Heritage Institute of Technology

(A Kalyan Bharti Trust Initiative)

(An Autonomous Institute under MAKAUT)

Civil Engineering Department

B.TECH. PROGRAMME

SYLLABUS

Effective from: July 2018

FIRST YEAR FIRST SEMESTER

A. Theory							
Sl. No	**Code**	**Subject**	**Contacts Hours / Week**				**Credit Points**
			L	**T**	**P**	**Total**	
1.	PHYS 1001	Physics – I	3	1	0	4	4
2.	MATH 1101	Mathematics – I	3	1	0	4	4
3.	CSEN 1001	Programming for Problem Solving	3	0	0	3	3
Total Theory			9	2	0	11	11
B. Laboratory							
1.	PHYS 1051	Physics Lab – I	0	0	3	3	1.5
2.	CSEN 1051	Programming for Problem Solving Lab	0	0	4	4	2
3.	MECH 1051	Workshop / Manufacturing Practices	1	0	4	5	3
Total Practical			1	0	11	12	6.5
Total of Semester without Honours			10	2	11	23	17.5
C. Honours							
1.	ECEN 1011	Basic Electronics	3	0	0	3	3
2.	ECEN 1061	Basic Electronics Lab	0	0	2	2	1
Total Honours			3	0	2	5	4
Total of Semester with Honours			13	2	13	28	21.5

FIRST YEAR SECOND SEMESTER

A. Theory							
Sl. No.	**Code**	**Subject**	**Contacts Hours / Week**				**Credit Points**
			L	**T**	**P**	**Total**	
1.	CHEM 1001	Chemistry – I	3	1	0	4	4
2.	MATH 1201	Mathematics – II	3	1	0	4	4
3.	ELEC 1001	Basic Electrical Engineering	3	1	0	4	4
4.	HMTS 1202	Business English	2	0	0	2	2
Total Theory			11	3	0	14	14
B. Laboratory							
1.	CHEM 1051	Chemistry Lab	0	0	3	3	1.5
2.	ELEC 1051	Basic Electrical Engineering Lab	0	0	2	2	1
3.	MECH 1052	Engineering Graphics & Design	1	0	4	5	3
4.	HMTS 1252	Language Lab	0	0	2	2	1
Total Practical			1	0	11	12	6.5
Total of Semester without Honours			12	3	11	26	20.5
C. Honours							
1.	HMTS 1011	Communication for Professionals	3	0	0	3	3
2.	HMTS 1061	Professional Communication Lab	0	0	2	2	1
Total Honours			3	0	2	5	4
Total of Semester with Honours			15	3	13	31	24.5

SECOND YEAR THIRD SEMESTER

A. Theory							
Sl. No.	**Code**	**Subject**	**Contacts Hours / Week**			**Total**	**Credit Points**
			L	**T**	**P**		
1.	CIVL 2101	Fundamentals of Strength of Materials	3	1	0	4	4
2.	CIVL 2102	Soil Mechanics – I	3	1	0	4	4
3.	CIVL 2103	Construction Materials and Technology	3	1	0	4	4
4.	BIOT 2105	Biology	2	0	0	2	2
5.	EVSC 2016	Environmental Sciences **(Mandatory Course)**	2	0	0	2	0
Total Theory			13	3	0	16	14
B. Laboratory							
1.	CIVL 2151	Strength of Materials Lab	0	0	2	2	1
2.	CIVL 2152	Soil Mechanics Lab – I	0	0	2	2	1
3.	CIVL 2153	Construction Materials Lab	0	0	2	2	1
4.	CIVL 2154	Building Planning and Drawing	0	0	4	4	2
Total Practical			0	0	10	10	5
Total of Semester without Honours			13	3	10	26	19
C. Honours							
1.	CIVL 2113	Fluid Mechanics	3	0	0	3	3
2.	CIVL 2163	Fluid Mechanics Lab	0	0	2	2	1
Total Honours			3	0	2	5	4
Total of Semester with Honours			16	3	12	31	23

SECOND YEAR FOURTH SEMESTER

A. Theory							
Sl. No.	**Code**	**Subject**	**Contacts Hours / Week**			**Total**	**Credit Points**
			L	**T**	**P**		
1.	MATH 2001	Mathematical Methods	3	1	0	4	4
2.	CIVL 2201	Structural Analysis – I	3	0	0	3	3
3.	CIVL 2202	Soil Mechanics – II	3	0	0	3	3
4.	CIVL 2203	Surveying	3	0	0	3	3
5.	CIVL 2204	Highway and Traffic Engineering	3	0	0	3	3
6.	HMTS 2001	Human Values and Professional Ethics	3	0	0	3	3
Total Theory			18	1	0	19	19
B. Laboratory							
1.	CIVL 2251	Soil Mechanics Lab – II	0	0	2	2	1
2.	CIVL 2252	Surveying Lab	0	0	4	4	2
3.	CIVL 2253	Highway Engineering Lab	0	0	2	2	1
4.	CIVL 2254	Quantity Survey, Specification and Valuation	0	0	2	2	1
Total Practical			0	0	10	10	5
Total of Semester			18	1	10	29	24

THIRD YEAR FIFTH SEMESTER

A. Theory							
Sl. No.	**Code**	**Subject**	**Contacts Hours / Week**			**Total**	**Credit Points**
			L	**T**	**P**		
1.	CIVL 3101	Structural Analysis – II	3	1	0	4	4
2.	CIVL 3102	Design of RCC Structures	3	1	0	4	4
3.	CIVL 3103	Environmental Engineering	3	1	0	4	4
4.	CSEN 3106	Data Structure & RDBMS	4	0	0	4	4
5.	CIVL 3141 - CIVL 3144	Professional Elective - I	3	0	0	3	3
6.	INCO 3016	Indian Constitution and Civil Society **(Mandatory Course)**	2	0	0	2	0
Total Theory			18	3	0	21	19
B. Laboratory							
1.	CIVL 3152	RCC Design and Detailing Lab	0	0	3	3	1.5
2.	CIVL 3153	Environmental Engineering Lab	0	0	3	3	1.5
3.	CSEN 3156	RDBMS Lab	0	0	3	3	1.5
Total Practical			0	0	9	9	4.5
Total of Semester			18	3	9	30	23.5

THIRD YEAR SIXTH SEMESTER

A. Theory							
Sl. No.	**Code**	**Subject**	**Contacts Hours / Week**			**Total**	**Credit Points**
			L	**T**	**P**		
1.	CIVL 3201	Design of Steel Structures	3	1	0	4	4
2.	HMTS 3201	Economics for Engineers	3	0	0	3	3
3.	CIVL 3241 - CIVL 3244	Professional Elective – II	3	0	0	3	3
4.	CIVL 3221 & CIVL 3222	Open Elective - I	3	0	0	3	3
Total Theory			12	1	0	13	13
B. Laboratory							
1.	CIVL 3251	Industrial Structure Design and Detailing Lab	0	0	3	3	1.5
2.	CIVL 3252	Computer-aided Structural Analysis and Design	1	0	4	5	3
Total Practical			1	0	7	8	4.5
C. Sessional							
1.	CIVL 3293	Term Paper and Seminar	0	0	4	4	2
Total Sessional			0	0	4	4	2
Total of Semester without Honours			13	1	11	25	19.5
D. Honours							
1.	CIVL 3214	Project Planning and Management	3	1	0	4	4
Total Honours			3	1	0	4	4
Total of Semester with Honours			16	2	11	29	23.5

FOURTH YEAR SEVENTH SEMESTER

A. Theory							
Sl. No.	**Code**	**Subject**	**Contacts Hours / Week**			**Total**	**Credit Points**
			L	**T**	**P**		
1.	HMTS 4101	Principles of Management	3	0	0	3	3
2.	CIVL 4141 - CIVL 4144	Professional Elective - III	3	0	0	3	3
3.	CIVL 4145 - CIVL 4148	Professional Elective - IV	3	0	0	3	3
4.	CIVL 4121 - CIVL 4125	Open Elective – II	3	0	0	3	3
5.	CIVL 4126 - CIVL 4130	Open Elective - III	3	0	0	3	3
Total Theory			15	0	0	15	15
B. Sessional							
1.	CIVL 4191	Industrial Training / Internship	-	-	-	-	2
2.	CIVL 4195	Project – I	0	0	8	8	4
Total Sessional			0	0	8	8	6
Total of Semester without Honours			15	0	8	23	21
C.Honours							
1.	CIVL 4115	Water Resources Engineering	3	1	0	4	4
Total Honours			3	1	0	4	4
Total of Semester with Honours			18	1	8	27	25

FOURTH YEAR EIGHTH SEMESTER

A. Theory							
Sl. No.	**Code**	**Subject**	**Contacts Hours / Week**			**Total**	**Credit Points**
			L	**T**	**P**		
1.	CIVL 4241 - CIVL 4244	Professional Elective – V	3	0	0	3	3
2.	CIVL 4221 & CIVL 4222	Open Elective – IV	3	0	0	3	3
Total Theory			6	0	0	6	6
B. Sessional							
1.	CIVL 4295	Project – II	0	0	16	16	8
2.	CIVL 4297	Comprehensive Viva-voce	-	-	-	-	1
Total Sessional			0	0	16	16	9
Total of Semester			6	0	16	22	15

PROFESSIONAL ELECTIVE COURSESFOR CIVIL ENGINEERING

Professional Elective - I	CIVL 3141	Foundation Engineering
	CIVL 3142	Rock Mechanics
	CIVL 3143	Offshore Structures
	CIVL 3144	Structural Dynamics and Earthquake Engineering
Professional Elective - II	CIVL 3241	Air and Noise Pollution
	CIVL 3242	Environmental Impact Assessment
	CIVL 3243	Ground Improvement Techniques
	CIVL 3244	Advanced Structural Analysis
Professional Elective - III	CIVL 4141	Prestressed Concrete Structures
	CIVL 4142	Design of Tall Structures
	CIVL 4143	Airport, Railway and Harbour Engineering
	CIVL 4144	Advanced Foundation Engineering
Professional Elective - IV	CIVL 4145	Irrigation Engineering
	CIVL 4146	Advanced Highway and Traffic Engineering
	CIVL 4147	Solid and Hazardous Waste Management
	CIVL 4148	Soil Dynamics and Machine Foundation
Professional Elective - V	CIVL 4241	Hydraulic Structures
	CIVL 4242	Finite Element Analysis
	CIVL 4243	Bridge Engineering
	CIVL 4244	Pavement Design

OPEN ELECTIVE COURSES OFFERED BYCIVILENGINEERING DEPARTMENT

Open Elective - I (Emerging Field)	CIVL 3221	Repair & Rehabilitation of Structures
	CIVL 3222	Sustainable Construction Methods
Open Elective - II	CIVL 4121	Project Planning and Management
	CIVL 4122	Introduction to Surveying
Open Elective - III	CIVL 4126	An Introduction to Concrete Technology
	CIVL 4127	Estimation and Valuation
Open Elective - IV	CIVL 4221	Building Materials
	CIVL 4222	Introduction to Finite Element Methods

NOTE:-

Open Elective – I (Emerging Field) - to be offered exclusively for the students of Civil Engineering

Open Elective-II, III and IV – to be offered for the students of other Departments.

Free Electives for Civil Engineering Students (4th Year 7th Semester):

[1] MECH 4123 : Mechanical Handling of Materials
[2] MECH 4129 : Quality Control and Management
[3] CHEN 4126 : Industrial Total Quality Management
[4] BIOT4126 : Biopolymer
[5] ELEC4126 : Principles of Electrical Machines

Free Electives for Civil Engineering Students (4th Year 8th Semester):

[1] MECH 4221 : Quantitative Decision Making
[2] MECH 4222 : Modern Manufacturing Technology
[3] BIOT 4222 : Non-conventional Energy
[4] CHEN 4222 : Introduction to Solar and Wind Technology

Honours Credit Chart

Sl. No.	Semester	Paper Code	Course Title	Contacts Hours / Week			Credit Points
				L	T	P	
1	First Year First Semester	ECEN 1011	Basic Electronics	3	0	0	3
2	First Year First Semester	ECEN 1061	Basic Electronics Lab	0	0	2	1
3	First Year Second Semester	HMTS 1011	Communication for Professionals	3	0	0	3
4	First Year Second Semester	HMTS 1061	Professional Communication Lab	0	0	2	1
5	Second Year Third Semester	CIVL 2113	Fluid Mechanics	3	0	0	3
6	Second Year ThirdSemester	CIVL 2163	Fluid Mechanics Lab	0	0	2	1
7	Third Year Sixth Semester	CIVL 3214	Project Planning and Management	3	1	0	4
8	Fourth Year Seventh Semester	CIVL 4115	Water Resources Engineering	3	1	0	4
	Total			15	2	6	20

Definition of Credit (as per AICTE):

- 1 Hour Lecture (L) per week = 1 Credit
- 1 Hour Tutorial (T) per week = 1 Credit
- 1 Hour Practical (P) per week = 0.5 Credit
- 2 Hours Practical (P) per week = 1 Credit

Range of Credits (as per AICTE):

- A total of 160 credits will be necessary for a student to be eligible to get B. Tech. degree.
- A student will be eligible to get B. Tech. degree with Honours if he/she completes an additional 20 credits. This could be acquired through various Honours courses offered by the respective departments.
- A part or all of the above additional credits may also be acquired through MOOCs. Any student completing any course through MOOC will have to submit an appropriate certificate to earn the corresponding credit.
- For any additional information, the student may contact the concerned HODs.

Online Courses Recommended For Civil Engineering Students

Code	Name	Credit Points	Corresponding Online Course	Offered by	Platform
ECEN1011	Basic Electronics	3	Fundamentals of Semiconductor Devices	IISc Bangalore	NPTEL
ECEN1061	Basic Electronics Lab	1			
HMTS1011	Communication for Professionals	3	Effective Business Communication	IIM Bangalore	Swayam
			AND		
HMTS1061	Professional Communication Lab	1	Developing Soft Skills and Personality	IIT Kanpur	Swayam
CIVL2113 & CIVL 2163	Fluid Mechanics & Fluid Mechanics Lab	3 + 1	Concepts of Thermodynamics	IIT Kharagpur	Swayam
			OR		
			Fluid Machines	IIT Kharagpur	Swayam
			OR		
			Advanced Concepts in Fluid Mechanics	IIT Kharagpur	Swayam
			OR		
			Fluid Mechanics	IIT Guwahati	Swayam
CIVL 3214	Project Planning and Management	4	Project Planning and Control	IIT Madras	NPTEL
CIVL4115	Water Resources Engineering	4	Irrigation and Drainage	IIT Kharagpur	Swayam
			OR		
			Remote Sensing and GIS	IIT Guwahati	Swayam
			OR		
			Remote Sensing and Digital Image Processing of Satellite Data	IIT Roorkee	Swayam

Credit Summary for B. Tech.in Civil Engineering Programme with effect from 2018-2019

Sl. No.	Course Type	Credit	AICTE suggested
1.	Humanities and Social Sciences including Management Courses	12	12
2.	Basic Science courses	21	25
3.	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc	26	24
4.	Professional core courses	57	48
5.	Professional Elective courses relevant to chosen specialization/branch	15	18
6.	Open subjects – Electives from other technical and /or emerging subjects	12	18
7.	Project work, seminar and internship in industry or elsewhere	17	15
8.	Mandatory Courses [Induction Program, Indian Constitution, Essence of Indian Traditional Knowledge, Organizational Behavior]	Non-credit	0
	Total	160	160
9.	Honours Courses	20	20
	Grand Total	180	180

Course Name: **PHYSICS - I**					
Course Code: **PHYS 1001**					
Contact hours per week:	L	T	P	Total	Credit Points
	3	1	0	4	4

Course Outcome:

1. Interpret oscillations under different conditions, with the understanding of Resonance phenomena followed by calculation of Q factor.
2. Analyze the Quantum phenomenon like Black body radiation, Compton effect and origin of X-ray spectrum.
3. Understand the wave character of light through the phenomenon of interference, diffraction and polarization.
4. Study of various crystal structures and classification of different crystal planes.
5. Explain the working principle of LASER, and apply the knowledge in different lasing system and their engineering applications in holography
6. Understand the dual nature of matter, Heisenberg's uncertainty relation and it's various application.

Module 1: Mechanics (7+5) = 12L

Elementary concepts of grad, divergence and curl. Potential energy function; F=-grad V, Equipotential surfaces and meaning of gradient; Conservative and non-conservative forces, Curl of a force field; Central forces ; conservation of angular momentum; Energy equation and energy diagrams; elliptical, parabolic and hyperbolic orbit; Kepler Problem; Application : Satellite manoeuvres .
Non-inertial frames of reference; rotating coordinate system; five term acceleration formula-centripetal and coriolis accelerations; applications: Weather system, Foucault pendulum.

Module 2: Optics = (4 +3+ 5) = 12 L

Oscillatory Motion:
Damped harmonic motion – Over damped, critically damped and lightly damped oscillators; Forced oscillation and resonance. Electrical equivalent of mechanical oscillator, Wave equation, plane wave solution.

Optics:

Elementary features of polarization of light waves. Double refraction, Production and analysis of linearly, elliptic and Circularly polarized light, Polaroid and application of polarizations.: Polarimeter.

Laser & Fiber Optics:

Characteristics of Lasers, Spontaneous and Stimulated Emission of Radiation, Meta-stable State, Population Inversion, Lasing Action, Einstein's Coefficients and Relation between them, Ruby Laser, Helium-Neon Laser, Semiconductor Diode Laser, Applications of Lasers.
Fiber optics - principle of operation, numerical aperture, acceptance angle, Single mode , graded indexed fiber.

Module 3: **Electrostatics (8+4) = 12 L**

Electrostatics in free space
Calculation of electric field and electrostatic potential for a charge distribution, Divergence and curl of electrostatic field, Laplace's and Poisson's equation for electrostatic potential. Boundary conditions of electric field and electrostatic potential. Method of images, energy of a charge distribution and its expression in terms of electric field.

Electrostatics in a linear dielectric medium
Electrostatic field and potential of a dipole, Bound charges due to electric polarization, Electric displacement, Boundary conditions on displacement, Solving simple electrostatic problem in presence of dielectric – point charge at the centre of a dielectric sphere, charge in front of dielectric slab, Dielectric slab and dielectric sphere in uniform electric field.

Module 4: **(6+3+3)= 12L**

Magnetostatics :
Biot-Savart law, divergence and curl of static magnetic field; vector potential and calculating it for a given magnetic field using Stokes' theorem; equation for vector potential and it's solutions for given current densities .

Magnetostatics in a linear magnetic medium:
Magnetization and associated bound currents; Auxiliary magnetic field $\vec{H}$; boundary conditions on $\vec{B}$ and $\vec{H}$. Solving for magnetic field due to simple magnet like a bar magnet; Magnetic susceptibility ; ferromagnetic , paramagnetic and diamagnetic materials; Qualitative discussion of magnetic field in presence of magnetic materials.

Faraday's Law:
Differential form of Faraday's law expressing curl of electric field in terms of time derivative of magnetic field and calculating electric field due to changing magnetic fields in quasi static approximation. Energy stored in a magnetic field.

Books of reference :

1. Optics – **Eugene Hecht** Pearson Education India Private Limited
2. Introduction to Electrodynamics, **David J. Griffiths**, Pearson Education India Learning Private Limited
3. Waves and Oscillations by **N.K. Bajaj**
4. Principles of Physics, 10ed, **David Halliday, Robert Resnick Jearl Walker** , Wiley
5. Electricity, Magnetism, and Light, **Wayne M. Saslow**, Academic Press
6. Classical mechanics, **Narayan Rana, Pramod Joag**, McGraw Hill Education
7. Introduction to Classical Mechanics, **R Takwale, P Puranik**, McGraw Hill Education
8. Optics, **Ghatak**, McGraw Hill Education India Private Limited
9. Refresher Course in B.Sc. Physics – Vol1 and Vol 2 – **C.L.Arora**

Course Name: **MATHEMATICS-I**					
Course Code: **MATH 1101**					
Contact hours per week:	L	T	P	Total	Credit Points
	3	1	0	4	4

Course Outcome:

1. Apply the concept of rank of matrices to find the solution of a system of linear simultaneous equations.
2. Develop the concept of eigen values and eigen vectors.
3. Use Mean Value Theorems for power series expansions of functions of one variable.
4. Analyze the nature of sequence and infinite series.
5. Describe the concept of differentiation and integration for functions of several variables with their applications in vector calculus.
6. Combine the concepts of gradient, curl, divergence, directional derivatives, line integrals, surface integrals and volume integrals.

Detailed Syllabus:

Module I: [10L]

Matrix: Inverse and rank of a matrix; Elementary row and column operations over a matrix; System of linear equations and its consistency; Symmetric, skew symmetric and orthogonal matrices; Determinants; Eigen values and eigen vectors; Diagonalization of matrices; Cayley Hamilton theorem; Orthogonal transformation.

Module II: [10L]

Vector Calculus: Vector function of a scalar variable, Differentiation of a vector function, Scalar and vector point functions, Gradient of a scalar point function, divergence and curl of a vector point function, Directional derivative, Related problems on these topics.

Infinite Series: Convergence of sequence and series; Tests for conver gence: Comparison test, Cauchy's Root test, D' Alembert's Ratio test(statements and related problems on these tests), Raabe's test; Alternating series; Leibnitz's Test (statement, definition); Absolute convergence and Conditional convergence.

Module III: [10L]

First order ordinary differential equations: Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

Ordinary differential equations of higher orders: General linear ODE of order two with constant coefficients, C.F. & P.I., D-operator methods, Method of variation of parameters, Cauchy-Euler equations.

Module IV: [10L]

Calculus of functions of several variables: Introduction to functions of several variables with examples, Knowledge of limit and continuity, Determination of partial derivatives of higher orders with examples, Homogeneous functions and Euler's theorem and related problems up to three variables.

Multiple Integration: Concept of line integrals, Double and triple integrals. Green's Theorem, Stoke's Theorem and Gauss Divergence Theorem.

References:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 2000.
2. E. Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 2006.
3. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
5. K. F. Riley, M. P. Hobson, S. J. Bence. Mathematical Methods for Physics and Engineering, Cambridge University Press, 23-Mar-2006.
6. S. L. Ross, Differential Equations", Wiley India, 1984.
7. G.F. Simmons and S.G. Krantz, Differential Equations, McGraw Hill, 2007.
8. Vector Analysis (Schaum's outline series): M. R. Spiegel, Seymour Lipschutz, Dennis Spellman (McGraw Hill Education)
9. Engineering Mathematics: S. S. Sastry (PHI)
10. Advanced Engineering Mathematics: M.C. Potter, J.L. Goldberg and E.F. Abonfadel (OUP), Indian Edition.
11. Linear Algebra (Schaum's outline series): Seymour Lipschutz, Marc Lipson (McGraw Hill Education)

Course Name: PROGRAMMING FOR PROBLEM SOLVING					
Course Code: CSEN 1001					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcomes:

1. Understand and remember functions of the different parts of a computer.
2. Understand and remember how a high-level language (C programming language, in this course) works, different stages a program goes through.
3. Understand and remember syntax and semantics of a high-level language (C programming language, in this course).
4. Understand how code can be optimized in high-level languages.
5. Apply high-level language to automate the solution to a problem.
6. Apply high-level language to implement different solutions for the same problem and analyze why one solution is better than the other.

Module I: [10L]

Fundamentals of Computer

History of Computers, Generations of Computers, Classification of Computers.

Basic Anatomy of Computer System, Primary & Secondary Memory, Processing Unit, Input & Output devices. Basic Concepts of Assembly language, High level language, Compiler and Assembler.

Binary & Allied number systems (decimal, octal and hexadecimal) with signed and unsigned numbers (using 1's and 2's complement) - their representation, conversion and arithmetic operations. Packed and unpacked BCD system, ASCII. IEEE-754 floating point representation (half- 16 bit, full- 32 bit, double- 64 bit).

Basic concepts of operating systems like MS WINDOWS, LINUX

How to write algorithms & draw flow charts.

Module II: [10L]

Basic Concepts of C

C Fundamentals:

The C character set identifiers and keywords, data type & sizes, variable names, declaration, statements.

Operators & Expressions:

Arithmetic operators, relational and logical operators, type, conversion, increment and decrement operators, bit wise operators, assignment operators and expressions, precedence and order of evaluation. Standard input and output, formatted output -- printf, formatted input scanf.

Flow of Control:

Statement and blocks, if-else, switch-case, loops (while, for, do-while), break and continue, go to and labels.

Module III: [10L]
Program Structures in C

Basic of functions, function prototypes, functions returning values, functions not returning values. Storage classes - auto, external, static and register variables – comparison between them. Scope, longevity and visibility of variables.
C preprocessor (macro, header files), command line arguments.
Arrays and Pointers:
One dimensional arrays, pointers and functions – call by value and call by reference, array of arrays. Dynamic memory usage– using malloc(), calloc(), free(), realloc(). Array pointer duality.
String and character arrays; C library string functions and their use.

Module IV: [10L]

Data Handling in C
User defined data types and files:
Basic of structures; structures and functions; arrays of structures.
Files – text files only, modes of operation. File related functions – fopen(), fclose(), fscanf(), fprintf(), fgets(), fputs(), fseek(), ftell().

Text Books
1. Schaum's outline of Programming with C – Byron Gottfried
2. Teach Yourself C- Herbert Schildt
3. Programming in ANSI C – E Balagurusamy

Reference Books
1. C: The Complete Reference – Herbert Schildt
2. The C Programming Language- D.M.Ritchie, B.W. Kernighan

Course Name: PHYSICS LAB – I					
Course Code: PHYS 1051					
Contact Hours per week	L	T	P	Total	Credit Points
	0	0	3	3	1.5

Course Outcomes:

1. Transform the theoretical knowledge into experimental set design
2. Understand principle, concept, working and application of new technology and comparison of results with theoretical calculations.
3. Analyze the result obtained through experiment.
4. Gain knowledge of new concept in the solution of practical oriented problems and to understand more deep knowledge about the solution to theoretical problems.
5. Understand measurement technology, usage of new instruments and real time applications in engineering studies.
6. Develop skills to impart practical knowledge in real time solution.

Minimum of six experiments taking at least one from each of the following four groups:

Group 1: Experiments in General Properties of matter

1. Determination of **Young's modulus** by **Flexure Method**
2. Determination of **bending moment** and **shear force** of a rectangular beam of uniform cross- section.
3. Determination of **modulus of rigidity** of the material of a rod by **static method**
4. Determination of **rigidity modulus** of the material of a **wire by dynamic method.**
5. Determination of **coefficient of viscosity** by Poiseulle's capillary flow method.

Group 2: Experiments in Optics

1. Determination of **dispersive power** of the material of a prism
2. Determination of wavelength of light by **Newton's ring** method.
3. Determination of wavelength of light by **Fresnel's biprism method.**
4. Determination of the **wavelength of a given laser** source by diffraction method

Group 3: Electricity & Magnetism experiments

1. Determination of **dielectric constant** of a given dielectric material.
2. Determination of resistance of **ballistic galvanometer by half deflection** method and study of variation of **logarithmic decrement** with series resistance.
3. Determination of the **thermo-electric power** at a certain temperature of the given thermocouple.
4. Determination of **specific charge (e/m)** of electron.

Group 4: Quantum Physics Experiments

1. Determination of **Planck's constant**.
2. Determination of **Stefan's radiation** constant.
3. Verification of **Bohr's atomic orbital** theory through **Frank-Hertz experiment**.
4. Determination of **Rydberg constant** by studying **Hydrogen/ Helium** spectrum.
5. Determination of **Hall co-efficient of semiconductors.**

6. Determination of **band gap** of semiconductors.
7. To study current-voltage characteristics, load response, areal characteristics and spectral response of photo voltaic solar cells.

Text Books:

1. Advanced Practical Physics (vol. 1 and vol. 2) B. Ghosh and K. G. Mazumdar.
2. Advanced course in practical physics D. Chattopadhyay and P.C. Rakshit.

Course Name: PROGRAMMING FOR PROBLEM SOLVING LAB					
Course Code: CSEN 1051					
Contact hrs per week:	L	T	P	Total	Credit Points
	0	0	4	4	2

Course outcome:

After completion of this course the students should be able:

1. To write simple programs relating to arithmetic and logical problems.
2. To be able to interpret, understand and debug syntax errors reported by the compiler.
3. To implement conditional branching, iteration (loops) and recursion.
4. To decompose a problem into modules (functions) and amalgamating the modules to generate a complete program.
5. To use arrays, pointers and structures effectively in writing programs.
6. To be able to create, read from and write into simple text files.

Software to be used: GNU C Compiler (GCC) with LINUX
NB: Cygwin (Windows based) may be used in place of LINUX

Topic 1: LINUX commands and LINUX based editors
Topic 2: Basic Problem Solving
Topic 3: Control Statements (if, if-else, if-elseif-else, switch-case)
Topic 4: Loops - Part I (for, while, do-while)
Topic 5: Loops - Part II
Topic 6: One Dimensional Array
Topic 7: Array of Arrays
Topic 8: Character Arrays/ Strings
Topic 9: Basics of C Functions
Topic 10: Recursive Functions
Topic 11: Pointers
Topic 12: Structures
Topic 13: File Handling

Text Books

1. Schaum's outline of Programming with C – Byron Gottfried
2. Teach Yourself C- Herbert Schildt
3. Programming in ANSI C – E Balagurusamy

Course Name: WORKSHOP / MANUFACTURING PRACTICES					
Course Code: MECH 1051					
Contact Hours per week	L	T	P	Total	Credit Points
	1	0	4	5	3

Course Outcomes:

Upon completion of this course

1. The students will gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials.
2. The students will be able to fabricate components with their own hands.
3. They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
4. By assembling different components, they will be able to produce small devices of their interest.
5. The students will be able to describe different components and processes of machine tools.
6. The students will be able to apply the knowledge of welding technology and they can perform arc and gas welding to join the material.

(i) Lectures & videos: (13 hours)

Detailed contents

1. Introduction on Workshop and Safety Precautions. **(1 lecture)**
2. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods **(3 lectures)**
3. CNC machining, Additive manufacturing **(1 lecture)**
4. Fitting operations & power tools **(1 lecture)**
5. Electrical & Electronics **(1 lecture)**
6. Carpentry **(1 lecture)**
7. Plastic moulding, glass cutting **(1 lecture)**
8. Metal casting **(1 lecture)**
9. Welding (arc welding & gas welding), brazing **(2 lecture)**
10. Viva-voce **(1 lecture)**

(ii) Workshop Practice: (52 hours) [L: 0; T:0 ; P : 4 (2 credits)]

1. Machine shop	**(12 hours)**
2. Fitting shop	**(8 hours)**
3. Carpentry	**(4 hours)**
4. Electrical & Electronics	**(4 hours)**
5. Welding shop **(Arc welding 4 hrs + gas welding 4 hrs)**	**(8 hours)**
6. Casting	**(4 hours)**
7. Smithy	**(4 hours)**
8. Plastic moulding& Glass Cutting	**(4 hours)**
9. Sheet metal Shop	**(4 hours)**

Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

Suggested Text/Reference Books:

(i) Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.

(ii) Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.

(iii)Gowri P. Hariharan and A. Suresh Babu,"Manufacturing Technology – I" Pearson Education, 2008.

(iv) Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.

(v) Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGrawHill House, 2017.

Course Name: BASIC ELECTRONICS					
Course Code: ECEN 1011					
Contact hrs per week:	L	T	P	Total	Credit points
	3	0	0	3	3

Course Outcomes:

After going through this course, the students will be able to

1. Categorize different semiconductor materials based on their energy bands and analyze the characteristics of those materials for different doping concentrations based on previous knowledge on semiconductors acquired.
2. Describe energy band of P-N Junction devices and solve problems related to P-N Junction Diode both from device and circuit perspectives.
3. Design different application specific circuits associated with diodes operating both in forward and reverse bias.
4. Analyze various biasing configurations of Bipolar Junction Transistor and categorize different biasing circuits based on stability.
5. Categorize different field-effect transistors based on their constructions, physics and working principles and solve problems associated with analog circuits based on operational amplifiers.
6. Design and implement various practical purpose electronic circuits and systems meant for both special purpose and general purpose and anlayze their performance depending on the type of required output and subsequently the applied input.

Module I [10 L]

Basic Semiconductor Physics:

Crystalline materials, Energy band theory, Conductors, Semiconductors and Insulators, Concept of Fermi Energy level, intrinsic and extrinsic semiconductors, drift and diffusion currents in semiconductor

Diodes and Diode Circuits:

Formation of p-n junction, Energy Band diagram, forward & reverse biased configurations, V-I characteristics, load line, breakdown mechanisms, Zener Diode and its Application.

Rectifier circuits: half wave & full wave rectifiers: ripple factor, rectification efficiency.

Module II [8 L]

Bipolar Junction Transistors (BJT):

PNP & NPN BJT structures, current components in BJT, CE, CB, CC configurations, V-I Characteristics of CB & CE modes, regions of operation, Base width modulation & Early effect, thermal runaway, Concept of Biasing: DC load line, Q-point, basics of BJT amplifier operation,

current amplification factors, different biasing circuits: fixed bias, collector to base bias, voltage divider bias.

Module III [9 L]

Field Effect Transistors (FET):

n-channel Junction Field Effect Transistor (JFET) structure & V-I characteristics.
Metal Oxide Semiconductor Field Effect Transistor (MOSFET): enhancement & depletion type MOSFETs (for both n & p channel devices), drain & transfer characteristics.
MOSFET as a digital switch, CMOS inverter, voltage transfer characteristic (VTC), NAND & NOR gate realization using CMOS logic.
Moore's Law, evolution of process node, state of integration (SSI, MSI, LSI, VLSI, ULSI), Classification of Integrated circuits (IC) and their applications.

Module IV [9 L]

Feedback in Amplifiers:

Concept of feedback, advantages of negative feedback (qualitative), Barkhausen criteria.

Operational Amplifier:

Ideal OPAMP characteristics, OPAMP circuits: inverting and non-inverting amplifiers, Adder, Subtractor, Integrator, Differentiator, Basic Comparator.

Special Semiconductor Devices:

Light Emitting Diode (LED), Silicon Controlled Rectifier (SCR), Photodiode: Operations, characteristics & applications.

References:

1. Boylestad & Nashelsky:Electronic Devices & Circuit Theory
2. R.A Gayakwad:Op Amps and Linear IC's, PHI
3. D. Chattopadhyay, P. C Rakshit : Electronics Fundamentals and Applications
4. Adel S. Sedra, Kenneth Carless Smith: Microelectronics Engineering
5. Millman & Halkias: Integrated Electronics.
6. Salivahanan: Electronics Devices & Circuits.
7. Albert Paul Malvino: Electronic Principle.

Course Name: BASIC ELECTRONICS LAB					
Course Code: ECEN 1061					
Contact hrs per week:	L	T	P	Total	Credit points
	0	0	2	2	1

Course Outcomes:

1. The students will correlate theory with diode behavior.
2. They will design and check rectifier operation with regulation etc.
3. Students will design different modes with BJT and FET and check the operations.
4. They will design and study adder, integrator etc. with OP-AMPs.

List of Experiments

1. Familiarization with passive and active electronic components such as Resistors, Inductors, Capacitors, Diodes, Transistors (BJT) and electronic equipment like DC power supplies, multi-meters etc.
2. Familiarization with measuring and testing equipment like CRO, Signal generators etc.
3. Study of I-V characteristics of Junction diodes.
4. Study of I-V characteristics of Zener diodes.
5. Study of Half and Full wave rectifiers with Regulation and Ripple factors.
6. Study of I-V characteristics of BJTs in CB mode
7. Study of I-V characteristics of BJTs in CE mode
8. Study of I-V characteristics of Field Effect Transistors.
9. Determination of input-offset voltage, input bias current and Slew rate of OPAMPs.
10. Determination of Common-mode Rejection ratio, Bandwidth and Off-set null of OPAMPs.
11. Study of OPAMP circuits: Inverting and Non-inverting amplifiers, Adders, Integrators and Differentiators.

Course Name: CHEMISTRY - I					
Course Code: CHEM 1001					
Contact hrs per week:	L	T	P	Total	Credit points
	3	1	0	4	4

Course Outcome:

The course outcomes of the subject are

1. Knowledge of understanding the operating principles and reaction involved in batteries and fuel cells and their application in automobiles as well as other sectors to reduce environmental pollution.
2. An ability to analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.for engineering applications.
3. Have knowledge of synthesizing nano materials and their applications in industry, carbon nano tube technology is used in every industry now-a-days.
4. Understanding of bulk properties and processes using thermodynamic considerations.
5. Elementary knowledge of IR, UV, NMR and X-ray spectroscopy is usable in structure elucidation and characterisation of various molecules.
6. Knowledge of electronic effect and stereochemistry for understanding mechanism of the major chemical reactions involved in synthesis of various drug molecules.

MODULE 1

Atomic structure and Wave Mechanics:

Brief outline of the atomic structure, Duel character of electron, De Broglies's equation, the Heisenberg uncertainty principle, brief introduction of quantum mechanics, the Schrodinger wave equation, Hermitian operator, solution of the Schrodinger equation for particle in a one dimensional box, interpretation of the wave function Ψ, concept of atomic orbital. 3**L**

Thermodynamics:

Carnot cycle, 2nd law of thermodynamics, entropy, Clausius inequality, free energy and work function, Clausius Clapeyron Equation, Chemical Potential, Activity and Activity coefficient. Gibbs Duhem Relation. 4**L**

Specctroscopic Techniques & Application

Electromagnetic spectrum: EMR interaction with matter - absorption and emission of radiation.
Principle and application of UV- visible and IR spectroscopy
Principles of NMR Spectroscopy and X-ray diffraction technique **3L**

MODULE 2

Chemical Bonding

Covalent bond, VSEPR Theory, hybridization, molecular geometries, Dipole moment, Intermolecular forces, V.B. and M.O. Theory and its application in Homo and Heteronuclear diatomic molecules, Band theory of solids, Pi-molecular orbitals of ethylene and butadiene. 5**L**

Periodicity

Effective nuclear charge, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electro-negativity, inert pair effect. **3L**

Ionic Equilibria

Acid Base Equilibria, Salt Hydrolysis and Henderson Equation, Buffer solutions, pH indicator, Common ion Effect, Solubility product, Fractional Precipitation. **2L**

MODULE 3

Conductance

Conductance of electrolytic solutions, Strong and Weak electrolytes, effect of temperature and concentration. Kohlrausch's law of independent migration of ions, transport numbers and hydration of ions. Application of conductance Acid-base and precipitation titration. **3L**

Electrochemical Cell

Thermodynamic derivation of Nernst equation, Electrode potential and its application to predict redox reaction; Standard Hydrogen Electrode, Reference electrode, cell configuration, half cell reactions, evaluation of thermodynamic functions; Reversible and Irreversible cells; Electrochemical corrosion.
Electrochemical Energy Conversion: Primary & Secondary batteries, Fuel Cells. **4L**

Reaction dynamics

Rate Laws, Order & Molecularity; zero, first and second order kinetics. Pseudo-unimolecular reaction, Arrhenius equation.
Mechanism and theories of reaction rates (Transition state theory, Collison theory).
Catalysis: Homogeneous catalysis (Definition, example, mechanism, kinetics). **3L**

MODULE 4

Stereochemistry

Representations of 3- dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. **4L**

Structure and reactivity of Organic molecule

Inductive effect, resonance, hyperconjugation, electromeric effect, carbocation, carbanion, free radicals, aromaticity. **3L**

Organic reactions and synthesis of drug molecule (4 lectures)

Introduction to reaction mechanisms involving substitution, addition, elimination and oxidation-reduction reactions. Synthesis of commonly used drug molecules. **3L**

TEXT BOOKS

1. Atkins' Physical Chemistry, P.W. Atkins (10^{th} Edition)
2. Organic Chemistry, I. L. Finar, Vol-1 (6^{th} Edition)
3. Engineering Chemistry, Jain & Jain,(16^{th} Edition)
4. Fundamental Concepts of Inorganic Chemistry, A. K. Das, (2^{nd} Edition)
5. Engineering Chemistry -I, Gourkrishna Dasmohapatra, (3^{rd} Edition)

REFERENCE BOOKS

1. General & Inorganic Chemistry, R. P. Sarkar
2. Physical Chemistry, P. C. Rakshit, (7^{th} Edition)
3. Organic Chemistry, Morrison & Boyd , (7^{th} Edition)
4. Fundamentals of Molecular Spectroscopy, C.N. Banwell, (4^{th} Edition)
5. Physical Chemistry, G. W. Castellan, (3^{rd} Edition)
6. Basic Stereo chemistry of Organic Molecules, Subrata Sen Gupta, (1^{st} Edition)

Course Name: MATHEMATICS-II					
Course Code: MATH 1201					
Contact hours per week:	L	T	P	Total	Credit Points
	3	1	0	4	4

Course Outcomes:

1. Demonstrate the knowledge of probabilistic approaches to solve wide range of engineering problem.
2. Recognize probability distribution for discrete and continuous variables to quantify physical and engineering phenomenon.
3. Develop numerical techniques to obtain approximate solutions to mathematical problems where analytical solutions are not possible to evaluate.
4. Analyze certain physical problems that can be transformed in terms of graphs and trees and solving problems involving searching, sorting and such other algorithms.
5. Apply techniques of Laplace Transform and its inverse in various advanced engineering problems.
6. Interpret differential equations and reduce them to mere algebraic equations using Laplace Transform to solve easily.

Detailed Syllabus:

Module I: [10L]

Basic Probability: Random experiment, Sample space and events, Classical and Axiomatic definition of probability, Addition and Multiplication law of probability, Conditional probability, Bayes' Theorem, Random variables, General discussion on discrete and continuous distributions, Expectation and Variance, Examples of special distribution: Binomial and Normal Distribution.

Module II: [10L]

Basic Numerical Methods: Solution of non-linear algebraic and transcendental equations: Bisection Method, Newton-Raphson Method, Regula-Falsi Method. Solution of linear system of equations: Gauss Elimination Method, Gauss-Seidel Method, LU Factorization Method, Matrix Inversion Method. Solution of Ordinary differential equations: Euler's Method, Modified Euler's Method, Runge-Kutta Method of 4th order.

Module III: [10L]

Basic Graph Theory: Graph, Digraph, Weighted graph, Connected and disconnected graphs, Complement of a graph, Regular graph, Complete graph, Sub-graph, Walk, Path, Circuit, Euler Graph, Cut sets and cut vertices, Matrix representation of a graph, Adjacency and incidence matrices of a graph, Graph isomorphism, Bipartite graph, Dijkstra's Algorithm for shortest path problem. Definition and properties of a Tree, Binary tree and its properties, Spanning tree of a

graph, Minimal spanning tree, Determination of spanning trees using BFS and DFS algorithms, Determination of minimal spanning tree using Kruskal's and Prim's algorithms.

Module IV: [10L]

Laplace Transformation: Basic ideas of improper integrals, working knowledge of Beta and Gamma functions (convergence to be assumed) and their interrelations. Introduction to integral transformation, Functions of exponential order, Definition and existence of Laplace Transform(LT) (statement of initial and final value theorem only), LT of elementary functions, Properties of Laplace Transformations , Evaluation of sine , cosine and exponential integrals using LT, LT of periodic and step functions, Definition and properties of inverse LT, Convolution Theorem (statement only) and its application to the evaluation of inverse LT, Solution of linear ODEs with constant coefficients (initial value problem) using LT

References:

1. Advanced Engineering Mathematics, E.Kreyszig, Wiley Publications
2. Introduction to Probability and Statistics for Engineers and Scientists, S.Ross, Elsevier
3. Introductory methods of Numerical Analysis, S.S. Sastry, PHI learning
4. Introduction to Graph Theory, D. B. West, Prentice-Hall of India
5. Engineering Mathematics, B.S. Grewal, S. Chand & Co.

Course Name: BASIC ELECTRICAL ENGINEERING					
Course Code: ELEC 1001					
Contact Hours per week	L	T	P	Total	Credit Points
	3	1	0	4	4

Course Outcomes:

After attending the course, the students will be able to

1. Analyse DC electrical circuits using KCL, KVL and network theorems like Superposition Theorem, Thevenin's Theorem, Norton's Theorem and Maximum Power Transfer Theorem.
2. Analyse DC Machines; Starters and speed control of DC motors.
3. Analyse magnetic circuits.
4. Analyse single and three phase AC circuits.
5. Analyse the operation of single phase transformers.
6. Analyse the operation of three phase induction motors.

Module-I:

DC Network Theorem: Kirchhoff's laws, Nodal analysis, Mesh analysis, Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Star-Delta conversion. [6L]

Electromagnetism: Review of magnetic flux, Force on current carrying conductors, Magnetic circuit analysis, Self and Mutual inductance, B-H loop, Hysteresis and Eddy current loss, Lifting power of magnet. [5L]

Module-II

AC single phase system: Generation of alternating emf, Average value, RMS value, Form factor, Peak factor, representation of an alternating quantity by a phasor, phasor diagram, AC series, parallel and series-parallel circuits, Active power, Reactive power, Apparent power, power factor, Resonance in RLC series and parallel circuit. [10L]

Module-III

Three phase system: Generation of three-phase AC power, Balanced three phase system, delta and star connection, relationship between line and phase quantities, phasor diagrams, power measurement by two wattmeter method. [4L]

DC Machines: Construction, EMF equation, Principle of operation of DC generator, Open circuit characteristics, External characteristics, Principle of operation of DC motor, speed-torque characteristics of shunt and series machine, starting of DC motor, speed control of DC motor. [7L]

Module-IV

Transformer: Construction, EMF equation, no load and on load operation and their phasor diagrams, Equivalent circuit, Regulation, losses of a transformer, Open and Short circuit tests, Efficiency, Introduction to three phase transformer. [6L]

Three-phase induction motor: Concept of rotating magnetic field, Principle of operation, Construction, Equivalent circuit and phasor diagram, torque-speed/slip characteristics. [4L]

Text Books:

1. Basic Electrical engineering, D.P Kothari & I.J Nagrath, TMH, Second Edition

2. Basic Electrical Engineering, V.N Mittle & Arvind Mittal, TMH, Second Edition

3. Basic Electrical Engineering, Hughes

4. Electrical Technology, Vol-I,Vol-II,Surinder Pal Bali, Pearson Publication

5. A Text Book of Electrical Technology, Vol. I & II, B.L. Theraja, A.K. Theraja, S.Chand & Company

Reference Books:

1. Electrical Engineering Fundamentals, Vincent Del Toro, Prentice-Hall

2. Advance Electrical Technology, H.Cotton, Reem Publication

3. Basic Electrical Engineering, R.A. Natarajan, P.R. Babu, Sictech Publishers

4. Basic Electrical Engineering, N.K. Mondal, Dhanpat Rai

5. Basic Electrical Engineering, Nath & Chakraborti

6. Fundamental of Electrical Engineering, Rajendra Prasad, PHI, Edition 2005.

Course Name: BUSINESS ENGLISH					
Course Code: HMTS 1202					
Contact Hours per week	L	T	P	Total	Credit Points
	2	0	0	2	2

Course Outcome:

The learner will

1. Acquire competence in using English language to communicate.
2. Be aware of the four essential skills of language usage-listening, speaking, reading and writing.
3. Be adept at using various modes of written communication at work.
4. Attain the skills to face formal interview sessions.
5. Write reports according to various specifications.
6. Acquire the skill to express with brevity and clarity

Module- I (6hrs.)

Grammar (Identifying Common Errors in Writing)

- Subject-verb agreement
- Noun-pronoun agreement
- Misplaced Modifiers
- Articles
- Prepositions
- Redundancies

Module- II (6hrs.)

Basic Writing Strategies

Sentence Structures

- Use of phrases and clauses in sentences
- Creating coherence
- Organizing principles –accuracy, clarity, brevity
- Techniques for writing precisely
- Different styles of writing: descriptive, narrative, expository
- Importance of proper punctuation

Module- III (8hrs)

Business Communication- Scope & Importance
Writing Formal Business Letters: Form and Structure- Parts of a Business letter, Business Letter Formats, Style and Tone, Writing strategies.

Organizational Communication: Agenda & minutes of a meeting, Notice, Memo, Circular
Organizing e-mail messages, E-mail etiquette
Job Application Letter: Responding to Advertisements and Forced Applications, Qualities of well-written Application Letters: The You-Attitude, Length, Knowledge of Job Requirement, Reader-Benefit Information, Organization, Style, Mechanics – Letter Plan: Opening Section, Middle Section, Closing Section
Resume and CV: Difference, Content of the Resume – Formulating Career Plans: Self Analysis, Career Analysis, Job Analysis, Matching Personal Needs with Job Profile – Planning your Resume – Structuring the Resume: Chronological Resume, The Functional Resume, Combination of Chronological and Functional Resume, Content of the Resume: Heading, Career Goal or Objectives, Education, Work Experience, Summary of Job Skills/Key Qualifications, Activities, Honors and Achievements, Personal Profile, Special Interests, References

Module- IV (6hrs)

Writing skills

- Comprehension: Identifying the central idea, inferring the lexical and contextual meaning, comprehension passage - practice
- Paragraph Writing: Structure of a paragraph, Construction of a paragraph, Features of a paragraph, Writing techniques/ developing a paragraph.
- Précis: The Art of Condensation- some working principles and strategies. Practice sessions of writing précis of given passages.
- Essay Writing: Characteristic features of an Essay, Stages in Essay writing, Components comprising an Essay, Types of Essays-Argumentative Essay, Analytical Essay, Descriptive Essays, Expository Essays, Reflective Essays

References:

1. Theories of Communication: A Short Introduction, Armand Matterlart and Michele Matterlart, Sage Publications Ltd.
2. Professional Writing Skills, Chan, Janis Fisher and Diane Lutovich. San Anselmo, CA: Advanced Communication Designs.
3. Hauppauge, Geffner, Andrew P. Business English, New York: Barron's Educational Series.
4. Kalia, S. &Agarwal,S. Business Communication,Wiley India Pvt. Ltd., New Delhi, 2015
5. Mukherjee, H.S., Business Communication- Connecting at work., Oxford University Press. 2nd Edition.2015
6. Raman, M. and Sharma, S., Technical Communication: Principles and Practice, 2nd Ed., 2011.

Course Name: CHEMISTRY LAB					
Course Code: CHEM 1051					
Contact Hours per week	L	T	P	Total	Credit Points
	0	0	3	3	1.5

Course outcome:

The course outcomes of the subject are

1. Knowledge to estimate the hardness of water which is required to determine the usability of water used in industries.

2. Estimation of ions like Fe^{2+}, Cu^{2+} and Cl^- present in water sample to know the composition of industrial water.

3. Study of reaction dynamics to control the speed and yield of various manufactured goods produced in polymer, metallurgical and pharmaceutical industries.

4. Handling physico-chemical instruments like viscometer, stalagmometer, pH-meter, potentiometer and conductometer.

5. Understanding the miscibility of solutes in various solvents required in paint, emulsion, biochemical and material industries.

6. Knowledge of sampling water can be employed for water treatment to prepare pollution free water.

List of Experiments:

1. Estimation of iron using $KMnO_4$ self indicator.
2. Iodometric estimation of Cu^{2+}.
3. Determination of Viscosity.
4. Determination of surface tension.
5. Adsorption of acetic acid by charcoal.
6. Potentiometric determination of redox potentials.
7. Determination of total hardness and amount of calcium and magnesium separately in a given water sample.
8. Determination of the rate constant for acid catalyzed hydrolysis of ethyl acetate.
9. Heterogeneous equilibrium (determination of partition coefficient of acetic acid in n butanol and water mixture).
10. Conductometric titration for the determination of strength of a given HCl solution against a standard NaOH solution.
11. pH-metric titration for determination of strength of a given HCl solution against a standard NaOH solution.
12. Determination of chloride ion in a given water sample by Argentometric method (using chromate indicator solution)

Reference Books:

1. Vogel's Textbook of Quantitative Chemical Analysis-G. H. Jeffery, J. Bassett, J. Mendham, R. C. Denney.
2. Advanced Practical Chemistry- S. C. Das
3. Practicals in Physical Chemistry- P. S. Sindhu

Course Name: BASIC ELECTRICAL ENGINEERING LAB					
Course Code: ELEC 1051					
Contact hours per week:	L	T	P	Total	Credit Points
	0	0	2	2	1

Course Outcomes: The students are expected to

1. Get an exposure to common electrical apparatus and their ratings.
2. Make electrical connections by wires of appropriate ratings.
3. Understand the application of common electrical measuring instruments.
4. Understand the basic characteristics of different electrical machines.

List of Experiments:

1. Characteristics of Fluorescent lamps
2. Characteristics of Tungsten and Carbon filament lamps
3. Verification of Thevenin's & Norton's theorem.
4. Verification of Superposition theorem
5. Verification of Maximum Power Transfer theorem
6. Calibration of ammeter and voltmeter.
7. Open circuit and Short circuit test of a single phase Transformer.
8. Study of R-L-C Series / Parallel circuit
9. Starting and reversing of speed of a D.C. shunt Motor
10. Speed control of DC shunt motor.
11. No load characteristics of D.C shunt Generators
12. Measurement of power in a three phase circuit by two wattmeter method.

Course Name: ENGINEERING GRAPHICS & DESIGN					
Course Code: MECH 1052					
Contact hours per week:	L	T	P	Total	Credit Points
	1	0	4	5	3

Course Outcomes:

After going through the course, the students will be able

1. To understand the meaning of engineering drawing.
2. To have acquaintance with the various standards (like lines, dimensions, scale etc.) and symbols followed in engineering drawing.
3. To represent a 3-D object into 2-D drawing with the help of orthographic and isometric projections.
4. To read and understand projection drawings.
5. To draw the section view and true shape of a surface when a regular object is cut by a section plane.
6. To use engineering drawing software (CAD).

Lecture Plan (13 L)

1. Importance and principles of engineering drawing (1 L)
2. Concepts of Conic sections and Scale (1 L)
3. Introduction to concept of projection (Projections of points, lines and surfaces) (4 L)
4. Definitions of different solids and their projections (1 L)
5. Section of solids and sectional view (1 L)
6. Isometric projection (2 L)
7. Introduction to CAD (2 L)
8. Viva Voce (1 L)

Detailed contents of Lab hours (52 hrs)

Module 1: Introduction to Engineering Drawing covering**,**
Principles of Engineering Graphics and their significance, usage of Drawing instruments, lines, lettering & dimensioning, Conic section like Ellipse (General method only); Involute; Scales – Plain, Diagonal. (4 hrs + 4 hrs)

Module 2: Orthographic Projections covering**,**
Principles of Orthographic Projections - Conventions - Projections of Points and lines inclined to both planes; Projections on Auxiliary Planes. Projection of lamina. (4 hrs+4 hrs + 4 hrs)

Module 3: Projections of Regular Solids covering,
those inclined to both the Planes- Auxiliary Views. (4 hrs + 4 hrs)

Module 4: Sections and Sectional Views of Right Angular Solids covering**,**
Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids. (4 hrs)

Module 5: Isometric Projections covering**,**
Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions. (4 hrs + 4 hrs)

Module 6: Overview of Computer Graphics covering,
listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids. (4 hrs)

Module 7: Customisation & CAD Drawing
consisting of set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles; (2 hrs)

Annotations, layering & other functions covering
applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation. (2 hrs)

Module 6: Demonstration of a simple team design project that illustrates
Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame. (4 hrs)

References:

1. Bhatt, N.D., Panchal V.M. & Ingle P.R., (2014) “Elementary Engineering Drawing”; Charotan Publishing House

2. Narayana, K.L. and Kannaaiah P “Engineering Graphics”; TMH

3. Lakshminarayanan, V. and Vaish Wanar, R.S “Engineering Graphics” Jain Brothers.

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

5. Agarwal B. & Agarwal C. M. (2012), Engineering graphics, TMH Publications.

Course Name: LANGUAGE LAB					
Course Code: HMTS 1252					
Contact hrs per week:	L	T	P	Total	Credit Points
	0	0	2	2	1

Course Outcome:

The learner will

1. Acquire the techniques to become an effective listener.
2. Acquire the skill to become an effortless speaker.
3. Organize and present information for specific audience.
4. Communicate to make a positive impact in professional and personal environment.
5. Engage in research and prepare authentic, formal, official documents.
6. Acquire reading skills for specific purpose.

Module- I (4hrs)

Listening Skills

- Principles of Listening: Characteristics, Stages.
- Types of Listening: Passive listening, Marginal or superficial listening, Projective Listening, Sensitive or Empathetic Listening, Active or Attentive listening.
- Guidelines for Effective Listening
- Barriers to Effective Listening
- Listening Comprehension

Module- II (8hrs)

- Interviewing
  Types of Interviews, Format for Job Interviews: One-to-one and Panel Interviews, Telephonic Interviews, Interview through video conferencing.
- Interview Preparation Techniques, Frequently Asked Questions, Answering Strategies, Dress Code, Etiquette, Questions for the Interviewer, Simulated Interviews.

Module- III (6hrs)

- Public Speaking: The Speech Process: The Message, The Audience, The Speech Style, Encoding, Feedback.
- Characteristics of a good speech : content and delivery, structure of a speech
- Modes of delivery in public speaking: Impromptu, Extemporaneous, Prepared or Memorized, Manuscript.

- Conversation: Types of conversation: formal and informal, Strategies for effective conversation, Improving fluency.
- Situational conversation practice: Greetings and making introductions, Asking for information and giving instructions, agreeing and disagreeing.
- Conversational skills in the business scenario: One-to-one and Group communication, Gender and Culture Sensitivity, Etiquette, Sample Business Conversation, Telephonic Conversation

Module- IV (8hrs)

Presentation Skills

- Speaking from a Manuscript, Speaking from Memory, Impromptu Delivery, Extemporaneous Delivery, Analyzing the Audience, Nonverbal Dimensions of Presentation
- Organizing the Presentation: The Message Statement, Organizing the Presentation: Organizing the Speech to Inform, The Conclusion, Supporting Your Ideas – Visual Aids: Designing and Presenting Visual Aids, Selecting the Right Medium.
- Project Team/Group Presentations

References:

1. Carter, R. And Nunan, D. (Eds), The Cambridge guide to Teaching English to Speakers of Other Languages, CUP, 2001
2. Edward P. Bailey, Writing and Speaking At Work: A Practical Guide for Business Communication, Prentice Hall, 3rd Ed., 2004
3. Munter, M., Guide to Managerial Communication: Effective Business Writing and Speaking, Prentice Hall, 5th Ed., 1999
4. Sen, S.,Mahendra,A. & Patnaik,P., Communication and Language Skills, Cambridge University Press, 2015
5. Locker,Kitty O. Business and Administrative Communication McGraw-Hill/ Irwin.
6. Chaney,L.and Martin,J., Intercultural Business Communication. Prentice Hall

Course Name: COMMUNICATION FOR PROFESSIONALS					
Course Code: HMTS 1011					
Contact hrs per week:	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

Students will be able to

1. Write business letters and reports
2. Communicate in an official and formal environment.
3. Effectively use the various channels of communication at work place.
4. Use language as a tool to build bridges and develop interpersonal relations in multi-cultural environment.
5. Learn to articulate opinions and views with clarity.
6. Use various techniques of communication for multiple requirements of globalized workplaces.

Module- I (9hrs.)

Introduction to Linguistics

- Phonetics- Vowel and Consonant Sounds (Identification & Articulation)
- Word- stress, stress in connected speech
- Intonation (Falling and Rising Tone)
- Voice Modulation
- Accent Training
- Vocabulary Building
- The concept of Word Formation
- Root words from foreign languages and their use in English
- Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives
- Synonyms, Antonyms and standard abbreviations

Module- II (10hrs.)

Communication Skills

- Definition, nature & attributes of Communication
- Process of Communication
- Models or Theories of Communication
- Types of Communication
- Levels or Channels of Communication
- Barriers to Communication

Module- III (10hrs.)

Professional Writing Skills

- Letter Writing : Importance, Types , Process, Form and Structure, Style and Tone
- Proposal Writing: Purpose, Types of Proposals, Structure of Formal Proposals.
- Report Writing: Importance and Purpose, Types of Reports, Report Formats, Structure of Formal Reports, Writing Strategies.

Module- IV (10hrs.)

Communication skills at Work

- Communication and its role in the workplace
- Benefits of effective communication in the workplace
- Common obstacles to effective communication
- Approaches and Communication techniques for multiple needs at workplace: persuading, convincing, responding, resolving conflict, delivering bad news, making positive connections,
- Identify common audiences and design techniques for communicating with each audience

References:

1 Kumar,S. &Lata, P. Communication Skills, OUP, New Delhi2011
2 Rizvi,Ashraf,M. Effective Technical Communication, Mc Graw Hill Education(India) Pvt. Ltd..Chennai,2018
3 Raman, M. and Sharma, S., Technical Communication: Principles and Practice, 2nd Ed., 2011

Course Name: PROFESSIONAL COMMUNICATION LAB					
Course Code: HMTS 1061					
Contact hours per week:	L	T	P	Total	Credit Points
	0	0	2	2	1

Course Outcome:

Students will be able to

1. Communicate in an official and formal environment.
2. Effectively communicate in a group and engage in relevant discussion.
3. Engage in research and prepare presentations on selected topics.
4. Understand the dynamics of multicultural circumstances at workplace and act accordingly.
5. Organize content in an attempt to prepare official documents.
6. Appreciate the use of language to create beautiful expressions

Module- I (4hrs)

Techniques for Effective Speaking
Voice Modulation: Developing correct tone
Using correct stress patterns: word stress, primary stress, secondary stress
Rhythm in connected speech

Module- II (6hrs.)

Effective Speaking and Social awareness

The Art of Speaking

- Encoding Meaning Using Nonverbal Symbols
- How to Improve Body Language
- Eye Communication, Facial Expression, Dress and Appearance
- Posture and Movement, Gesture, Paralanguage
- Encoding meaning using Verbal symbols: How words work and how to use words
- Volume, Pace, Pitch and Pause
- Cross-Cultural Communication : Multiple aspects/dimensions of culture
- Challenges of cross-cultural communication
- Improving cross-cultural communication skills at workplace.

Module- III (6hrs)

- Group Discussion: Nature and purpose
- Characteristics of a successful Group Discussion
- Group discussion Strategies: Getting the GD started, contributing systematically, moving the discussion along, promoting optimal participation, Handling conflict, Effecting closure.

Module- IV (10hrs.)

Professional Presentation Skills

Nature and Importance of Presentation skills

Planning the Presentation: Define the purpose, analyze the Audience, Analyze the occasion and choose a suitable title.

Preparing the Presentation: The central idea, main ideas, collecting support material, plan visual aids, design the slides

Organizing the Presentation: Introduction-Getting audience attention, introduce the subject, establish credibility, preview the main ideas, Body-develop the main idea, present information sequentially and logically, Conclusion-summaries, re-emphasize, focus on the purpose, provide closure.

Improving Delivery: Choosing Delivery methods, handling stage fright

Post-Presentation discussion: Handling Questions-opportunities and challenges.

References:

1. Carter, R. And Nunan, D. (Eds), The Cambridge guide to Teaching English to Speakers of Other Languages, CUP, 2001
2. Edward P. Bailey, Writing and Speaking At Work: A Practical Guide for Business Communication, Prentice Hall, 3rd Ed., 2004
3. Munter, M., Guide to Managerial Communication: Effective Business Writing and Speaking, Prentice Hall, 5th Ed., 1999
4. R. Anand, Job Readiness For IT & ITES- A Placement and Career Companion, , McGraw Hill Education.2015
5. Malhotra, A., Campus Placements, McGraw Hill Education.2015

Course Name: FUNDAMENTALS OF STRENGTH OF MATERIALS					
Course Code: CIVL 2101					
Contact Hours per week	L	T	P	Total	Credit Points
	3	1	0	4	4

Course Objective:

The course will assist the students to:

1. Provide the basic concepts and principles of strength of materials.
2. Give an ability to calculate stresses and deformations of objects under external loadings.
3. Provide the guidelines to calculate the member forces in truss structures.
4. Give an ability to apply the knowledge of strength of materials on engineering applications and design problems.

Module I [8L]

i. Concept of different types of applied and reaction forces; Free body concept and diagram; Concept and equilibrium of forces in two dimensions; Equations of equilibrium; Equilibrium of three concurrent forces — Lami's theorem.
ii. Centre of gravity; Centre of mass & centroid; Centroid of various shapes.
iii. Area moment of inertia: Moment of inertia of a plane figure; Polar moment of inertia of a plane figure; Parallel axes theorem.
iv. Concept of simple stress and strain; concept of salient points in the stress- strain diagram of ductile and brittle material; Modulus of elasticity. Relation between different Elastic moduli, Composite section, thermal stress.

Module II [14L]

i. Principal stresses, principal plane, and Mohr’s circle.
ii. Hoop and meridonial stresses in thin cylindrical, conical and spherical shells.
iii. Shear force and bending moment diagrams for statically determinate beams subjected to concentrated, uniformly distributed, and linearly varying loads, relationship between loads, shear force and bending moment.

Module III [8L]

i. Bending of beams, elastic flexure formulae, Bending and shear stress, shear centre and shear flow.
ii. Analysis of determinate two dimensional trusses.
iii. Torsion in circular solid and hollow shafts.

Module IV [14L]

i. Slope and deflection analysis of determinate beams using Double integration method, Area-Moment theorem and Conjugate beam theory.
ii. Strain energy: Strain energy and complementary strain energy, Strain energy due to axial load, bending and shear.
iii. Columns: Fundamentals, criteria for stability in equilibrium, column buckling theory, Euler's load for columns with different end conditions – limitations and problems, eccentric load and secant formula.

Reference books

Sl. No.	Name of the book	Name of Author/Authors	Publisher
1	Elements of Strength of Material	S. P. Timoshenko and D. H. Young	EWP Pvt. Ltd
2	Engineering Mechanics of Solids	E. P. Popov	Pearson Education
3	Strength of Materials	R. Subramanian	OXFORD University Press
4	Strength of Materials	S S Bhavikatti	Vikas Publishing House Ltd
5	Strength of Material	A. Pytel & F. L. Singer	AWL Inc
6	Engineering Mechanics	J. L. Mariam	John Willey
7	Engineering Mechanics	I. H. Shames	PHI
8	Strength of Materials	S. S Rattan	McGraw Hill Education Pvt. Ltd.

Course Outcome:

After going through this course, the students will be able to:

1. Illustrate the equilibrium conditions and the concept of centre of gravity, moment of inertia of various sections.
2. Explain the elastic properties of ductile and brittle materials through stress-strain curves.
3. Determine various types of forces and stresses developed in structural elements.
4. Calculate the bending moment, shear force and deflection of beams along with developed strain energy under various loads and shear center and shear flow of prismatic sections.
5. Identify torsional moment and twist on a circular shaft.
6. Calculate the buckling load of columns using Euler's theory for different support conditions.

Course Name: SOIL MECHANICS - I					
Course Code: CIVL 2102					
Contact Hours per week	L	T	P	Total	Credit Points
	3	1	0	4	4

Course Objective:

The course will assist the students to:

[1] Indentify different types of rock and understand their properties.
[2] Classify soil as per grain size distribution curve and understand the index properties of soil.
[3] Apply the concept of total stress, effective stress and pore water pressure for solving geotechnical problems.
[4] Apply the knowledge of permeability and seepage in solving flow problems in soil mechanics.
[5] Calculate vertical stress within a soil mass subjected to different types of loading on the ground surface and draw pressure isobar.

Sl. No.	Module	Details of Course Contents	Hours	Total
1	I	**PROPERTIES AND CLASSIFICATION OF ROCKS** **Classification and physical properties of minerals**. **Classification of rocks**: Igneous Rocks: Origin, mode of occurrence, forms & texture, classification and engineering importance, Sedimentary Rocks: Process of sedimentation, classification and engineering importance, Metamorphic Rocks: Agents and types of metamorphism, classification and engineering importance. **Weathering and Erosion of rocks**: Agents and kinds of weathering, soil formation & classification based on origin. **Engineering properties of rocks**: Porosity, permeability, compressive strength, tensile strength and abrasive resistance. **Structural Geology**: Introduction to structural elements of rocks, dip & strike, definition, description, classification of folds, faults and joints.	10	40
2	II	**PROPERTIES AND CLASSIFICATION OF SOILS** **Soil Formation and Characterization**: Introduction, Origin of Soil, Formation and Types of soil, Formative classification, Typical Indian Soil, Some Special Types of Soils, Structure and Composition, Clay Mineralogy. **Soil Phase Relationships**: Weight - Volume Relationship, Density, Unit weight, Moisture Content,	10	

		Specific Gravity, Relative density, Functional Relationships. **Index Properties:** Introduction, Particle Size Distribution, Mechanical Analysis - Sieve Analysis, Sedimentation Analysis – Hydrometer and Pipette Methods. Consistency of Soil – Atterberg Limits, Different Indices, Discussion on Limits and Indices. **Classification**: Classification by Structure, Particle Size Classification, Textural System, PRA System (AASHTO Classification), Unified Classification System, As per IS Code Recommendation, Field Identification of Soils, Classification by Casagrande's Plasticity Chart.		
3	III	**SOIL WATER SYSTEM** **Effective Stress and Pore Water Pressure:** Modes of Occurrence of Water in Soil – Free Water, Held Water, Structural Water, Capillary Water, Gravitational Water, Adsorbed Water, Pore Water, Pore Water Pressure, Effective Pressure, Total Pressure, Effective Pressure under Different Conditions and in Different Cases of Flow through Soils, Critical Hydraulic Gradient, Quick Sand Condition. **Permeability**: Introduction, Darcy's Law, Coefficient of Permeability, Discharge Velocity, Seepage Velocity, Factors affecting Permeability, Determination of Coefficient of Permeability by Constant and Falling Head Methods, Permeability of Stratified Soil Deposits, Field Determination of Permeability for Unconfined and Confined Aquifers. **Seepage**: Introduction, Flow net, Properties and Use of Flow net, Estimation of Seepage loss, Seepage Pressure, Two Dimensional Flow, Laplace's Equations, Flow through Earthen Dam, Piping and Heaving, Uplift pressure, Design of Filters.	10	
4	IV	**STRESS DISTRIBUTION IN SOILS** Introduction, Geostatic Stress, Boussinesq's and Westergaard's Theories regarding Vertical Stress Distribution due to Point Load, Determination of Vertical Stress due to Line and Strip Loads, Vertical Stress under Uniformly Loaded Circular Area, Isobar and Pressure Bulb, Vertical Stress Beneath a Corner of a Rectangular Area, Point Load Method, 2:1 Method, Newmark's Influence Chart, Contact Pressure.	10	

RECOMMENDED BOOKS:

TEXT BOOKS	
Sl. No.	Name of the books
1.	Singh, P., *Engineering and General Geology*, Katson Publishing House Delhi.
2.	Reddy, D. V., *Engineering Geology for Civil Engineers*, Oxford, IBH.
3.	Billings, M. P., *Structural Geology*, Wiley Eastern Prentice-Hall, U.S.A.
4.	Murthy, V.N.S., *Textbook of Soil Mechanics and Foundation Engineering (Geotechnical Engineering Series)*, CBS Publishers and Distributors Pvt. Ltd.
5.	Punmia, B.C. and Jain, A. K., *Soil Mechanics and Foundations*, Laxmi Publications (P) Ltd.
6.	Das, B. M., *Principles of Geotechnical Engineering*, Thomson Brooks / Cole

REFERENCE BOOKS	
Sl. No.	**Name**
1.	Tyrell, G. W., *The Principles of Petrology*, Springer.
2.	Lambe T. W. and Whitman, R.V., *Soil Mechanics*, Wiley Eastern Ltd.
3.	Holtz, R. D., Kovacs, W. D. and Sheahan, T. D., *An Introduction to Geotechnical Engineering*, Pearson Publication.
4.	Terzaghi, K., Peck, R. B. and Mesri, G., *Soil Mechanics in Engineering Practice*, A Wiley Interscience Publication (John Wiley & Sons, Inc.).
5.	Singh, A., *Soil Engineering in Theory & Practice (Vol.1, 2 & 3)*, Jain Book Agency Publishers.

Course Outcome:

After going through this course, the students will be able to:

[1] Indentify the properties of rocks and which one is suitable for construction purpose.
[2] Classify soil as per grain size distribution curve and understand the index properties of soil.
[3] Apply the concept of total stress, effective stress and pore water pressure for solving geotechnical problems.
[4] Assess the permeability of different types of soil and solve flow problems.
[5] Estimate the seepage loss, factor of safety against piping failure using flow net related to any hydraulic structure.
[6] Determine vertical stress on a horizontal plane within a soil mass subjected to different types of loading on the ground surface and also the maximum stressed zone or isobar below a loaded area.

Course Name: CONSTRUCTION MATERIALS AND TECHNOLOGY					
Course Code: CIVL 2103					
Contact Hours per week	L	T	P	Total	Credit Points
	3	1	0	4	4

Course Objective:

The course will assist the students to:

1. To familiarize the students about the characteristics of construction materials used in civil engineering
2. To develop the skills for identification of suitable construction materials for civil engineering projects.
3. To develop the skills for identification of proper technology that deals with the construction.
4. To identify the factors to be considered in construction of buildings and develop the construction practices and techniques.

SL. No	Module	Details of Course Content	Hours	Total
1	I	**Construction Materials I** **Bricks** Introduction, Classification, Characteristics of good bricks, Ingredients of good brick earth, Harmful substance in brick earth, Testing of bricks, Fly ash brick. **Cement** Introduction, Chemical Composition of Cement, Hydration of Cement, Types of Portland Cement, Tests on Cement and Cement Paste **Aggregates** Introduction, Classification, Mechanical and Physical Properties, Deleterious Substances, Alkali-Aggregate Reaction. Testing of Aggregates **Lime** Introduction, Classification, Slaking and hydration **Steel** Composition, properties, manufacturing, uses. **Paints, Enamels and Varnishes** Composition of oil paint, characteristic of an ideal paint, enamels, distemper, water wash and colour wash, Varnish	**2** **4** **3** **1** **1** **1**	**42**

2	**II**	**Construction Materials II: Concrete** **PROPERTIES OF FRESH CONCRETE** Workability, Factors Affecting Workability, Tests on workability Segregation, Bleeding, Setting time, Mixing and Vibration of Concrete, Mixers and Vibrators, Curing Methods, Maturity. **STRENGTH OF CONCRETE** Water/Cement ratio, Gel/Space ratio, Compression Test on Cubes, Cylinders, Flexural strength of concrete **ADMIXTURES** Different types, Effects and uses. **MIX DESIGN by I.S. 10262(2009)**	**4** **4** **1** **3**	
3	**III**	**Construction Technology -I** **Foundations** Function of Foundations, Essential requirement of good foundation, Different types of shallow and deep Foundations. **Brick masonry** Definitions, Rules for bonding, Type of bonds, Comparison of English Bond and Flemish Bond **Walls, Doors and Windows** Load bearing wall, Partition wall, and Reinforced brick wall. Common types of doors and windows of timber and metal.	**4** **4** **2**	
4	**IV**	**Construction Technology -II** **Stairs** Technical Terms, Requirements of good stair, Dimension of steps, Classification, Geometric design of a dog legged stair case. **Flooring** Components of a floor, selection of flooring materials, Brick flooring, Cement concrete flooring, mosaic, marble, Terrazzo flooring, Tiled roofing. Centering and Shuttering, Plastering and Pointing: Plastering with cement mortar, Defects in plastering, pointing, White washing, colour washing, Distempering. **Roofs** Types, Pitched roofs and their sketches, **Truss**: Various types of trusses, Roof Covering materials: AC sheets GI sheet.	**2** **2** **2** **1** **1**	

RECOMMENDED BOOKS:

TEXT BOOKS	
Sl. No.	**Name of the books**
1.	Duggal S.K. *Building Materials* , New Age International
2.	Varghese P.C. *Building Materials*, PHI Learning Pvt. Ltd-New Delhi.
3.	Punmia B.C. *Building Construction*, Laxmi Publications.

REFERENCE BOOKS

Sl. No.	**Name of the books**
1.	M. S. Shetty R. *Concrete Technology*, S. Chand.
2.	Nevile A.M. & Brooks J.J. *Concrete Technology*, Pearson Education.
3.	S.C. Rangwala *Engineering Materials*, Charotar Publishing

Course Outcome:

After going through this course, the students will be able to:

1. Impart knowledge regarding the various building and general construction products and their quality, durability and availability.
2. Impart knowledge regarding the various types of properties, uses and variety of materials used in the construction industry.
3. Study the behavior of concrete at its fresh and hardened state
4. Study about the concrete design mix.
5. Expose themselves to various quality control aspects of the civil engineering materials.
6. Learn and use the terms common in the building industry.

Course Name: BIOLOGY					
Course Code: BIOT 2105					
Contact Hours per week	L	T	P	Total	Credit Points
	2	0	0	2	2

MODULE-I: BASIC CELL BIOLOGY

Prokaryotic and Eukaryotic cells, Cell theory; Cell structure and function, Cell organelles, Structure and function of DNA and RNA, Central Dogma; Genetic code and protein synthesis.

MODULE-II: BIOCHEMISTRY AND CELLULAR ASPECTS OF LIFE

Biochemistry of carbohydrates, proteins and lipids; Fermentation; Cell cycle; Basics of Mendelian Genetics.

MODULE-III: ENZYMES AND INDUSTRIAL APPLICATIONS

Enzymes – significance, co-factors and co-enzymes, classification of enzymes; models for enzyme action; Restriction enzymes; industrial applications of enzymes.

MODULE-IV: BIODIVERSITY AND BIOENGINEERING INNOVATIONS

Basic concepts of environmental biosafety, bioresources, biodiversity, bioprospecting, bioremediation, biosensors; recent advances in engineering designs inspired by examples in biology.

TEXT BOOKS:

1. Wiley Editorial, "*Biology for Engineers: As per Latest AICTE Curriculum*," Wiley-India, 2018.
2. S. ThyagaRajan, N. Selvamurugan, M. P. Rajesh, R. A. Nazeer, Richard W. Thilagaraj, S. Barathi, and M. K. Jaganathan, "*Biology for Engineers*," Tata McGraw-Hill, New Delhi, 2012.

REFERENCE BOOKS:

1. Jeremy M. Berg, John L. Tymoczko and Lubert Stryer, "*Biochemistry*," W.H. Freeman and Co. Ltd., 6th Ed., 2006.
2. Robert Weaver, "*Molecular Biology*," MCGraw-Hill, 5th Edition, 2012.
3. Jon Cooper, "*Biosensors A Practical Approach*" Bellwether Books**,** 2004.
4. Martin Alexander, "*Biodegradation and Bioremediation,*" Academic Press, 1994.
5. Kenneth Murphy, "*Janeway's Immunobiology*," Garland Science; 8th edition, 2011.

Course Outcomes:

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

1. Understand the basic structure and function of cells and cellular organelles.
2. Understand the fundamental concepts of DNA, RNA and central dogma of cells.
3. Characterize the different types of proteins, lipids and carbohydrates.
4. Analyze the mechanism of inheritance of characters through generations.
5. Understand and implement the working principles of enzymes and their applications in biological systems and industry.
6. Design and evaluate different environmental engineering projects with respect to background knowledge about bioresources, biosafety and bioremediation.

Course Name: ENVIRONMENTAL SCIENCES					
Course Code: EVSC 2016					
Contact Hours per week	L	T	P	Total	Credit Points
	2	0	0	2	0

Module 1

Socio Environmental Impact **6L**

Basic ideas of environment and its component
Population growth: exponential and logistic; resources; sustainable development. 3L
Concept of green chemistry, green catalyst, green solvents
Environmental disaster and social issue, environmental impact assessment, environmental audit, environmental laws and protection act of India. 3L

Module 2 **6L**
Air Pollution
Structures of the atmosphere, global temperature models
Green house effect, global warming; acid rain: causes, effects and control. 3L
Lapse rate and atmospheric stability; pollutants and contaminants; smog; depletion of ozone layer; standards and control measures of air pollution. 3L

Module 3 **6L**
Water Pollution
Hydrosphere; pollutants of water: origin and effects; oxygen demanding waste; thermal pollution; pesticides; salts.
Biochemical effects of heavy metals; eutrophication: source, effect and control. 2L
Water quality parameters: DO, BOD, COD.
Water treatment: surface water and waste water. 4L

Module 4 **6L**
Land Pollution
Land pollution: sources and control; solid waste: classification, recovery, recycling, treatment and disposal. 3L
Noise Pollution
Noise: definition and classification; noise frequency, noise pressure, noise intensity, loudness of noise, noise threshold limit value; noise pollution effects and control. 3L

Text/Books
1. GourKrishna Das Mahapatra, Basic Environmental Engineering and Elementary Biology, Vikas Publishing House P. Ltd.
2. A. K. De, “Environmental Chemistry”, New Age International.
3. A. K. Das, Environmental Chemistry with Green Chemistry, Books and Allied P. Ltd

References/Books

1. S. C. Santra, Environmental Science, New Central Book Agency P. Ltd
2. D. De, D. De, Fundamentals of Environment & Ecology, S. Chand & Company Ltd.

Course Outcome:

The course outcomes of the subject are

1. Understand the natural environment and its relationships with human activities.
2. Characterize and analyze human impacts on the environment.
3. Integrate facts, concepts, and methods from multiple disciplines and apply to environmental problems.
4. Educate engineers who can work in a multi-disciplinary environment to anticipate and address evolving challenges of the 21st century.
5. Understand and implement scientific research strategies, including collection, management, evaluation, and interpretation of environmental data.
6. Design and evaluate strategies, technologies, and methods for sustainable management of environmental systems and for the remediation or restoration of degraded environments.

Course Name: STRENGTH OF MATERIALS LAB					
Course Code: CIVL 2151					
Contact Hours per week	L	T	P	Total	Credit Points
	0	0	2	2	1

Course objective:

The course will assist the students to:

1. Provide the idea about the method of finding out the tensile, compressive and bending strengths of materials.
2. Construct the ability among students about the concepts of torsion test.
3. Explain the procedure of test requirement of hardness and impact tests.
4. Give an ability to have a concept of stiffness of spring and the procedure to find experimentally its value.

List of Experiments:

1. Tension test on structural materials: Mild steel and TMT bar.
2. Compression test on structural materials: Timber, bricks and concrete cubes.
3. Bending test on mild steel beam and concrete beam.
4. Torsion test on mild steel circular bar.
5. Hardness tests on ferrous and non-ferrous metals: Brinnel and Rockwell tests.
6. Test on closely coiled helical spring / leaf spring.
7. Impact tests: Izod and Charpy.
8. Demonstration of Fatigue test.

Course Outcome:

After going through this course, the students will be able to:

1. Demonstrate the method and findings of tension and compression tests on ductile and brittle materials.
2. Explain the method of bending tests on mild steel beam and concrete beam.
3. Demonstrate the method and findings of Torsion test on mild steel circular bar and concrete beam.
4. Illustrate the concept of hardness and explain the procedure and findings of Brinnel and Rockwell tests.
5. Demonstrate the concept and procedure of calculation of spring constant and elaborate its use in Civil Engineering.
6. Demonstrate the method and findings of Izod and Charpy impact tests.
7. Understand the concepts of fatigue test.

Course Name: SOIL MECHANICS LAB - I					
Course Code: CIVL 2152					
Contact Hours per week	L	T	P	Total	Credit Points
	0	0	2	2	1

Course Objective:

The course will assist the students to:

1. Distinguish different types of soils and rock samples by visual inspection.
2. Identify microscopic structure of rocks and minerals.
3. Determine index properties of different types of soils.
4. Interpret the grain size distribution curve for different types of soils.
5. Identify co-efficient of permeability and compaction characteristics of different types of soils.

List of Experiments:

1. Field identification of different types of soils as per Indian Standards [collection of field samples and identifications without laboratory testing].
2. Identification of rocks and minerals [Hand Specimens].
3. Microscopic study of rocks and minerals.
4. Determination of natural moisture content.
5. Determination of specific gravity of cohesionless and cohesive soils.
6. Determination of grain size distribution by sieve and hydrometer analyses.
7. Determination of Atterberg limits (liquid limit, plastic limit and shrinkage limit).
8. Determination of co-efficient of permeability by constant and variable head permeability tests.
9. Determination of in-situ density by core cutter method and sand replacement method.
10. Determination of compaction characteristics of soil by standard Proctor compaction test.

REFERENCE BOOKS & CODES:	
Sl. No.	**Name**
1.	Das, B.M. *Soil Mechanics Laboratory Manual*, Oxford university press.
2.	SP 36 (Part I & II): *Compendium of Indian Standards on Soil Engineering*.

Course Outcome:

After going through this course, the students will be able to:

1. Classify visually different types of soils and rock samples as obtained in the field.
2. Interpret the microscopic nature of rocks involved in the analysis and design of foundations embedded in it.
3. Determine the index properties of soil to understand different types of soils as obtained from field investigation.
4. Identify different types of soils from the nature of grain size distribution.
5. Assess the co-efficient of permeability of different types of soils for analysis of flow problems in soil mechanics.
6. Determine the compaction characteristics of soil to identify whether it is suitable for use in embankment construction.

Course Name: CONSTRUCTION MATERIALS LAB					
Course Code: CIVL 2153					
Contact hours per week	L	T	P	Total	Credit Points
	0	0	2	2	1

Course Objective:

The course will assist the students to develop:

1. the skills on the test of cement
2. the skills on test of aggregates.
3. an ability to perform the test of fresh and hardened concrete.
4. an ability to perform the concrete mix design.

List of Experiments:

1. **Tests on cement** – specific gravity, fineness, soundness, normal consistency, setting time, compressive strength on cement mortar cubes
2. **Tests on fine aggregate** – specific gravity, bulking, sieve analysis, fineness modulus, moisture content, bulk density and deleterious materials.
3. **Tests on coarse aggregate** - specific gravity, sieve analysis, fineness modulus and bulk density.
4. **Tests on Fresh Concrete**: Workability: Slump, Vee-Bee, Compaction factor tests
5. **Hardened Concrete**: Compressive strength on Cubes, Split tensile strength, Static modulus of elasticity, Flexure tests, Non destructive testing (Rebound hammer & Ultrasonic pulse velocity)
6. **Mix Design of Concrete**.

References:

1. Relevant latest IS codes on Aggregates, Cement & Concrete [269, 383, 2386, 10262(2009), SP23]
2. Laboratory manual of concrete testing by V.V. Sastry and M. L. Gambhir

Course Outcome:

After going through this course, the students will be able to:

1. Outline the importance of testing of cement and its properties
2. Assess the different properties of aggregate
3. Summarize the concept of workability and testing of concrete
4. Describe the preparation of fresh concrete
5. Describe the properties of hardened concrete.
6. Develop mix design of concrete as per provision of the IS Codes.

Course Name: BUILDING PLANNING & DRAWING					
Course Code: CIVL 2154					
Contact Hours per week	L	T	P	Total	Credit Points
	0	0	4	4	2

Course Objectives:

The course will assist the students to:

1. Increase ability to communicate with people
2. Learn to sketch and take field dimensions.
3. Learn to take data and transform it into graphic drawings.
4. Learn basic Auto Cad skills.
5. Learn basic engineering drawing formats.
6. Prepare themselves for future Engineering positions

FOUNDATIONS

- Footing for a RCC column and Brick wall.
- Combined footing.
- Strip footing.
- Raft foundation.
- RCC Pile Foundation.

DOORS, WINDOWS AND STAIRS

- Glazed and paneled doors of standard sizes.
- Glazed and paneled windows of standard sizes.
- Special windows and ventilators.
- Proportioning and planning of dog-legged and open well staircase.

ROOFS AND TRUSSES

- Types of sloping roofs, lean-to-roofs, RCC roof.
- King post and Queen post trusses.

FUNCTIONAL DRAWING OF BUILDINGS

- To draw the line diagram, plan, elevation and section of Residential Buildings (flat, pitched and combined roofs), Office Buildings (flat roof) showing positions of various components including lift well and their sizes, load bearing wall and column.
- Details of plumbing and sanitary lines, septic tank.

Reference Books:

Sl No.	Title	Author
1	Principles of Building Drawing	Shah & Kale
2	Text Book of Building Construction	Sharma & Kaul
3	Building Construction	BC Punmia
4	Civil Engineering Drawing	M. Chakraborti

Course Outcomes:

After going through this course, the students will be able to:

1. Draw the plan, section and elevation of a building
2. Select, construct and interpret appropriate drawing scale as per the situation.
3. Layout development of solids for practical situations, architectural and engineering scales will increase.
4. Have knowledge in details about every individual section of a building, truss, doors and windows and detailed information about the different types of foundation.
5. Have the ability to perform basic sketching techniques.
6. Convert sketches to engineering drawings and become familiar with office practice and standards.

Course Name: FLUID MECHANICS					
Course Code: CIVL 2113					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Objective:

The course will assist the students to:

1. Introduce themselves to the fundamental aspects of fundamental knowledge of fluid, its properties and behavior under various conditions of internal and external flows.
2. Learn to develop steady state mechanical energy balance equation for fluid flow systems, estimate pressure drop in fluid flow systems and determine performance characteristics of fluid machinery.
3. Develop understanding about hydrostatic law, principle of buoyancy and stability of a floating body and application of mass, momentum and energy equation in fluid flow.
4. Imbibe basic laws and equations used for analysis of static and dynamic fluids.
5. Inculcate the importance of fluid flow measurement and its applications in Industries.
6. Determine the losses in a flow system, flow through pipes, boundary layer flow and flow past immersed bodies.

Sl. No.	Module	Details of course contents	Hours	Total
1.	**I**	**FLUID STATICS** Fluid pressure at a point, Variation of pressure within a static fluid, measurement of pressure, total fluid pressure on plane and curved areas, Center of pressure, buoyancy, stability of submerged and floating bodies, meta-centre. **FUNDAMENTALS OF OPEN CHANNEL FLOW** Scope and importance, characteristics of open channel flow, distinction between pipe flow and open channel flow, types of flow: Steady, Unsteady; Uniform, Non uniform, Gradually varied flow, Rapidly varied flow (definition only). **STEADY UNIFORM FLOW IN OPEN CHANNEL** Characteristics, Chezy's, Manning's formulae, Hydraulically efficient Rectangular and trapezoidal sections. Design features of rigid boundary channels.	4 4 4	44
2.	**II**	**WEIRS AND NOTCHES** Rectangular, triangular, trapezoidal and cippoletti notch, sharp crested and broad crested weirs, submerged weirs. **FLOW THROUGH PIPES** Laminar and turbulent flow through pipes, Reynold's number, fluid friction in pipes, head loss due to friction. Darcy- Weisbach equation, Friction factors for commercial pipes, use of Mody's diagram, minor losses in pipes, basic concept of boundary layer, drag, lift, concept of water hammer and surge tank.	4 6	

3.	**III**	**SPECIFIC ENERGY / NON-UNIFORM FLOW IN OPEN CHANNEL** Definition, Diagram. Critical, Sub-critical and Supercritical flows. Establishment of critical flow, Specific force: Definition and diagram, Hydraulic Jump. **DIMENSIONAL ANALYSIS AND MODEL STUDIES** Dimensions and dimensional homogeneity, Importance and use of dimensional analysis. Buckingham Pi Theorem**:** Statement and application, Geometric, Kinematic and Dynamic similarity. Non Dimensional Numbers, Froude and Reynold model laws and applications.	4 2 4	
4.	**IV**	**MACHINERIES IN FLUID MECHANICS** Turbines, Classification and types, power and efficiency, Working Principles of Pelton, Francis and Kaplan turbines, draft tube, Cavitations in pumps and turbines. Application of principles of similarity of hydraulic machines, specific speed of pumps and turbines, centrifugal and reciprocating pumps, performance characteristics graph for head, discharge and efficiency, hydraulic machines in parallel and series, hydraulic Ram.	6 6	

RECOMMENDED BOOKS:

TEXT BOOKS	
Sl. No.	Name of the book
1	Modi P.N. and Seth S.M., *Hydraulics and Fluid Mechanics including hydraulics machines,* 19th edition, Standard Book House
2	Pati S., *A textbook of Fluid mechanics and Hydraulic machines,* 1st edition, McGraw Hill Education (India) Pvt Ltd
3	Som S.K., Biswas G. and Chakraborty S., *Introduction to fluid mechanics and fluid machines,* 3rd edition, McGraw Hill Education (India) Pvt Ltd
4	Ojha C.S.P., Berndtsson R. and Chandramouli P.N., *Fluid Machines and Machinery*, 1st edition, Oxford University Press

REFERENCE BOOKS	
Sl. No.	Name of the book
1	Cengel Y. A. and Cimbala J. M., *Fluid Mechanics: Fundamentals and Applications*, 2nd edition, Tata McGraw Hill Education Private Limited
2	Pritchard P.J. and Leylegian J.C., *Fox and McDonald's Introduction to Fluid Mechanics*, 8th edition, John Wiley & Sons
3	Massey B.S. and Ward-Smith John., *Mechanics of Fluids*, 9th edition, Taylor & Francis.
4	Bansal R.K., *A textbook of Fluid Mechanics and Hydraulic Machines*, 9th edition, Laxmi Publications (P) Ltd

Course Outcome:

After going through this course, the students will be able to:

1. Understand basic fluid properties (density, viscosity, bulk modulus), flow forces (pressure, shear stress, surface tension) and flow regimes (laminar/turbulent, compressible/ incompressible, steady/unsteady).
2. Use and know limitations of steady and unsteady Bernoulli equation along and normal to a streamline.
3. Explain the conservation of mass and momentum through differential analysis in simple geometries.
4. Study scope, importance, characteristics and various types of flows in an open channel.
5. Understand the techniques of dimensional analysis, similitude and modeling and introduce the important non-dimensional groups in fluid mechanics.
6. Know the concepts to internal and external flows and introduce the boundary layer concept, lift and drag, flow separation, and drag reduction fundamentals.

Course Name: FLUID MECHANICS LAB					
Course Code: CIVL 2163					
Contact Hours per week	L	T	P	Total	Credit Points
	0	0	2	2	1

Course Objective:

The course will assist the students to:

1. Be acquainted with the fundamentals of fluid mechanics.
2. Practice in the analytical formulation of fluid mechanics problems using Newton's Laws of motion and thermodynamics.
3. Be acquainted with the introduction to experimental method.
4. Get exposure to practical applications, work on a small design project, and the writing of a technical report related to the design project.
5. Discuss and practice standard measurement techniques of fluid mechanics and their applications.
6. Impart knowledge in measuring pressure, discharge and velocity of fluid flow.

List of Experiments:

1. To determine the coefficient of discharge for an Orifice meter
2. Calibration of V- Notch
3. Determination of Co-efficient of Discharge for Venturimeter
4. Measurement of velocity of fluid in pipe using a pitot tube
5. Measurement of water surface profile for flow over Broad crested weir
6. To verify Bernoulli's equation experimentally
7. Measurement of water surface profile for a hydraulic jump
8. Determination of efficiency of a Centrifugal pump
9. Determination of efficiency of a Pelton wheel Turbine
10. Determination of efficiency of a Francis Turbine

REFERENCE BOOKS:

Sl. No.	Name of the book
1	Laboratory Manual: Hydraulics and Hydraulic Machines by R. V. Raikar, PHI Learning.
2	Laboratory manual for Civil Engineering second edition by H S Moondra and R Gupta, CBS Publishers, New Delhi.
3	Fluid Mechanics by Modi & Seth Standard Book House, New Delhi.
4	Fluid Mechanics by A.K.Jain, Khanna Publishers, Nath Market, Nai Sarak, New Delhi.
5	Fluid Mechanics & Machinery by H. M. Raghunath – CBS Publishers, New Delhi.

Course Outcome:

After going through this course, the students will be able to:

1. Apply the basic equation of fluid statics to determine forces on planar and curved surfaces that are submerged in a static fluid; to manometers; to the determination of buoyancy and stability; and to fluids in rigid-body motion.
2. Use the conservation laws in integral form and apply them to determine forces and moments on surfaces of various shapes and simple machines.
3. Use the conservation laws in differential forms and apply them to determine velocities, pressures and acceleration in a moving fluid.
4. Determine flow rates, pressure changes, minor and major head losses for viscous flows through pipes, ducts, simple networks and the effects of pumps, fans, and blowers in such systems.
5. Apply principles of fluid mechanics to the operation, design, and selection of fluid machinery such as pumps and turbines.
6. Use Euler's and Bernoulli's equations and the conservation of mass to determine velocities, pressures, and accelerations for incompressible and inviscid fluids.

Course Name: MATHEMATICAL METHODS					
Course Code: MATH 2001					
Contact Hours per week	L	T	P	Total	Credit Points
	3	1	0	4	4

MODULE I : [12L]

Functions of Complex Variables:

Complex numbers and its geometrical representation.

Functions of a complex variable – Limits, Continuity, and Differentiability.

Analytic Functions, Cauchy- Riemann equations, Necessary and sufficient conditions for analyticity of complex functions (Statement only), Harmonic functions.

Line Integral on complex plane, Cauchy-Goursat theorem, Cauchy's Integral Formula. Taylor's and Laurent's series expansion.

Zeros, Different types of Singularities. Definitions of poles and residues, Residue Theorem, Evaluation of real integrals using residue theorem.

MODULE II : [12L]

Fourier Series , Integrals and Transforms:

Definite Integral , Orthogonality of Trigonometric Functions , Power Series and its convergence . Periodic Functions, Even and Odd Functions, Dirichlet's Conditions, Euler Formulas for Fourier coefficients , Fourier series representation of a function, e.g. Periodic square wave, Half wave rectifier, Unit step function.

Half Range series, Parseval's Identity.

Fourier Integral theorem, Fourier transform, Fourier sine and cosine transform, Linearity, Scaling , Frequency Shifting and Time shifting properties, Convolution Theorem.

Discussion of some physical problems : e.g Forced oscillations.

MODULE III : [12L]

Series Solutions to Ordinary Differential Equations and Special Functions:

Series solution of ODE: Ordinary point , Singular point and Regular Singular point, series solution when $x = a$ is an ordinary point, Frobenius method.

Legendre's Equation , Legendre's polynomials and its graphical representation.

Bessel's equation , Bessel's function of first kind and its graphical representation.

Finite Difference Method and its application to Boundary Value Problem.

MODULE IV : [12L]

Partial Differential Equations:

Introduction to partial differential equations, Formation of partial differential equations,

Linear and Nonlinear pde of first order, Lagrange's and Charpit's method of solution.

Second order partial differential equations with constant coefficients , Illustration of wave equation, one dimensional heat equation, Laplace's equation, Boundary value problems and their solution by the method of separation of variables.

Solution of Boundary value problems by Laplace and Fourier transforms.

Suggested Books:

1. Complex Variables and Applications
   Brown Churchill
   MC Graw Hill
2. Complex Variable
   Murrey R. Spiegel
   Schaum's Outline Series
3. Theory of Functions of a Complex Variable
   Shanti Narayan, P. K. Mittal
   S. Chand
4. Larry C. Andrew, B. K. Shivamoggi
   Integral Transforms for Engineers and Applied Mathematicians
   Macmillan
5. Fourier Analysis with Boundary Value Problem
   Murrey R. Spiegel
   Schaum's Outline Series
6. Mathematical Methods
   Potter, Merle C., Goldberg, Jack.
   PHI Learning
7. Ordinary and Partial Differential Equations
   M. D. Raisinghania,
   S. Chand
8. Elements of Partial Differential Equation
   Ian Naismith Sneddon
   Dover Publications
9. Advanced Engineering Mathematics
   Kreyszig
   Willey
10. Higher Engineering Mathematics
    B. V. Ramana
    Tata McGraw-Hill

Course Outcome:-

After completing the course the student will be able to:

1. Construct appropriate mathematical models of physical systems.
2. Recognize the concepts of complex integration, Poles and Residuals in the stability analysis of engineering problems.
3. Generate the complex exponential Fourier series of a function and make out how the complex Fourier coefficients are related to the Fourier cosine and sine coefficients.
4. Interpret the nature of physical phenomena when the domain is shifted by Fourier Transform e.g. continuous time signals and systems.
5. Develop computational understanding of second order differential equations with analytic coefficients along with Bessel and Legendre differential equations with their corresponding recurrence relations.
6. Master how partial differentials equations can serve as models for physical processes such as vibrations, heat transfer etc.

Course Name: STRUCTURAL ANALYSIS -I					
Course Code: CIVL 2201					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Objective:

The course will assist the students to:

1. Introduce themselves to concept of global structural stability, theory of structural analysis, and methods in structural analysis.
2. Develop an idea to model a structure with proper loads and support conditions.
3. Build an ability to idealize and analyze statically determinate and indeterminate structures.
4. Provide knowledge among on moving loads and procedure to calculate the influence line diagram of several functions for beams and truss.

Module I [16L]

BASICS OF STRUCTURAL ANALYSIS

(i) Concept of static and kinematic indeterminacy, Determination of degree of indeterminacy for different types of structures.

(ii) Theorem of minimum potential energy, law of conservation of energy, principle of virtual work, the first theorem of Castigilano, Betti's law, Clark Maxwell's theorem of reciprocal deflection.

ANALYSIS OF DETERMINATE STRUCTURES

Portal Frames, Three hinged arches, Cables.

DEFLECTION OF DETERMINATE STRUCTURES

Energy methods. Unit Load method for beams, Deflection of trusses and Simple Portal Frames.

Module II [6L]

INFLUENCE LINE DIAGRAM

Statically determinate beams and trusses under series of concentrated and uniformly distributed rolling loads, criteria for maximum and absolute maximum moments and shear.

Module III [16 L]

THEOREM OF THREE MOMENTS

Introduction to statically indeterminate structures, advantages of indeterminate structures over determinate structures, solved simple numerical problems on computation of static indeterminacy, Clapeyron's theorem of three moments, derivation of three moment equation, solved numerical problems of continuous beams based on different support conditions and support settlement.

STRAIN ENERGY

Castigliano's 2nd Theorem; solved numerical problems.

ANALYSIS OF STATICALLY INDETERMINATE BEAMS BY FORCE METHOD

Basic introduction to force method of analysis, analysis of statically indeterminate beams by force method, Solved examples, Theorem of Least work, numerical problems on theorem of least work.

TWO HINGED ARCHES

Analysis of two hinged arch, solved problems on two hinged arch.

Module IV [4L]

INFLUENCE LINE DIAGRAM OF INDETERMINATE STRUCTURES

Influence lines for statically indeterminate beams, Muller- Breslau Principle, ILD for continuous beams, Problems on ILD for continuous beam, trusses etc.

Text & References:

Sl. No.	Name	Author	Publishers
1.	Basic Structural Analysis	C.S.Reddy	Tata Mc Graw Hill
2.	Statically Indeterminate Structures	C.K.Wang	Mc Graw Hill
3.	Structural Analysis-A unified Classical and Matrix Approach.	A. Ghali and A.M.Neville	E & FN SPON
4.	Theory of Structures	Timoshenko and Wang	Tata Mc Graw Hill
5.	Engineering Mechanics of Solids	E.P.Popov	Pearson Education

Course Outcomes

After going through this course, the students will be able to:

1. Distinguish between stable and unstable and statically determinate and indeterminate structures.
2. Apply equations of equilibrium to structures and compute the reactions.
3. Calculate the internal forces in cable and arch type structures
4. Evaluate and draw the influence lines for reactions, shears and bending moments in beams due to moving loads.
5. Use approximate methods for analysis of statically indeterminate structures.
6. Calculate the deflections of truss structures and beams.

Course Name: SOIL MECHANICS - II					
Course Code: CIVL 2202					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Objective:

The course will assist the students to:

1. Gain an in-depth knowledge of the shear strength characteristics of soils.
2. Assess the consolidation and compaction properties of soils.
3. Determine the lateral earth pressure on rigid retaining wall and design it accordingly.
4. Investigate the stability of soil slopes under different conditions.

Sl. No.	Module	Details of Course Content	Hours	Total
1.	I	**SHEAR STRENGTH** Introduction, Basic Concept of Shear Resistance and Shear Strength of Soil, Mohr Circle of Stress, Sign Conventions, Mohr - Coulomb Theory, Relationship between Principal Stresses for both Cohesive and Cohesionless Soils, Stress Controlled and Strain Controlled Tests, Laboratory Determination of Soil Shear Parameters - Direct Shear Test, Unconfined Compression Test, Vane Shear Test, Triaxial Test as per Relevant IS Codes, Classification of Shear Tests Based on Drainage Conditions, Stress - Strain Relationship of Clays and Sands, Concept of Critical Void Ratio. Skempton's Pore Pressure Parameters, Introduction to Stress path.	10	40
2.	II	**CONSOLIDATION & COMPACTION** **Consolidation**: Introduction, Terzaghi's theory of one dimensional consolidation, Compressibility characteristics of soils, Compression index, Coefficients of Compressibility and Volume Change, Coefficient of consolidation, Degree and Rate of Consolidation, Time factor, Settlement computation, Laboratory One Dimensional Consolidation Test as per IS Code, Determination of Consolidation Parameters. **Compaction:** Introduction, Standard and Modified Proctor Compaction tests, Field Compaction methods, Factors affecting compaction, Factors affecting Compaction Characteristics of Soil.	10	
3.	III	**EARTH PRESSURE & STABILITY OF**	10	

		CONCRETE RETAINING WALLS **Lateral Earth Pressure**: Introduction, Plastic equilibrium of soil, Earth Pressure at Rest, Active and Passive Earth Pressures, Rankine's and Coulomb's Earth Pressure Theories, Determination of Active and Passive Earth Pressures under different conditions, Analytical and Graphical methods for Determination of Earth pressure against various Earth Retaining Structures. **Stability of Concrete Retaining Walls:** Stability checks for Cantilever retaining wall against Overturning, Sliding and Bearing Capacity.		
4.	IV	**STABILITY OF SLOPES** Introduction, Types of failure, Different types of Factor of safety, Analysis of infinite and finite slopes, Stability of Clay Slopes under Undrained Condition, Friction circle method, Taylor's stability number, Ordinary or Swedish or Fellenius method of slices, Bishop's simplified method of stability analysis.	10	

RECOMMENDED BOOKS:-

TEXT BOOKS	
Sl. No.	**Name**
1.	Murthy, V.N.S., *Textbook of Soil Mechanics and Foundation Engineering* (Geotechnical Engineering Series), CBS Publishers and Distributors Pvt. Ltd.
2.	Punmia, B.C. and Jain, A.K., *Soil Mechanics and Foundations*. Laxmi Publications (P) Ltd.
3.	Das, B.M., *Principles of Geotechnical Engineering*, Thomson Brooks / Cole.
4.	Ranjan, G. and Rao, A.S.R., *Basic and Applied Soil Mechanics*, New Age International Pvt. Ltd, Publishers.

REFERENCE BOOKS	
Sl. No.	**Name**
1.	Lambe, T. W. and Whitman, R.V., *Soil Mechanics*, Wiley Eastern Ltd.
2.	Holtz, R. D., Kovacs, W. D. and Sheahan, T. D., *An Introduction to Geotechnical Engineering*, Pearson Publication.
3.	Terzaghi, K., Peck, R. B. and Mesri, G., *Soil Mechanics in Engineering Practice*, A Wiley Interscience Publication (John Wiley & Sons, Inc.).
4.	Craig, R. F., *Craig's Soil Mechanics*, Spon Press (Taylor and Francis Group)

Course Outcome:

After going through this course, the students will be able to:

1. Apply the concept of shear strength to analyze different geotechnical problems and determine the shear strength parameters from lab and field tests.
2. Assess the compaction characteristics of soil for solving geotechnical problems.
3. Estimate the consolidation settlement using relevant parameters for a soil.
4. Calculate earth pressure on rigid retaining walls on the basis of classical earth pressure theories.
5. Analyze and design rigid retaining walls (cantilever types) from geotechnical engineering consideration.
6. Compute safety of dams and embankments on the basis of various methods of slope stability analysis.

Course Name: SURVEYING					
Course Code: CIVL 2203					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Objective:

The course will assist the students to:

1. Provide the knowledge of the importance of surveying in the field of civil engineering
2. Study the basics of linear/angular measurement methods like chain surveying, compass surveying, etc.
3. Develop the basic knowledge levelling and theodolite survey in elevation and angular measurements
4. Build an idea about the advanced surveying instruments used in present days.

Module I [8L]

BASICS OF SURVEYING

Introduction to Surveying

Definition, principles of surveying, types of scales (numerical problems), basic concepts of plans and maps.

Chain and compass Surveying

Basic introduction to different types of chains and accessories, errors in chain surveying, Basic concept and terminologies related to compass survey, local attraction and its elimination, open and closed traverse.

Plane Table Surveying

Principle, equipment and methods, two and three point problems.

Module II [12L]

METHODS OF MEASUREMENT

Levelling and Contouring

Definitions and terminology, types and methods of levelling, use of Dumpy level, Auto level and supporting accessories, different terms used in contouring, characteristics of contour and contour interval.

Theodolite Surveying and Tacheometry

Components of Theodolite, adjustments, measurement of vertical and horizontal angels, concepts of trigonometric levelling, definitions and principles of tacheometry and stadia system, fixed hair stadia method, calculation of horizontal and vertical distance using tacheometer.

Module III [12L]

COMPUTATION PROCEDURE AND SETTING OUT WORKS

Computation of Area and Volume

Computation of area using trapezoidal rule and Simpson's 1/3rd rule. Computation of volume of different cross sections.

Setting out of Horizontal Curves

Elements of simple circular curves and methods of setting out simple circular curve by linear and angular methods. Requirements, types and elements of transition curve.

Setting Out Of Vertical Curves

Introduction to vertical curves and its types.

Module IV [8L]

INTRODUCTION TO HIGHER SURVEYING

Measurement Procedure Using Advanced Instruments

Total Station and its different parts, practical application of Total Station.

Triangulation

Concepts of triangulation and triangulation systems in brief.

Hydrographic Survey

Shoreline survey, soundings, locating soundings and reduction of soundings, basic concept of Mean sea level, bathymetry.

Aerial Photogrammetry

Terminology, equipments and photo-theodolite

Reference books

Sl. No.	Name of the Books
1.	Duggal S. K. *Surveying (Vol-1 and 2)*. 4th edition, McGraw Hill Education (India) Pvt Ltd.
2.	Roy S.K. *Fundamentals of Surveying*. 2nd edition, PHI Learning Pvt. Ltd-New Delhi.
3.	Punmia B.C., Jain A.K. and Jain A.K. *Surveying (Vol-1 and 2)*. 15th edition, Laxmi Publications (P) Ltd.
4.	Bannister A., Raymond S. and Baker R. *Surveying*. 1st edition, Pearson India.
5.	Subramanian R. *Surveying and Levelling*. 2nd editon, Oxford university Press.

Course Outcome:

After going through this course, the students will be able to:

1. Study the basics of linear/angular measurement methods like chain surveying, compass surveying.
2. Understand the concepts of leveling and contouring.
3. Demonstrate the method of theodolite survey in terms of elevation and angular measurements, along with tacheometry.
4. Calculate the area and volume of any given land using different methods and rules.
5. Understand the method of setting out procedure of horizontal and vertical curves.
6. Explain various methods of higher surveying, such as triangulation, hydrographic survey, areal photogramatry and demonstrate the basic functions of advanced instrument like Total station.

Course Name: HIGHWAY AND TRAFFIC ENGINEERING					
Course Code: CIVL 2204					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Objectives:

The course will assist the students to:

1. Provide the knowledge of Highway Network Planning, Highway alignment and Highway Geometric Design.
2. Study different pavement materials and design different types of pavements.
3. Building and idea about Highway Construction including the drainage and its maintenance and safety.
4. Develop and idea of Traffic engineering, Traffic Signal Design and Design of at grade Intersections:
5. Analyse Parking and Accident in Transport System.

Module I [12L]

Highway Network Planning:
Different modes of transportation, Role & Development of highway transportation, Classification, Network patterns, Planning surveys, Evaluation by saturation system, Introduction to highway economics.
Highway Alignment:
Factors controlling alignments, Principles of highway alignment, engineering surveys for highway alignment and location.
Highway Geometric Design:
Importance of geometric design, design controls, pavement cross-sectional elements, PIEV theory, Sight distance, Design of horizontal alignments, Design of vertical alignments, Geometric Design of Hill Roads.

Module II [12L]

Pavement Materials:
Types and component parts of pavement and their functions, highway and airport pavement materials, basic soil & aggregate properties relevant to pavement application, basic properties of bitumen and tar, Modified Bitumen (PMB, CRMB) tests on pavement materials, Use of geo-synthetics.
Design of Pavements:
Design factors, classification of axle types, contact pressure, EWLF & ESAL concept, Traffic analysis: vehicle damage factor.
Flexible Pavement Design:
Design of flexible pavements (GI method, CBR method, Triaxial method -only introduction), IRC method of design.
Rigid Pavement Design:
Design considerations, Westergaard's theory and assumptions, Design of dowel and tie bars, Joints in Rigid Pavements, IRC method of design.

Module III [8L]

Highway Construction:
Construction of earth roads, gravel roads, WBM roads, Cement Concrete Pavements, Bituminous pavements.
Highway Maintenance:
Pavement failures, causes of failure, routine and periodic maintenance of highways.
Highway Drainage:
Importance of highway drainage, surface and sub-surface drainage, drainage of slopes and erosion control, road construction in water logged areas.
Highway Safety:
Introduction to highway safety, accident characteristics and factors, accident recording and analysis, road safety audit, safety education, traffic law enforcement, elements of highway safety management system, road safety management system.

Module IV [10L]

Traffic Engineering:
Introduction, road users and vehicle characteristics, microscopic and macroscopic flow characteristics, time headways, interrupted and un- interrupted traffic, speed and travel time variation, travel time and delay studies, flow and density measurement techniques, highway capacity and level of service, level of service estimation, traffic signs.
Traffic Signal Design and Design of at grade Intersections:
Signal phasing, cycle length, fixed and vehicle actuated signal, Webster method, IRC method, signal co-ordination and problems on signal design, types of intersections, rotary and round-about, design aspects.
Parking and Accident Analysis:
Parking inventory study, on street and off street parking facilities, introduction to Intelligent Transport System, accident characteristics, accident recording and analysis.

RECOMMENDED BOOKS:

TEXT & REFERENCE BOOKS	
Sl. No.	Name of the books
1.	High Way Engineering, Khanna & Justo, Nemchand& Brothers, Roorkee
2.	Principles of Transportation Engineering, P. Chakraborty& A. Das - PHI
3.	Transportation Engineering- C.J Khisty& B.K Lall., PHI
4.	Kadiyali L.R. Traffic Engineering and Transport Planning, Khanna Publishers, New Delhi, India, 1997
CODES FOR REFERENCE	
Sl. No.	Name of the Codes
1.	I.S Specifications on Concrete , Aggregate & Bitumen Bureau of Indian Standard
2.	Relevant latest IRC Codes (IRC-37 – 2001, IRC-37 – 2012, IRC 58 – 2011, IRC 73 - 1980, IRC 86 - - 1983, IRC 106 – 1990, IRC 64 – 1990, IRC 15- 2002 - Indian Road Congress

Course Outcome:

After going through this course, the students will be able to:

1. Plan highway networks and Design highway geometrics.
2. Characterize the properties of soil, aggregate, bitumen, and bituminous mixes.
3. Analyze and design rigid and flexible pavement (IRC Method).
4. Understand the principles of construction, maintenance and safety of highways.
5. Conduct traffic studies, analyze traffic data and design intersections.
6. Design traffic signal and analyze parking & accidents.

Course Name: HUMAN VALUES AND PROFESSIONAL ETHICS					
Course Code: HMTS 2001					
Contact Hours per week	L	T	P	Total	Credit Points
	3	0	0	3	3

Module I (10 L)

Human society and the Value System

Values: Definition, Importance and application.

Formation of Values: The process of Socialization
Self and the integrated personality
Morality, courage, integrity

Types of Values:

Social Values: Justice, Rule of Law, Democracy, Indian Constitution, Secularism
Aesthetic Values: Perception and appreciation of beauty
Organizational Values: Employee: Employer--- rights, relationships, obligations
Psychological Values: Integrated personality and mental health
Spiritual Values &their role in our everyday life
Value Spectrum for a Good Life, meaning of Good Life

Value Crisis in Contemporary Society

Value crisis at----
Individual Level
Societal Level
Cultural Level
Value Crisis management --- Strategies and Case Studies

Module II (10L)

Ethics and Ethical Values
Principles and theories of ethics
Consequential and non-consequential ethics
Egotism, Utilitarianism, Kant's theory and other non-consequential perspectives
Ethics of care, justice and fairness, rights and duties

Ethics-- Standardization
Codification
Acceptance
Application

Types of Ethics--- Ethics of rights and Duties
Ethics of Responsibility
Ethics and Moral judgment
Ethics of care
Ethics of justice and fairness
Work ethics and quality of life at work

Professional Ethics

Ethics in Engineering Profession;
moral issues and dilemmas, moral autonomy(types of inquiry)

Kohlberg's theory, Gilligan's theory (consensus and controversy)
Code of Professional Ethics Sample Code of ethics like ASME, ASCE. IEEE Institute of Engineers, Indian Institute of materials management, Institute of Electronics and telecommunication engineers
Violation of Code of Ethics---conflict, causes and consequences
Engineering as social experimentation, engineers as responsible experimenters (computer ethics, weapons development)
Engineers as managers, consulting engineers, engineers as experts, witnesses and advisors, moral leadership
Conflict between business demands and professional ideals social and ethical responsibilities of technologies.
Whistle Blowing: Facts, contexts, justifications and case studies
Ethics and Industrial Law
Institutionalizing Ethics: Relevance, Application, Digression and Consequences

Module III (10L)

Science, Technology and Engineering
Science, Technology and Engineering as knowledge and profession
----Definition, Nature, Social Function and Practical application of science
Rapid Industrial Growth and its Consequences
Renewable and Non- renewable Resources: Definition and varieties
Energy Crisis
Industry and Industrialization
Man and Machine interaction
Impact of assembly line and automation
Technology assessment and Impact analysis
Industrial hazards and safety
Safety regulations and safety engineering
Safety responsibilities and rights
Safety and risk, risk benefit analysis and reducing risk
Technology Transfer: Definition and Types
The Indian Context

Module IV (6L)

Environment and Eco- friendly Technology
Human Development and Environment
Ecological Ethics/Environment ethics
Depletion of Natural Resources: Environmental degradation
Pollution and Pollution Control
Eco-friendly Technology: Implementation, impact and assessment
Sustainable Development: Definition and Concept
Strategies for sustainable development
Sustainable Development--- The Modern Trends
Appropriate technology movement by Schumacher and later development Reports of Club of Rome.

Suggested Readings:

1. Tripathi,A.N., Human Values, New Age International, New Delhi,2006
2. Ritzer, G., Classical Sociological Theory, The McGraw Hill Companies, New York, 1996.
3. Doshi,S.L., Postmodern Perspectives on Indian Society, Rawat Publications, New Delhi,2008.
4. Bhatnagar, D.K., Sustainable Development, Cyber Tech Publications, New Delhi, 2008.
5. Kurzwell,R., The age of Spiritual Machines, Penguin Books, New Delhi,1999.
6. Weinberg, S.K., Social Problems in Modern Urban Society, Prentice Hall, Inc., USA, 1970.
7. Giddens, Anthony 2009. Sociology. London: Polity Press (reprint 13th Edition).

Course Outcome:

The student will

1. be aware of the value system and the importance of following such values at workplace
2. learn to apply ethical theories in the decision making process
3. follow the ethical code of conduct as formulated by institutions and organizations
4. Implement the principles governing work ethics
5. Develop strategies to implement the principles of sustainable model of development
6. Implement ecological ethics wherever relevant and also develop eco-friendly technology

Course Name: SOIL MECHANICS LAB - II					
Course Code: CIVL 2251					
Contact Hours per week	L	T	P	Total	Credit Points
	0	0	2	2	1

Course Objective:

The course will assist the students to:

1. Identify the compressibility characteristics of soil.
2. Determine unconfined compressive strength of cohesive soil.
3. Determine shear strength parameters of soil by vane shear, direct shear and triaxial tests.
4. Identify California Bearing Ratio (CBR) of soil.
5. Explain standard penetration test.

List of Experiments:

1. Determination of compressibility characteristics of soil by oedometer test.
2. Determination of unconfined compressive strength of soil by unconfined compression test.
3. Determination of shear strength parameters of soil by direct shear test.
4. Determination of undrained shear strength of soil by vane shear test.
5. Determination of shear strength parameters of soil by unconsolidated undrained triaxial test.
6. Determination of California Bearing Ratio (CBR) of soil.
7. Standard penetration test.

REFERENCE BOOKS & CODES:	
Sl. No.	**Name**
1.	Das, B.M. *Soil Mechanics Laboratory Manual*, Oxford University Press.
2.	SP 36 (Part I & II): *Compendium of Indian Standards on Soil Engineering*.

Course Outcome:

After going through this course, the students will be able to:

1. Assess the compressibility characteristics of soil to estimate the settlement of the foundation.
2. Interpret the undrained shear strength of cohesive soil from unconfined compression and vane shear tests to evaluate the bearing capacity of proposed foundation to be constructed on the soil.
3. Determine shear strength parameters of both cohesionless and cohesive types of soil by triaxial test for routine geotechnical analysis.
4. Identify friction angle of cohesionless soil by direct shear test for the analysis of geotechnical structures.
5. Assess California Bearing Ratio (CBR) values of soil to select whether that particular soil is suitable for construction of embankment.
6. Analyze the standard penetration test (SPT) results to interpret the type of soil profile and to verify the bearing capacity of foundations from SPT values.

Course Name: SURVEYING LAB					
Course Code: CIVL 2252					
Contact Hours per week	L	T	P	Total	Credit Points
	0	0	4	4	2

Course Objective:

The main objective of this course is to

1. Develop the concept of taking linear and angular field measurements using different instruments.
2. Provide the idea about the procedure to draw the traverse survey and topographic plan using field data.
3. Develop an idea about the drawing of leveling data and interpret them to calculate the volume of cutting and filling of soil for a particular road profile.
4. Build an idea about the field procedure of setting out of curve and layout drawing on the ground.

List of Experiments:

1. **Chain and Compass survey:** Preparation of maps, method of ranging-method of taking offsets, measurement of bearings, chain and compass traverse.
2. **Levelling:** Temporary adjustment of Dumpy level, Differential leveling, Profile leveling and plotting of long and cross sections.
3. **Theodolite survey:** Traversing using theodolite, preparation of Gale's traverse table using the field data.
4. **Curve setting:** Setting out of simple circular curve and transition curve by angular method.
5. **Setting out of building:** Setting out procedure of building layout.
6. **Total station:** Demonstration of the instrument and perform Levelling using it.

Course Outcome:

After going through this course, the students will be able to:

1. Prepare maps by chain and compass traverse.
2. Perform temporary adjustment of Dumpy level, Differential leveling, Profile leveling and plot long and cross sections.
3. Construct traverse plot using theodolite with the help of Gale's traverse table.
4. Set out circular curve and transition curve and estimate the error in setting out method.
5. Instruct the procedure of setting out of building layout.
6. Demonstrate different parts of a Total station and can perform simple operations of the instrument.

Course Name: HIGHWAY ENGINEERING LAB					
Course Code: CIVL 2253					
Contact Hours per week	L	T	P	Total	Credit Points
	0	0	2	2	1

Course objective:

The course will assist the students to:

1. Conduct different tests to find out the properties of various aggregates.
2. Characterize the pavement materials.
3. Know about quality control of the pavement materials.
4. Know about quality control of aggregates.
5. Design and test bituminous mix.

List of Experiments:

A. Test on Highway Materials:

1. Aggregates –
   a) Impact Value Test.
   b) Los Angeles Abrasion Value Test.
   c) Water Absorption and Specific Gravity.
   d) Elongation and Flakiness Index.
2. Bitumen –
   a) Specific Gravity Test.
   b) Penetration Value Test.
   c) Softening Point Test.
   d) Loss on Heating Test.
   e) Flash and Fire point Test.

B. Bituminous Mix Design by Marshall Stability Method.

C. Stripping Value Test.

References:

1. BIS Codes on Aggregates and Bituminous Materials.
2. Highway Material Testing (Laboratory Manual) by S.K. Khanna and CE. G. Justo.
3. Relevant IS and I.R.C codes.

Course Outcome:

After going through this course, the students will be able to:

1. Learn various concepts in highway engineering.
2. Design and test bituminous mix.
3. Gather knowledge about the quality control techniques of various aggregates and pavement materials.
4. Characterize bituminous grade according to their work suitability.
5. Understand the factors influencing road vehicle performance characteristics and design.
6. Access the quality of different bitumen grade.

Course Name: QUANTITY SURVEY, SPECIFICATION AND VALUATION					
Course Code: CIVL 2254					
Contact Hours per week	L	T	P	Total	Credit Points
	0	0	2	2	1

Course Objective:

The course will assist the students to:

1. Know the importance of preparing the types of estimates under different conditions.
2. Know about the rate analysis and bill preparations.
3. Study about the specification writing.
4. Understand the valuation of land and buildings.

1. Introduction of Estimation in Civil Engineering:
Introduction-Principles of estimating, Types of estimates, approximate estimates, items of work, unit of measurement, unit rate of payment.

2. Preparation of Bill of Quantities:
Measurements and calculations of quantities of Civil engineering works, Preparation of abstracts of bill of quantities.

3. Analysis of Rates of different items with specifications:
Specifications for materials and construction of a building. Rate analysis for Earthwork, PCC, Shuttering, Reinforcement, RCC, brick work, plastering, flooring and finishing, Use of standard schedules such as PWD schedules of rates. Specifications.

4. Quantity Estimation of infrastructures:
Quantity estimates of road, Underground reservoir, Surface drain, Septic tank

5. Valuation:
Concept of price, value and cost. Purpose of valuation; free hold and lease hold properties; market value, present value; sinking fund; year's purchase. Different methods of land valuation. Different methods of valuation of real properties. Outgoing, appreciation, depreciation, different methods for fixation of rents. Valuation of plants and machineries.

References:

1. Estimating, costing, Specification and Valuation in Civil Engineering by M. Chakroborty
2. Estimating and Costing in Civil Engineering" by B.N. Dutta, USB Publishers & Distributers
3. IS CODE SP34

Course Outcome:

After going through this course, the students will be able to:

1. Apply different types of estimates in different situations.
2. Prepare quantity estimates for buildings, roads, rails and canal works.
3. Calculate the quantity of materials required for civil engineering works as per specifications.
4. Demonstrate the concepts of specification writing.
5. Evaluate contracts and tenders in construction practices.
6. Prepare cost estimates.

Course Name: STRUCTURAL ANALYSIS - II					
Course Code: CIVL 3101					
Contact hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	**1**	**0**	**4**	**4**

Course Objectives:

The course will assist the students to:

1. Apply the Slope Deflection and Moment Distribution Method to analyze indeterminate structures.
2. Develop and analyze the concept of suspension bridge and stiffness girders
3. Apply and analyze the concepts of curved beam analysis in hooks, rings and Bow girders.
4. Develop the concept bending in unsymmetrical beams.
5. Develop the fundamental concepts of plastic analysis using kinematic method and apply them
6. Develop and analyze the portal frames using Portal and Cantilever Method.
7. Develop and analyze the indeterminate structures (continuous beams and frames) using Flexibility and Stiffness methods.

Sl. No.	Module	Details of Course content	Hours	Total
1.	I	Analysis of statically Indeterminate Structures: Moment distribution method-solution of continuous beam, effect of settlement and rotation of support, frames with or without side sway. Slope deflection method: method and application in continuous beams and frames. Suspension Bridge and stiffening girders.	6 4 2	42
2.	II	Curved Beam analysis: Hooks, rings and Bow girders. Unsymmetrical bending.	12	
3.	III	Plastic analysis of structures: beams and portal frames.	8	
4.	IV	Approximate method of analysis of structures: Portal and Cantilever methods. Matrix methods of structural analysis – Stiffness and flexibility approaches for analysis of beam.	4 6	

Course Outcomes:

On completion of the course, the students will be able to:

1. Apply the Slope Deflection and Moment Distribution Method to analyze indeterminate structures.
2. Develop and analyze the concept of suspension bridge and stiffness girders

3. Apply and analyze the concepts of curved beam analysis in hooks, rings and Bow girders.

4. Develop the concept bending in unsymmetrical beams.

5. Develop the fundamental concepts of plastic analysis using kinematic method and apply them in frames and continuous beam analysis.

6. Develop and analyze the portal frames using Portal and Cantilever method.

7. Develop and analyze the indeterminate structures (continuous beams and frames) using flexibility and Stiffness methods.

RECOMMENDED BOOKS:

TEXTBOOKS	
Sl. No.	**Name of the books**
1.	M. Vijayanand Dr. K.U. Muthu, Dr. H. Narendra, Dr. Maganti Janardhana , *Indeterminate Structural Analysis*, Wiley Publications.
2.	C.S.Reddy, *Basic Structural Analysis,* Tata Mc. Graw Hill Publishing House.
3.	A. Ghali and A.M. Neville, *Structural Analysis-A unified Classical and matrix approach.*, E & FN SPON Publishing House.

REFERENCE BOOKS:

TEXTBOOKS	
Sl. No.	**Name of the books**
1.	Timoshenko and Wang, *Theory of structure,* Tata McGraw Hill Publishing House
2.	S.Ramamruthum, *Theory of Structures*, Dhanpat rai Publishing House.
3.	V. N. Vazirani, M. M. Ratwani, et al., *Analysis of Structures (Theory, Design & Details of Structures) – Vil. 1 and Vol.2,* Dhanpat Rai Publishing House.

Course Name: DESIGN OF R.C.C. STRUCTURES					
Course Code: CIVL 3102					
Contact hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	**1**	**0**	**4**	**4**

Course Objective:

1. The course focuses on understanding the behavior of reinforced concrete components and systems subjected to gravity as well as lateral loads.
2. Introduce appropriate relevant Indian Standard codes and its interpretation.
3. Develop an idea to perform analysis and design of reinforced concrete members and connections.
4. Provide professional knowledge to relate contemporary issues in the design and fabrication of reinforced concrete structural elements.
5. Build an idea of the behaviour of prestressed concrete member and prestress losses.

SL. No	Module	Syllabus	Hours	Total
1	I	**Introduction:** Principles of Design of Reinforced Concrete Members - Working Stress and Limit State Method of Design Basic concepts of Balanced, Under-reinforced and Over-reinforced Beam section by Working Stress Method and Limit State Method **Working Stress Method of Design**: Analysis and Design of Beams and Columns. **Limit State Method of Design:** Basic Concepts and IS Code Provisions (IS: 456 2000) for Design against Strength and Serviceability Limit States. Concepts of bond stress and development length; Use of 'design aids for reinforced concrete' (SP: 16).	2 1 4 4	42
2	II	**Analysis, design and detailing** of singly reinforced rectangular, 'T', 'L' and doubly reinforced beam sections by limit state method. **Design and detailing** of one-way and two-way slab panels as per IS code provisions **Design and detailing** of continuous beams and slabs as per IS code provisions	5 3 3	

3	III	**Staircases:** Types; Design and detailing of reinforced concrete doglegged staircase **Design and detailing** of reinforced concrete short columns of rectangular and circular cross-sections under axial load. **Design** of short columns subjected to axial load with moments (uniaxial and biaxial bending) – using SP 16.	2 4 4	
4	IV	**Design and detailing** of reinforced concrete footing and pile foundation as per IS code provisions by limit state method **Prestressed concrete** Basics of prestressing, pre-tensioning and post-tensioning, load balancing method, straight/bent/parabolic cables, stresses at transfer and final stages, stress concept method (P-line), strength concept method (C-line), cracking moment, loss in prestress.	6 4	

Course Outcome:

After going through this course, the students will be able to:

1. Understand material properties and design methodologies for reinforced concrete structures.
2. Assess different type of loads and prepare layout for reinforced concrete structures.
3. Identify and apply the applicable industrial design codes relevant to the design of reinforced concrete members.
4. Analyse and design various structural elements of reinforced concrete building like beam, slab, column, footing, and staircase based on both strength and serviceability criteria.
5. Understand the basic concept and mechanical behaviour of prestressed concrete.
6. Prepare structural drawings and detailing and produce design calculations and drawing in appropriate professional format.

RECOMMENDED BOOKS:-

CODES:

1. IS: 456 - 2000

"Indian Standard for Plain and reinforced concrete – code of practice" Bureau of

Indian Standard

2. SP: 16 Design Aid to IS 456
3. IS:1343-1980

"Indian Standard Prestressed Concrete — code of practice"

TEXT BOOKS:

1. Reinforced Concrete Design by Pillai and Menon
2. Reinforced concrete Design by S.N.Sinha
3. Limit State Design of Reinforced Concrete by P. C. Varghese
4. Prestressed Concrete by N. Krishna Raju

REFERENCE BOOKS:

1. Fundamental design of Reinforced concrete by N.C.Sinha & S.K. Roy

Course Name: ENVIRONMENTAL ENGINEERING Course Code: CIVL 3103					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	**1**	**0**	**4**	**4**

Course Objective:

The course will assist the students to:

1. Elaborate the structure of drinking water supply systems, water collection, water purification and water supply scheme for drinking water.
2. Understand the water quality criteria and standards, and their relation to public health.
3. Apply knowledge of basic water chemistry to solve problems associated with drinking water treatment.

SL. No.	Module	Details of Course Content	Hours	Total
1	I	**Water Demand:** Per capita demand; Variations in demand; Factors affecting demand; Design period; Population Forecasting Methods. **Sources of water**: Surface and ground water. **Water Distribution:** Analysis of pipe networks by Hardy Cross Method, Storage and distribution of water; Estimation of reservoir capacity.	10	40
2	II	**Water Quality Parameter:** Physical and Chemical water quality parameters; Sources, impacts and methods of measurement **Water Treatment :** Typical flow chart for ground and surface water treatments; Unit Processes- Aeration, Plain sedimentation, coagulation & flocculation, Water Softening, Filtration, Disinfection.	12	
3	III	**Conveyance of Waste Water:** Definition of Common Terms, Quantity of sewage and storm sewage. **Sewer Design:** Hydraulic design of sewers, Analysis of partial flow diagrams and Nomograms.	8	
4	IV	**Wastewater Quality Parameters:** Physical, chemical and biological. **Wastewater treatment:** Typical flow chart for municipal wastewater treatment; Primary, Secondary & Tertiary Treatments: Unit Processes- Activated Sludge Process, Trickling Filter Process, Septic Tank, Advance Methods of Wastewater treatment.	10	

Course Outcome:

After going through this course, the students will be able to:

1. Identify the nature and quality of water & waste water as per its characteristics like physical, chemical & biological.
2. Estimate the future water demand by using various population forecasting methods.
3. Define and design in detail about the various water treatment units.
4. Define and design in detail about the various waste water treatment units.
5. Estimate the quantity of sewage produced and design the sewerage system.
6. Analysis and design of water distribution networks.

References:

1. Environmental Engineering. Howard S. Peavy, Donald R. Rowe ,George Tchobanoglous, McGraw-Hill
2. Wastewater Engineering by Metcalf & Eddy, McGraw-Hill
3. Environmental Engineering, N. N. Basak, McGraw-Hill
4. Water Supply Engineering(VOL I) by Santosh Kr Garg, Khanna Publishers.
5. Sewage Disposal and Air pollution Engineering (VOL – II) by Santosh Kr Garg, Khanna Publishers.
6. Wastewater Engineering by B.C. Punmia & A.K. Jain, Laxmi Publications.
7. IS-10500:2012 (Drinking Water).
8. IS 3025.

Course Name: DATA STRUCTURE & RDBMS Course Code: CSEN 3106					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	4	**0**	**0**	**4**	**4**

Module I: **(11L)**

Linear Data structures:

Singly Linked List- Insertion at beginning, at end and any position of the List. Deletion by value, by position: beginning, end and any position of the List Stack and Queue: Both array and Linked Representation, Circular queue using array only.

Application of stack: Infix to postfix conversion, Evaluation of postfix expression.

Module II: **(10L)**

Recursion: Design of Recursive algorithm.

Non-Linear Data Structures:

Trees: Binary Trees: Array and Linked representation, Binary tree Traversal Techniques, reconstruction of binary tree using traversal sequence.

Binary Search Trees - Insertion and Deletion algorithms.

Sorting Algorithms: Bubble sort, Insertion sort, Selection sort, Quick sort and their comparison.

Searching Algorithms: Linear search, Binary search and their comparison.

Database Concept

Module III: (10L)

Introduction to Database Concepts, File Processing System and Database Management System, DBMS Architecture and Data Independence.

Data Model: Basic Concepts, Entity-Relationship Diagram, Keys, Cardinality, Weak Entity Set.

Introduction to relational algebra & SQL: Operators like select, project, rename, Cartesian product, join, union, intersect, minus, DDL, DML.

Module IV: (10L)

Relational Database Design: Functional Dependencies, Normalization: Different anomalies in database designing

1NF, 2NF, 3NF and BCNF.

Introduction to Transaction Processing Concepts: ACID properties, Serializability and Recoverability

Text Books:

Data Structures:

I) Title: Data Structures.

Author: Seymour Lipschutz.

Publication: Tata McGraw-Hill (India)

II) Title: Data Structures and Program Design in C.

Author: Kruse Robert L., Robert Kruse, Cl Tondo.

Publication: Pearson Education India.

Database Concept:

I) Title: Fundamentals of Database Systems

Author: Elmasri Ramez and Navathe Shamkant

Publication: Pearson.

II) Title: Database System Concepts

Author: A. Silberschatz, H.F Korth, S.Sudarshan

Publication: McGraw Hill Education (India) Private Limited

Reference Books:

Data Stucture:

I) Title: Data Structures using C.

Author: Tanenbaum A. S, Langsam Y., Augenstein M. J.

Publication: Pearson.

II) Title: The Art of Computer Programming

Author: Donald E. Knuth

Publication: Addison-Wesley Professional

Database Concept:

I) Title: Introduction to Database Management Vol. I, II, III,

Author: Date C. J.

Publication: Addison Wesley.

II) Title: Principles of Database Systems

Author: Ullman JD.

Publication: Galgottia Publication

Course Name: FOUNDATION ENGINEERING Course Code: CIVL 3141					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	**0**	**0**	**3**	**3**

Course Objective:

The course will assist the students to:

1. Estimate bearing capacity of shallow foundation by different methods.
2. Evaluate various types of settlements for shallow and deep foundations.
3. Demonstrate different types of sub-soil exploration techniques.
4. Determine pile load capacity by various methods.
5. Analyze problems related to sheet pile walls.

Sl. No.	Module	Details of Course Content	Hours	Total
1.	I	**SHALLOW FOUNDATION** Introduction, Bearing Capacity, Factors affecting Bearing Capacity, Modes of Failures, Methods for Determining Bearing Capacity of Soils. Terzaghi's Bearing Capacity Theory, Effect of Depth of Embedment, Eccentricity of Load, Foundation Shape on Bearing Capacity, Ground Water Table on Bearing Capacity. Isolated Footings with Combined Action of Loads and Moments, Bearing Capacity as per IS: 6403. **Settlement:** Allowable Bearing Pressure and Settlement Analysis (as per IS: 8009), Immediate and Consolidation Settlements, Rigidity and Depth Factor Corrections, Settlement Values as aer IS: 1904 Recommendations.	10	40
2.	II	**SITE INVESTIGATION & SOIL EXPLORATION** Introduction, Planning of Sub-Surface Exploration, Methods of Boring, Sampling, Different Types of Samples, Spacing, Depth and Number of Exploratory Borings, Bore Log, Preparation of Sub-Soil Investigation Report. **In-Situ Tests:** Standard Penetration Test, Static Cone Penetration Test, Dynamic Cone Penetration Test, Field Vane Shear Test, Plate Load Test, Bearing Capacity From SPT, SCPT, DCPT and Plate Load Test Data. **Indirect Methods of Soil Exploration:** Geophysical Method: Seismic Refraction and Electrical Resistivity Methods.	10	
3.	III	**PILE FOUNDATION** Introduction, Types of Piles, Material, Suitability and Uses, Method of Installation of Piles - Classification of Piles Based on Material, Installation Techniques – Selection and Uses, Determination of Types and Lengths of Piles, Load Transfer Mechanism, Determination of Load Carrying Capacities of Piles by Static and Dynamic Formulae as per IS Codes, Pile Spacing and Group Action, Group Efficiency, Negative Skin Friction, Pile Load Test, Settlement of Pile Group (as per	10	

		IS: 8009), Lateral Load Capacity of Pile by Is: 2911 and Reese & Matlock Methods, Uplift Capacity of Pile - Introduction.		
4.	IV	**SHEET PILE STRUCTURES** Type of Sheet Piling, Analysis of Cantilevered Sheet Pile, Analysis of Anchored Bulk Head by Free Earth and Fixed Earth Support Methods.	10	

TEXT BOOKS:

Sl. No.	Name
1.	V.N.S. Murthy, "Textbook of Soil Mechanics and Foundation Engineering" (Geotechnical Engineering Series), CBS Publishers and Distributors Pvt. Ltd.
2.	B.M. Das, "Principles of Foundation Engineering", Thomson Brooks / Cole.
3.	B.C. Punmia and A.K. Jain, "Soil Mechanics and Foundations", Laxmi Publications (P) Ltd.
4.	B.M. Das, "Principles of Geotechnical Engineering", Thomson Brooks / Cole.
5.	Gopal Ranjan and A. S. R. Rao, "Basic and Applied Soil Mechanics", New Age International Publishers.

REFERENCES:

Sl. No.	Name
1.	J. E. Bowels, "Foundation Analysis & Design", McGraw-Hill Book Company.
2.	P.C.Varghese, "Foundation Engineering", PHI Learning Pvt. Ltd.
3.	K. Terzaghi, R. B. Peck and G. Mesri, "Soil mechanics in engineering practice", Wiley-Interscience.

Course Outcome:

After going through this course, the students will be able to:

1. Compute bearing capacity of shallow foundation by different methods.
2. Evaluate the settlement of shallow foundation by different methods.
3. Understand different subsoil exploration methods and interpret field and laboratory test data to obtain design parameters for geotechnical analysis.
4. Determine the load carrying capacity of pile foundation.
5. Compute the efficiency and settlement of pile group.
6. Analyze and design sheet pile structures.

Course Name: ROCK MECHANICS Course Code: CIVL 3142					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	**0**	**0**	**3**	**3**

Course Objective:

The course will assist the students to:

1. Identify and classify rock characteristics.
2. Interpret type of rock on the basis of field exploration.
3. Determine nature of rock mass and its engineering properties.
4. Interpret strength and failure of rocks by different theories.
5. Analyze and design foundations and slopes on rock.

Sl. No.	Module	Details of Course Content	Hours	Total
1.	I	**Introduction to rock mechanics** Introduction, Relevance of rock mechanics, Application of rock mechanics, Differentiating between soil and rock, Classification of intact rock. Compressive strength of weak rock, Origins of shear strength in intact rock, Shear strength parameters, Stability of a cut slope in weak rock, Discontinuities in rock masses, The importance of discontinuities to stability, Load changes. **Methods of rock exploration** Introduction, methods of rock exploration, rock exploration by direct penetration, methods of geophysical prospecting, in-situ tests on rock.	10	40
2.	II	**Geological processes and the nature of rock masses** Introduction, Earth stresses, Faults, Folding, Rock textures, fabrics and effect on properties, Rock joints and other discontinuities, Major geological structures. **Physical and Mechanical Properties of Rocks** Introduction, Porosity, Density, Moisture content, Degree of saturation, Permeability, Electrical and Thermal properties, Swelling, Anisotropy, Durability, Compressive and Tensile Strength of Rock, Elasticity, Plasticity, Poisson's ratio, Hardness.	10	

3.	III	**Strength and Failure of Rocks** Types of Failure, Yield Criterion or Failure Theories, Types of Failures in Rock Material, Griffith's Theory of Fracture Initiation in the Rock Mass, Relation between Grain Size and Strength of Rock. **Improvement in Properties of Rock Mass** Introduction, Grouting, Grouting materials, Grouting operations, Methods of Grouting, Mechanism of Rock Bolting, Principles of Design, Cable Anchorage.	10	
4.	IV	**Stability of Slopes and Foundations on Rock** Introduction, Foundation on Rocks: Shallow foundations, Pile Foundations, Foundation construction, Allowable bearing pressure. Stability of rock slopes: Modes of failure, Methods of analysis, Prevention and control of rock slope failure.	10	

TEXT BOOKS:

Sl. No.	Name
1.	Steve Hencher, "Practical Rock Mechanics", CRC Press (Taylor and Francis Group).
2.	Debasis Deb and Abhiram Kumar Verma, "Fundamentals and Applications of Rock Mechanics", PHI.
3.	Richard E. Goodman, "Introduction to Rock Mechanics", Wiley.
4.	B. P. Verma, "Engineering Geology and Rock Mechanics", Khanna Publishers.
5.	J. C. Jaeger, Neville. G. W. Cook and R. Zimmermann, "Fundamentals of Rock Mechanics", Wiley-Blackwell.

REFERENCES:

Sl. No.	Name
1.	Nagaratnam Sivakugan, Sanjay Kumar Shukla and Braja M. Das, "Rock Mechanics: An Introduction", CRC Press (Taylor and Francis Group).
2.	Lianyang Zhang, "Engineering Properties of Rocks: An Introduction", Butterworth-Heinemann.
3.	Charles Jaegar, "Rocks Mechanics and Engineering", Cambridge University Press.

ADDITIONAL READINGS:

Journal and Conference papers in the area of Rock Mechanics.

Course Outcome:

After going through this course, the students will be able to:

1. Classify intact rock mass and also understand discontinuities present in it.
2. Describe various methods of rock exploration to classify the rock mass.
3. Interpret the nature of rock masses.
4. Evaluate various engineering properties of rocks.
5. Assess failure theories in rocks.
6. Determine methods required to improve rock properties.
7. Analyze and design foundations and slopes constructed in rock.

Course Name: OFFSHORE STRUCTURES Course Code: CIVL 3143					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	**0**	**0**	**3**	**3**

Course Objectives:

The course will assist the students to:

1. Understand the basic concept of wave force, wave related formulation and various types of offshore structures
2. Assess the basic concept of stochastic processes and perform the fatigue analysis of offshore structures
3. Develop an idea to analyze the various loads and design of offshore structural elements
4. Build an idea about marine concrete and its corrosion and construction of offshore structures

SL. No	Module	Details of Course Contents	Hours	Total
1	I	**WAVE HYDRODYNAMICS** Concept of wave, linear and non-linear wave theories, wave forecasting, formulation and solution, wave celerity, length and period, wave forces – Morison equation, types of offshore structures	10	42
2	II	**STOCHASTIC PROCESSES IN STRUCTURAL MECHANICS** Basic Theory of Stochastic Processes: Introduction, statistics of stochastic processes, stationary, ergodic and non stationary processes, auto and cross correlation and co variance function, stochastic calculus and mean square limit, conditions for continuity Fatigue analysis, stochastic analysis of offshore structures, soil-structure interaction problem	10	
3	III	**DESIGN OF OFFSHORE STRUCTURES** Operational loads - Environmental loads due to wind, wave, current and buoyancy - Morison's Equation - Maximum wave force on offshore structure - Concept of Return waves - Principles of Static and dynamic analyses of fixed platforms - Use of approximate methods - Design of structural elements	12	
4	IV	**MARINE CONSTRUCTION** Marine concrete, Construction of offshore structures, Marine pipelines, case studies	10	

Course Outcomes:

After going through this course, the students will be able to:

1. Describe the basic concept of wave force, wave formulations and classify the different types of offshore structures
2. Assess and classify the stochastic processes and able to understand soil structure interaction problems
3. Able to perform the fatigue assessment analysis of offshore structures and understands the basic concept of SN curves.
4. Estimate the various components of operational loads on offshore structures and analyze and design various structural elements of offshore structures
5. Characterize marine concrete and able to explain the concern for marine corrosions
6. Study the basic concepts and necessary requirements for construction of offshore structures and marine pipelines.

RECOMMENDED BOOKS:

TEXT BOOKS	
Sl. No.	Name of the Books
1.	Chakrabarti, S.K., Hydrodynamics of Offshore Structures, Springer Verlag, 1987
2.	Mohamed A. El-Reedy , Offshore Structures: Design, Construction and Maintenance, 2nd edition, Gulf Professional Publishing;

Course Name: STRUCTURAL DYNAMICS & EARTHQUAKE ENGINEERING Course Code: CIVL 3144					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	**0**	**0**	**3**	**3**

Course Objectives:

1. Introduce fundaments of vibrations of SDOF system
2. Introduce damped and undamped system
3. Introduce free and forced vibration
4. Introduce free and forced vibration of MDOF system
5. Introduce free and forced vibration of continuous system
6. Introduce ductile detailing of structures

Sl. No.	Module	Details of Course Content	Contact hours	Total
1.	I	**Theory of vibration:** Degrees of freedom, Undamped single degree freedom system, Damped single degree freedom system, Natural frequency, modes of vibration, Introduction to multiple degree freedom system	10	44
2.	II	**Response of single degree freedom system due to harmonic loading:** Undamped Harmonic excitation, Damped harmonic excitation. **Response due to Transient loading:** Duhamel's Integral, Response due to constant force, rectangular load, Introduction to numerical evaluation of Duhamel's integral of un-damped system.	10	
3.	III	**Elements of seismology**: Fundamentals: Elastic Rebound Theory, Plate tectonics, Definitions of magnitude, Intensity, Epicenter etc. Seismograph, Seismic zoning. Response of simple structural system, recent Earth Quakes.	10	
4.	IV	**Principles of Earthquake Resistant Design**: Terminology, General Principles and Philosophy of earth quake resistant design, Methods of analysis, Equivalent lateral force method and response spectrum method of analysis for multistoried building as per Indian Standard Code of Practice, Fundamental concepts of ductile detailing, Introduction to performance based design.	14	

Course Outcomes:

At the completion of this course, the student should able to

1. Convert structure into SDOF system
2. Find response of free and force vibration (harmonic, periodic and transient) of SDOF system
3. Find natural frequency and mode shapes of MDOF system
4. Carry out modal analysis of MDOF system
5. Understand the behavior of structures under earthquake
6. Design earthquake resistance design of structures

References:

1. Structural Dynamics (Theory and computation), Mario Paz, CBS Publishers and Distributor.
2. Dynamics of Structures, Clough and Penzien, Computers & Structures, Inc. 1995 University Ave.Berkeley, CA 94704USA
3. Dynamics of Structure (Theory and application to earthquake engineering), A. K. Chopra, Pearson Education.
4. Dynamics of Structures, Ashok K. Jain, Pearson Education.
5. Earthquake resistant design of Structures, Agarwal and Shrikhande, PHI.
6. Earthquake-resistant design of structures, S.K. Duggal, Oxford University Press.
7. IS1893: PartI, 2002, IS 13920:1993, IS4326:1993.

Course Name: INDIAN CONSTITUTION AND CIVIL SOCIETY Course Code: INCO 3016					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	2	**0**	**0**	**2**	**0**

Module 1

Introduction to the Constitution of India-Historical Background,

Making of Indian Constitution -the process of framing the constitution, the constituent assembly.

Module II

Salient Features of the Indian constitution

Comparison with the constitutions of other countries

Module III

Relevance of the Constitution of India

Constitution and Governance

Constitution and Judiciary

Constitution and Parliament-Constitutional amendments

Module IV

Constitution and Society- democracy, secularism, justice

Constitution and the individual citizen- Fundamental Rights, Directive Principles of state policy and Fundamental duties

Reference Books

C.M.Elliot, (ed.), Civil Society and Democracy, OUP, Oxford, 20012..

David Held et.al (ed),The Idea of the Modern State, Open Univ. Press, Bristol, 1993

Neera Chandoke, State and Civil Society, Sage, Delhi, 19953

Course Name: R.C.C. DESIGN AND DETAILING LAB Course Code: CIVL 3152					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	**0**	**3**	**3**	**1.5**

Course Outcome:

After going through this course, the students will be able to:

1. Understand material properties and design methodologies for reinforced concrete structures.
2. Assess different type of loads and prepare layout for reinforced concrete structures.
3. Identify and apply the applicable industrial design codes relevant to the design of reinforced concrete members.
4. Analyse and design various structural elements of reinforced concrete building like beam, slab, column, footing, and staircase.
5. Assessment of serviceability criteria for reinforced concrete beam and slab.
6. Prepare structural drawings and detailing and produce design calculations and drawing in appropriate professional format.

Course Details:

Analysis, design and detailing of multistoried R. C.C. framed building with brick wall.

References:

I.S- 456-2000, SP 34, SP 16, IS-875, IS 1893-2002

Standard text books of RCC design.

Course Name: ENVIRONMENTAL ENGINEERING LAB Course Code: CIVL 3153					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	**0**	**3**	**3**	**1.5**

List of Experiments:

Experiment no.	Experiment name	Type of test
01	Determination of Color & Turbidity in an aqueous sample	Physical
02	Determination of pH and various solids (Total solids, Total suspended solids, Total dissolved solids and Volatile Solids) in an aqueous sample.	
03	Determination of electrical conductivity and chloride in an aqueous sample	
04	Determination of Total & Phenolphthalein alkalinity in an aqueous sample and speciation of different alkalinities	Chemical
05	Determination of Total , Magnesium and Calcium hardness in an aqueous solution	
06	Determination of concentration of fluorides in an aqueous solution	
07	Determination of Iron in an aqueous sample.	
08	Determination of the optimum coagulant dose for a given sample of water through Jar test	
09	Determination of chlorine demand of a contaminated water sample	
10	Determination of Dissolve oxygen (DO) in a given wastewater sample.	
11	Determination of chemical oxygen demand for a given wastewater sample.	
12	Determination of biochemical oxygen demand (BOD_5 at 20°C) for a given wastewater sample.	
13.	Determination of bacteriological quality of water : presumptive test, confirmative test and determination of Most Probable Number(MPN)	Bacteriological

Course Outcome:

After going through this course, the students will be able to:

1. Determine physical, chemical and biological characteristics of water and wastewater.
2. Determine optimum dosage of coagulant.
3. Assess the quality of water and wastewater.
4. To understand the different important water quality parameters, their relevance to human health and in treatment processes.
5. To know the permissible limits of different water quality parameter as per the standards.
6. Prepare technical laboratory report.

Course Name: RDBMS LAB Course Code: CSEN 3156					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	**0**	**3**	**3**	**1.5**

Experiments on Database on RDBMS Platform (Oracle):

DDL Commands: Creating Tables along with constraints like: Primary Key, Foreign Key, unique, Not Null, Check. Altering Table Structure like adding and modifying constraints, adding and modifying column data types, etc.

DML: Inserting rows, Updating rows, Deleting rows

SQL Query: Cartesian Product, All types of Join, Union, Intersect, Minus, Single Row functions, multiple row functions using GROUP BY clause, ORDER BY Clause, Nested

Sub-Queries

Introduction to PL/SQL: Programming Language Constructs in PL SQL like variable declaration, Conditional Statements, different types of loop structures, functions, etc.

Programming using Cursors.

Books:

DBMS Laboratory

Title: SQL, PL/SQL: The Programming Language Of Oracle (With CD-ROM) (English)

4th Revised Edition

Author: Ivan Bayross

Publisher: BPB Publications

Course Name: DESIGN OF STEEL STRUCTURES Course Code: CIVL 3201					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	**1**	**0**	**4**	**4**

Course Objective:

The course will assist the students to:

1. Identify the behavior of structural steel components (members and connections)
2. Interpret the Indian Standard codes for loads and design.
3. Develop an idea in the design of simple steel structures.
4. Apply professional knowledge to relate statics, mechanics of solids, and structural analysis to understand the relationship between analysis and design of steel structures.
5. Build an idea of professional and contemporary issues.

Sl. No.	Module	Details of Course Content	Hours	Total
1	I	**Materials and Specification**: Rolled steel sections, mechanical properties of steel and their specifications for structural use. Codes of practices. **Structural connections:** Bolted and welded connections: Introduction to different types of connectors, types of bolted and welded joints, assumptions, failure and efficiency of joints. Design of bolted and welded connections for axial load, torsion and shear, tension and shear, interaction check. High strength friction grip bolted joints.	8	42
2	II	**Tension members**: Working stress and limit state design of tension members, I.S code provisions, design rules, examples. **Compression members**: Effective lengths about major and minor principal axes, I.S code provisions. i) Design of axially loaded compression member: Working stress and limit state design of axially loaded compression members using rolled steel and built up sections. Examples. ii) Design of beam – column: Design of rolled steel and built up columns under eccentric loading, design of lacing and batten plates. Design of column bases: Design of slab base, gusseted base, connection detailing.	13	
3	III	**Beams:** Working stress and limit state design in bending, compression and tension. Design of rolled steel sections, plated beams, concepts of curtailment of flanges. **Plate girders**: Design of web, flanges and stiffeners. Splices and connections using bolts and welding.	13	

4	IV	**Gantry system**: Design gantry girder and gantry column considering I.S code provisions.	8	

Course Outcome:

After going through this course, the students will be able to:

1. Familiar with the material properties of structural steel, analyse the different bolted and welded connections and design them for concentric and eccentric loads.
2. Design different steel sections subjected to axial compression and tension following Indian codes of practices.
3. Comprehend the differences between laterally supported and unsupported flexure members and design of the flexure members using Indian codes of practice.
4. Analyse and design rolled and built up compression members along with base connection subjected to axial compression, bending and tension.
5. Calculate shear force and bending moment on rolled and built up girders and design it following Indian standard design guidelines.
6. Identify different components of gantry system, calculate lateral and vertical loads acting on the system and design them.

TEXT BOOKS:	
Sl. No	**Name**
1.	N. Subramanian , "Design of steel structures", Oxford University Press
2.	A.S. Arya and J.L. Ajmani, " Design of steel structures", Nemchand and Bros.
3.	S.K. Duggal , "Limit state design of steel structures (2^{nd} edition)", McGraw Hill India, New Delhi.

REFERENCES:	
Sl. No.	**Name**
4.	M.L. Gambhir , "Fundamentals of structural steel design", McGraw Hill India, New Delhi
5.	Karuna Moy Ghosh , "Analysis and design of steel structures, 2^{nd} ed.", Prentice Hall, India

Reference code: IS: 800 – 2007, SP 6 (I) – 1964.

Course Name: ECONOMICS FOR ENGINEERS Course Code: HMTS 3201					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	**0**	**0**	**3**	**3**

Module 1:

Market: Meaning of Market, Types of Market, Perfect Competition, Monopoly, Monopolistic and Oligopoly market.

The basic concept of economics – needs, wants, utility.

National Income - GDP, GNP. Demand & Supply, Law of demand, Role of demand and supply in price determination, Price Elasticity.

Inflation: meaning, reasons, etc. **(6L)**

Module 2:

Business: Types of business, Proprietorship, Partnership, Joint-stock company, and cooperative society – their characteristics.

Banking: role of commercial banks; credit and its importance in industrial functioning. Role of central bank: Reserve Bank of India.

International Business or Trade Environment. **(4L)**

Module 3:

Financial Accounting- Journals, Ledgers, Trial Baslance, Profit & Loss Account, Balance Sheet.

Financial Statement Analysis (Ratio and Cash Flow analysis). **(8L)**

Cost Accounting- Terminology, Fixed, Variable and Semi-variable costs.

Break Even Analysis. Cost Sheet. Budgeting and Variance Analysis.

Marginal Cost based decisions. **(6L)**

Module 4:

Time Value of Money: Present and Future Value, Annuity, Perpetuity.

Equity and Debt, Cost of Capital. **(4L)**

Capital Budgeting: Methods of project appraisal - average rate of return - payback period - discounted cash flow method: net present value, benefit cost ratio, internal rate of return.

Depreciation and its types, Replacement Analysis, Sensitivity Analysis. **(8L)**

Suggested Readings:

1. R. Narayanswami, *Financial Accounting- A Managerial Perspective.* Prentice-Hall of India Private Limited. New Delhi
2. Horne, James C Van, *Fundamentals of Financial Management*. Prentice-Hall of India Private Limited, New Delhi
3. H. L. Ahuja., *Modern Economic Theory*. S. Chand. New Delhi.
4. Newman, Donald G., Eschenbach, Ted G., and Lavelle, Jerome P. *Engineering Economic Analysis.* New York: Oxford University Press. 2012.

Course Name: AIR AND NOISE POLLUTION Course Code: CIVL 3241					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	**0**	**0**	**3**	**3**

Course Objective:
The course will assist the students to:
1. Understand the essential concepts of Air and Noise pollution.
2. Relate the level of air pollution to human health impacts.
3. Develop skills relevant to control of air pollution.

SL. No.	Module	Details of Course Content	Hours	Total
1	I	**Introduction**: Overview on Environmental Pollution-Air, Water, Solid waste. Concept of Pollution control- Air, Water, Solid waste. **Air Pollution**: Air Pollutants: Types- Primary and secondary pollutant, Sources, Effects; Air quality standard. Meteorological aspect of Air Pollution: Lapse Rate, Inversion, Plume Pattern; Air Pollution Dispersion Model: Point Source Gaussian Plume Model, Stability Classes, Stability Charts, Design of Stack Height.	2 8	40
2	II	**Air pollution Control**: Self cleansing mechanism of the environment; Dilution method; Engineered Control of Air Pollutants: Control of the particulates, Control of Gaseous Pollutants, Control of Air pollution from Automobiles. **Industrial Water pollution control**: Characteristics of various industrial waste water, physical and chemical. Specific treatment technologies- physical, chemical and biological, Management of treatment plant sludge.	8 2	
3	III	**Noise Pollution:** Definition; Sources of noise, characteristics of noise; Sound Pressure, Power and Intensity level; Noise Measurement: Relationships among Pressure, Power and Intensity Levels, Frequency Band, Decibel Addition, Measures of community Noise i.e. LN, Leq, Ldn, Lnp; strategies for noise pollution control. **Global Environmental Issues**: Ozone Depletion, Acid Rain, Global Warming-Green House Effects, Eutrophication, photochemical smog.	6 2	

4	IV	**Administrative Control on Environment:** Functions of Central and State Pollution Control Boards; Environmental Clearance Process for Industries and Infrastructural Projects. **Environmental Laws:** Relevant Water Acts, Air Acts, Motor Vehicle Acts, solid and hazardous waste acts. **Urban Waste Management:** Introduction, Source, Quality and composition of municipal solid waste, Collection, transfer, processing and transportation, Method of disposal- Sanitary landfill, Composting, Incineration, Pyrolysis, Anaerobic digestion and Energy recovery.	2 2 4	

References:

Sl.No.	Title	Author	Publisher
1	Introduction to Environmental Engineeringand Science	G. Masters, W. Ela	PHI
2	Environmental Engineering: A Design Approach	A. Sincero, G. Sincero	PHI
3	Environmental Engineering	H. Peavy, D. Rowe, G. Tchobanoglous	TMH
4	Environmental Engineering, Vol. II	S. K. Garg	Khanna Publishers
5	Air Polution	Rao and Rao	TMH
6	Water Supply, Waste Disposal and Environmental Pollution Engineering	A. K. Chatterjee	Khanna Publishers
7	Sewage Treatment & Disposal And Wastewater Engg	P. N. Modi	Standard Book House

Course Outcome:

After going through this course, the students will be able to:

1. Understand the basic concepts of environmental pollution.
2. Justify the use of pollution control equipment and their design.
3. Identify air pollution problems.
4. Understand industry specific treatment technologies.
5. Assess the various aspects of noise pollution and understand the different environmental laws.
6. Get an overall understanding of various ways to manage solid waste.

Course Name: ENVIRONMENTAL IMPACT ASSESSMENT Course Code: CIVL 3242					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	**0**	**0**	**3**	**3**

Course Objective:

The course will assist the students to:

1. Identify the need to assess and evaluate the impact on environment.
2. Summarize the major principles of environmental impact assessment.
3. Understand the different steps within environmental impact assessment.

Sl. No.	Module	Details of Course Contents	Hours	Total
1.	I	**Environment & its components:-** Concept of Environment and Ecology. Classification of Ecology, Ecological Imbalances, Sustainable Development, Eco-system- Structure, Function & productivity. Pyramid of energy. Different types of eco-system- Forest, Grass land, Dessert, marine etc. Analysis of eco-system. Inter-relationship in an eco-system.	8	40
2.	II	**Introduction to EIA:-** EIA functions, Social Impact Analysis, Basic Principles, Procedure, Objectives of EIA, Essential Components- Environmental planning, MIS (Management Information System), Monitoring, Research, Performance review. Methodology of EIA, Limitations of EIA, contents of EIA documentation.	12	
3.	III	**EIA of Various Projects:-** EIA of Thermal Power Plants, Mining & Water Resources project, EIA- Case study of projects. **Risk Analysis:-** EIA Specialized areas like Environmental health impact assessment, Environmental risk analysis, Economic valuation methods, Cost-benefit analysis. Prediction and assessment of impacts on physical, biological and socio-economic environment. Resettlement and rehabilitation.	12	
4.	IV	**Legislation:-** National & International laws, India's impact	8	

		assessment notification (1994,2006). Role of control boards for obtaining environmental clearance, Role of general public, Post project monitoring by governing bodies.		

Course Outcome:

After going through this course, the students will be able to:

1. Learn and understand the basics of ecology and environment.
2. Characterize the different types of ecosystem and their inter-relationship.
3. Assess risks posing threats to the environment.
4. Assess different case studies/examples of EIA in practice.
5. Assess the importance of stakeholders in the EIA process.
6. Understand and implement the analysis of EIA for various projects.

Course Name: GROUND IMPROVEMENT TECHNIQUES Course Code: CIVL 3243					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	**0**	**0**	**3**	**3**

Course Objective:

The course will assist the students to:

1. Classify various methods of ground improvement techniques based on the soil conditions.
2. Demonstrate different types of in-situ treatment for cohesionless and cohesive soils.
3. Develop the concept of reinforced earth and analyze the related problems accordingly.
4. Identify different grouting techniques to improve soil condition.

Sl. No.	Module	Details of Course Content	Hours	Total
1.	I	**PROBLEMATIC SOIL AND IMPROVEMENT TECHNIQUES** Introduction, Role of Ground Improvement in Foundation Engineering, Methods of Ground Improvement, Selection of Suitable Ground Improvement Techniques Based on Soil Conditions. **Filtration, Drainage and Dewatering:** Introduction, Design Consideration, Design Parameters, Design Examples.	10	40
2.	II	**IN-SITU TREATMENT OF COHESIONLESS AND COHESIVE SOILS** In-Situ Densification of Cohesionless Soils and Consolidation of Cohesive Soils: Dynamic Compaction, Vibroflotation, Sand Compaction Piles and Deep Compaction. Preloading with Sand-Drains, and Fabric Drains, Stone Columns and Lime Columns – Installation Techniques – Simple Design – Relative Merits of above Methods and their Limitations.	10	
3.	III	**EARTH REINFORCEMENT** Concept of Reinforcement, Types of Reinforcing Material, Reinforced Earth Wall – Mechanism, Simple Design – Applications of Reinforced Earth. Overview and Classification of Geotextiles, Role of Geotextiles in Filtration, Drainage, Erosion Control, Road Works and Containment. Concept of Soil Nailing, Soil and Rock Anchors – Simple Design, Overview of Underpinning.	10	

4.	IV	**GROUT TECHNIQUES** Types of Grouts, Grout Equipments and Machinery, Injection Methods, Grout Monitoring, Stabilization with Cement, Lime, Flyash and Chemicals, Stabilization of Expansive Soil.	10	

TEXT BOOKS:

Sl. No.	Name
1.	Raj, Purushothama. P., "Ground Improvement Techniques", Laxmi Publications (P) Ltd.
2.	Han, J., "Principles and Practice of Ground Improvement", John Wiley & Sons, Inc.
3.	Koerner, R.M., "Designing with Geosynthetics", McGraw-Hill Book Company.

REFERENCES:

Sl. No.	Name
1.	Moseley, M. P. and Kirsch, K., Ground Improvement Techniques, Spon Press (Taylor and Francis Group)
2.	FHWA-IF-99-015, Ground Anchors and Anchored Systems (Geotechnical Engineering Circular No. 4), FHWA (U.S. Department of Transportation).
3.	FHWA-NHI-10-024, Design and Construction of Mechanically Stabilized Earth Walls and Reinforced Soil Slopes – Volume I (FHWA GEC 011 – Volume I), FHWA (U.S. Department of Transportation).
4.	FHWA-NHI-10-025, Design and Construction of Mechanically Stabilized Earth Walls and Reinforced Soil Slopes– Volume II (FHWA GEC 011 – Volume II), FHWA (U.S. Department of Transportation).

ADDITIONAL READINGS:

Journal and Conference papers in the area of Ground Improvement Techniques.

Course Outcome:

After going through this course, the students will be able to:

1. Identify the importance of ground improvement and its suitability depending on the type of soil.
2. Analyze dewatering methods for ground improvement.
3. Illustrate in-situ densification techniques applied to cohesionless soil.
4. Analyze and design ground improvement technique for cohesive soil.
5. Analyze reinforced earth problems.
6. Examine different types of geotextiles and interpret its function with its applications.
7. Apply the knowledge of grouting for various field applications.

Course Name: ADVANCED STRUCTURAL ANALYSIS Course Code: CIVL 3244					
Contact Hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	**0**	**0**	**3**	**3**

Course Objectives:

1. To understand the behavior and basic concepts of analytical methods for two dimensional Structural Engineering problems
2. To develop the ability for mathematical modeling of structural Systems
3. To understand the Governing differential equations of thin rectangular Plates
4. To understand the basics of stresses, strains, equilibrium and compatibility, and introduction to three-dimensional problems.
5. To provide the student with the tools and an understanding of the use of vectors and tensors in describing the deformation and motion of elastic solids, the formulation of the governing equations using physical laws
6. Increase the ability to solve the solution of simple linear elasticity problems using various analytical techniques.

SL No.	Module	Details of Course Contents	Contact hours	Total
1.	I	Matrix methods of structural analysis: Application of matrix methods to plane truss, beams, continuous frames.	12	42
2.	II	Finite difference and relaxation technique-application to simple problems.	10	
3.	III	Theory of plate bending: Navier's Sol utions. Levy's solution. Plate buckling problem. Membrane theory of domes and cylindrical shells.	10	
4.	IV	Theory of Elasticity: Three dimensional stress and strain analysis, stress strain transformation, stress invariants, equllibrium and compatibility equations. Two dimensional problems in Cartesian and polar coordinates. Plane stress, plane stain problems, St. Venant's principle.	10	

Course Outcome:

At the completion of this course, the student should able to

1. Apply stiffness and flexibility method using system approach
2. Develop skill in understanding the behavior of plates and analytical techniques to solve the two dimensional structural engineering problems

3. Construct the mathematical models of structural systems
4. Understand the application of differential equations for the response of 2 D problem
5. Define 3D state of stress and strains, equilibrium and compatibility.
6. Derive the governing equations and their solutions for application to problems in plane stress state, plane strain state, torsion, bending.

References:

1. Matrix, finite element, computer and structural analysis, M. Mukhopadhyay, ANE Books.
2. Intermediate Structural analysis, C. K. Wang, Mc-Graw Hill
3. Matrix method of Structural Analysis, P.N.Godbole, R.S. Sonparote, S.U.Dhote, PHI.
4. Theory of Plates and Shells, Timoshenko & Krieger, Mc-Graw-Hill
5. Theory of Elasticty, Timoshenko & Goodier, Mc-Graw-Hill

Course Name: REPAIR AND REHABILITATION OF STRUCTURES					
Course Name: CIVL 3221					
Contact hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	**0**	**0**	**3**	**3**

Course Objective:

The course will assist the students to:

1. Identify the causes of deterioration in structures and suggest suitable remedial measures.
2. Illustrate the types of damages and understand their mechanisms.
3. Infer the causes and prevention mechanisms of corrosion in steel reinforcement.
4. List down various types and properties of repair materials.
5. Evaluate a structural damage and recommend suitable repair and strengthening methods, identify the latest health monitoring and building instrumentation methods.

Sl. No.	Module	Details of Course Content	Hours	Total
1	**I**	**Durability and Deterioration of Structures:** **Causes of Deterioration:** **Physical causes -** Weathering action, creep, shrinkage, temperature effect, fire damage, foundation settlement, accidental loading. **Chemical causes -** Chloride and salt attack, sulphate attack, alkali reaction, biological attack. **Corrosion effect on RCC structures:** Corrosion process and mechanism, damage due to corrosion, causes and prevention of corrosion.	**4** **4** **3**	**44**

2	**II**	**Damage Assessment & Repair Materials:** **Damage Assessment:** Site survey, workmanship, cracks and pattern of cracking, erosion, spalling, joint leakage and seepage non-destructive, semi-destructive and destructive testing. **Repair Materials:** Function of repair materials, chemical admixtures, patching, sealing, watering proofing and bonding materials. **Special type of repair materials:** Chemical admixtures, mineral admixtures, epoxy resin, polymeric materials, fiber reinforcement, ferrocement.	**4** **3** **4**	
3	**III**	**Repair and Rehabilitation:** **Planning for repair:** Identification of the causes for deterioration, planning for the repair methods **Repair of cracks and damages:** Repair procedure, methods of repair, concrete removal and preparation for repair, blasting, crushing, impacting, milling, mechanical and chemical cleaning, blast cleaning, bonding agents, reinforcement steel and anchors. **Restoration of original strength:** Strengthening of RC members.	**2** **6** **3**	
4	**IV**	**Retrofitting of Structures:** **Techniques for Retrofitting:** Introduction, structural concrete strengthening, strengthening with external reinforcement, external post tensioning, section enlargement, seismic rehabilitation of existing building. **Retrofitting of RCC structures:** Structural deficiencies retrofit strategies. **Retrofitting of foundations:** Identification of the deficiencies, methods of execution. **Retrofitting using FRP composites:** Strengthening of masonry walls, RCC beams, columns.	**3** **3** **3** **2**	

Course Outcomes:

After learning the course the students should be able to:

1. Identify various damages to concrete structures
2. Predict damage assessment of any building showing signs of deterioration and thus should be able to detect the possible cause /source of deterioration.
3. Develop a detailed knowledge of the concrete repair industry equipped with variety of repair materials and techniques.
4. Utilize various types of newly developed repair materials in the process repair and rehabilitation of structures.
5. Summarize and apply the importance of quality control in concrete construction and significance of protection and maintenance of structures.
6. Assess damage to structures and various repair and retrofitting techniques.

RECOMMENDED BOOKS:

TEXTBOOKS	
Sl. No.	**Name of the books**
1.	Bhattacharjee J. *Concrete Structures: Repair, Rehabilitation and Retrofitting,* CBS Publishers & Distribution Pvt. Ltd.
2.	Gambhir M.L. *Concrete Technology- Theory & Practice,* Tata Mcgraw Hill Education Pvt. Ltd.
3.	*Handbook on Repair & Rehabilitation of R.C.C. Buildings,* Central Public Works Department

REFERENCE BOOKS:

TEXTBOOKS	
Sl. No.	**Name of the books**
1.	Grantham M.G. *Concrete Repair- A practical guide,* Taylor & Francis Pvt. Ltd.
2.	Bungey J.H., Millard S.G. & Grantham M.G., *Testing of Concrete in structures,* 4th Edition, Taylor and Francis Publishing House, London and New York, 2006.
3.	*Handbook on causes and prevention of cracks in buildings,* Bureau of Indian Standards
4.	V. M. Malhotra, Nicholas J. Carino, *Handbook on Nondestructive Testing of Concrete,* 2004.

Course Name: SUSTAINABLE CONSTRUCTION METHODS					
Course Name: CIVL 3222					
Contact hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	**0**	**0**	**3**	**3**

Course Objective:

The course will assist the students to:

1. Demonstrate understand the concepts of energy.
2. Outline various building materials and it's impact on environment.
3. Categorize various aspects of sustainable and green building design in the context of global warming and climate change.
4. Develop an insight into various Energy Efficient Materials and Sustainable Construction Technologies.

Sl. No.	Module	Details of Course Content	Hours	Total
1	**I**	**Issues in sustainability:** Economic development along with energy use and carbon emission, energy conservation and renewable energy, energy and construction. Alternative construction materials, sustainability and resources of construction materials.	**5** **6**	**44**
2	**II**	**Sustainable development:** Leed and griha rating system, alternative materials for brick, mortar and concrete. Alternative roofing system, curved roof surfaces. Green building and energy conservation. Alternative construction technologies.	**4** **4** **3**	
3	**III**	**Renewable construction materials:** Mud block, stone block, bamboo based materials, pre-cast construction materials. Alternative structural materials, timber structures, timber and steel. Low cost housing.	**4** **4** **3**	

4	**IV**	**Alternative construction materials:** Lime stone, pozolana, fly ash, rice husk, blast furnace slag. Lime pozolana cement, Lime pozolana mortar, lime fly ash mortar. Stone construction, rubble masonry. Low cost earthquake resistance building. Cast-in-situ roofs. Utilisation of "Construction and demolition" wastes, filler slab.	**5** **6**	

Course Outcomes:

After learning the course, the students should be able to:

1. Develop an understanding on sustainability.
2. Apply the knowledge on renewable energy conservation through material usage.
3. Develop an insight on environmental impact of building materials.
4. Relate the understanding of building materials and construction technique that are sustainable and energy efficient.
5. Demonstrate various aspects of green building construction and it's rating system applied throughout the world.
6. Apply alternate building materials in the construction of low cost houses.

RECOMMENDED BOOKS:

TEXTBOOKS	
Sl. No.	**Name of the books**
1.	Bhattacharjee J. *Concrete Structures: Repair, Rehabilitation and Retrofitting,* CBS Publishers & Distribution Pvt. Ltd.
2.	Gambhir M.L. *Concrete Technology- Theory & Practise,* Tata Mcgraw Hill Education Pvt. Ltd.
3.	*Handbook on Repair & Rehabilitation of R.C.C. Buildings,* Central Public Works Department

REFERENCE BOOKS:

TEXTBOOKS	
Sl. No.	**Name of the books**
1.	Grantham M.G. *Concrete Repair- A practical guide,* Taylor & Francis Pvt. Ltd.
2.	Bungey J.H. *Testing of Concrete in structures*, Taylor and Francis Publishing House.
3.	*Handbook on causes and prevention of cracks in buildings,* Bureau of Indian Standards

Course Name: INDUSTRIAL STRUCTURE DESIGN AND DETAILING LAB					
Course Name: CIVL 3251					
Contact hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	0	**0**	**3**	**3**	**1.5**

Course Outcome:

After going through this course, the students will be able to:

1. Familiar with the material properties of structural steel, analyse the different bolted and welded connections and design them for concentric and eccentric loads.
2. Design different steel sections subjected to axial compression and tension following Indian codes of practices.
3. Comprehend the differences between laterally supported and unsupported flexure members and design of the flexure members using Indian codes of practice.
4. Analyse and design rolled and built up compression members along with base connection subjected to axial compression, bending and tension.
5. Calculate shear force and bending moment on rolled and built up girders and design it following Indian standard design guidelines.
6. Identify different components of gantry system, calculate lateral and vertical loads acting on the system and design them.

Course Details:

Analysis, design and detailing of different components of a factory shed and gantry girder as per IS800-2007.

References: I.S. 875 (part I, II and III) - 1987, I.S: 800-2007, SP: 6 (I) – 1964.

TEXT BOOKS:

Sl. No	Name
1.	N. Subramanian , "Design of steel structures", Oxford University Press
2.	A.S. Arya and J.L. Ajmani, " Design of steel structures", Nemchand and Bros.
3.	S.K. Duggal , "Limit state design of steel structures (2^{nd} edition)", McGraw Hill India, New Delhi.

REFERENCES:

Sl. No.	Name
1.	M.L. Gambhir , "Fundamentals of structural steel design", McGraw Hill India, New Delhi
2.	Karuna Moy Ghosh , "Analysis and design of steel structures, 2^{nd} ed.", Prentice Hall, India

Course Name: COMPUTER-AIDED STRUCTURAL ANALYSIS AND DESIGN					
Course Name: CIVL 3252					
Contact hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	1	**0**	**4**	**5**	**3**

Course Outcome:

After going through this course, the students will be able to:

1. Understand the details of STAAD.Pro software package.
2. Prepare input data of STAAD.Pro.
3. Analyze and design structures using STAAD.Pro software.
4. Design different components of structures.
5. Apply wind load and seismic loads from load definition
6. Assign built up section member properties and generate geometry using structural wizard.

Course Content:

1. Study of capabilities of STAAD software for modeling and design – Radial and Cartesian coordinate systems, generating simple structures like two dimensional and three dimensional frames and truss.
2. Study on space, plane, floor and truss options in STAAD.
3. Assigning steel and concrete materials to different structures. Application of built – up steel sections and steel – concrete composites.
4. Different supports available in STAAD.
5. Different loads like member load, floor load, area load, plate load, wind load, seismic load etc.
6. Design of a concrete framed structure using STAAD.
7. Design of an industrial shed using STAAD.

Course Name: PROJECT PLANNING AND MANAGEMENT					
Course Name: CIVL 3214					
Contact hours per week	**L**	**T**	**P**	**Total**	**Credit Points**
	3	**1**	**0**	**4**	**4**

Course Outcome:

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

1. Develop the bar chart for the project.
2. Compile the tender documents.
3. Estimate the critical path of the project i.e. the maximum duration which the project require for completion.
4. Understand the uses of various construction equipments at site and the preparation of concrete.
5. Make use of the bylaws of different authorities to get the approval of drawings for construction.
6. Understand the process of arbitration in case the projects suffer from disputation.

SL. No.	Module	Details of Course Contents	Contact Hours	Total
1	I	**Planning**: General consideration, Definition of aspect, prospect, roominess, grouping, circulation, Privacy. **Regulation and Bye laws** : Bye Laws in respect of side space, Back and front space, Covered areas, height of building etc., Lavatory blocks , ventilation, Requirements for stairs, lifts in public assembly building, offices **Fire Protection**: Fire fighting arrangements in public assembly buildings, planning , offices, auditorium	2 4 2	36
2	II	**Construction plants & Equipment**: Plants & equipment for earth moving, road constructions, excavators, dozers, scrapers, spreaders, rollers, their uses. **Plants &Equipment for concrete construction**: Batching plants, Ready Mix Concrete, concrete mixers, Vibrators etc., quality control.	4 4	
3	III	**Planning &Scheduling of constructions Projects**: **Planning by CPM**: Preparation of network, Determination of slacks or floats. Critical activities. Critical path. Project duration. **Planning by PERT**: Expected mean time, probability of completion of project, Estimation of critical path, problems.	4 4	

4	IV	**Management: Professional practice**, Definition, Rights and responsibilities of owner, engineer, Contractors, types of contract **Departmental Procedures**: Administration, Technical and financial sanction, operation of PWD, Tenders and its notification, EMD and SD, Acceptance of tenders, Arbritation	4 8	

Recommended books, IS Codes:-

1. Estimating, costing, Specification and Valuation in Civil Engineering by M. Chakroborty
2. Construction Planning, Equipments and methods Puerifoy, R.L. McGraw Hill.
3. Management in construction industry P. P. Dharwadkar Oxford and IBH Publishing company New Delhi
4. Construction Management, Critical path Methods in Construction, J. O. Brien Wiley Interscience
5. PERT and CPM L. S. Srinath
6. Project planning and control with PERT and CPM Construction equipments and its management B. C. Punmia, K. K. Kandelwal and S. C. Sharma
7. National Building code BIS

Course Name: PRINCIPLES OF MANAGEMENT					
Course Code: HMTS4101					
Contact hours per week:	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Outcome:

Upon completion of the course, students will be able

1. To study the evolution of Management.
2. To understand various management functions and have some basic knowledge on different aspects of management.
3. To understand the planning process in an organization.
4. To understand the concept of organizational structure.
5. To demonstrate the ability to direct, lead and communicate effectively.
6. To analyse and isolate issues and formulate best control methods.

Module I:

Introduction (8L)

Management: Definition, nature, purpose and scope of management

Skills and roles of a Manager, functions, principles;

Evolution of Management Thought: Taylor Scientific Management, Behavioural Management, Administrative Management, Fayol's Principles of Management, Hawthorne Studies.

Types of Business organization -Sole proprietorship, partnership, company-public and private sector enterprises -Organization culture and Environment –Current trends and issues in Management.

Module II (8L)

Planning: Types of plans, planning process, Characteristics of planning, Traditional objective setting, Strategic Management, premising and forecasting.

Organizing: Nature and Purpose-Formal and informal, organizational chart, organization structure-types-line and staff authority, departmentalization, delegation of authority, centralization and decentralization.

Controlling: Concept, planning-control relationship, process of control, Types of Control, Control Techniques
Human Resource Management-HR Planning, Recruitment, Selection, Training and Development, Performance Management, Career planning and management

Module III (8L)

Directing: Foundations of individual and group behaviour –motivation –motivation theories –motivational-Techniques –job satisfaction –job enrichment –leadership –types and theories of leadership –Communication –process of communication –barrier in communication –effective communication –communication and IT

Decision-Making: Process, Simon's model of decision making, creative problem solving, group decision-making.

Coordinating: Concepts, issues and techniques.

Module IV (8L)

Leading: Managing Communication: Nature & function of communication, methods of interpersonal communication, barriers of effective communication, direction of communication flow, role of technology in managerial communication

Motivating Employees: Define motivation, compare and contrast early theories of motivation, compare and contrast contemporary theories of motivation & current issues.

Being an Effective Leader Define leader/ leadership, compare and contrast early theories of leadership, understand three contingency theories, understand modern views on leadership. Motivation, Leadership, Communication, Teams and Teamwork.

Management by Objectives (MBO): Management by exception; Styles of management: (American, Japanese and Indian), McKinsey's 7-S Approach, Self-Management

Reference Books:

1. Stephen P. Robbins and Mary Coulter, "Management", Pearson Education, 2017, 13th edition
2. Koontz H. and Weihrich H., "Essentials of Management", McGraw Hill Int. Ed., 2015, 10thedition
3. Bhat A and Kumar A. "Management: Principles, Processes & Practices", Oxford University Press, 2016, 2nd edition
4. Robbins, Coulter, and DeCenzo, "Fundamentals of Management", Pearson Education, 2016, 9th edition
5. Richard L.Daft, "Management", Cengage Learning, 10th edition.

Course Name: PRESTRESSED CONCRETE STRUCTURES					
Course Code: CIVL 4141					
Contact hours per week:	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Objective:

The course will assist the students to:

1. Learn the introduction of prestressed concrete member and its deflection properties.
2. Develop the design criteria of prestressed concrete section for flexure and shear properties.
3. Analyze the anchorage zone stress for post-tensioned members.
4. Improve the knowledge regarding the methods of analysis of statically indeterminate structures.
5. Develop knowledge regarding the composite construction of prestressed and In-situ concrete.
6. Understand the design of prestressed concrete poles and sleepers and introduction of partial prestressing.

SL. No	Module	Syllabus	Hours	Total
1.	I	**Introduction of Prestressed Concrete**: Materials, Prestressing System, Advantages of Prestressing, Analysis of Prestress and Bending Stress, Losses **Deflections of Prestressed Concrete Members**: Importance, Factors, Short term and Long term Deflection	8 4	42
2.	II	**Shear and Torsional Resistance**: Design of Shear Reinforcement, Design of Reinforcement for Torsion, Shear and Bending. **Limit State Design Criteria**: Inadequacy of Elastic and Ultimate Load Methods, Criteria for Limit States, Strength and Serviceability. **Design of Prestressed Concrete Section:** For Flexure & methods by Lin and Magnel.	6 2 4	
3.	III	**Anchorage Zone Stresses in Post Tensioned Members**: Stress Distribution in End Block, Anchorage Zone Reinforcement **Statically Indeterminate Structures**: Advantages of Continuous Member, Effect of Prestressing, Methods of Achieving Continuity and Method of Analysis of Secondary Moments	4 6	
4.	IV	**Composite Construction of Prestressed and In-situ Concrete**: Types, Analysis of Stresses **Prestressed Concrete Poles and Sleepers**: Design of Sections for Compression and Bending. Introduction to Partial Prestressing.	4 4	

Recommended books: -

Code: IS 1343:1980

Text Books:

1. N. Krishna Raju, “Prestressed Concrete”, Fourth Edition, McGraw Hill.
2. N.C.Sinha and S.K.Roy, “Fundamentals of Prestressed Concrete”, S. Chand Publishing.
3. S.Ramamurtham,“Prestressed Concrete”,Dhanpat Rai Books.

Reference Book:

1. T.Y.Lin and N.H.Burns, “Design of Prestressed Structures”, Wiley Eastern Ltd.

Course Outcome:

After going through this course, the students will be able to:

1. Understand the general and mechanical behavior of prestressed concrete.
2. Perform analysis and design of prestressed concrete members and connections.
3. Identify and interpret the appropriate relevant design code.
4. Understand the methods of the design and fabrication of prestressed concrete members.
5. Perform an industry relevant design project in a team.
6. Develop their professional and ethical issues and lifelong learning of the importance of prestressed concrete.

Course Name: DESIGN OF TALL STRUCTURES					
Course Code: CIVL 4142					
Contact hours per week:	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Objective:

The course will assist the students to:

1. Develop a fundamental concept on tall buildings, its requirements and various guiding parameters for analysis and design.
2. Understand various structural forms and their use in tall buildings.
3. Generate the philosophy of dynamic analysis of wind by gust factor method and a basic idea on wind tunnel test.
4. Understand and apply the concept of response spectrum analysis following latest IS codes to address the dynamic nature of seismic excitation.
5. Build an idea on the application of latest ductile detailing codes to detail tall buildings under severe horizontal loads.
6. Analyze and design shear walls in a tall building.

Sl. No.	Module	Details of Course Content	Hours	Total
1.	I	**INTRODUCTION** Concept of tall buildings, factors affecting growth, height and structural forms. Tall building structure- design process, strength and stability, stiffness and drift limitation, creep, shrinkage and temperature effects. **BASIC STRUCTURAL FORMS** Braced frame structures, Rigid frame structures, In-filled frame structure, Flat plate and flat- slab structures, Shear wall structures, Wall- frame structures, Framed-tube structures, Outrigger –braced structures, Suspended structures, Core- structures, Space and hybrid structures.	10	44
2.	II	**WIND ANALYSIS** Design considerations for nature of wind, use of Gust Factor Method to assess the dynamic effect of wind on structures. Introductory concept of wind tunnel test, objectives of wind tunnel tests.	10	
3.	III	**SEISMIC ANALYSIS** Tall building behaviour during earthquakes, use of Response Spectrum Method to assess the dynamic effect of earthquake on structures. Basic concept of Time History Analysis.	12	

4.	IV	**DESIGN PHILOSOPHY OF A TALL BUILDING WITH SHEAR WALLS** Concept of P-delta effects. Concepts of ductile detailing of building, referring to IS 13920-2016. Detailed concept of shear wall design for a Tall building.	12	

TEXT BOOKS:	
Sl. No.	**Name**
1.	Bryan S. Smith and Alex Coull., "Tall Building Structures: Analysis and Design", John Wiley & Sons, Inc, New York, 1991.
2.	P. Agarwal and M. Shrikhande, "Earthquake Resistant Design of Structures", PHI Learning Pvt. Ltd, 2006.
3.	S. N. Manohar, "Design and Construction of Tall Chimneys", McGraw-Hill Book Co., New York, 1972.

REFERENCES:	
Sl. No.	**Name**
1.	B. S. Taranath, "Structural Analysis and Design of Tall Buildings- Steel and Composite Construction", CRC Press, 2012.
2.	M. Sarkisian, "Designing Tall Buildings- Structure as Architecture", Routledge, 2012.
3.	D. Parker and A. Wood, "The Tall Buildings-Reference Book, Routledge", 2013.

CODES:

IS 875 (Part-3): 2015, IS 1893 (Part-1): 2016, IS 1893 (Part 4): 2005, IS 4998 (Part 1): 1992, IS 13920: 2016, IS 16700: 2017.

Course Outcome:

After going through this course, the students will be able to:

1. Demonstrate the requirements and types of tall buildings and explain the parameters involved in analysis and design of the same.
2. Describe and analyze some of the structural forms used in the construction of tall buildings.
3. Analyze tall buildings under wind load by gust factor method following latest IS code and explain the procedure of wind tunnel test in brief.
4. Explain and evaluate the concept of response spectrum analysis following latest IS codes to address the dynamic nature of seismic excitation.
5. Demonstrate the procedure of ductile detailing in tall buildings under severe horizontal loads following latest codes.
6. Analyze and design shear walls in a tall building.

Course Name: AIRPORT, RAILWAY AND HARBOUR ENGINEERING					
Course Code: CIVL 4143					
Contact hours per week:	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Objective:

The course will assist the students to:

1. Develop an idea about railways in India; and to understand the alignment of railway lines, basic components and functions, geometric design of railways.
2. Analyze, design and maintain tracks (rail).
3. Develop an idea of air transport, aircraft characteristics, airport obstructions, runway orientation and to design the runway and taxiway.
4. Develop brief knowledge about terminal area, airport layout, drainage, marking and lighting.

Sl. No.	Module	Details of Course Content	Hours	Total
1.	I	**Railways in India:** *Introduction* - Role of Indian railways in National Development, Railways for urban transportation. *Alignment of Railway Lines* - Location survey, Engineering surveys for track alignment- Obligatory points, Conventional and modern methods. (Remote sensing, GIS). **Permanent Way components and Functions:** Rails- Types of rails, Rail fastenings, Concept of gauges, Coning of wheels, Sleepers- Functions, Materials, Density, Ballast - Functions, Materials, Ballast less tracks. **Geometric Design of railway tracks:**Grade compensation and gradient, Widening of gauges in curves, Super elevation, Horizontal, Vertical and Transition curves.	2 8 4	44
2.	II	**Track Maintenance:** Points and Crossings- Design of Turnouts, Working principles, Various types of track junctions. **Rolling Stock, Railway Section and Yards:** Rolling Stock. Tractive power, Track resistance, Layouts of railway stations and yards, Re-laying of tracks, Level crossings. **Signaling and Interlocking:** Signaling, Interlocking and Track circuiting- Construction and Maintenance. **Design of tracks for high speed:** Geometrical requirements Ballasted or Ballast less, Design methodology, Maintenance considerations.	2 2 2 2	

3.	III	**Air Transport:** Introduction, need for air transport, brief history of air transport, organizations of air transport (IAAI, NAA, AAI, ICAO, FAA), Air transport growth. **Aircraft component and Airport planning:** Component parts and its function, aircraft characteristics and their influence on airport planning, air traffic characteristics, development of new airports, factors affecting airport site selection, Airport Maintenance. **Airport obstruction:** Zoning laws, classification of obstructions, imaginary surfaces, approach zones, turning zones. **Design of Runway and Taxiway:** Runway orientation, wind rose diagrams, basic runway length, corrections for runway length, airport classification, geometric design, airport capacity, runway configuration, taxiway design, geometric standards, exit taxiways, holding aprons, location of terminal buildings, aircraft hangers, parking.	3 4 2 6	
4.	IV	**Terminal area & airport layout:** Terminal area, planning of terminal buildings, apron, size of gate position, number of gate position, aircraft parking system, hanger, general planning considerations blast considerations. **Airport drainage:** Requirement of airport drainage, design data, surface drainage design. **Airport marking and lighting:** Marking lighting of runways, taxiway, approach other areas.	3 2 2	

RECOMMENDED BOOKS:

TEXT AND REFERENCE BOOKS	
Sl. No.	**Name of the books**
1.	A Text Book of Railway Engineering, S.P. Arora & S.C. Saxena. Dhanpat Rai Publication.
2.	Railway Engineering, Satish Chandra, Oxford University press.
3.	Airport planning and Design, S.K.Khanna&M.G.Arora. Nemchand& Bros. Roorkee, India.
4.	Airport Transportation Planning & Design-. Virendra Kumar & Satish Chandra. Galgotia Publication Pvt. Ltd., New Delhi.

Course Outcome:

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

1. Understand the importance of railway infrastructure, planning and design
2. Identify the factors governing the design.
3. Design and analyze the railway track system.
4. Get an idea about air transport (brief idea), different air transport organizations, components of aircraft and their influences on airport, airport planning and obstruction.
5. Analyze wind for runway orientation and design runways as well as taxiways.
6. Have a brief knowledge of terminal area, airport layout, drainage, marking and lighting.

Course Name: ADVANCED FOUNDATION ENGINEERING					
Course Code: CIVL 4144					
Contact hours per week:	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Objective:

The course will assist the students to:

1. Determine bearing capacity of shallow foundation under different soil and loading conditions by various established theories.
2. Develop concept of analysis of beams on elastic foundation and apply it for the analysis of mat foundation.
3. Estimate the load carrying capacity and settlement of pile and drilled pier foundations under different soil and loading conditions.
4. Evaluate the stability conditions for well foundation and cellular cofferdams.
5. Analyze braced excavation and design its various components.
6. Illustrate the effects on foundations constructed on expansive soils and required treatments.

Sl. No.	Module	Details of Course Content	Hours	Total
1.	I	**Shallow foundation**: Terzaghi's, Meyerhoff's, Hansens's bearing capacity theories, bearing capacity based on SPT, for layered soils, under eccentric and inclined loads. **Advanced Method of Analysis**: Beams on elastic foundation, Infinite beam, finite beam, Modulus of subgrade reaction, factors affecting modulus of subgrade reaction. **Combined and mat foundation**: Introduction, safe bearing pressures for mat foundation, eccentric loading, proportioning of cantilever footing, analysis of combined footings and mat foundation by conventional rigid method, analysis of combined footings by elastic line method, analysis of mat foundation by approximate flexible methods, settlement of mat foundation, floating foundation.	12	40
2.	II	**Pile foundation**: Introduction, vertical load carrying capacity, estimation of point load by Vesic's and Meyerhoff's methods, correlation of point load with SPT and CPT results, frictional resistance in clay and sand, point load, tension and laterally loaded piles, Brom's method, efficiency and settlement of pile group in multi-layered deposits, eccentric and inclined loads on pile group, pile load test and cyclic load test, bearing capacity of piles resting in rock, under-reamed piles. **Drilled pier foundation:** Introduction, types, advantages and disadvantages, design parameters, vertical bearing capacity, settlement at working loads, uplift capacity.	12	

3.	III	**Caisson (well) foundation:** Introduction, types of wells or caissons, stability analysis of well foundations, limit equilibrium method for determining grip length of wells in cohesionless and cohesive soils, determination of scour depth in cohesionless soil, thickness of steining of wells. **Cellular cofferdams:** Introduction, components, dimensions, stability analysis.	8	
4.	IV	**Braced excavation**: Introduction, pressure envelope for braced cut design, pressure envelope for cuts in layered soil, design of various components of braced cut, bottom heave of a cut in clay, stability of the bottom of a cut in sand, lateral yielding of sheet piles and ground settlement. **Foundation on Expansive (swelling) soils**: General characteristics, mechanism of swelling, evaluation of swelling potential by single index method, classification of swelling soils by indirect measurement, swelling pressure, estimation of magnitude of swelling, design of foundation in swelling soil.	8	

TEXT BOOKS:	
Sl. No.	**Name**
1.	J. E. Bowels, "Foundation Analysis and Design", McGraw-Hill Book Company.
2.	BrajaM. Das, "Principles of Foundation Engineering", Thomson Book.
3.	N. Som and S.C. Das, "Advanced Foundation Engineering", PHI Learning Pvt. Ltd.
4.	V. N. S. Murthy, "Advanced Foundation Engineering", CBS Publishers
REFERENCES:	
Sl. No.	**Name**
1.	P. C. Varghese, "Foundation Engineering", PHI Learning Pvt. Ltd.
2.	M. Gunaratne, "The Foundation Engineering Handbook", Taylor and Francis group.
3.	H. G. Poulos and E. H. Davis, "Pile Foundation Analysis and Design", Rainbow-Bridge Book Co.
4.	R. W. Day, "Foundation Engineering Handbook", McGraw-Hill Book Company.

ADDITIONAL REFERENCES:

Journal and Conference papers in the area of Advanced Foundation Engineering.
https://nptel.ac.in/courses/105/108/105108069/coordinated by IISc, Bangalore.
https://nptel.ac.in/courses/105/105/105105039/coordinated by IIT, Kharagpur.
https://nptel.ac.in/courses/105/101/105101083/coordinated by IIT, Bombay.

Course Outcome:

After going through this course, the students will be able to:

1. Solve bearing capacity problems of shallow foundations under actual site conditions.
2. Evaluate the importance of raft foundation and principles of design for buildings and tower structures.
3. Analyze and design load pile and drilled pier foundations based on sub-soil investigation report.
4. Predict the stability of well foundation and cellular cofferdams under various types of river beds and loading conditions.
5. Design braced excavation considering construction requirements and its impact on adjacent structures.
6. Identify problems and remedies for foundation in expansive soil.

Course Name: IRRIGATION ENGINEERING					
Course Code: CIVL 4145					
Contact hours per week:	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Objective:

The course will assist the students to:

1. Study occurrence movement and distribution of *water* that is a prime resource for development of a civilization
2. Understand the necessity of irrigation and water requirement of various crops.
3. Introduce students to basic concepts of water, plants, their interactions, as well as irrigation and drainage systems design, planning and management.
4. Provide students an ability to understand the applications of mathematical and scientific concepts in analyzing intricate technical problems of irrigation water management and finding solutions for them.
5. Describe the types and necessity of canal irrigation.
6. Explain the procedure and method of design of irrigation channel.

SL No.	Module	Details of Course Contents	Hours	Total
1.	I	**Introduction to irrigation**: Definition, necessity, benefits and ill-effects of irrigation, Types of Irrigation systems, classification of methods of irrigation, Surface, Sub-surface and Sprinkler irrigation methods, Problems	6	38
2.	II	**Water requirement of crops**: Crop period or Base period, Duty & Delta of a crop, relation between Duty & Delta, Duty at various places, flow Duty and quantity Duty, factors affecting Duty, measures for improving Duty of water, crop seasons, Consumptive use of water-evapotranspiration, Irrigation efficiencies, Problems	10	
3.	III	**Canal Irrigation**: Introduction, classification of irrigation canals, Efficient section, certain important definitions, Time factor, Capacity factor, full supply coefficient, Nominal duty, Channel losses, Examples.	10	

4.	IV	**Design of irrigation Channel:** Procedure of design of irrigation channel by Kennedy's theory, Lacey's theory, Comparison of two theories, Drawbacks in Lacey's theory, Problem related to Kennedy's theory, Lacey's theory Longitudinal section of a channel, Balancing depth, Losses in channels, Maintenance of irrigation channels To provide students an ability to understand the applications of mathematical and scientific concepts to analyse intricate technical, social and environmental problems in irrigation water management and finding solutions for them.	12	

Course Outcome:

After studying the subject, the student will be able to:

1. Develop the knowledge of hydrology that deals with the occurrence, distribution, movement and properties of water on the earth.
2. Understand the concepts of soil-water-plant relationship as well as to expose them to the principles and practices of crop production.
3. Understand the various principles of irrigation management and to analyse the different types of irrigation systems and their performances based on service-oriented approach.
4. Know the basic requirements of irrigation and various irrigation techniques, requirements of the crops
5. Understand the use of economic concepts in irrigation development and to impart knowledge on economic planning so as to enable viable allocation of resources in the irrigation sector.
6. Explain the distribution systems for canal irrigation and the basics of design of unlined and lined irrigation canals design.

Course Name: ADVANCED HIGHWAY AND TRAFFIC ENGINEERING					
Course Code: CIVL 4146					
Contact hours per week:	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Objective:

The course will assist the students to

1. Have a basic idea about geometric design policies as per IRC guidelines, to understand definition, scope of geometric design and design control, factors affecting the geometric design and to design the geometric element of highway.
2. Develop a good understanding about highway location, alignment design, project preparation and design principles of intersection.
3. Conduct basic traffic surveys, analyse the traffic data; understand the traffic flow characteristics (mid-block section and intersection), capacity of roadway, traffic signs, and design traffic signals.
4. Have a basic understanding about traffic impacts, parking studies, accident studies, traffic management techniques, and intelligent transportation system.

Sl. No.	Module	Details of Course Content	Hours	Total
1.	I	**Highway geometric design:** Introduction to highway geometric design: Highway geometric design policies as per IRC guidelines, Definition and scope of geometric design, Primary and dependent design controls. Human and vehicle factors: Human factors and typical vehicle factors applied in geometric design. Elements of design: sight distances; horizontal alignment; transition curves, super elevation and side friction; Vertical alignment: - grades, crest and sag curves; Highway cross-sectional elements and their design for rural highways, urban streets and hill roads.	2 1 6 2	
2.	II	**Highway project preparation:** Survey and investigation – importance, types, traffic survey, guidelines for alignment and route selection, desk study, photogrammetry in highway location, conventional ground study, drainage study, aspect of soil investigation related to pavement, pavement design investigation. Design, drawing, estimates, earthwork quantities, project report, stages in project preparation. **Intersection Design:** Types of intersections, conflicts at Intersections, Requirements of at –grade intersection types of at-grade intersections, channelization –traffic islands; types of grade separated intersections; Rotary intersection –concept of rotary, design factors of rotary Advantages and limitations of rotary intersections.	6 5	

3.	III	**Traffic Engineering I**: Organization of traffic engineering department and its importance under Indian conditions, Road user and vehicle characteristics, Traffic flow parameters - Speed, density and volume relationships, headway, spacing, delay. Traffic measurement techniques, highway capacity and level of service (LOS). Traffic signal design: Design Principles of Traffic Signal, Evaluation of a traffic signal: Delay models.	4 2 6	
4.	IV	**Traffic Engineering II**: Traffic impact, Parking studies, Accident studies- accident characteristics, Road safety principles and practice, Identification of hazardous locations. **Traffic Management:** Traffic management strategies, Traffic management techniques, Work zone traffic management, Traffic calming, Congestion studies and road pricing. **Intelligent Transportation System (ITS):** Introduction, Integrated components of ITS, Major areas of application and working process of ITS.	4 3 3	

RECOMMENDED BOOKS:

TEXT AND REFERENCE BOOKS	
Sl. No.	**Name of the books**
1.	Khanna, Justo, and Veerararagavan. Highway Engineering (Revised 10th Ed.), Nemchand& Bros., Roorkee
2.	F. L. Mannering, S. S. Washburn and W. P. Kilareski, Principles of Highway Engineering and Traffic Analysis, Wiley India, 2011.
3.	L. R Kadiyali. Traffic Engineering and Transportation Planning. Khanna Publishers, New Delhi, 2008.
4.	C. JotinKhisty, B. Kent Lall, Transportation Engineering: An Introduction, Prentice Hall, 2003.
5.	C. S. Papacostas and P. D. Prevedouros. Fundamentals of Transportation Engineering. Prentice-Hall, New Delhi, 2009.
6.	Dr. L. R Kadiyali. Principles and Practice of Highway Engineering, Khanna Publishers.
7.	M A Chowdhary and A Sadek. Fundamentals of Intelligent Transportation systems planning. Artech House Inc., US, 2003.
8.	Sussman, J. Perspectives on Intelligent Transportation Systems (ITS). New York, NY: Springer, 2005.
9.	T. R. Currin, Introductions to Traffic Engineering: A Manual for Data Collection and Analysis. Brooks/Cole Thomason Learning, Canada, 2001.
10.	Hensher, D.A. and K.J. Button (eds) (2003) Handbook of Transport and the Environment, Handbooks in Transport #4, Amsterdam: Elsevier.

CODES / STANDARDS FOR REFERENCE	
Sl. No.	**Name of the Codes**
1.	A policy on geometric design of highways and streets, American Association of State Highway Officials, 2011.
2.	Geometric design standards for urban roads in plains (IRC: 86- 1983), The Indian Roads Congress, 1983.
3.	Geometric design standards for rural (non-urban) highways (IRC: 73-1980), The Indian Roads Congress, 1980.
4.	Guidelines for expressways – Part I, Ministry of Road Transport & Highways, 2010.
5.	Various other relevant codes on geometric design such as IRC: SP:87-2010, IRC: SP:84-2009, IRC: SP:48-1998, IRC:92-1985
6.	Highway Capacity Manual. Transportation Research Board. National Research Council, Washington, D.C., 2010.

Course Outcome:

After going through this course, the students will be able to:

1. Understand the geometric design policies, design control and factors affecting it.
2. Design the geometric elements of highway.
3. Understand highway location, alignment design, project preparation and design principles of intersection.
4. Conduct traffic studies, analyze traffic data and design traffic signals.
5. Analyze parking & accidents; understand traffic impacts, traffic management techniques.
6. Understand traffic management and intelligent transportation system.

Course Name: SOLID AND HAZARDOUS WASTE MANAGEMENT					
Course Code: CIVL 4147					
Contact hours per week:	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Objective:

The course will assist the students to:

1. Understand the components of solid waste management system.
2. Study the collection, transfer and transport of municipal solid waste.
3. Examine the various processing/treatment options and study operations of various material recovery, resource recovery and energy recovery facility.
4. Study the design and operation of a solid waste landfill, site remediation and reclamation.
5. Develop knowledge about the different industrial solid waste pollutants and their minimization and recovery technologies.

Sl.No.	Module	Details of Course Contents	Hours	Total
1.	I	**Fundamentals of Solid Waste Management and ISWM system:** Sources and types of Municipal Solid Waste, waste generation rates, factors affecting generation, composition, characteristics, methods of sampling, effects of improper disposal of solid waste, functional elements of solid waste management, Municipal Solid Waste Rules; concept of ISWM system, source reduction of waste — reduction, reuse, recycling, onsite storage methods, handling and segregation of wastes at source.	8	40
2.	II	**Waste collection and Transportation:** Methods of collection of municipal solid wastes, collection vehicles, primary and secondary collection, manpower, collection routes, vehicle routing, transfer station – location and operation.	10	
3.	III	**Waste processing techniques:** Objectives of waste processing, component separation and volume reduction, various processing technologies — biological and chemical conversion methods, resource and energy recovery from composting, bio-methanation, thermal processing methods, design of a composting facility and incinerator. **Landfill design and operation**: Various disposal methods, landfills — site selection, site infrastructure, essential components of landfill; types of landfilling methods, landfill planning – phased operation, leachate management and gas control; Environmental monitoring systems for landfill sites, closure and post-closure plans for landfills, landfill site rehabilitation, reclamation and remediation.	14	

4.	IV	**Hazardous Waste Management –**Basic Characterization of hazardous waste; compatibility and flammability of chemicals; fate and transport of chemicals; health effects. Chemical and thermal treatment of hazardous waste – Solidification, chemical fixation and encapsulation, incineration. **Radioactive Waste Management –**Basic Sources, measures and health effects; nuclear power plants and fuel production; waste generation from nuclear power plants; disposal options.	8	

RECOMMENDED BOOKS:

1. CPHEEO, Ministry of Urban Development: Manual on Municipal Solid Waste Management 2000.
2. CPHEEO, Ministry of Urban Development: Manual on Municipal Solid Waste Management 2016 25.
3. Tchobanoglous G., Theisen H., Vigil S.: Integrated Solid Waste Management Engineering Principles and Management Issues (McGraw Hill Education).

Course Outcome:

After going through this course, the students will be able to:

1. Review the components and characteristics of a solid waste management system.
2. Identify the various collection, transfer and transport mechanisms of municipal solid waste management.
3. Design and operate various processing, material and energy recovery facilities.
4. Design and operate solid waste landfill.
5. Identify the different industrial solid waste pollutants and their minimization and recovery technologies.
6. Understand the processing and handling of hazardous and radio-active waste management.

Course Name: SOIL DYNAMICS AND MACHINE FOUNDATION					
Course Code: CIVL 4148					
Contact hours per week:	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Objective:

The course will assist the students to:

1. Develop the concept of theory of vibration.
2. Illustrate different types of wave propagation through elastic, homogeneous and isotropic medium.
3. Interpret dynamic properties of soil.
4. Evaluate liquefaction characteristics of various types of soil profiles.
5. Estimate earth pressure and bearing capacity of shallow foundation under seismic condition.
6. Identify various types of machine foundations and analyze block type machine foundation.

Sl. No.	Module	Details of Course Content	Hours	Total
1.	I	**Introduction:** Scope and objective, Nature and types of dynamic loading, Importance of soil dynamics. **Vibration theory:** Vibration of elementary systems; Degrees of freedom (SDOF and MDOF systems); Equation of motion for SDOF system; Types of vibrations; Earthquake excitation; Undamped and damped free vibrations; Torsional vibration; Critical damping; Decay of motion; Undamped and damped forced vibration; Constant force and rotating mass oscillators; Dynamic magnification factor; Transmissibility ratio, Vibration isolation; Vibration measuring instruments; Equation of motion for MDOF system.	10	40
2.	II	**Wave propagation in an elastic, homogeneous and isotropic medium:** Longitudinal and torsional elastic waves in infinitely long rod; Solution for one-dimensional and three-dimensional equations of motion; Wave propagation in an infinite, homogeneous isotropic, elastic medium, wave propagation in elastic half-space; Earthquake waves – P-wave, S-wave, Rayleigh wave and Love wave; geophysical prospecting, typical values of compression and shear wave velocities. **Dynamic Soil Properties:** Stresses in soil element; Determination of dynamic soil properties; Field tests; Laboratory tests; Model tests; Stress-strain behavior of cyclically loaded soils; Estimation of shear modulus; Modulus reduction curve; Damping ratio; Linear, equivalent-linear and non-linear models; Ranges and applications of dynamic soil tests, factors affecting shear modulus, elasticmodulus and elastic constants.	10	

3.	III	**Dynamic earth pressure:** Introduction, pseudo-static methods, displacement analysis. **Dynamic bearing capacity of shallow foundations:** Introduction, dynamic analysis. **Liquefaction**: Introduction, mechanism of liquefaction, Laboratory studies, dynamic triaxial test, Cyclic simple shear test, Comparison of cyclic stress causing liquefaction under triaxial and simple shear conditions, standard curves and correlations for liquefaction, evaluation of zone of liquefaction in field, simplified procedure for liquefaction estimation, evaluation of liquefaction potential using Standard Penetration Resistance, factors affecting liquefaction.	10	
4.	IV	**Machine Foundations:** Introduction, types of machines and foundations, general requirements of machine foundation, Basic design criteria; Methods of analysis; Mass-Spring-Dashpot model; Elastic-Half-Space theory; Tschebotarioff's reduced natural frequency method. Foundations: Modes of vibrations, Vertical, lateral, longitudinal, yawing, pitching and rocking modes of oscillations; Design guidelines as per IS codes; Analysis and design of typical problems. **Introduction to Rotary and Impact type machines.**	10	

TEXT BOOKS:	
Sl. No.	**Name**
1.	Shamsher Prakash, "Soil Dynamics", McGraw-Hill Book Company.
2.	Braja M. Das, "Principles of Soil Dynamics", PWS-KENT Publishing Company.
3.	Steven L. Kramer, "Geotechnical Earthquake Engineering", Prentice Hall Inc.
4.	Srinivasalu and Vaidyanathan, "Hand Book of Machine Foundation", McGraw-Hill.

REFERENCES:	
Sl. No.	**Name**
1.	D. D. Barkan, "Dynamics of Bases and Foundations", McGraw-Hill Book Company.
2.	E. E. Richart Jr., J. R. Hall Jr. and R. D. Woods. "Vibrations of Soils and Foundations", Prentice Hall Inc.
3.	T. H. Wu, "Soil Dynamics", Allyn and Bacon Inc.
4.	S. Saran, "Soil Dynamics and Machine Foundations", Galgotia Publications Pvt. Ltd.

ADDITIONAL READINGS:

Journal and Conference papers in the area of Soil Dynamics and Machine Foundations.
https://nptel.ac.in/courses/105/101/105101005/coordinated by IIT, Bombay.
https://nptel.ac.in/courses/105/107/105107066/coordinated by IIT, Roorkee.

Course Outcome:

After going through this course, the students will be able to:

1. Understand the basic concept of vibration and illustrate wave propagation through medium.
2. Determine dynamic properties of soil.
3. Evaluate dynamic earth pressure and analyze shallow foundation under actual seismic loading.
4. Asses the liquefaction characteristics for different soil profiles.
5. Examine and discuss various machine foundations.
6. Design block type machine foundation machines for wide range of speeds, loads and operating conditions.

Course Name: PROJECT PLANNING AND MANAGEMENT					
Course Code: CIVL 4121					
Contact hours per week:	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Objective:

The course will assist the students to:

1. Understand the tender and bar chart of any project.
2. Compute the critical path of a project.
3. Understand the various construction equipments and its suitability.
4. Study the design and operation of a solid waste landfill, site remediation and reclamation.
5. Develop knowledge about the different by-laws and understand the process of arbitration.

Sl. No.	Module	Details of course content	Hours	Total
1.	I	**Planning** General consideration, Definition of aspect, prospect, roominess, grouping, circulation, Privacy. **Regulation and By-laws** By-Laws in respect of side space, Back and front space, covered areas, height of building etc.,Lavatory blocks, ventilation, Requirements for stairs, lifts in public assembly building, offices **Fire Protection** Firefighting arrangements in public assembly buildings, planning, offices, auditorium	2 4 2	36
2.	II	**Construction plants & Equipment** Plants & equipment for earth moving, road constructions, excavators, dozers, scrapers, spreaders, rollers, their uses. **Plants &Equipment for concrete construction** Batching plants, Ready Mix Concrete, concrete mixers, Vibrators etc., quality control.	4 4	
3.	III	**Planning &Scheduling of constructions Projects** **Planning by CPM:** Preparation of network, Determination of slacks or floats. Critical activities. Critical path. Project duration **Planning by PERT** Expected mean time, probability of completion of project, Estimation of critical path, problems.	4 4	
4.	IV	**Management: Professional practice:** Definition, Rights and responsibilities of owner, engineer, Contractors, types of contracts. **Departmental Procedures:** Administration, Technical and financial sanction, operation of PWD, Tenders and its notification, EMD and SD, Acceptance of tenders, Arbitration.	4 8	

TEXT BOOKS:	
Sl. No.	**NAME**
1.	M. Chakroborty, “Estimating, Costing, Specification and Valuation in Civil Engineering”, M. Chakroborty publisher.
2.	P. P. Dharwadkar, “Management in Construction Industry”, Oxford and IBH Publishing company New Delhi.
3.	L. S. Srinath, “PERT and CPM Principles and Applications”, Affiliated East-West Press (Pvt.) Ltd.
4.	B. C. Punmia, K. K. Kandelwal, “Project Planning and Control with PERT and CPM”, Laxmi Publications Private Limited.

REFERENCE BOOKS:	
Sl. No.	**NAME**
1.	R. Puerifoy, C. J. Schexnayder and A. Shapira, “Construction Planning, Equipments and Methods”, McGraw Hill.
2.	J. O′Brien and Fredrick L. Plotnick, “CPM in Construction Management”, McGraw-Hill Education.
3.	National Building code BIS.

Course Outcome:

After going through this course, the students will be able to:

1. Develop the bar chart for the project.
2. Compile the tender documents.
3. Estimate the critical path of the project i.e., the maximum duration which the project requires for completion.
4. Understand the uses of various construction equipments at site and the preparation of concrete.
5. Make use of the bylaws of different authorities to get the approval ofdrawings for construction.
6. Understand the process of arbitration incase the projects suffer from disputation.

Course Name: INTRODUCTION TO SURVEYING					
Course Code: CIVL 4122					
Contact hours per week:	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Objective:

The course will assist the students to:

1. Carry out preliminary surveying in the field.
2. Take accurate measurements, field booking, plotting and adjustment of traverse.
3. Use various conventional instruments involved in surveying.
4. Interpret previously plotted maps and contour plots with reference to a benchmark.
5. Explain any open or closed traverse in a surveying work.
6. Build knowledge to take horizontal distance using angular measurements by tacheometry.

Sl. No.	Module	Details of Course Content	Hours	Total
1.	I	**INTRODUCTIONTO SURVEYING** Definition, principles of surveying, types of scales (numerical problems), basic concepts of plans and maps. **CHAIN SURVEYING** Types of chains, accessories for chain surveying with their use, methods of ranging and methods of offsets, obstacles in chain surveying.	10	40
2.	II	**COMPASS SURVEYING** Definition, instrument and terminology, local attraction and its elimination, open and closed traverse, adjustment of traverse. **PLANE TABLE SURVEYING** Principle, equipment and methods, two and three point problems.	10	
3.	III	**LEVELING** Definitions and terminology, types and methods of leveling, use of leveling instruments and supporting accessories. **CONTOURING** Different terms used in contouring, characteristics of contour and contour interval, preparation of contour maps.	10	
4.	IV	**THEODOLITE SURVEYING** Components of Theodolite, adjustments, measurement of vertical and horizontal angels, concepts of trigonometric leveling. **TACHEOMETRY** Definitions and principles of tacheometry and stadia system, fixed hair stadia method, calculation of horizontal and vertical distance using tacheometer.	10	

TEXT BOOKS:	
Sl. No.	**Name**
1.	Basak N.N. *Surveying and Levelling.* 2nd edition, McGraw Hill Education.
2.	Roy S.K. *Fundamentals of Surveying*. 2nd edition, PHI Learning Pvt. Ltd-New Delhi.
3.	Kanetkar T. P. and Kulkarni S. V. *Surveying & Levelling* (Part – 1). Pune Vidyarthi GrihaPrakashan Pune.
REFERENCES:	
Sl. No.	**Name**
1.	Venkatramaiah C. *Textbook of Surveying*. 2nd edition, Orient Blackswan Pvt. Ltd. –New Delhi.
2.	Duggal S. K. *Surveying (Vol-1 and 2).* 4th edition, McGraw Hill Education (India) Pvt Ltd.

Course Outcome:

After going through this course, the students will be able to:

1. Explain the basic principles of surveying.
2. Outline the basics of linear measurement methods like chain surveying.
3. Illustrate the basics of angular measurement methods like compass surveying.
4. Demonstrate the basic concept of plane table surveying.
5. Describe the concepts of leveling and contouring.
6. Demonstrate the method of theodolite survey in terms of elevation and angular measurements, along with tacheometry.

Course Name: AN INTRODUCTION TO CONCRETE TECHNOLOGY					
Course Code: CIVL 4126					
Contact hours per week:	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Objective:

The course will assist the students to:

1. Know the basic information regarding quality of water to be used in concrete, it's pH level and harmful contents.
2. Know various physical, chemical and rheological properties of fresh concrete such as workability, slump test, compacting factor test, flow table test, segregation, bleeding, setting time, various curing methods and maturity of concrete.
3. Know various strength properties of concrete and microstructural aspects of concrete: hydration phases, gel space ratio.
4. Know the variety of admixtures used in concrete, their effects and advantages and disadvantages; Mix design of concrete as per IS 10262:2009, 2019.
5. Know the application of various types of concrete; introduction to non-destructive tests such as Rebound Hammer and UPV.

Sl.No.	Module	Details of Course Contents	Hours	Total
1.	I	**QUALITY OF WATER** Mixing water, Curing Water, Harmful Contents. **PROPERTIES OF FRESH CONCRETE** Workability, Factors Affecting Workability, Slump test, Compacting Factor Test, Flow Table Test, Segregation, Bleeding, Setting time, Mixing and Vibration of Concrete, Mixers and Vibrators, Curing Methods, Maturity.	3 6	36
2.	II	**STRENGTH OF CONCRETE** Water/Cement ratio, Gel/Space ratio, Strength in Tension, Compression, Effect of Age on Strength, Relation between Compressive and Tensile Strength, Fatigue Strength, Stress-Strain Relation and Modulus of Elasticity, Poisson's Ratio, Shrinkage and Creep, Compression Test on Cubes, Cylinders.	9	
3.	III	**ADMIXTURES** Different types, Effects, Uses, Retarders and Admixtures. **MIX DESIGN BY I.S. 10262(2009)**	9	
4.	IV	**SPECIAL CONCRETE & CONCRETING TECHNIQUES** Light- weight Concrete, High performance Concrete. Polymer Concrete, Fibre-reinforced Concrete, Waste Material Based Concrete, Shotcrete, Ferrocement, Self-Compacting Concrete, Foam Concrete Modification in the Microstructure. Deterioration of reinforced Concrete and its Prevention. Repair Technology and its restoration and health monitoring. **INTRODUCTION TO NON-DESTRUCTIVE TESTS** (rebound hammer & ultrasonic pulse velocity).	6 3	

RECOMMENDED BOOKS:

TEXT BOOKS	
Sl. No.	**Name of the books**
1.	A.M. Neville, "Properties of Concrete", Pearson Education Publication.
2.	M.S. Shetty, "Concrete Technology", S. Chand Publishing House.
3.	M.L. Gambhir, "Concrete Technology: Theory and Practice", 5th Edition, Tata McGraw Hill Education.
4.	J. Bhattacharjee, "Concrete Structures: Repair, Rehabilitation and Retrofitting", CBS Publications.

REFERENCE BOOKS

Sl. No.	Name of the books
1.	P. Kumar Mehta and Paulo J.M. Monteiro, "Concrete: Microstructure, Properties, and Materials", Tata McGraw Hill Education.
2.	A.M. Neville&J. J. Brooks,"Concrete Technology", Pearson Education.
3.	S.C. Rangwala,"Engineering Materials", Charotar Publishing.

Relevant IS Codes: IS 10262:2009, IS 10262: 2019.

Course Outcome:

After going through this course, the students will be able to:

1. Understand the properties of ingredients of concrete.
2. Study the behavior of concrete at its fresh and hardened state.
3. Study about the concrete design mix.
4. Know about the procedures in concreting.
5. Understand special concrete and their use.
6. Understand the various Non-Destructive tests.

Course Name: ESTIMATION AND VALUATION					
Course Code: CIVL 4127					
Contact hours per week:	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Objective:

The course will assist the students to:

1. Know the importance of preparing the types of estimates under different conditions.
2. Know about the rate analysis and bill preparations.
3. Know how to prepare a format for preparation and presentation of an estimate.
4. Study about the specification writing.
5. Understand the valuation of land and buildings

SYLLABUS:

Sl.No.	Module	Details of Course Contents	Hours	Total
1.	I	**Introduction of Estimation in Civil Engineering:** Introduction-Principles of estimating, Types of estimates, approximate estimates, items of work, unit of measurement, unit rate of payment. **Preparation of Bill of Quantities:** Measurements and calculations of quantities of Civil engineering works, Preparation of abstracts of bill of quantities.	3 6	36
2.	II	**Analysis of Rates of different items with specifications:** Specifications for materials and construction of a building. Rate analysis for Earthwork, PCC, Shuttering, Reinforcement, RCC, brick work, plastering, flooring and finishing, Use of standard schedules such as PWD schedules of rates. Specifications.	3 6	
3.	III	**Quantity Estimation of infrastructures:** Quantity estimates of road, Underground reservoir, Surface drain, Septic tank	9	
4.	IV	**Valuation:** Concept of price, value and cost. Purpose of valuation; free hold and lease hold properties; market value, present value; sinking fund; year's purchase. Different methods of land valuation. Different methods of valuation of real properties. Outgoing, appreciation, depreciation, different methods for fixation of rents. Valuation of plant and machineries.	9	

REFERENCE BOOKS

Sl. No.	Name of the Books
1.	M. Chakroborty, "Estimating, Costing, Specification and Valuation in Civil Engineering", M. Chakroborty publisher.
2.	B.N. Dutta,"Estimating and Costing in Civil Engineering", USB Publishers & Distributers.
3.	IS CODE SP 34.
4.	National Building Code.

Course Outcome:

After going through this course, the students will be able to:

1. Apply different types of estimates in different situations.
2. Prepare quantity estimates for buildings, roads, rails and canal works.
3. Calculate the quantity of materials required for civil engineering works as per specifications.
4. Demonstrate the concepts of specification writing.
5. Evaluate contracts and tenders in construction practices.
6. Prepare cost estimates.

Course Name: WATER RESOURCES ENGINEERING					
Course Code: CIVL 4115					
Contact hours per week:	L	T	P	Total	Credit Points
	3	1	0	4	4

Course Objective:

The course will assist the students to:

1. Introduce the phenomena of hydrology, watershed and different parts involved in hydrologic cycle.
2. Impart the knowledge of various irrigation techniques, requirements of the crops.
3. Impart the knowledge of hydrology that deals with the occurrence, distribution, movement and properties of water on the earth.
4. Enable the students to understand the processes of measurement of precipitation, evaporation, evapo-transpiration, infiltration, streamflow and runoff.
5. Learn about distribution systems for canal irrigation, design of unlined and lined irrigation canals design sediment problems associated with canal.
6. Enable the students to understand the factors that causes water logging and its effects.

SL No.	Module	Details of Course Contents	Hours	Total
1.	I	**Catchment area and Hydrologic cycle, Measurement of rainfall** – Rain gauges, Estimation of missing rainfall data, checking of consistency, Optimum number of Rain gauges. Calculation of average rainfall over area – different methods, Frequency analysis of rainfall intensity duration curve. Rainfall mass curve, hyetograph, Examples. **Evaporation, evapo-transpiration and infiltration**: Processes, Factors affecting run off, estimation of run-off, rainfall run off relationship.	4 4	36
2.	II	**Stream flow measurement**: Direct and indirect methods, Examples. Stage discharge relationships, back water effect, unsteady flow effect. **Hydrographs**; characteristics: Base flow separation. Unit Hydrographs. Derivation of unit hydrographs, S-curve. **Types of Irrigation systems, methods of irrigation**: Water requirements of crops: Crop period or Base period, Duty & Delta of a crop, relation between Duty & Delta, Duty at various places, flow Duty & quantity Duty, factors affecting Duty, measures for improving Duty of water, crop seasons	4 4 4	

3.	III	**Canal Irrigation**: Introduction, classification of irrigation canals, Efficient section, certain important definitions, Time factor, Capacity factor, full supply coefficient, Nominal duty, Channel losses, Examples.	10	
4.	IV	**Water logging and drainage**: Causes, effects and prevention of waterlogging. Type of drains-open drains and closed drains (introduction only), Discharge and spacing of closed drains. Examples.	6	

RECOMMENDED BOOKS:

SL. No.	Name of Text and Reference books	Author	Publishers
1.	Engineering Hydrology	K. Subramanya	Tata McGraw-Hill
2.	A Text Book of Hydrology	P. Jaya Ram Reddy	Laxmi Publications-New Delhi
3.	Irrigation, Water Resource & Water PowerEngineering	Dr. P.N Modi	Standard Book House-New Delhi
4.	Irrigation and Water Resources Engineering	G.L. Asawa,	New Age International Publishers, New Delhi (2005)

Course Outcome:

After going through this course, the students will be able to:

1. Understand the design of water resources systems utilizing the basic principles of the hydrologic cycle and the watershed.
2. Know about the concepts of movement of ground water beneath the earth.
3. Understand the value of probability and statistical analysis in deriving precipitation and stream flow data and hydrograph theories.
4. Impart the knowledge of irrigation techniques, efficiencies, optimal irrigation of the fields, consumptive water requirements of the crops and crop types.
5. Understand the distribution systems for canal irrigation and the basics of design of unlined and lined irrigation canals system.
6. Master the concept of water logging and drainage systems.

Course Name: HYDRAULIC STRUCTURES					
Course Code: CIVL 4241					
Contact hours per week:	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Objective:

The course will assist the students to:

1. Integrate hydraulics and water resources background by involving the students in water structures design applications.
2. Develop understanding of the basic principles and concepts of analysis and design of hydraulic structures.
3. Develop insight into the basic physical principles that govern the control of flows in hydraulic systems
4. Explain analytical and mathematical skills needed to describe and predict flow conditions in hydraulic structures
5. Develop ability in students to effectively apply various principles and skills to the analysis and design of structures in hydraulic system.
6. Understand the fundamental concept, design and maintenance of hydraulic structures such as dams, diversion headworks etc.

Sl. No.	Module	Details of Course Contents	Hours	Total
1.	I	**Diversion Head Works:** Necessity, Difference between Weir and Barrage, Type of Weirs, Selection of site, layout and description of each part, Effects of construction of a weir on the river regime.	8	38
2.	II	**Theories of seepage and Design of weirs and Barrages:** Failure of Hydraulic Structures Founded on Pervious foundations: i) By piping ii) By Direct uplift, Bligh's creep theory of seepage flow, Khosla's theory & concept of flow nets, concept of exit gradient and critical exit gradient, Khosla's method of independent variable for determination of pressures and exit gradient for seepage below a weir or a barrage, necessary corrections, examples.	10	

3.	III	**Dam (General):** Definition, classification of Dams, factors governing selection of type of dam, selection of suitable site for a dam. **Earthen Dams:** Introduction, Types of Earthen Dams, Methods of Construction, Causes offailure, Design Criteria, Determination of line of seepage or phreatic line in Earthen Dam, seepage control in Earthen Dam, Examples.	5 5	
4..	IV	**Gravity Dam:** Definition, Typical cross- section, Forces acting on Gravity Dam, Combination of forces for design, Mode of failure and criteria for structural stability of Gravity Dams, Principal and shear stresses. Elementary profile of a Gravity Dam, Concept of High and low Gravity Dam, Examples.	10	

Recommended Books:

Text and Reference Books	
Sl. No.	**Name of the books**
1.	"Irrigation Engineering and hydraulic structures." by Santosh Kumar Garg (Khanna Publishers)
2.	"Irrigation, water Resources and Water Power Engineering." ByP.N.Modi (Standard Book House, Delhi-6)
3.	"Irrigation and Water Resources Engineering" by G.L. Asawa, (New Age International Publishers, New Delhi (2005).)

Course Outcome:

After going through this course, the students will be able to:

1. Know the fundamental of hydraulic structures and the applications
2. Determine the classification of hydraulic structures according to use, function and materials.
3. Apply the fundamental principles of crossing structures at different intersections.
4. Incorporate the fundamental principles of flow underneath hydraulic structures and check the safety against piping.
5. Apply the fundamental principles of different types of storage such as earth and gravity dams.
6. Design crossing and storage structures while working in teams.

Course Name: FINITE ELEMENT ANALYSIS					
Course Code: CIVL 4242					
Contact hours per week:	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Objective:

The course will assist the students to:

1. Introduce importance and application of finite element method.
2. Apply knowledge of mathematics to understand the basic concepts of the finite element method.
3. Model engineering problems using the finite element method and apply suitable boundary conditions to a global structural equation and reduce it to solvable form.
4. Formulate 1 D, 2 D problems and conduct the numerical integration using Finite Element approach.
5. Formulate the stiffness matrix to solve beam, plate and truss problems.
6. Analyze more complex problems using commercial FEM software such as SAP2000.

Sl. No.	Module	Details of Course Content	Contact Hours	Total
1.	I	**Introduction to Finite Element Analysis:** Basic Concepts of Finite Element Analysis and its necessity. **Numerical tools for Finite Element Formulation:** Variational Principle: Ritz method, Weighted residual method: Galerkin approach, Petrov-Galerkin approach.	2 8	44
2.	II	**Finite element Formulation:** Formulation of Euler-Bernoulli beam element and Timoshenko beam element, Imposition of boundary conditions.	12	
3.	III	**Elements and their properties:** One dimensional and two-dimensional elements (Bar element, Beam element, Plate element), Interpolation functions, Numerical integration.	10	
4.	IV	**Finite element solutions:** Formulation of stiffness matrix and solution of beam, plate and truss problems, Problems on Plates with cutout. Introduction to the software SAP2000.	12	

TEXT BOOKS:	
Sl. No.	**Name**
1.	Bathe K.J, Finite Element Procedures. Prentice HallIndia Learning Private Limited (1996).
2.	Cook R.D, Malkus, Plesha and Witt, Concepts and Applications of Finite Elements Analysis, 4th edition, Wiley.
3.	Mukhopadhyay M. and Hamid S. A., Matrix and Finite Element Analyses of Structures, ANE Books Ltd.
4.	Reddy J.N., An Introduction to the Finite Element Method, 3rd edition,McGraw Hill Publication.

REFERENCES:	
Sl. No.	**Name**
1.	Krishnamoorty C. S., Finite Element Analysis: Theory and Programming, 2nd edition, Mc Graw Hill Publication.
2.	Chandrupatla T. R. and Belegundu A. D., Introduction to Finite Elements in Engineering, 4th edition, Prentice Hall India Learning Private Limited group.

ADDITIONAL REFERENCES:

https://nptel.ac.in/courses/105/105/105105041/
https://nptel.ac.in/courses/112/104/112104193/
https://nptel.ac.in/courses/112/104/112104116/

Course Outcome:

After going through this course, the students will be able to:

1. Possess a good understanding of the theoretical basis of the direct stiffness, weighted residual method, Rayleigh-Ritz method and Galerkin method to solve engineering problems.
2. Outline the requirements for convergence.
3. Write shape functions for four and eight noded quadrilateral, six noded triangular elements and apply numerical integration to solve 1D and 2D integrations.
4. Formulate and solve axially loaded bar problems.
5. Formulate and analyze truss and beam problems.
6. Experience the exposure to SAP 2000.

Course Name: BRIDGE ENGINEERING					
Course Code: CIVL 4243					
Contact hours per week:	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Objective:

The course will assist the students to:

1. Discuss types, components and loadings of bridges.
2. Understand the selection of site for bridges.
3. Develop an idea on the application of latest Indian standard codes to design various reinforced concrete & steel bridges and its components.

Sl. No.	Module	Details of Course Content	Hours	Total
1.	I	**Introduction:** Definition and basic forms, components of a typical bridge, classification of bridges, site investigation, bridge hydrology and hydraulics. **Loads:** I.R.C loads, impact factors, wind loads, longitudinal forces, lateral forces and centrifugal forces. **Bearings:** Types of bearings, details of bearing, joints, design examples.	8	44
2.	II	**Reinforced concrete solid slab bridge**: Introduction, general design features, economic span, effective width method, simply supported and cantilever slab bridges, analysis and design. **Box culvert bridge**: Introduction, design method and design example.	12	
3.	III	**Design of a T beam bridge**: Introduction, components, design of interior panel of slab, longitudinal and cross girders, Pigeaud's method, design example. **Composite bridge**: General aspects, method of construction, analysis of composite section, shear connectors, design of compositebeam.	12	
4.	IV	**Steel bridges:** General features, types of stress, design of railway truss bridge and plate girder bridge. **Cable Stayed Bridge:** General features, Philosophy of design.	12	

TEXT BOOKS:	
Sl. No.	**Name**
1.	K.S. Rakshit, *Design and Construction of Highway Bridges*,New Central BookAgency Pvt. Limited.
2.	N. Krishna Raju, *Design of Bridges*, Oxford & IBH Publishing Co. Pvt. Ltd.
3.	D. Johnson Victor, *Essentials of Bridge Engineering*, Oxford & IBH Publishing Co. Pvt. Ltd.

REFERENCES:	
Sl. No.	**Name**
1.	Aswani, VaziraniandRatwani, *Design of Concrete Bridges*, Khanna Publishers.
2.	Arya and Ajmani, *Design of Steel Structures*, Nem Chand and Bros.
3.	S. Ponnusamy, *Bridge Engineering*, McGraw Hill India.

CODES:

IRC 6 (Sec-II): 2016, IRC 21 (Sec-III): 2000, IRC 22 (Sec-VI): 2015, IRC 24 (Sec-V): 2010, IRC 83 (Part-II): 2015, IS 456: 2000.

Course Outcome:

After going through this course, the students will be able to:

1. Demonstrate the types and components of bridges and explain the various types of loading on road bridges in India.
2. Explain the selection of site for bridges and demonstrate the factors influencing the choice of bridge type.
3. Determine design discharge, linear waterway, economical span and scour depth.
4. Illustrate the requirement of different types of bearings in bridges and analyze and design some of the bearings used in bridges.
5. Analyze and design reinforced concrete solid slab bridge, box culvert and T-beam bridge following latest Indian standard codes.
6. Analyze and design composite bridge, plate girder bridge and steel truss bridge following latest Indian standard codes and explain the basic philosophy of design of cable stayed bridge.

Course Name: PAVEMENT DESIGN					
Course Code: CIVL 4244					
Contact hours per week:	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Objective:

The course will assist the students to:

1. Develop understanding about different types of pavements both structurally and functionally, axle load, vehicle damage factor and estimate design traffic.
2. Understand design criteria, various design methods for flexible pavement.
3. Understand design criteria, various design methods for rigid pavement.
4. Understand the principles of pavement evaluation, identify various pavement distresses, and design overlay for different pavements.

Sl. No.	Module	Details of Course Content	Hours	Total
1.	I	**Introduction:** Classification of pavements, Difference between highway and runway pavements, Factors affecting structural design. Concept of innovative pavement materials, comparisons of flexible and rigid pavements. **Traffic Considerations in Pavement Design:** Vehicle types, Axle configurations, Contact shapes and contact stress distribution, Concept of standard axle load and ESWL, Vehicle damage factor, Axle load surveys, Estimation of design traffic.	4 6	
2.	II	**Pavement Analysis and Design:*Flexible pavement*** - Principles of pavement design, Concepts of structural and functional failures, Performance criteria; Analysis of pavements: Analysis of stress, strain and deflection characteristics of flexible pavements, Linear Elastic Theory. **Design of flexible pavement:** Empirical methods (no soil strength criteria and CBR), IRC, AASHTO and Asphalt Institute Design.	4 7	
3.	III	**Rigid Pavement:** Factors affecting the design of rigid pavement, Analysis of stresses in rigid pavement, critical combination. **Design of Rigid Pavement:** IRC, design based on fatigue behavior of concrete, reinforcement design in slab, Design of joints – (types, requirement, and spacing), Design of dowel and tie bars. Continuous reinforced cement concrete, Fibre reinforced concrete, Prestressed concrete pavements. Semi-rigid pavements.	4 6 2	

4.		**Pavement Evaluation:** Distresses in Pavements; Functional Evaluation of Pavement (Pavement Roughness and Skid Resistance);Structural Evaluation Of pavement (Benkelman Beam and Falling Weight Deflectometer), Pavement Maintenance with and without Overlay (needs, principles). **Overlay Design:** For flexible pavement – IRC, Asphalt institute method, TRRL, extension of design of new pavement, analytical methods. For rigid pavement – types of overlay, design of rigid overlay, flexible overlay over rigid slab. White Topping.	5 6	

RECOMMENDED BOOKS:

TEXT AND REFERENCE BOOKS	
Sl. No.	**Name of the books**
1.	Principles of Pavement Design, E. J. Yoder & M.W. Witzack, John Wiley and Sons.
2.	Pavement Analysis and Design, Yang H. Huang, Pearson.
3.	Highway Engineering, Khanna & Justo, Nemchand& Brothers, Roorkee.
4.	Principles and Practice of Highway Engineering, Dr. L. R Kadiyali. Khanna Publishers.
5.	Principles of Transportation Engineering, P. Chakraborty& A. Das -PHI.

CODES / STANDARDS FOR REFERENCE	
Sl. No.	**Name of the Codes**
1.	Relevant latest IRC Codes (IRC-37 –2001, IRC-37 –2012, IRC-37 –2018, IRC 58 –2015, IRC 81 -1997-Indian Road Congress&Relevant AASHTO Guidelines.

Course Outcome:

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

1. Differentiate between different types of pavements, both structurally and functionally.
2. Understand axle load, vehicle damage factor and estimate design traffic.
3. Analyze and design flexible pavement using various methods.
4. Analyze and design rigid pavement using various methods.
5. Understand the principles of pavement evaluation and identify various pavement distresses.
6. Design overlay for flexible and rigid pavements.

Course Name: BUILDING MATERIALS					
Course Code: CIVL 4221					
Contact hours per week:	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Objective:

The course will assist the students to:

1. Know the various conventional construction materials, properties and their uses the various latest and modern construction materials, properties and their uses.
2. Know and understand the general construction processes and their sequences.
3. Know and understand the various techniques which are useful for the substructure construction.
4. Know and understand the various techniques which are useful for the superstructure construction.

Sl. No.	Module	Details of Course Contents	Hours	Total
1.	I	**Building Materials -I** **Bricks:** Introduction, Classification, Characteristics of good bricks, Ingredients of good brick earth, Harmful substance in brick earth, Different forms of bricks, Testing of bricks, Defects of bricks, Fly ash bricks. **Cement:** Introduction, Chemical Composition of Cement, Hydration of Cement. Tests on Cement and Cement Paste – specific gravity, fineness, consistency, setting time, soundness, strength. Types of Portland Cement – Ordinary, Rapid hardening, Low-heat, Sulphate resisting, Portland slag, Portland pozzolana, Super sulphated cement, White cement. **Aggregates:** Introduction, Classification, Mechanical and Physical Properties, Deleterious Substances, Alkali-Aggregate Reaction. Testing of Aggregates – Particle size distribution, Flakiness, Elongation Tests, Aggregate Crushing Value, Ten Percent Fines Value, Impact Value, Abrasion Value. **Lime:** Introduction, Classification, Slaking and hydration, Hardening, Lime putty, Storage, Handling.	2 5 5	42
2.	II	**Building Materials -II** **Ferrous Metals:** Introduction, Pig Iron- composition, properties, uses. Cast Iron- Properties, Manufacturing, uses. Wrought iron- properties, uses. Steel- composition, properties, manufacturing, uses. Rolled steel sections, Reinforcing steel bars, Rusting and corrosion of steel, Tensile testing of steel, Alloy steel. **Mortars:** Introduction, Classification, Uses, Characteristics of good mortar, Ingredients. **Wood and Wood Products:** Classification of Timber, Structure, Characteristics of good timber, Seasoning of timber, Defects in Timber, Diseases of timber, Decay of Timber, Veneers, Plywood, Applications of wood and wood products. **Paints, Enamels and Varnishes:** Composition of oil paint, characteristic of an ideal paint, preparation of paint, covering power of paints, Painting: Plastered surfaces, painting wood surfaces, painting metal Surfaces. Defects, Effect of weather, enamels, distemper, water wash and colour wash, Varnish, French Polish, Wax Polish. **Miscellaneous Materials:** Gypsum- Classification, Plaster of Paris, Gypsum wall Plasters, Gypsum Plaster Boards, Adhesives, Heat and sound insulating materials, Anticorrosive, Waterproofing.	5 1 1 1 3	

3.	III	**Building Construction –I** **Foundations:** Function of Foundations, Essential requirement of good foundation, Different types of shallow and deep Foundations. **Brick masonry:** Definitions, Rules for bonding, Type of bonds – stretcher bond, Header bond, English bond, Flemish Bond, Comparison of English Bond and Flemish Bond (one and one and half brick thick wall) **Wall, Doors and Windows:** Load bearing wall, Partition wall, Reinforced brick wall Common types of doors and windows of timber and metal.	4 4 2	
4.	IV	**Building Construction -II** **Stairs:** Technical Terms, Requirements of good stair, Dimension of steps, Classification, Geometric design of a dog legged stair case. **Flooring:** Components of a floor, selection of flooring materials, Brick flooring, Cement concrete flooring, mosaic, marble, Terrazzo flooring, Tiled roofing. **Centering and Shuttering, Plastering and Pointing:** Centering and Shuttering, Plastering with cement mortar, Defects in plastering, pointing, white washing, colour washing, Distempering. **Roofs:** Types, Pitched roofs and their sketches, Lean – to roof, King Post – Truss, Queen post truss and Simple steel Truss, Roof Covering materials: AC sheets GI sheets.	2 2 2 2	

RECOMMENDED BOOKS:

TEXT BOOKS

Sl. No.	Name of the books
1.	S. K. Duggal, “Building Materials”, New Age International
2.	P. C. Varghese, “Building Materials”, PHI Learning Pvt. Ltd-New Delhi.
3.	B. C. Punmia,“Building Construction”, Laxmi Publications.

REFERENCE BOOKS

Sl. No.	Name of the books
1.	M. S. Shetty, “Concrete Technology”, S. Chand.
2.	A.M. Neville and J. J. Brooks, “Concrete Technology”, Pearson Education.
3.	S.C. Rangwala,“Engineering Materials”, Charotar Publishing.

Course Outcome:

After going through this course, the students will be able to:

1. Gain knowledge regarding the various building and general construction products and their quality, durability and availability.
2. Gain knowledge regarding the various types of properties, uses and variety of materials used in the construction industry.
3. Study the behavior of concrete at its fresh and hardened state.
4. Study about the concrete design mix.
5. Expose themselves to various quality control aspects of the civil engineering materials.
6. Learn and use the terms common in the building industry.

Course Name: INTRODUCTION TO FINITE ELEMENT METHODS					
Course Code: CIVL 4222					
Contact hours per week:	L	T	P	Total	Credit Points
	3	0	0	3	3

Course Objective:

The course will assist the students to:

1. Introduce importance and application of finite element method.
2. Apply knowledge of mathematics to understand the basic concepts of the finite element method.
3. Model engineering problems using the finite element method and apply suitable boundary conditions to a global structural equation and reduce it to solvable form.
4. Formulate 1 D, 2 D problems and conduct the numerical integration using Finite Element approach.
5. Formulate the stiffness matrix to solve beam, plate and truss problems.
6. Introduction to analyze more complex problems using commercial FEM software such as SAP2000.

Sl. No.	Module	Details of Course Content	Contact Hours	Total
1.	I	**Introduction to Finite Element Analysis:** Basic Concepts of Finite Element Analysis and its necessity. **Numerical tools for Finite Element Formulation:** Variational Principle: Ritz method, Weighted residual method: Galerkin approach, Petrov-Galerkin approach.	2 8	44
2.	II	**Finite element Formulation:** Formulation of Euler-Bernoulli beam element and Timoshenko beam element, Imposition of boundary conditions.	12	
3.	III	**Elements and their properties:** One dimensional and Two dimensional elements (Bar element, Beam element, Plate element), Interpolation functions, Numerical integration.	10	
4.	IV	**Finite element solutions:** Formulation of stiffness matrix and solution of beam, plate and truss problems, Problems on Plates with cutout. Introduction to the software SAP2000.	12	

TEXT BOOKS:	
Sl. No.	**Name**
1.	Bathe K.J, Finite Element Procedures. Prentice HallIndia Learning Private Limited (1996).
2.	Cook R.D, Malkus, Plesha and Witt, Concepts and Applications of Finite Elements Analysis, 4th edition, Wiley.
3.	Mukhopadhyay M. and Hamid S. A., Matrix and Finite Element Analyses of Structures, ANE Books Ltd.
4.	Reddy J.N., An Introduction to the Finite Element Method, 3rd edition,McGraw Hill Publication.

REFERENCES:	
Sl. No.	**Name**
1.	Krishnamoorty C. S., Finite Element Analysis: Theory and Programming, 2nd edition, Mc Graw Hill Publication.
2.	Chandrupatla T. R. and Belegundu A. D., Introduction to Finite Elements in Engineering, 4th edition, Prentice Hall India Learning Private Limited group.

ADDITIONAL REFERENCES:

https://nptel.ac.in/courses/105/105/105105041/
https://nptel.ac.in/courses/112/104/112104193/
https://nptel.ac.in/courses/112/104/112104116/

Course Outcome:

After going through this course, the students will be able to:

1. Possess a good understanding of the theoretical basis of the direct stiffness, weighted residual method, Rayleigh-Ritz method and Galerkin method to solve engineering problems.
2. Outline the requirements for convergence.
3. Write shape functions for four and eight noded quadrilateral, six noded triangular elements and apply numerical integration to solve 1D and 2D integrations.
4. Formulate and solve axially loaded bar problems.
5. Formulate and analyze truss and beam problems.
6. Experience the exposure to SAP 2000.