the role and importance of sewage treatment plants.
CO2: Identify and discuss the issues and concepts related to sewage disposal.
CO3: Identify and discuss the various method of treatment.
CO4: Design a sewage treatment plant and understand the application of various sewage treatment techniques

Text Books:

1. Environmental Engineering – Sewage Disposal and Air Pollution Engineering (Volume -2), S.K. Garg, KhannaPublishers, India, 2015.
2. J. S Birdie, G S Birdie: Water Supply and Sanitation Engineering, 9th Edition, Dhanpat Rai Publications, India, 2014.
3. Manual for Sewage Treatment by Ministry of Urban Development, Govt of India.
4. Wastewater Engineering by Metcalf & Eddy, McGraw Hill.

Reference Books:

1. H. Peavy, D. Rowe, G. Tchobanoglous "Environmental Engineering", Ist Edition, McGraw Higher Education Publications, India, 2017.
2. Wastewater Treatment Concepts & Design Approach by G.L. Karia and R.A. Christian, PHI

Semester – VIII

Name of the Course	**Principles of Engineering Economics and Management**		
Course Code	**HSMC-8001**	Credits: 3	L-2, T-1, P-0
Lectures to be delivered	52 (L = 39, T = 13 for each semester)		
Semester End Examination	Max. Time: 3 hrs.	Max. Marks: 100	Min.Pass Marks:40
Internal Assessment (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%		Max. Marks: 50	

Instructions

For Paper Setters:

The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

Course Objectives

- To understand fundamental concepts of economics
- To understand various theories of economics
- To understand basic principles of managements

Section	Course Content
Section-A	**Economics**: Definitions; Nature & scope of Economics; Economics Systems- meaning of Capitalism; Socialism & mixed economy. **Demand and supply analysis**: Law of demand and supply, exception to the law of demand; Elasticity of demand and supply and their types; Methods of measuring elasticity of demand and supply.
Section-B	**Theory of production**: Scales of production, Law of returns; Break even analysis. **Monetary and Fiscal policy:** Meaning & objectives of fiscal policy in a developing country like India; Functions of Reserve Bank of India and commercial banks. **Economics & business environment**: Privatization; Growth of private capitalism in India; Business/Trade Cycles – Meaning; Characteristics & classification; foreign capital & economic development.

Section-C	**Management principles**: Meaning & types of Management; Concept of Scientific Management; Management by Objectives; System Approach to Management. **Financial management**: Meaning; Functional areas of financial management; Sources of Finance; Meaning of financial accounting; accounting principles- concepts & conventions; Importance of final accounts – profit & loss a/c and balance sheet; Need and importance of capital budgeting. **Marketing management**: Introduction to marketing management; Market segmentation; Developing & managing advertising programs; Deciding on media & measuring effectiveness.
Section-D	**Production Management:** Procedure for production planning & Control; Plant Location & Lay-out; Routing; Scheduling; CPM & PERT **Quality Management:** Quality Management System, Quality Management Principles, ISO 9001 Structure, Quality Audits, ISO Registration, Requirements, Benefits of ISO registration.

Course Outcomes:

CO1: Identify and discuss the role and importance of economics in civil engineering.
CO2: Identify and discuss the issues and concepts related to production and quality management.
CO3; Apply cost estimation and alternative analysis techniques for engineering applications.
CO4: Identify and discuss the complex issues related to management.

Text Books:

1.Business Organisation & Management by B.P.Singh, T.N.Chabra, Dhanpat Rai & Sons

2.Modern Economic Theory by K .K. Dewett, S.Chand & Co

3. Marketing Management by Philip Kotler, Prentice Hall of India 4.Financial Management by I.M. Pandey, Vikas Publishin g House

Reference Books:

1.Indian Economic by Ruddar Dutt, K. P. M. Sundaram, S.Chand & Co

2.Advanced Economic Theory by H.L.Ahuja, S.Chand & Co

3.Production Operation Management by Dr. B.S. Goel, Pragati Prakash an

4.Statistical Quality Control by Grant, Leaven worth, Tata Mc. Graw Hill

5. Personnel Management by, Edwin B.Flippo, Tata Mc. Graw Hll .

Electives

Name of the Course	**Repair and Rehabilitation of Structures**		
Course Code	**CE-7011**	Credits-3	L-2, T-1, P-0
Total Lectures	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks:100	Min. Pass Marks:40	Max.Time:3Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:
The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:
Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculator is allowed to use in examinations.

Course Objectives:

- To understand fundamental concepts related to repair of structures.
- To understand various types of testing methods.
- To understand different type of repair and retrofit techniques.

Section	Course Content
Section-A	Aging of structures – performance of structures – need for repair and rehabilitation – Distress in concrete/steel structures, Causes of distress, Damage assessment and Evaluation models evaluation methods for condition, strength, serviceability
Section-B	Damage testing methods, Non-Destructive testing methods, Semi destructive testing and Destructive test methods,
Section-C	Methods of repairs - Repair and maintenance of buildings, Repair materials, repair techniques, and quality control methods for repair of concrete, masonry, steel and timber.
Section-D	Retrofit techniques required in structures resulting from change in function, loading, and seismic forces, retrofit of foundations, base isolation and energy dissipation, Retrofit of Historical and heritage buildings.

Course Outcomes:

CO1: Identify and discuss the role and importance repair and retrofit in structures.
CO2: Identify and discuss the various methods of repair and retrofit.
CO3: Apply principles of compatibility of structural element and material
CO4: Assess the deficiency in the functional requirement of the building.

Text Books:

1. Handbook of seismic retrofit of buildings, CPWD, IBC and IIT Madras, Narosa Publishing.
2. Seismic design, assessment and retrofitting of concrete buildings by Michael N. Fardis Springer.

Reference Books:

1. Retrofitting Design of Building Structures by Xilin Lu, CRC Press.
2. Earthquake-Resistant Structures: Design, Build and Retrofit by Mohiuddin Ali Khan Butterworth- Heinemann.
3. Concrete Structures, Materials, Maintenance and Repair, by Denison Campbell, Allen and Harold Roper, Longman Scientific and Technical UK.
4. RN Raikar, Diagnosis and treatment of Structures in Distress, R and D Centre, Structural Designers and Consultants, New Bombay, India,1994

Name of the Course	Ground Improvement Technique		
Course Code	**CE-7012**	Credits-3	L-2, T-1, P-0
Total Lectures	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:
The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:
Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculator is allowed to use in examinations.

Course Objectives:

- To understand fundamental concept of dewatering.
- To identify the problematic soil and suggest suitable remedial measures.
- To understand how to stabilize soil.

Section	Course Content
Section-A	Dewatering: Need and objectives of Ground Improvement, Classification of Ground Modification Techniques - suitability and feasibility, Emerging Trends in ground improvement, methods of de- watering- sumps and interceptor ditches- single, multi stage well points - vacuum well points- Horizontal wells-foundation drains-blanket drains- criteria for selection of fill material around drains– Electro- osmosis.
Section-B	Grouting: Chemical grouting, commonly used chemicals, grouting systems, grouting operations, applications, compaction grouting, application and limitations, plant for preparing grouting materials, jet grouting, jet grouting process, geometry and properties of treated soils and applications.
Section-C	Compaction: Principles of compaction, Engineering behaviour of compacted clays, field compaction techniques static vibratory, impact, Earth moving machinery, Compaction control, application to granular soils, cohesive soils, depth of improvement, environmental considerations, induced settlements, compaction using vibratory probes, vibro techniques, vibro equipment, vibro compaction and replacement process, vibro systems and liquefaction, soil improvement by thermal treatment, preloading techniques, surface compaction, introduction to bio technical stabilization
Section-D	Stabilisation: Introduction to soil improvement by adding materials, lime, flyash, cement and other chemicals and bitumen, sand column, stone column, sand drains, prefabricated drains, lime column, soil- lime column, stabilization of soft clay or silt with lime, bearing capacity of lime treated soils, settlement of lime treated soils, improvement in slope stability, control methods. Expansive soils: Problems of expansive soils – tests for identification – methods of determination of swell pressure. Improvement of expansive soils– Foundation

	techniques in expansive soils – under reamed piles

Course Outcomes:

CO1: Identify and discuss the role and importance of theories in soil stabilizations.
CO2: Identify and discuss the issues and concepts related to grouting.
CO3: Identify and discuss the complex issues related to expansive soils.
CO4: Identify and discuss various compaction techniques including vibratory methods.

Text Books:

1. Ground Improvement by M.P. Moseley and K. Kirsch, Spon Press.
2. Ground Control and Improvement by Petros P Xanthakos, Lee W Abramson and Donald A Bruce, Wiley Interscience.
3. Ground Improvement Techniques by P. Purushothama Raj, Laxmi Publications.

Reference Books:

1. Ground Improvement by Klaus Kirsch & Alan Bell, CRC Press.
2. Soil Improvement Technique and their Evolution by W.E. Van Impe.

Name of the Course	Earth Retaining Structures		
Course Code	**CE-7013**	Credits-3	L-2, T-1, P-0
Total Lectures	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:

The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculator is allowed to use in examinations.

Course Objectives:

- To understand fundamental aspects of Stability analysis ofstructures
- To understand the Rigid retaining structures
- To understand how to evaluate stability analysis of slopes

Section	Course Content
Section-A	Introduction, Rankine and Coulomb theories, Graphical method, Passive earth pressure by curved rupture surface. Stability analysis of gravity type, Cantilever type, Counterfort type retaining walls, Design of Soil reinforced retaining walls.
Section-B	Rigid retaining structures: Types; stability analysis. Flexible retaining structures: Types; material; cantilever sheet piles; anchored bulkheads– methods of analysis, moment reduction factors; anchorage.
Section-C	Reinforced soil walls: Elements and stability. Soil arching. Braced excavation: Pressure distribution in sands and clays; bottom heave. Underground structures in soils: Pipes; tunnels. Tunneling techniques.
Section-D	Braced excavations, Analysis and design of sheet piles, Stability of slopes, Finite and infinite slopes, Swedish circle method, Taylor's modified Swedish circle method, Taylor's stability charts and Bishop's method of analysis.

Course Outcomes:

CO1: Identify and discuss the role and importance of earth retaining structures.
CO2: Identify and discuss the issues and concepts related to reinforced soil walls.
CO3: Identify and discuss the rigid retaining structures.
CO4: Students will be able to design retaining walls, anchored bulkheads, braced cuts, coffer dams and earth dams

Text Books:

1. Earth pressure and earth retaining structures by Clayton, Milititski and Woods, Taylor & Francis Group, London.
2. Principles of Geotechnical Engineering by Braja M. Das, Thomson

Reference Books:

1.Soil Mechanics and Foundation Engineering: Dr. K. R. Arora, Standard Publisher Dist.

Name of the Course	**GIS and Remote Sensing**		
Course Code	**CE-7014**	Credits-3	L-2, T-1, P-0
Total Lectures	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:

The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculator is allowed to use in examinations.

Course Objectives:

- To understand fundamental concept of GIS
- To understand the various components and Data type in GIS
- To understand how to do modelling in GIS

Section	Course Content
Section-A	Remote Sensing: Remote sensing system; Physics of remote sensing, EMR characteristics and interaction in atmosphere and with ground objects, spectral properties of water bodies, vegetation, soil etc, resolution, sensors and platforms, types of resolution, image processing, classification; geometric and radiometric distortions, geo-referencing, digital image processing, image enhancement, transformations and classification; visual interpretation techniques, applications of remote sensing for earth resource management; applications of optical and microwave remote sensing techniques in Civil Engineering
Section-B	Image Interpretation and Analysis: Types of Data Products – types of image interpretation – basic elements of image interpretation - visual interpretation keys – Digital Image Processing – Pre-processing – image enhancement techniques – multispectral image Classification – Supervised and unsupervised.
Section-C	Image Interpretation and Analysis: Types of Data Products – types of image interpretation – basic elements of image interpretation - visual interpretation keys – Digital Image Processing – Pre-processing – image enhancement techniques – multispectral image Classification – Supervised and unsupervised.
Section-D	Data Entry, Storage and Analysis: Data models – vector and raster data – data compression – data input by digitization and scanning – attribute data analysis – integrated data Analysis – Modeling in GIS Highway alignment studies – Land Information System.

Course Outcomes:

CO1: Identify and discuss the role and importance of GIS in civil engineering.
CO2: Identify and discuss the issues and concepts related to information systems.
CO3: Identify and discuss the various models in GIS.
CO4: To relate observations from remote sensing satellite data to models (mathematical, computational and conceptual) and mapping

Text Books:

1. Concepts & Techniques of GIS by C.P.Lo Albert, K.W. Yonng.
2. Remote sensing and Image interpretation by T. M. Lillesand and R. W. Keifer.
3. Remote Sensing and GIS by B. Bhatta.

Reference Books:

1. Fundamentals of Remote Sensing by George Joseph.

Name of the Course	Finite Element Method		
Course Code	**CE-7021**	Credits-3	L-2, T-1, P-0
Total Lectures	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:

The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculator is allowed to use in examinations.

Course Objectives:

- To learn basic concept of finite element method
- To apply FEM in different civil engineering problems
- To learn how it is used in different field of engineering

Section	Course Content
Section-A	Basic Concepts, Discretization; Displacement, Force and Hybrid Models. Interpolation Functions for General Element Formulations: Compatibility and Completeness, Polynomial Forms: One Dimensional Elements, Geometric Isotropy, Triangular Elements, Rectangular Elements, Three Dimensional Elements, Isoperimetric Formulations, Axisymmetric Elements; Numerical Integration.
Section-B	Applications in Solid Mechanics: Plane Stress/Strain: FE Formulation: CST, LST; Stiffness Matrix, Load Matrix Formation Rectangular Element Isoparametric Formulation: Plate Elements and Shell Elements, Three-Dimensional Elements FE Formulation: Axisymmetric Stress Analysis, Torsion, Interface Elements, Infinite Elements
Section-C	Application in Structural Dynamics and Vibrations: Mass (Consistent and Diagonal) and Damping, Matrices; Modal Analysis, Time History Analysis, Explicit Direct Integration/ Implicit Direct Integration and Mixed Methods. Introduction to Nonlinear Problems: Geometric and Material (Elasto-plastic), Solution Methods: Newton Ralphson Method, Modified Newton-Ralphson Method, Arc Method, A Problem of Geometric Nonlinearity.
Section-D	Stationary Principles, Rayleigh Ritz Method and Interpolation; Weighted Residual Methods and Variational Methods, Numerical Errors and Convergence.

Course Outcomes:

CO1: Understand the basic aspects of finite element methods.
CO2: Develop an engineering solution for 1-D (spring) element using finite element approaches.
CO3: Apply principles of different Finite Element Formulation Techniques.
CO4: Assess the Applications of FEM in in civil engineering.

Text Books:

1. David Hutton, "Fundamentals of Finite Element Analysis", Tata McGraw Hill 2005.
3. R. D. Cook, Malkus and Plesha, "Concepts and Applications of Finite Element Analysis", 3rd Ed., John Wiley.1989.
4. T. J. R. Hughes, "The Finite Element Method: Linear Static and Dynamic Analysis", Prentice Hall. 1987.
5. Klaus Juergen Bathe, "Finite Element Procedures", Prentice Hall of India. 2003.
6. O. C. Zienkiewicz., R. L. Taylor & J. Z. Zhu., "The Finite Element Method Its Basis & Fundamentals", Elsivier Publications.

Reference Books:

1. An Introduction to the Finite Element Method, 3rd Edition, McGraw-Hill Science/Engineering/Math by Reddy, J. N., 2005.
2. A First Course in the Finite Element Method by Logan D. L., Thomson-Engineering, 3rd edition, 2001.

Name of the Course	Environmental Management and Impact Assessment		
Course Code	**CE-7022**	Credits-3	L-2, T-1, P-0
Total Lectures	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:

The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculator is allowed to use in examinations.

Course Objectives:

- Learn the basic objectives necessary to conduct EIA.
- Understand and predict the impacts of different activities on several environmental factors.
- Understand the concept of risk management.

Section	Course Content
Section-A	Environmental Management: Definition, scope, components, structure and process, Preventive policy of environment management, waste minimization, Concept of environmental management - Conservation, preservation and sustainable development, conservation of water and energy, use of renewable sources, pollution control strategy, disposal of treated effluents, solid waste Disposal.
Section-B	EIA Methodologies: Criteria for the selection of EIA Methodology, EIA Methods, Predictive Models for Impact Assessment. Environmental quality, monitoring and base line data. Environmental Protection acts, Rules and Standards, EIA guidelines.
Section-C	Environmental Impact Assessment: Definition and scope, preliminary screening requiring EIA of projects. Impact identification, Assessment of Impact; Impact Evaluation. Types of EIA, rapid and comprehensive. Prediction and assessment of impacts on physical, biological and socio- economic environment. Specific studies on environmental impact assessment of certain projects: Hydropower project, highway project, cement manufacturing.
Section-D	Environmental audit: Introduction - Types of Audits - Features of Effective auditing – program, Planning - Definition - Organization of Auditing Program - pre visit data collection Audit Protocol - Onsite Audit - Data Sampling-Inspections - Evaluation and presentation Audit Report. Procedure for EIA Clearance: EIA review and screening; state level screening, clearance from DOE and MOEF

Course Outcomes:

CO1: Recognize the need for EIA of potential projects.
CO2: Identify and discuss the use of methodologies in assessment of impacts of potential projects.
CO3: Apply principles of natural processes for sustainable development.
CO4: Assess the activities leading to adverse impact on the environment

Text Books:

1. Jain, R.K., Urban, L.V. and Stacey, G.S., Environment Impact Analysis, Von Nostrand Reinhold Company.
2. Lawrence, David P., Environmental Impact Assessment (Practical Solutions to Recurrent Problems), Wiley International, New Jersey.
3. MoEF, GoI, Environment Impact Assessment, Impact Assessment Division, January 2001 (Manual).
4. Water (Prevention and Control of Pollution) Act 1974. Air (Prevention and Control of Pollution) Act 1981.
5. Trivedi, P.R., Natural Resources Conservation, APH Publishing Corporation, New Delhi.
6. Westman, Walter E., "Ecology, Impact Assessment and Environment Planning" John Wiley and Sons, Canada, 1985

Reference Books:

1. Environmental Impact Assessment; C.W. Canter
2.Environmental Impact Assessment Theory and practice; Peter Wathern

Name of the Course	Engineering Geology and Rock Mechanics		
Course Code	CE-7023	Credits-3	L-2, T-1, P-0
Total Lectures	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:

The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculator is allowed to use in examinations.

Course Objectives:

- To understand fundamental aspects of rock mechanics
- To understand the stability in rock slopes
- To understand how to evaluate stresses in rocks

Section	Course Content
Section-A	Introduction: Rock Mechanics and its relationship with soil mechanics and engineering geology, application of rock mechanics to civil engineering problems. Classification of rocks: Lithological classification, engineering classification of rocks, classification based on wave velocity ratio, R.Q.D. Classification of rock masses i.e. RMR and Q systems.
Section-B	Engineering Properties of Rock Masses Lab. Tests: Void- index test, Compression & tensile tests, Permeability, Strength characteristics, Strength of intact and fissured rocks, Effect of test conditions.
Section-C	Stability in Rock Slopes: Modes of failures in rock masses simplified Bishop's method, Janbu's method, Hock's method, Wedge's method. In Situ Testing of Rocks: Field direct shear test, Triaxial test, Use of flat jacks, Cable jacking, Chambertest & Plate load test.
Section-D	Stabilization of Rocks: Rock Bolting, Principle of rock Bolting, Rock grouting, Grouting materials, Grouting operations & method of grouting. Foundation of Rocks: Stress distribution in foundation, methods of determination of bearing capacity of rocks, improvement of rock properties, pressure grouting for tunnels and dams, dental concreting, shear zone treatment

Course Outcomes:

CO1: Identify and discuss the role and importance of stresses in rocks.
CO2: Identify and discuss the issues and concepts related to stabilization of rocks.
CO3: Apply principles of natural processes on and within the earth.
CO4: Assess the impact of natural forces on civil engineering structures and other such projects.

Text Books:

1. Introduction to Rock Mechanics, by Goodman R.E., John Wiley and Sons, New York.
2. Rock Mechanics for Underground Mining, by Brady B.H.G. and Brown E.T., Kluwer Academic Publishers

Reference books:

1. Engineering in Rocks for Slopes, Foundations and Tunnels, by Ramamurthy T., PHI Learning Pvt. Ltd.
2. Rock Mechanics in Engineering Practice: K.G. Stagg, Jojn Wiley & Sons.
3. Under-ground excavation in rock: Evert Hoek, Edwin T. Brown, Institution of Mining and Metallurgy.
4. Rock Mechanics in Engineering Practice: By C Jaeger, Cambridge.

Name of the Course	Open Channel Flow		
Course Code	CE-7024	Credits-3	L-2, T-1, P-0
Total Lectures	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:

The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculator is allowed to use in examinations.

Course Objectives:

- To understand fundamental aspects of open channel flow
- To understand the boundary layer theory
- To understand different types of drags

Section	Course Content
Section-A	Gradually Varied Flow: Equations of GVF, Slope Profiles, Computations of GVF Profiles. Rapidly Varied Flow: Hydraulic Jump – Concept and computations, Principles of energy dissipation, Jump as Energy dissipaters, tail water rating curve and jump height curves.
Section-B	Boundary Layer Theory: Concept of boundary layer, laminar and turbulent boundary layers, boundary layer thickness, von Karman integral equation, laminar sub layer, hydro dynamically smooth and rough boundaries, separation of flow and its control, cavitation.
Section-C	Laminar and Turbulent Flow through Pipes: Laminar flow through pipes, turbulent flow, Reynolds equations, Prandtl's mixing length theory, velocity distribution over a flat plate and in a pipe section, Darcy-Weisbach equation, friction factor, Moody diagram, minor losses, pipe networks, Venturimeter, orifice meter, water hammer, surge tanks
Section-D	Drag and Lift: Skin-friction and form drag, drag on sphere, cylinder and flat plate, Karman vortex shedding, generation of lift around a cylinder, lifting vanes. Introduction to Open Channel Flow: Comparison between open channel flow and pipe flow, geometrical parameters of a channel, classification of open channels, classification of open channel flow, Velocity Distribution of channel Section.

Course Outcomes:

CO1: Identify and discuss the role and importance open channel flow in civil engineering.
CO2: Identify and discuss the issues and concepts related to drag and lift.
CO3: Identify and discuss the complex issues related to laminar and turbulent flow.
CO4: Evaluate the results obtained by solving above problems

Text Books:

1. Chow, V.T., "Open Channel Hydraulics", McGraw Hill.
2. Subramanya, K., "Flow in Open Channels", Tata McGraw-Hill.
3. Ranga Raju, K.G., "Flow through Open Channels", Tata McGraw-Hill.

Reference Books:

1. Chanson, H., "The Hydraulics ofOpen Channel Flow: An Introduction", Elsevier Scientific.
2. Chaudhry, M.H., "Open Channel Flow", Prentice-Hall, New Jersey, USA.

Name of the Course	Bridge Engineering		
Course Code	**CE-8011**	Credits-3	L-2, T-1, P-0
Total Lectures	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:

The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculator is allowed to use in examinations.

Course Objectives:

- To understand fundamental aspects bridge design.
- To understand the effect of stress on bridges.
- To understand how to evaluate Hydraulic & Structural Design of various parts of bridge.

Section	Course Content
Section-A	Introduction: Definitions, components of a bridge, classification, importance and standard specifications. Investigation for bridge: Site selection, data drawing, design discharge linear water way, economical span, location of piers and abutments, vertical clearance above HFL, scour depth. Traffic projection, investigation report choice of bridge type
Section-B	Standard specification for Road Bridge: IRC bridge code, determination of dead loads and live loads, wind loads, longitudinal forces, centrifugal forces, horizontal forces due to water current buoyancy effect, earth pressure, temperature effect, deformation stresses, Secondary stresses, erection stresses, seismic forces. Culverts: Design of slab culvert and box culvert.
Section-C	Design of T- beam reinforced concrete bridges.
Section-D	Hydraulic & Structural Design of Piers, abutments, wing-wall and approaches. Brief Description of Bearings, joints, articulation and other details. Bridge Foundation Design: Various types, necessary investigations and design criteria of well foundation

Course Outcomes:

CO1: Identify and discuss the role and importance of design in bridge.

CO2: Identify and discuss the issues and concepts salient to stresses in bridge.

CO3: Apply principle of analysis and design to the different types of bridges

CO4: Read and execute the drawings and detailing of reinforcement for the designed bridges in the field.

Text Books:

1. Essentials of Bridge Engineering, D. J. Victor, Oxford & IBH Pub. N. Delhi.
2. Design of concrete bridge: Aswani, Vazirani, Ratwani, Khanna Publishers

Reference books:

1. Bridge Engineering by S. Ponnuswamy, McGraw Hill Publication.
2. Design of Bridges by N. Krishna Raju, Oxford & IBH, N. Delhi.
3. Bridge Deck Analysis by R. P. Pama & A. R. Cusens, John Wiley & Sons.
4. Design of Bridge Structures by T. R. Jagadish & M. A. Jairam, Prentice Hall of India, N. Delhi

Name of the Course	Dam and Reservoir design		
Course Code	CE-8012	Credits-3	L-2, T-1, P-0
Total Lectures	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:

The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculator is allowed to use in examinations.

Course Objectives:

- To understand fundamental concepts related to dams and reservoir
- To understand the effect of various type of material used in construction of dams
- To understand which type of dam to be constructed in different conditions

Section	Course Content
Section-A	Introduction: Planning of project, Purpose of development, Project study, Ecological and environmental considerations, Flood studies, Economic considerations. Physical factor governing selection of type, legal, economic, aesthetic considerations, and foundation and construction materials. Investigation, Source of information, Surface exploration, sampling, Field and laboratory tests.
Section-B	Reservoir Planning: Reservoir storage zone and uses of reservoir, Types, Mass Inflow and Mass Demand curves, Planning of reservoirs, Life of reservoir and design criteria. Selection of type of dam, Classification of types, Physical factor governing selection of type, legal, economic, aesthetic considerations
Section-C	Foundation and construction materials: Investigation, Source of information, Surface exploration, sampling, Field and laboratory tests. Earth fill Dam: Origin, Selection of type, Design principles, Foundation design, Embankments, Embankment details
Section-D	Rockfill Dam: Origin and usage, Definition and types, Foundation design, Embankment design, Membrane design. Concrete gravity Dam: Introduction, Origin and development, Forces acting on dam, Requirements for stability, Dams on pervious foundations.

Course Outcomes:

CO1: Identify and discuss the role and importance of design of dams and reservoirs
CO2: Identify and discuss various types of dams
CO3: Identify and discuss the parameters to be taken into consideration for construction of Dams.

CO4: Identify different problems related to hydrology and water resources.

Text Books:

1. Engineering for Dams (Volumes I, II & III) by Creager, Justin & Hinds
2. Hydraulic Structures by Varshney
3. Irrigation & Water Power Engg. by Punmia & Pandey B.B.Lal.
4. Water Power Engineering by Dandekar

Name of the Course	Industrial Waste Treatment		
Course Code	CE-8013	Credits-3	L-2, T-1, P-0
Total Lectures	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:

The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of thesemester end examination for the course.

For Candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculator is allowed to use in examinations.

Course Objectives:

- To understand fundamental aspects related to industrial waste
- To understand various sludge characteristics
- To understand the flow diagram for waste treatment for certain industries

Section	Course Content
Section-A	Introduction to industrial waste, types of wastes: solid, Liquid, and gaseous wastes; Toxic organics, Heavy metals, Hazardous waste etc. Characteristics of industrial wastes – Population equivalent – Bioassay studies – effects of industrial effluents on streams, sewer, land, sewage treatment plants and human health. Stream quality criteria and effluent standards, characterization studies, Variation in waste water flow-rates and constituents.
Section-B	Environmental legislations related to prevention and control of industrial effluents and hazardous wastes. Source and character of wastes; design and operation of wastewater treatment facilities; ultimate disposal of wastewater residues and considerations of discharge criteria.
Section-C	Sludge characteristics and disposal methods -design and operation of sludge drying bed. Waste management techniques. Control of Volatile organic compounds by absorption, adsorption, combustion and biofiltration. Waste generation, characterization and treatment of industrial waste.
Section-D	Flow diagram for waste treatment for certain industries: cement industry, construction industry, iron and steel industry, tannery industry, Fertilizer plant waste, sugar mill waste etc. Waste minimization as a tool for environmental protection.

Course Outcomes:

CO1: Identify and discuss the role and importance of industrial waste treatment.
CO2: Identify and discuss the issues and concepts related to waste management techniques.

CO3: Identify and discuss various waste disposal techniques.
CO4: Identify and discuss the concepts related to waste minimization.

Text Books:

1. Rao M. N. & Dutta A. K. , "Wastewater Treatment", Oxford – IBH Publication, 1995.
2. Eckenfelder W.W. Jr., "Industrial Water Pollution Control", McGraw Hill Book Company, New Delhi, 2000.
3. Patwardhan. A.D., Industrial Wastewater Treatment", Prentice Hall of India, New Delhi 2010.
4. Nemerow, N.L., "Industrial Waste Management", McGraw Hill. 2007.

Reference Books:

1. Shen T.T., "Industrial Pollution Prevention", Springer, 1999.
2. Stephenson R.L. and Blackburn J.B., Jr., "Industrial Wastewater Systems Hand book", Lewis Publisher, NewYork, 1998
3. Freeman H.M., "Industrial Pollution Prevention Hand Book", McGraw Hill Inc., New Delhi, 1995.
4. Bishop, P.L., "Pollution Prevention: Fundamental & Practice", McGraw Hill, 2000.
5. Pandey, "Environmental Management" Vikas Publications, 2010.
6. Industrial Wastewater Management, Treatment and Disposal", (WEF – MOP – FD3) McGraw Hill, 2008

Name of the Course	Solid Waste Treatment		
Course Code	**CE-8014**	Credits-3	L-2, T-1, P-0
Total Lectures	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:

The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculator is allowed to use in examinations.

Course Objectives:

- Identify the physical and chemical composition of waste
- Analyze the functional elements for solid waste management
- Understand the techniques and methods used in transformation, conservation, and recovery of materials from solid wastes.

Section	Course Content
Section-A	Sources and Types: Solid waste: Definitions, Types and Sources of waste, Waste Generation, Factors affecting the generation rate, Composition Characteristics and properties, sampling. Problems and issues of Solid waste management, need for SWM, Effects of improper disposal of solid wastes- Public Health and Environmental effects. Elements of Solid waste management and Financial Aspects. Solid waste management rules, 2016, Role of NGO‘s
Section-B	Waste Collection and Storage: Methods of Residential and Commercial Waste Collection, Collection Vehicles, Manpower Collection Routes, Analysis of Collection Systems. Effect of storage, Materials used for Containers- Segregation of Solid Wastes, Public Health and economic aspects of open storage, Waste Segregation and storage, Case Studies under Indian Scenario as well as worldwide, Source reduction of waste, reuse and recycling.
Section-C	Waste Transfer: Transfer Stations – Selection of Location, Operation and Maintenance, Mechanical methods with or without compaction, economy in transportation of waste, optimization of transportation routes, Options Under Indian Conditions. Processing Techniques: Objectives of Waste Processing – Physical Processing Techniques and Equipment; Resource Recovery from Solid Waste Composting and Bio- methanation; Thermal Processing Options – Case Studies Under Indian Conditions.

Section-D	Land Disposal of Solid Waste-Sanitary Landfills – Site Selection, Design and Operation of Sanitary Landfills – Landfill Liners – Management of Leachate and Landfill Gas- Landfill Bioreactor– Dump site Rehabilitation. Hazardous Solid Waste: Generation, Rate Variation, Characteristics (Physical, Biological & Chemical); Hazardous waste management: Exposure and risk assessment, environment legislation, characterization and site assessment, waste minimization, incineration, transportation, storage, landfill disposal

Course Outcomes:

CO1: Identify and discuss the detailed composition of Solid waste both Physical and Chemical.

CO2: Identify and discuss the functional elements for solid waste management.

CO3: Analyze how to dispose off the waste in an environment friendly manner.

CO4: Understand & analyze the concepts & importance of hazardous waste management

Text Books:

1. Tchobanoglous G, Theisen H and Vigil SA. Integrated Solid Waste Management, Engineering Principles and Management Issues, McGraw-Hill, 1993. Kenneth A. Berman, Jerome L. Paul: Algorithms, Cengage Learning, 2002.
2. Mantell, C.L., Solid Waste Management, John Wiley, New York, 1975.
3. Peavy, H.S, Rowe, D.R., and G. Tchobanoglous, Environmental Engineering", McGraw Hill Inc., New York,1985.
4. Chandrappa, Ramesh, Das, D.B., Solid Waste Management: Principles and Practice, Springer, 2012.

Reference Books:

1. Government of India, ―Manual on Municipal Solid Waste Management‖, CPHEEO, Ministry of Urban Development, New Delhi, 2016.
2. Qian X, Koerner RM and Gray DH, Geotechnical Aspects of Landfill Design and Construction Prentice Hall, 2002.
3. George Tchobanoglous and Frank Kreith, Handbook of Solid waste Management, McGraw Hill, New York, 2002.
4. Bhide A.D. And Sundaresan, B.B. Solid Waste Management Collection, Processing and Disposal, 2001.

OPEN ELECTIVES

Name of the Course	**Total Quality Management**		
Course Code	**OEC-CE-1**	Credits: 3	L-3, T-0, P-0
Total Lectures	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:
The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:
Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculator is allowed to use in examinations.

Course Objectives:

- To introduce the importance of quality in improving competitiveness
- To develop competency in assessment of Cost of Poor Quality
- To Implement Quality Implementation Programs.
- To have exposure to challenges in Quality Improvement Programs.

Section	Course Content
Section-A	Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of manufacturing and service quality - Basic concepts of TQM - Definition of TQM – TQM Framework - Contributions of Deming, Juran and Crosby – Barriers to TQM. Quality Control and Improvement Tools: Check Sheet, Histogram, Pareto Chart, Cause and Effect diagram, Scatter diagram, Control chart, Graph, Affinity diagram, Tree diagram, Matrix diagram, Process decision program chart, Arrow diagram, Acceptance Sampling, Process capability studies, Zero defect program (POKA-YOKE).
Section-B	TQM PRINCIPLES: Leadership – Strategic quality planning, Quality statements – Customer focus – Customer orientation, Customer satisfaction, Customer complaints, Customer retention -Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal – Continuous process improvement – PDSA cycle, 5s, Kaizen – Supplier partnership – Partnering, Supplier selection, Supplier Rating.
Section-C	TQM TOOLS & TECHNIQUES: The seven traditional tools of quality – New management tools – Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT – Bench marking – Reason to bench mark, Bench marking process – FMEA – Stages, Types. Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Cost of Quality – Performance measures.

Section-D	Quality Management System & Quality Audit: Introduction to IS/ISO 9004:2000 – quality management systems – guidelines for performance improvements. Quality Audits, Audit objectives, types of quality audit, Quality Auditor. TQM culture, Leadership – quality council, employee involvement, motivation, empowerment, recognition and reward- Introduction to software quality**.**

Course Outcomes:

CO1: To realize the importance of significance of quality
CO2: Manage quality improvement teams
CO3: Identify requirements of quality improvement programs
CO4: Identify the key aspects of the quality improvement cycle and to select and use appropriate tools and techniques for controlling, improving and measuring quality

Text Books:

1. Dale H. Besterfiled, et at., "Total Quality Management", Pearson Education Asia, 3rd Edition, Indian Reprint.
2. Ross, J.E.: Total Quality Management, Vanity Books International.

Reference Books:

1. H.LaI, Lt. Gen ,Wiley Eastern Limited, 1990 , Total Quality Management
2. Bounds Greg , McGraw , Beyond Total Quality Management
3. Kanishka Bedi, Oxford Higher Education, Quality Management
4. Juran, J.M. & Gryna, F.M.: Quality Planning and Analysis, Tata McGraw Hill Publishing Co. Ltd., New Delhi
5. Charantimath, P.M.: Total Quality Management, Pearson Education.

Name of the Course	Indian Financial System		
Course Code	**OEC-CE-2**	Credits: 3	L-3, T-0, P-0
Total Lectures	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:

The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculator is allowed to use in examinations.

Course Objectives:

- This course aims at providing the students the intricacies of Indian financial system for better financial decision making.
- Provide an in-depth view of the process in financial management of the firm.
- Develop knowledge on the allocation, management and funding of financial resources.
- Improving students' understanding of the time value of money concept and the role of a financial manager in the current competitive business scenario

Section	Course Content
Section-A	Introduction: Meaning – Classification of Financial System. Financial Markets – Functions and Significance of Primary Market, Secondary Market, Capital Market, & Money.
Section-B	Financial institutions: Introduction – Meaning – Classification of Financial System. Financial Markets – Functions and Significance of Primary Market, Secondary Market, Capital Market, & amp; Money Market.
Section-C	Commercial banks Introduction: Role of Commercial Banks – Functions of Commercial Banks – Primary Functions and Secondary Functions – Investment Policy of Commercial Banks. Narasimaham committee report on banking sector reforms.
Section-D	Regulatory institutions: Reserve Bank of India (RBI) – Organization– Objectives – Role and Functions. The Securities Exchange Board of India (SEBI) – Organization and Objectives. Financial services: Meaning & amp; Definition – Features – Importance. Types of Financial Services – factoring, leasing, venture capital, Consumer finance – housing & amp; vehicle finance.

Course Outcomes:

CO1: Understand the role and function of the financial system in reference to the macro economy.

CO2: Demonstrate an awareness of the current structure and regulation of the Indian financial services sector.
CO3: Evaluate and create strategies to promote financial products and services.
CO4:Analyze various aspects of financial institutions and their working.

Text Books:

1. Vasantha Desai: The Indian Financial System, HPH Electric Drive by M. Chilikin, Medtech.
2. G. Ramesh Babu; Indian Financial System. HPH
3. Dr. Bharatish Rao, B.R. Bharghavi – Indian Financial System, VBH
4. Meir Kohn: Financial Institutions and Markets, Tata McGraw Hill

Name of the Course	Energy Assessment and Auditing		
Course Code	**OEC-CE-3**	Credits: 3	L-3, T-0, P-0
Total Lectures	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:

The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculator is allowed to use in examinations.

Course Objectives:

- The objective of Energy Management is to achieve and maintain optimum energy procurement and utilisation, throughout the organization
- To minimise energy costs / waste without affecting production & quality.
- To minimise environmental effects.

Section	Course Content
Section-A	Energy Scenario: Energy needs of growing economy, Long term energy scenario, Energy pricing, Energy sector reforms, Energy and environment: Air pollution, Climate change, Energy security, Energy conservation and its importance, Energy strategy for the future, Energy conservation Act-2001 and its features. Basics of Energy and its various forms: Electricity basics- DC & AC currents, electricity tariff, load management and maximum demand control, power factor improvement, selection & location of capacitors, Thermal Basics-fuels, thermal energy contents of fuel, temperature & pressure, heat capacity, sensible and latent heat, evaporation, condensation, steam, moist air and humidity & heat transfer, units and conversion.
Section-B	Energy Management & Audit: Definition, energy audit, need, types of energy audit. Energy management (audit) approach-understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel & energy substitution, energy audit instruments. Material and Energy balance: Facility as an energy system, methods for preparing process flow, material and energy balance diagrams.
Section-C	Energy Action Planning: Key elements, force field analysis, Energy policy purpose, perspective, contents, formulation, ratification, Organizing - location of energy management, top management support, managerial function, roles and responsibilities of energy manager, accountability. Motivating-motivation

	of employees: Information system-designing barriers, strategies; Marketing and communicating-training and planning. Financial Management: Investment-need, appraisal and criteria, financial analysis techniques simple pay- back period, return on investment, net present value, internal rate of return, cash flows, risk and sensitivity analysis; financing options, energy performance contracts and role of ESCOs.
Section-D	Project Management: Definition and scope of project, technical design, financing, contracting, implementation and performance monitoring. Implementation plan for top management, Planning Budget, Procurement Procedures, Construction, Measurement & Verification. Energy Monitoring, Targeting and Global environmental concerns: Defining monitoring & targeting, elements of monitoring & targeting, data and information-analysis, techniques -energy consumption, production, cumulative sum of differences (CUSUM). United Nations Framework Convention on Climate Change (UNFCC), sustainable development, Kyoto Protocol, Conference of Parties (COP), Clean Development Mechanism (CDM), Prototype Carbon fund (PCF).

Course Outcomes:

CO1: Identification of energy conservation opportunities in various industrial processes.
CO2: Gain knowledge on tools and techniques employed in energy auditing.
CO3: Comprehend an Energy Audit report, including economic parameters.
CO4: Carry out energy planning and financial management.

Text Books:

1. L.C. Witte, P.S. Schmidt, D.R. Brown, "Industrial Energy Management and Utilisation" Hemisphere Publ, Washington, 198
2. O. Callaghn, P.W. "Design and Management for Energy Conservation", Pergamon Press, Oxford.

Reference Books:

1. I.G.C. Dryden, "The Efficient Use of Energy" Butterworths, London.
2. W.C. turner, "Energy Management Hand book" Wiley, New York.
3. W.R. Murphy and G. Mc KAY "Energy Management" Butterworths, London.
4. Handbook of Energy Audits by Albert Thuman – Fairman Press Inc.
5. Energy basis for man and nature by Howard T.Odum & Elisbeth. C. Odum.

Name of the Course	**Non-Conventional Energy Resources**		
Course Code	**OEC-CE-4**	Credits: 3	L-3, T-0, P-0
Total Lectures	52 (L = 39, T = 13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:

The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculator is allowed to use in examinations.

Course Objectives:

- To exploit renewable energy resources and effective technologies.
- To provide a survey of the most important renewable energy resources and the technologies for harnessing these.
- Resources within the framework of a broad range of simple to state- of -the-art energy systems.

Section	Course Content
Section-A	Introduction to Energy Sources: World energy futures, Conventional energy sources, Non-conventional energy sources, Prospects of Renewable energy sources.
Section-B	Solar Energy: Introduction to solar radiation and its measurement, Introduction to Solar energy Collectors and Storage, Solar thermal electric conversion, Thermal electric conversion systems, Solar electric power generation, Solar photo-voltaic, Solar Cell principle, Semiconductor junctions, Conversion efficiency and power output, Basic photo- voltaic system for power generation.
Section-C	Wind Energy and Wind Energy Conversion: Introduction to wind energy conversion, the nature of the wind, Power in the wind, Wind data and energy estimation, Site Selection considerations, basic Components of a wind energy conversion system, Classification of WEC Systems.
Section-D	Energy conservation-principles, technologies, waste heat utilization, heat regenerators, energy storage, devices, instruction and control.

Course Outcomes:

CO1: Identify energy demand and relate with available energy resources

CO2: Analyse harnessing of solar energy.

CO3: Explore the concepts involved in wind energy conversion system by studying its components, types and performance.

CO4: Explore the concepts related to solar and wind energy.

Text Books:

1. Renewable energy sources and conversion technology by N.K. Bansal, M. Kleemann, & M. Heliss, Tata McGraw-Hill.
2. Renewable Energy by S. Bent, Academic Press.
3. Renewable Energy: Power for a Sustainable Future by G. Boyle, Oxford University Press.

Name of the Course	**Applied fuzzy Electronic System**		
Course Code	**OEC-CE-5**	Credits: 3	L-3, T-0, P-0
Total Lectures	52 (L = 39, T = 13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:

The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculator is allowed to use in examinations.

Course Objectives:

- To understand Fuzzy Sets, Possibility Distributions.
- To analysis Fuzzy Rule.
- To be aware of uncertainty in information.
- To learn approximate method of Extension.
- Analysis Fuzzy Logic in Control Engineering.

Section	Course Content
Section-A	History of Fuzzy Logic, Fuzzy Sets, Possibility Distributions, Fuzzy Rules, Sets, Operations of Fuzzy Sets, Properties of Fuzzy Sets, Geometric Interpretations of Fuzzy Sets, Possibility Theory, Fuzzy Relations and their Compositions, Fuzzy Graphs, Fuzzy Numbers, Functions with Fuzzy Arguments, Arithmetic, Operations of Fuzzy Numbers.
Section-B	Fuzzy Rules: Fuzzy Mapping Rule, Fuzzy Implication Rule, Fuzzy Rule Based Models for Function Approximations, Theoretical Foundation of Fuzzy Mapping Rules, Types of Fuzzy Rule Based Models: Mamdani Model, TSK Model, Standard Additive Model, Fuzzy Implications and Approximate Reasoning: Propositional Logic, First Order Predicate Calculus, Fuzzy Implications, Approximate Reasoning, Criteria and Family of Fuzzy Implications, Possibility vs. Probability, Probability of Fuzzy Event, Probabilistic, Interpretations of Fuzzy Sets, Fuzzy Measure.
Section-C	Uncertainty in information; Classical Sets, Fuzzy Sets and their properties; Cardinality of Classical Relations and their properties, The a- Level Set, Cardinality of Fuzzy Relations and their properties; Composition; Tolerance and Equivalence relationship; Membership Functions; Fuzzification and Defuzzification process; Fuzzy to Crisp Conversions; Lambda cuts; Extension Principle, Crisp functions and its mapping, Fuzzy functions and its mapping; Fuzzy Numbers; Internal Analysis in Arithmetic. Fuzzy Logic in Control Engineering: Fundamental Issues in Control.

Section-D	Engineering, Control Design Process, Semiformal Aspects of Design Process, Mamdani Architecture of Fuzzy Control, The Sugeno- Takagi Architecture. Fuzzy Logic in Hierarchical Control Architecture, Historical Overview and Reflections on Mamdani`s Approach, Analysis of Fuzzy Control System via Lyapunov`s Direct Method, Linguistic Approach to the analysis of Fuzzy Control System, Parameter Plane Theory of Stability, Takagi-Sugeno-Kang Model of Stability Analysis.

Course Outcomes:

CO1: Understand the Operations of Fuzzy Sets, Properties of Fuzzy Sets, Geometric Interpretations of Fuzzy Sets, Possibility Theory.

CO2: Design Fuzzy Mapping Rule, Fuzzy Implication Rule, Fuzzy Rule Based Models for Function Approximations, Theoretical Foundation of Fuzzy Mapping Rules, Types of Fuzzy Rule Based Models.

CO3: Aware Principle of Vertex Method, DSW Algorithm, and Restricted DSW Algorithm and their comparison, Classical Predicate Logic; Fuzzy Logic.

CO4: Understand Fundamental Issues in Control Engineering, Control Design Process, Semiformal Aspects of Design Process.

Text Books:

1. John Yen, Reza Langari, “Fuzzy Logic: Intellegent Control and Information”, Pearson Publication.
2. Ahmad M. Ibrahim, “Introduction to Applied Fuzzy Electronics”, Prentice Hall Publication

Reference Books:

1. Ahmad M. Ibrahim, “Fuzzy Logic for Embedded Systems Applications”, Newnes Publications.

Name of the Course	Cyber Law and Ethics		
Course Code	**OEC-CE-6**	Credits: 3	L-3, T-0, P-0
Total Lectures	52 (L = 39, T = 13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:

The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:

Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculator is allowed to use in examinations.

Course Objectives:

- The objectives of this course are to enable learner to understand, explore, and acquire a critical understanding cyber law.
- Develop competencies for dealing with frauds and deceptions (confidence tricks, scams) and other cyber-crimes that are taking place via the internet.

Section	Course Content
Section-A	Introduction to Security: Security principles, threats and attack techniques, Cryptographic mechanisms, Classical Encryption Techniques Symmetric and Asymmetric cryptography. Introduction to Cyber Crime and Cyber Offences: Evolution of computer technology, emergence of cyber space. Cyber Jurisprudence, Jurisprudence and law, Cyber Ethics, Cyber Jurisdiction, Hierarchy of courts, Civil and criminal jurisdictions, Cyberspace-Web space, Web hosting and web Development agreement, Legal and Technological Significance of domain Names, Internet as a tool for global access. Cyber-crime and information security, Classifications of cybercrimes. Botnets -The fuel for cybercrime. Phishing, Password cracking, keyloggers and sql injection, attacks on wireless networks. Cyber-crime: Illustrations, Examples and mini cases, Illustrations of financial frauds in cyber domain, digital signature related crime scenarios.
Section-B	Information Technology Act: Overview of IT Act, 2000, Amendments and Limitations of IT Act, Digital Signatures, Cryptographic Algorithm, Public Cryptography, Private Cryptography, Electronic Governance, Legal Recognition of Electronic Records, Legal Recognition of Digital Signature, Certifying Authorities, Cyber Crime and Offences, Network Service Providers Liability, Cyber Regulations Appellate Tribunal, Penalties and Adjudication.
Section-C	Cost of Cyber Crimes and IPR Issues: lessons for organization, web threats for organization, security and privacy implications from cloud computing, social media marketing: security risks and perils for organizations, social computing

	and the associated challenges for organizations, protecting people's privacy in the organization, organizational guidelines for internet usage, safe computing guidelines and computer usage policy, incident handling: an essential component of cyber security.
Section-D	Cyber Ethics: The Importance of Cyber Law, Significance of cyber Ethics, Need for Cyber regulations and Ethics. Ethics in Information society, Introduction to Artificial Intelligence Ethics: Ethical Issues in AI and core Principles, Introduction to Block chain Ethics

Course Outcomes:

CO1: Make learner conversant with the social and intellectual property issues emerging from 'cyberspace.

CO2: Explore the legal and policy developments in various countries to regulate cyberspace

CO3: Develop the understanding of relationship between commerce and cyberspace CO4: Give learners in depth knowledge of information technology act and legal frame work of right to privacy, data security and data protection.

CO4: Make study on various case studies on real time crimes

Text Books:

1. Nina Godbole, Sunit Belapure, Cyber Security, Wiley India Pvt. Ltd.; 2011.
2. Dieter Gollmann, John Wiley & Sons, ISBN: 470-86293-9; 2006.

Reference Books:

1. William Stallings, Network Security Essentials, 4th Edition, Pearson Publication.
2. Bruce Schneier, Applied Cryptography, Wiley & Sons; Edition 2001.

Name of the Course	**Artificial Intelligence and Machine Learning**		
Course Code	**OEC-CE-7**	Credits: 3	L-3, T-0, P-0
Total Lectures	52 (L = 39, T = 13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:
The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:
Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculator is allowed to use in examinations.

Course Objectives:

- To introduce the basic concepts, theories and state-of-the-art techniques of artificial intelligence.
- To introduce basic concepts and applications of machine learning.
- Help students to learn the application of machine learning /A.I algorithms in the different fields of science, medicine, finance etc.

Section	Course Content
Section-A	Background and overview: Overview of terminology, formulations and concepts, Introduction of main tasks, error and performance metrics, data preparation/annotation, Components of learning, data representation, linear classification, formulation of ML problem.
Section-B	Learnability: Hoeffding's inequality, overfitting, performance/complexity, bias/variance trade-off, End-to-End Machine Learning Project, Feature selection, Feature transformation, model selection and validation, regularization.
Section-C	Regression: Linear Regression, Polynomial Regression, Logistic Regression, Regularized Linear Models, Logistic Regression SVM and kernels Hyperplane, separation with hard margin, soft margin, support vector Classification, kernel methods, support vector regression.
Section-D	Unsupervised learning: Clustering, k-means algorithm, PCA, Neural Networks, Logistic regression, gradient descent, Perceptron, MLP, back propagation. Development Mechanism (CDM), Prototype Carbon fund (PCF).

Course Outcomes:

CO1: Understand concept of knowledge representation and predicate logic and transform the real life information in different representation.
CO2: Understand state space and its searching strategies.
CO3: Understand machine learning concepts and range of problems that can be handled by machine learning.
CO4: Apply the machine learning concepts in real life problems.

Text Books:

1. J. Gabriel, Artificial Intelligence: Artificial Intelligence for Humans (Artificial Intelligence, Machine Learning), Create Space Independent Publishing Platform, First edition, 2016.
2. Jeff Heaton, Introduction to the Math of Neural Network, Heaton Research

Reference Books:

1. S.S.V. Chandra, Artificial Intelligence and Machine Learning, Prentice Hall India Learning Private Limited, First edition, 2014.
2. Shai Shalev-Shwartz and Shai Ben-David, Understanding Machine Learning: From Theory to Algorithms c, Cambridge University, 2014.

Name of the Course	**Artificial Neural Networks**		
Course Code	**OEC-CE-8**	Credits: 3	L-3, T-0, P-0
Total Lectures	52 (L = 39, T = 13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:
The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:
Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. A non- programmable calculator is allowed to use in examinations.

Course Objectives:

- To provide an introduction to the field of artificial neural networks and machine learning;
- To teach students how to solve practical problems via implementation of these techniques via simulation;
- To promote further independent learning on the topics of artificial neural networks and machine learning.

Section	Course Content
Section-A	Introduction: A Neural Network, Human Brain, Models of a Neuron, Neural Networks viewed as Directed Graphs, Network Architectures, Knowledge Representation, Artificial Intelligence and Neural Networks Learning Process: Error Correction Learning, Memory Based Learning, Hebbian Learning, Competitive, Boltzmann Learning, Credit Assignment Problem, Memory, Adaption, Statistical Nature of the Learning Process.
Section-B	Single Layer Perceptrons: Adaptive Filtering Problem, Unconstrained Organization Techniques, Linear Least Square Filters, Least Mean Square Algorithm, Learning Curves, Learning Rate Annealing Techniques, Perceptron–Convergence Theorem, Relation Between Perceptron and Bayes Classifier for a Gaussian Environment. Multilayer Perceptron: Back Propagation Algorithm XOR Problem, Heuristics, Output Representation and Decision Rule, Computer Experiment, Feature Detection.
Section-C	Back Propagation: Back Propagation and Differentiation, Hessian Matrix, Generalization, Cross Validation, Network Pruning Techniques, Virtues and Limitations of Back Propagation Learning, Accelerated Convergence, Supervised Learning.

Section-D	Self-Organization Maps (SOM): Two Basic Feature Mapping Models, Self-Organization Map, SOM Algorithm, Properties of Feature Map, Computer Simulations, Learning Vector Quantization, Adaptive Patter Classification.

Course Outcomes:

CO1: Know the main provisions neuromathematics.
CO2: Know the main types of neural networks.
CO3: Know and apply the methods of training neural networks.
CO4: Know the application of artificial neural networks.
CO5: To be able to formalize the problem, to solve it by using a neural network.

Text Books:

1. Neural Networks a Comprehensive Foundations, Simon Haykin, PHI edition.

Reference Books:

1. Artificial Neural Networks - B. Vegnanarayana Prentice Hall of India P Ltd 2005.
2. Neural Networks in Computer Inteligance, Li Min Fu MC GRAW HILL EDUCATION 2003.
3. 2. Neural Networks -James A Freeman David M S Kapura Pearson Education 2004.

Name of the Course	**Open Source Technologies**		
Course Code	**OEC-CE-10**	Credits: 3	L-2, T-1, P-0
Lectures to be delivered	**52** (L = 39, T=13 for each semester)		
Semester End Examination	Max. Time: 3 hrs.	Max. Marks: 100	Min. Pass Marks:40
Internal Assessment (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%		Max. Marks: 50	

Instructions

For Paper Setters: The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For candidates: Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non- programmable calculators is allowed.

Course Objectives

- The syllabus covers the study open source principles, strategies, how to contribute, Linux distributions, source code management tools, automation tools and reporting tools.

Section	Course Content
Section-A	The syllabus covers the study open source principles, strategies , how to contribute , Linux distributions, source code management tools, automation tools and reporting tools
Section-B	Open source development, Proprietary software development model vs. Open Source software development model, models for FOSS- Cathedral model and Bazaar model. Introduction to collaborative development (Developer commSectionies, mailing lists, IRC, wiki, version control, bug tracking, handling non-technical issues, localization, accessibility, documentation by doxygen). Software package management (RPM, DEB - building, and creating software repositories) Open Standards, Licensing and legal aspects in detail.
Section-C	Configuration of Network communication services and File system DHCP, DNS, WINES, NFS, NIS, Web server, Ftp Server, E-mail Server, Telnet Server, etc. Configuration through webmin or usermin, Installing and configuring of Cygwin, Installing and configuring of CMS – moodle, druple etc.
Section-D	Useful tool and Scripting languages Shell programming, AWK, python etc, Report writing tools. Operating System utilities, TCP/IP utilities, Network analyzer, Traffic analysis, Protocol analysis, Network Management Using SNMP

Course Outcomes

After successful completion of the course, students will be able to:

CO1: Demonstrate the configuration of software services on servers.
CO2: Exercise the FOSS tools for the software development.
CO3: To understand the configuration of Network communication services.
CO4: To study useful tools and scripting languages

Text Books:

1.Distributed Systems and Networks "by William Buchanan TMH Publication.

2. The complete reference Linux" by Richard L. Peterson Tata Mcgraw Hill Publication

Reference Books:

1.Introduction to Free Software" - by SELF project.

Name of the Course	Data Science		
Course Code	**OEC-CE-11**	Credits-4	L-3, T-1, P-0
Total Lectures	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min. Pass Marks: 40	Max. Time: 3 Hrs.
Internal Assessment: (based on sessional tests 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

For Paper Setters:
The question paper will consist of five Sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.

For Candidates:
Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Non- programmable calculators allowed using in examinations.

Course Objectives:

- Knowledge of Data Science
- Knowledge of Python
- To understand Panda

Section	Course Content
Section-A	Introduction to Data Science - Why Python? - Essential Python libraries - Python Introduction- Features, Identifiers, Reserved words, Indentation, Comments, Built-in Data types and their Methods: Strings, List, Tuples, Dictionary, Set - Type Conversion- Operators. Decision Making- Looping- Loop Control statement- Math and Random number functions. User defined functions - function arguments & its types.
Section-B	User defined Modules and Packages in Python- Files: File manipulations, File and Directory related methods - Python Exception Handling. OOPs Concepts -Class and Objects, Constructors – Data hiding- Data Abstraction- Inheritance. NumPy Basics: Arrays and Vectorized Computation- The NumPyndarray - Creating ndarrays - Data Types for ndarrays - Arithmetic with NumPy Arrays- Basic Indexing and Slicing - Boolean Indexing-Transposing Arrays and Swapping Axes. Universal Functions: Fast Element-Wise Array Functions- Mathematical and Statistical Methods-Sorting Unique and Other Set Logic.
Section-C	Introduction to Pandas Data Structures: Series, Data Frame, Essential Functionality: Dropping Entries Indexing, Selection, and Filtering- Function Application and Mapping- Sorting and Ranking. Summarizing and Computing Descriptive Statistics- Unique Values, Value Counts, and Membership. Reading and Writing Data in Text

Section-D	Data Cleaning and Preparation: Handling Missing Data - Data Transformation: Removing Duplicates, Transforming Data Using a Function or Mapping, Replacing Values, Detecting and Filtering Outliers- String Manipulation: Vectorized String Functions in pandas. Plotting with pandas: Line Plots, Bar Plots, Histograms and Density Plots, Scatter or Point Plots.

Course Outcomes:

Upon successful completion of the course, the students will be able to:

CO1: Have comprehensive knowledge of Data Science and working of Python and Panda as an advanced course

CO2: To know different modules and packages in Python

CO3: To get familiarized with Pandas data structures

CO4: Have comprehensive knowledge of Data cleaning and preparation

Text Books:

1. Y. Daniel Liang, "Introduction to Programming using Python", Pearson, 2012.

Reference Books:

1. Wes McKinney, "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and I Python", O'Reilly, 2nd Edition, 2018.
2. Wesley J. Chun, "Core Python Programming", Prentice Hall, 2006.

Syllabus of NCC- Elective Course- OEC-CE-09

Appendix "A"

BROAD COURSE DESIGN FOR NCC GENERAL ELECTIVE CREDIT COURSE

NCC GENERAL ELECTIVE CREDIT COURSE DESIGN SUMMARY					
Semester	Credits Allocated			Total	Remarks
	Theory	Practical	Camp		
Semester - I	1	1		2	
Semester - II	1	1		2	
Semester – III	1	1	5	7	Credits of 1st Camp merged with 3rd Sem
Semester – IV	2	1		3	
Semester – V	1	1	5	7	Credits of 2nd Camp merged with 5th Sem
Semester - VI	2	1		3	
Total	**08**	**6**	**10**	**24**	**Twenty-Four Credits**

INSTITUTIONAL TRAINING SYLLABUS

COMMON SUBJECTS				
S no.	Subject	Periods (1 hour duration each)		
		Lectures/Tutorials	Practicals	Total
1.	NCC General	06	-	06
2.	National Integration	04		04
3.	Drill	-	45	45
4.	Weapon Training	-	25	25
5.	Personality Development	25		25
6.	Leadership	12	-	12
7.	Disaster Management	13		13
8.	Social Service & Community Development	08	39	47
9.	Health & Hygiene	-	10	10
10	Adventure	01		01
11	Environmental awareness & conservation	03		03
12.	Obstacle Training	-	09	09
13.	General Awareness	04		04
14.	Border & Coastal Areas	06		06
		82	**128**	**210**
SPECIALZED SUBJECTS (ARMY)				
1.	Armed Forces	09	-	09
2	Map Reading	-	24	24
3	Communications	03	03	06
4	Infantry Weapons	03	03	06
5.	Field Craft & Battle Craft		22	22
6	Military History	23	-	23
TOTAL HOURS SPECIALISED SUBJECTS		**38**	**52**	**90**
GRAND TOTAL HOURS (TOTAL CREDITS)		120 (08 cr)* *15 HOUR THEORY = 1 CREDIT POINT	180 (6 cr)** **30 HOURS PRACTICAL TRAINING = 1 CREDIT POINT	**300**

SEMSTER WISE DISTRIBUTION OF NCC SYLLABUS FOR THEORY

S. NO.	SUBJECT	SEMESTER						TOTAL
		I	II	III	IV	V	VI	
1	NCC General	6	-	-	-	-	-	6
2	National Integration and Awareness	4	-	-	-	-	-	4
3	Personality Development	2	5	5	4	6	3	25
4	Leadership	-	5	4	3	-	-	12
5	Disaster Management	-	-	3	10	-	-	13
6	Social Service and Community Development	3	5	-	-	-	-	8
7	Adventure	-	-	1	-	-	-	1
8	Environmental awareness & conservation	-	-	-	3	-	-	3
9	General Awareness	-	-	-	4	-	-	4
10	Border & Coastal Areas	-	-	2	-	2	2	6
11	Armed Forces	-	-	-	6	-	3	9
12	Infantry Weapons	-	-	-	-	3	-	3
13	Communication	-	-	-	-	-	3	3
14	Military History	-	-	-	-	4	19	23
	Total Periods	15	15	15	30	15	30	120
	Total Credit Points	1	1	1	2	1	2	08

SEMSTER WISE DISTRIBUTION OF NCC SYLLABUS FOR PRACTICAL

S. NO.	SUBJECT	SEMESTER						TOTAL
		I	II	III	IV	V	VI	
1.	Drill	12	12	8	7	3	3	45
2.	Field Craft & Battle Craft	3	4	4	4	4	3	22
3	Map Reading	3	5	4	4	4	4	24
4	Weapon Training	5	4	4	4	4	4	25
5	Communication	-	-	-	-	-	3	03
6	Infantry Weapons	-	-	-	-	-	3	03
7	Social Service and Community Development	7	5	5	6	5	10	38
8	Health & Hygiene	-	-	-	5	5	-	10
9	Obstacle Training	-	-	5	-	5	0	10
10	Total Periods	30	30	30	30	30	30	180
	Total Credit Points	1	1	1	1	1	1	6

NCC CAMP TRAINING SYLLABUS

COMMON SUBJECTS				
S No.	Subjects	Periods		Total
1.	Physical Training	-	18	18
2.	Drill	-	32	32
3.	Weapon Training	08	28	32
4.	National Integration and Awareness	08	-	04
5.	Personality Development	08	12	20
6.	Leadership	08	-	04
7.	Disaster Management	08	-	04
8.	Social Service and Community Development	-	08	08
9.	Health & Hygiene	08		04
10.	Obstacle Training	-	04	04
11.	Military History	04	-	-
12.	Communication	04	-	-
13.	Games	-	18	18
14.	Culture	-	18	18
15.	Spare	-	04	04
	TOTAL	**56**	**142**	**170**
SPECIALISED SUBJECTS				
1.	Map Reading			
2.	Infantry Weapons	04	24	24
3.	Field Craft & Battle Craft		02	04
	TOTAL	04	12	12
		60(4 cr)	**180(6 cr)**	**240(10 cr)**