



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA**  
**KAKINADA – 533 003, Andhra Pradesh, India**

**DEPARTMENT OF CIVIL ENGINEERING**

## **COURSE STRUCTURE AND SYLLABUS**

**For**

**B. TECH CIVIL ENGINEERING**

*(Applicable for batches admitted from 2019-2020)*



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA**

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**I Year – I SEMESTER**

Sl. No	Course Code	Subjects	L	T	P	Credits
1	BS1101	Mathematics – I	3	0	0	3
2	BS1102	Mathematics – II	3	0	0	3
3	BS1108	Engineering Physics	3	0	0	3
4	ES1104	Engineering Mechanics	3	1	0	4
5	ES1103	Engineering Drawing	1	0	3	2.5
6	HS1102	English Lab	0	0	3	1.5
7	BS1109	Engineering Physics Lab	0	0	3	1.5
8	PR1101	Engineering Exploration Project	0	0	2	1
<b>Total Credits</b>			<b>16</b>	<b>0</b>	<b>12</b>	<b>19.5</b>

**I Year – II SEMESTER**

Sl. No	Course Code	Subjects	L	T	P	Credits
1	HS1201	English	3	0	0	3
2	BS1203	Mathematics – III	3	0	0	3
3	BS1210	Engineering Chemistry	3	0	0	3
4	ES1201	Programming for problem Solving Using C	3	0	0	3
5	ES1207	Computer Aided Engineering Drawing	1	0	3	2.5
6	ES1202	Programming for problem Solving Using C Lab	0	0	3	1.5
7	BS1211	Engineering Chemistry Lab	0	0	3	1.5
8	HS1203	Communications Skills Lab	0	0	3	1.5
9	ES1219	Workshop Practice Lab	0	0	3	1.5
10	MC1201	Environmental Science	3	0	0	0
<b>Total Credits</b>			<b>15</b>	<b>0</b>	<b>11</b>	<b>20.5</b>



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**I YEAR: I- SEMESTER**

Sl. No.	Course Code	Course Title	L	T	P	Credits
1	BS301	Complex Variables and Statistical Methods	3	0	0	3
2	PC301	Strength of Materials-I	3	0	0	3
3	PC302	Fluid Mechanics	3	0	0	3
4	ES301	Surveying and Geometrics'	3	0	0	3
5	PC303	Building Materials, Construction and Planning	3	0	0	3
6	PC304	Transportation Engineering-I	3	0	0	3
7	PC305	Strength of Materials Lab	0	0	3	1.5
8	PC306	Surveying Field Work – I	0	0	3	1.5
9	MC301	Constitution of India	2	0	0	0
		<b>Total Credits</b>				<b>21</b>

**II YEAR: II- SEMESTER**

Sl. No.	Course Code	Course Title	L	T	P	Credits
1	PC401	Strength of Materials-II	3	0	0	3
2	PC402	Hydraulics and Hydraulic Machinery	3	0	0	3
3	ES401	Engineering Geology	3	0	0	3
4	PC403	Transportation Engineering - II	3	0	0	3
5	PC404	Environmental Engineering - I	3	0	0	3
6	PC405	Engineering Geology Lab	0	0	2	1
7	PC406	Transportation Engineering Lab	0	0	3	1.5
8	PC407	Fluid Mechanics & Hydraulics Machinery Lab	0	0	3	1.5
9	MC401	Essence of Indian Traditional Knowledge/ Professional Ethics and Human Values	2	0	0	0
		<b>Total Credits</b>				<b>19</b>



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**III YEAR: I- SEMESTER**

Sl. No.	Course Code	Course Title	L	T	P	Credits
1	PC501	Structural Analysis	3	0	0	3
2	PC502	Concrete Technology	2	0	0	2
3	PC503	Water Resources Engineering - I	3	0	0	3
4	PC504	Environmental Engineering - II	3	0	0	3
5	PE501	Program Elective – I	3	0	0	3
6	OE501	Open Elective – I	3	0	0	3
7	PC506	Concrete Technology Lab	0	0	3	1.5
8	PC507	Surveying Field Work - II	0	0	3	1.5
		<b>Total Credits</b>				<b>20</b>

**III YEAR: II- SEMESTER**

Sl. No.	Course Code	Course Title	L	T	P	Credits
1	PC601	Design & Drawing of Reinforced Concrete Structures	3	0	0	3
2	PC602	Water Resources Engineering – II	3	0	0	3
3	PC603	Geotechnical Engineering - I	3	0	0	3
4	HS601	Managerial Economics & Financial Analysis	3	0	0	3
5	PE601	Program Elective – II	3	0	0	3
6	OE601	Open Elective – II	3	0	0	3
7	PC604	CAD Lab	0	0	3	1.5
8	PC605	Environmental Engineering Lab	0	0	3	1.5
9	PR601	Socially Relevant Project	0	0	2	1
10	MC601	Employability Skills	0	0	2	0
		<b>Total Credits</b>				<b>22</b>



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**IV YEAR: I- SEMESTER**

Sl. No.	Course Code	Course Title	L	T	P	Credits
1	PC701	Design & Drawing of Steel Structures	3	0	0	3
2	PC702	Geotechnical Engineering - II	3	0	0	3
3	PC703	Remote Sensing & GIS	3	0	0	3
4	PE701	Program Elective – III	3	0	0	3
5	OE701	Open Elective – III	3	0	0	3
6	PC704	Remote Sensing & GIS Lab	0	0	3	1.5
7	PC705	Geotechnical Engineering Lab	0	0	3	1.5
8	PR701	Industrial Training/ Internship or Seminar	0	0	3	1
9	PR702	Project Work Phase-I	0	0	4	2
<b>Total Credits</b>						<b>21</b>

**IV YEAR: II- SEMESTER**

Sl. No.	Course Code	Course Title	L	T	P	Credits
1	PC801	Estimation Specifications and Contract	3	0	0	3
2	PE801	Program Elective - IV	3	0	0	3
3	PE802	Program Elective – V	3	0	0	3
4	PR801	Project Work Phase-II	0	0	16	8
<b>Total Credits</b>						<b>17</b>



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<b>Open Electives</b>	<b>Professional Elective-I</b>	<b>Professional Elective-II</b>	<b>Professional Elective-III</b>	<b>Professional Elective-IV</b>	<b>Professional Elective-V</b>
a) Disaster Management	a) Repair & Rehabilitation of Buildings	a) Pre-stressed Concrete	a) Bridge Engineering	a) Finite Element Methods	a) Advanced Structural Analysis
b) Environmental Pollution & Control	b) Environmental Impact Assessment	b) Watershed Management	b) Industrial Waste Water Treatment	b) Design & Drawing of Irrigation Structures	b) Urban Hydrology
c) Elements of Civil Engineering	c) Reinforced Soil Structures	c) Advanced Foundation Engineering	c) Earth & Rock-fill Dams	c) Soil Dynamics and Machine Foundations	c) Ground Improvement Techniques
d) Green Technology	d) Traffic Engineering	d) Urban Transportation Planning	d) Intelligent Transportation Systems	d) Road Safety Engineering	d) Pavement Management Systems
e) Smart Cities	e) Construction Technology & Management	e) Architecture and Town Planning	e) Building Services	e) Disaster Management & Mitigation	e) Low-cost Housing
f) Project Management				f)SWAYAM / NPTEL /MOOCS COURSES (12 weeks duration )	f) SWAYAM / NPTEL /MOOCS COURSES (12 weeks duration )
g) Traffic Safety					
h) Geo-Spatial Technologies					
i) Waste Water Treatment					



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<b>I Year - I Semester</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>Mathematics-I (BS1101)</b> <b>(Common to all Branch's for I Year B. Tech)</b>					

**Course Objectives:**

- This course will illuminate the students in the concepts of calculus.
- To enlighten the learners in the concept of differential equations and multivariable calculus.
- To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real world problems and their applications.

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

- utilize mean value theorems to real life problems (L3)
- solve the differential equations related to various engineering fields (L3)
- familiarize with functions of several variables which is useful in optimization (L3)
- Apply double integration techniques in evaluating areas bounded by region (L3)
- Students will also learn important tools of calculus in higher dimensions. Students will become familiar with 2- dimensional and 3-dimensional coordinate systems (L5)

**UNIT I: Sequences, Series and Mean value theorems: (10 hrs)**

Sequences and Series: Convergences and divergence – Ratio test – Comparison tests – Integral test – Cauchy's root test – Alternate series – Leibnitz's rule.

Mean Value Theorems (without proofs): Rolle's Theorem – Lagrange's mean value theorem – Cauchy's mean value theorem – Taylor's and Maclaurin's theorems with remainders.

**UNIT II: Differential equations of first order and first degree: (10 hrs)**

Linear differential equations – Bernoulli's equations – Exact equations and equations reducible to exact form.

Applications: Newton's Law of cooling – Law of natural growth and decay – Orthogonal trajectories – Electrical circuits.



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**UNIT III: Linear differential equations of higher order: (10 hrs)**

Non-homogeneous equations of higher order with constant coefficients – with non-homogeneous term of the type  $e^{ax}$ ,  $\sin ax$ ,  $\cos ax$ , polynomials in  $x^n$ ,  $e^{ax}V(x)$  and  $x^nV(x)$  – Method of Variation of parameters.

Applications: LCR circuit, Simple Harmonic motion.

**UNIT IV: Partial differentiation: (10 hrs)**

Introduction – Homogeneous function – Euler’s theorem – Total derivative – Chain rule – Jacobian – Functional dependence – Taylor’s and Mc Laurent’s series expansion of functions of two variables. Applications: Maxima and Minima of functions of two variables without constraints and Lagrange’s method (with constraints).

**UNIT V: Multiple integrals: (8 hrs)**

Double and Triple integrals – Change of order of integration – Change of variables. Applications: Finding Areas and Volumes.

**Text Books:**

1. **B. S. Grewal**, Higher Engineering Mathematics, 43<sup>rd</sup> Edition, Khanna Publishers.
2. **B. V. Ramana**, Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.

**Reference Books:**

1. **Erwin Kreyszig**, Advanced Engineering Mathematics, 10<sup>th</sup> Edition, Wiley-India.
2. **Joel Hass, Christopher Heil and Maurice D. Weir**, Thomas calculus, 14<sup>th</sup> Edition, Pearson.
3. **Lawrence Turyn**, Advanced Engineering Mathematics, CRC Press, 2013.
4. **Srimantha Pal, S C Bhunia**, Engineering Mathematics, Oxford University Press.





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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>MATHEMATICS - II (BS1102)</b> <b>(Common to all Branch's for I Year B. Tech)</b>					

**Course Objectives:**

- To instruct the concept of Matrices in solving linear algebraic equations
- To elucidate the different numerical methods to solve nonlinear algebraic equations
- To disseminate the use of different numerical techniques for carrying out numerical integration.
- To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real world problems and their applications.

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

- develop the use of matrix algebra techniques that is needed by engineers for practical applications (L6)
- solve system of linear algebraic equations using Gauss elimination, Gauss Jordan, Gauss Seidel (L3)
- evaluate approximating the roots of polynomial and transcendental equations by different algorithms (L5)
- apply Newton's forward & backward interpolation and Lagrange's formulae for equal and unequal intervals (L3)
- apply different algorithms for approximating the solutions of ordinary differential equations to its analytical computations (L3)

**Unit I: Solving systems of linear equations, Eigen values and Eigen vectors: (10 hrs)**

Rank of a matrix by echelon form and normal form – Solving system of homogeneous and non-homogeneous equations linear equations – Gauss Elimination for solving system of equations – Eigen values and Eigen vectors and their properties.

**Unit-II: Cayley-Hamilton theorem and Quadratic forms: (10 hrs)**

Cayley-Hamilton theorem (without proof) – Finding inverse and power of a matrix by Cayley-Hamilton theorem – Reduction to Diagonal form – Quadratic forms and nature of the quadratic forms – Reduction of quadratic form to canonical forms by orthogonal transformation.

Singular values of a matrix, singular value decomposition (Ref. Book – 1).



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**UNIT III: Iterative methods:**

**(8 hrs)**

Introduction – Bisection method – Secant method – Method of false position – Iteration method – Newton-Raphson method (One variable and simultaneous Equations) – Jacobi and Gauss-Seidel methods for solving system of equations.

**UNIT IV: Interpolation:**

**(10 hrs)**

Introduction – Errors in polynomial interpolation – Finite differences – Forward differences – Backward differences – Central differences – Relations between operators – Newton's forward and backward formulae for interpolation – Interpolation with unequal intervals – Lagrange's interpolation formula – Newton's divide difference formula.

**UNIT V: Numerical integration and solution of ordinary differential equations: (10 hrs)**

Trapezoidal rule – Simpson's  $1/3^{\text{rd}}$  and  $3/8^{\text{th}}$  rule– Solution of ordinary differential equations by Taylor's series – Picard's method of successive approximations – Euler's method – Runge-Kutta method (second and fourth order).

**Text Books:**

1. **B. S. Grewal**, Higher Engineering Mathematics, 43<sup>rd</sup> Edition, Khanna Publishers.
2. **B. V. Ramana**, Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.

**Reference Books:**

1. **David Poole**, Linear Algebra- A modern introduction, 4<sup>th</sup> Edition, Cengage.
2. **Steven C. Chapra**, Applied Numerical Methods with MATLAB for Engineering and Science, Tata Mc. Graw Hill Education.
3. **M. K. Jain, S. R. K. Iyengar and R. K. Jain**, Numerical Methods for Scientific and Engineering Computation, New Age International Publications.
4. **Lawrence Turyn**, Advanced Engineering Mathematics, CRC Press.



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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>ENGINEERING PHYSICS (BS1108)</b>					

**Course Objectives:**

Physics curriculum which is re-oriented to the needs of non-circuitual branches of graduate engineering courses offered by JNTUniversity Kakinada that serves as a transit to understand the branch specific advanced topics. The course is designed to:

- Impart concepts of mechanics required to identify forces and moments in mechanical systems by vector representation-extend Newton's second law for inertial and non-inertial frames of reference- study different types of harmonic oscillatory motions.
- Tap the Simple harmonic motion and its adaptability for improved acoustic quality of concert halls- impart concepts of flaw detection techniques using ultrasonics.
- Study the structure- property relationship exhibited by solid materials within the elastic limit.
- Impart knowledge in basic concepts of LASERs along with its Engineering applications- Familiarize types of sensors for various engineering applications
- Explore the knowledge of magnetic and dielectric materials and their utility in appliances.

**UNIT-I**

**(10hrs)**

**MECHANICS:** Basic laws of vectors and scalars, rotational frames-conservative and non – conservative forces ,  $F = - \text{grad } V$ , Newton's laws in inertial and linear accelerating non-inertial frames of reference, rotating frame of reference with constant angular velocity, Harmonic oscillator ; damped harmonic motion ; Forced oscillations and resonance.

**Outcome:**

**The students will be able to**

- Identify forces and moments in mechanical systems using scalar and vector techniques
- extend Newton's second law for inertial and non-inertial frame of reference
- explain simple harmonic motion and damped harmonic motions

**UNIT-II (10hrs)**

**ACOUSTICS & ULTRASONICS:** Introduction – Reverberation - Reverberation time - Sabine's formula (Derivation using growth and decay method)–absorption coefficient and its determination-factors affecting acoustics of buildings and their remedies.

Production of ultrasonics by Magnetostriction and piezoelectric methods – Detection of ultrasonics - acoustic grating - Non-Destructive Testing- pulse echo system through transmission and reflection modes - Applications.



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**Outcome:**

**The students will be able to**

- explain how sound is propagated in buildings
- analyze acoustic properties of typically used materials in buildings
- recognize sound level disruptors and their use in architectural acoustics
- Use of ultrasonics in flaw detection using NDT technique

**UNIT-III**

**(9hrs)**

**ELASTICITY:**, stress, strain, Hooke's law, stress-strain curve, generalized Hooke's law with and without thermal strains for isotropic materials, different types of moduli and their relations, bending of beams – Bending moment of a beam – Depression of cantilever.

**Outcome:**

**The students will be able to**

- Understand the elasticity and plasticity concepts
- Study different types of moduli and their relation
- Analyze the concepts of shearing force and moment of inertia

**UNIT-IV** (9hrs)

**LASERS & SENSORS:** Characteristics–Spontaneous and Stimulated emission of radiation – population inversion - Einstein's coefficients & Relation between them and their significance - Pumping Mechanisms - Ruby laser – Helium Neon laser – Applications.

**SENSORS** (qualitative description only): Different types of sensors and applications; Strain and Pressure sensors- Piezoelectric, magnetostrictive sensors, Temperature sensor - bimetallic strip, pyroelectric detectors.

**Outcome:**

**The students will be able to**

- **Understand** the basic concepts of LASER light Sources
- Study Different types of laser systems
- Identify different types of sensors and their working principles

**UNIT-V** (10hrs)

**MAGNETISM & DIELECTRICS:** Introduction – Magnetic dipole moment – Magnetization- Magnetic susceptibility and permeability – Origin of permanent magnetic moment – Bohr Magneton - Classification of magnetic materials (Dia, Para and Ferro) – Domain concept of Ferromagnetism - Hysteresis – soft and hard magnetic materials – Applications of Ferromagnetic materials.

Introduction - Dielectric polarization – Dielectric polarizability, Susceptibility and Dielectric constant-types of polarizations: Electronic and Ionic (Quantitative), Orientational polarizations (qualitative)-Lorentz internal field – Claussius\_Mossoti equation- Frequency dependence of polarization - Applications of dielectrics.



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**Outcome:**

**The students will be able to**

- **explain** the concept of dielectric constant and polarization in dielectric materials.
- **summarize** various types of polarization of dielectrics .
- **interpret** Lorentz field and Claussius\_Mosotti relation in dielectrics.
- **classify** the magnetic materials based on susceptibility and their temperature dependence.
- **explain** the applications of dielectric and magnetic materials .
- **Apply** the concept of magnetism to magnetic devices.

**Text Books:**

1. “Engineering Mechanics” by Manoj K Harbola, Cengage Publications 2<sup>nd</sup> Eds.
2. “A text book of Engineering Physics” by P G Kshirsagar & M N Avadhanulu, S Chand & Company Ltd.
3. “Engineering Physics” by R K Gaur and S L Gupta, Dhanpat Rai Publications.
4. “Sensor and Transducers” by Ian R Sinclair, Elsevier (Newnes) 3<sup>rd</sup> Eds.

**Reference Books:**

1. “Engineering Physics” by M R Srinivasan, New Age International Publishers.
2. “Lectures on Physics” by Richard P Feynman, Pearson Publishers, New Millennium Eds.
3. “Lasers and Non-linear Optics” by B B Laud, New Age International Publishers (3<sup>rd</sup> Eds.).



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		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>
<b>ENGINEERING MECHANICS (ES1104)</b>					

**Objectives:** The students completing this course are expected to understand the concepts of forces and its resolution in different planes, resultant of force system, Forces acting on a body, their free body diagrams using graphical methods. They are required to understand the concepts of centre of gravity and moments of inertia and their application, Analysis of frames and trusses, different types of motion, friction and application of work - energy method.

- The students are to be exposed to the concepts of force and friction, direction and its application.
- The students are to be exposed to application of free body diagrams. Solution to problems using graphical methods and law of triangle of forces.
- The students are to be exposed to concepts of centre of gravity
- The students are to be exposed to concepts of moment of inertia and polar moment of inertia including transfer methods and their applications.
- The students are to be exposed to motion in straight line and in curvilinear paths, its velocity and acceleration computation and methods of representing plane motion.
- The students are to be exposed to concepts of work, energy and particle motion

**UNIT – I** Introduction to Engg. Mechanics – Basic Concepts.

**Systems of Forces :** Coplanar Concurrent Forces – Components in Space – Resultant – Moment of Force and its Application – Couples and Resultant of Force Systems. Introduction, limiting friction and impending motion, Coulomb's laws of dry friction, coefficient of friction, cone of friction

**UNIT II Equilibrium of Systems of Forces :** Free Body Diagrams, Equations of Equilibrium of Coplanar Systems,

Spatial Systems for concurrent forces. Lami's Theorem, Graphical method for the equilibrium of coplanar forces, Converse of the law of Triangle of forces, converse of the law of polygon of forces condition of equilibrium.

**UNIT – III Centroid :** Centroids of simple figures (from basic principles) – Centroids of Composite Figures

**Centre of Gravity :** Centre of gravity of simple body (from basic principles), centre of gravity of composite bodies, Pappus theorem.

**FRICITION**

Types of friction – Limiting friction – Laws of Friction – static and Dynamic Frictions – Angle of Friction – Cone of limiting friction – Friction of wedge, block and Ladder

**UNIT IV**

**Area moments of Inertia :** Definition – Polar Moment of Inertia, Transfer Theorem, Moments of Inertia of Composite Figures, Products of Inertia, Transfer Formula for Product of Inertia.

**Mass Moment of Inertia :** Moment of Inertia of Masses, Transfer Formula for Mass Moments of Inertia, mass moment of inertia of composite bodies.



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**UNIT – V**

**Kinematics:** Rectilinear and Curvilinear motions – Velocity and Acceleration – Motion of Rigid Body – Types and their Analysis in Planar Motion.

Introduction – Rectilinear motion – Motion with uniform and variable acceleration – Curvilinear motion – Components of motion – Circular motion – Projectiles – Instantaneous centre

**Kinetics:** Kinetics of a particle – D'Alembert's principle – Motion in a curved path – work, energy and power. Principle of conservation of energy – Kinetics of a rigid body in translation, rotation – work done – Principle of work-energy – Impulse-momentum

**TEXT BOOKS:**

1. Engineering Mechanics - S.Timoshenko & D.H.Young., 4<sup>th</sup>Edn , Mc Graw Hill publications.
2. Engineering Mechanics statics and dynamics – R.C.Hibbeler, 11<sup>th</sup>Edn – Pearson Publ.

**REFERENCES:**

1. Engineering Mechanics, statics and Dynamics, J.L.Meriam, 6<sup>th</sup>Edn – Wiley India Pvt Ltd.
2. Engineering Mechanics: Statics and Dynamics 3rd edition, Andrew Pytel and Jaan Kiusalaas, Cengage Learning publishers.
3. Engineering Mechanics, dynamics, Bhavikatti S.S – NewAge International Publishers.
4. Engineering Mechanics, statics and dynamics – I.H. Shames, – Pearson Publications
5. Mechanics For Engineers, statics - F.P.Beer & E.R.Johnston – 5<sup>th</sup>Edn Mc Graw Hill Publ.
6. Mechanics For Engineers, dynamics - F.P.Beer & E.R.Johnston – 5<sup>th</sup>Edn Mc Graw Hill Publ.
7. Theory & Problems of engineering mechanics, statics & dynamics – E.W.Nelson, C.L.Best & W.G. McLean, 5<sup>th</sup>Edn – Schaum's outline series - Mc Graw Hill Publ.
8. Engineering Mechanics, Ferdinand . L. Singer, Harper – Collins.
9. Engineering Mechanics statics and dynamics, A Nelson, Mc Graw Hill publications
10. Engineering Mechanics, Tayal. Umesh Publications.



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		<b>1</b>	<b>0</b>	<b>3</b>	<b>2.5</b>
<b>ENGINEERING DRAWING (ES1103)</b>					

**Course Objective:** Engineering drawing being the principal method of communication for engineers, the objective is to introduce the students, the techniques of constructing the various types of polygons, curves and scales. The objective is also to visualize and represent the 3D objects in 2D planes with proper dimensioning, scaling etc.

**Unit I**

**Objective:** To introduce the students to use drawing instruments and to draw polygons, Engg. Curves.

**Polygons:** Constructing regular polygons by general methods, inscribing and describing polygons on circles.

**Curves:** Parabola, Ellipse and Hyperbola by general and special methods, cycloids, involutes, tangents & normals for the curves.

**Scales:** Plain scales, diagonal scales and vernier scales

**Unit II**

**Objective:** To introduce the students to use orthographic projections, projections of points & simple lines. To make the students draw the projections of the lines inclined to both the planes.

**Orthographic Projections:** Reference plane, importance of reference lines, projections of points in various quadrants, projections of lines, line parallel to both the planes, line parallel to one plane and inclined to other plane.

Projections of straight lines inclined to both the planes, determination of true lengths, angle of inclination and traces.

**Unit III**

**Objective:** The objective is to make the students draw the projections of the plane inclined to both the planes.

Projections of planes: regular planes perpendicular/parallel to one reference plane and inclined to the other reference plane; inclined to both the reference planes.

**Unit IV**

**Objective:** The objective is to make the students draw the projections of the various types of solids in different positions inclined to one of the planes.

Projections of Solids – Prisms, Pyramids, Cones and Cylinders with the axis inclined to both the planes.

**Unit V**

**Objective:** The objective is to represent the object in 3D view through isometric views. The student will be able to represent and convert the isometric view to orthographic view and vice versa.





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Conversion of isometric views to orthographic views; Conversion of orthographic views to isometric views.

Computer Aided Design, Drawing practice using Auto CAD, Creating 2D&3D drawings of objects using Auto CAD

**Note:**In the End Examination there will be no question from CAD.

**TEXT BOOKS:**

1. Engineering Drawing by N.D. Butt, Chariot Publications
2. Engineering Drawing by Agarwal & Agarwal, Tata McGraw Hill Publishers

**REFERENCE BOOKS:**

1. Engineering Drawing by K.L.Narayana& P. Kannaiah, Scitech Publishers
2. Engineering Graphics for Degree by K.C. John, PHI Publishers
3. Engineering Graphics by PI Varghese, McGrawHill Publishers
4. Engineering Drawing + AutoCad – K Venugopal, V. Prabhu Raja, New Age

**Course Outcome:** The student will learn how to visualize 2D & 3D objects.



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<b>I Year - I Semester</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>
<b>ENGLISH LAB (HS1102)</b>				

**UNIT I:**

Vowels, Consonants, Pronunciation, Phonetic Transcription

**UNIT II:**

Past tense markers, word stress-di-syllabic words, Poly-Syllabic words

**UNIT III:**

Rhythm & Intonation

**UNIT IV:**

Contrastive Stress (Homographs)

**UNIT V:**

Word Stress: Weak and Strong forms  
 Stress in compound words

**References books:**

1. Infotech English, Maruthi Publications (with Compact Disc).
2. Exercises in Spoken English Part 1,2,3,4, OUP and CIEFL.
3. English Pronunciation in use- Mark Hancock, Cambridge University Press.
4. English Phonetics and Phonology-Peter Roach, Cambridge University Press.
5. English Pronunciation in use- Mark Hewings, Cambridge University Press.
6. English Pronunciation Dictionary- Daniel Jones, Cambridge University Press.
7. English Phonetics for Indian Students- P. Bala Subramanian, Mac Millan Publications.



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		<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>
<b>ENGINEERING PHYSICS LAB (BS1109)</b>					

**(Any 10 of the following listed 15 experiments)**

**LIST OF EXPERIMENTS:**

1. Determination of Rigidity modulus of a material- Torsional Pendulum.
2. Determination of Young's modulus by method of single cantilever oscillations.
3. Determination of Acceleration due to Gravity and Radius of Gyration - Compound Pendulum.
4. Verification of laws of vibrations in stretched strings – Sonometer.
5. Determination of spring constant of springs using coupled oscillators.
6. Magnetic field along the axis of a current carrying coil – Stewart and Gee's apparatus
7. Study the variation of B versus H by magnetizing the magnetic material (B-H curve).
8. Measurement of magnetic susceptibility by Gouy's method.
9. Determination of ultrasonic velocity in liquid (Acoustic Grating) Det
10. Determination of dielectric constant by charging and discharging method Det
11. Determination of wavelength of Laser by diffraction grating Det
12. Determination of particle size using Laser. Det
13. Determination of Pressure variation using strain Gauge sensor. Det
14. Determination of Moment of Inertia of a Fly Wheel. Det
15. Determination of Velocity of sound –Volume Resoantor. Det



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<b>I Year - I Semester</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>
<b>ENGINEERING EXPLORATION PROJECT(PR1101)</b>				

**COURSE OBJECTIVES:**

- Build mindsets & foundations essential for designers
- Learn about the Human-Centered Design methodology and understand their real-world applications
- Use Design Thinking for problem solving methodology for investigating illdefined problems.
- Undergo several design challenges and work towards the final design challenge

Apply Design Thinking on the following Streams to

- Project Stream 1: Electronics, Robotics, IOT and Sensors
- Project Stream 2: Computer Science and IT Applications
- Project Stream 3: Mechanical and Electrical tools
- Project Stream4: Eco-friendly solutions for waste management, infrastructure, safety, alternative energy sources, Agriculture, Environmental science and other fields of engineering.

**HOW TO PURSUE THE PROJECT WORK?**

- The first part will be learning-based-masking students to embrace the methodology by exploring all the phases of design thinking through the wallet/ bag challenge and podcasts.
- The second part will be more discussion-based and will focus on building some necessary skills as designers and learning about complementary material for human- centered design.
- The class will then divide into teams and they will be working with one another for about 2 – 3 weeks. These teams and design challenges will be the basis for the final project and final presentation to be presented.
- The teams start with **Design Challenge** and go through all the phases more in depth from coming up with the right question to empathizing to ideating to prototyping and to testing.
- Outside of class, students will also be gathering the requirements, identifying the challenges, usability, importance etc
- At the end, Students are required to submit the final reports, and will be evaluated by the faculty.

**TASKS TO BE DONE:**

Task 1: Everyone is a Designer

- Understand class objectives & harness the designer mindset

Task 2: The Wallet/Bag Challenge and Podcast

- Gain a quick introduction to the design thinking methodology
- Go through all stages of the methodology through a simple design challenge
- Podcast: Observe, Listen and Engage with the surrounding environment and identify a design challenge.

Task 3: Teams & Problems

- Start Design Challenge and learn about teams & problems through this



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- Foster team collaboration, find inspiration from the environment and learn how to identify problems

**Task 4: Empathizing**

- Continue Design Challenge and learn empathy
- Learn techniques on how to empathize with users
- Go to the field and interview people in their environments
- Submit Activity Card

**Task 5: Ideating**

- Continue Design Challenge and learn how to brainstorm effectively
- Encourage exploration and foster spaces for brainstorming
- Submit Activity Card

**Task 6: Prototyping**

- Continue Design Challenge and learn how to create effective prototypes
- Build tangible models and use them as communication tools
- Start giving constructive feedback to classmates and teammates
- Submit Activity Card

**Task 7: Testing**

- Finish Design Challenge and iterate prototypes and ideas through user feedback
- Evolve ideas and prototypes through user feedback and constructive criticism
- Get peer feedback on individual and group performance
- Submit Activity Card

**Task 8:**

- Final Report Submission and Presentation

**Note:** The colleges may arrange for Guest Speakers from Various Design Fields: Graphic Design, Industrial Design, Architecture, Product Design, Organizational Design, etc to enrich the students with Design Thinking Concept.

**REFERENCES:**

1. Tom Kelly, *The Art of Innovation: Lessons in Creativity From IDEO, America's Leading Design Firm* (Profile Books, 2002)
2. Tim Brown, *Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation* (HarperBusiness, 2009)
3. Jeanne Liedtka, Randy Salzman, and Daisy Azer, *Design Thinking for the Greater Good: Innovation in the Social Sector* (Columbia Business School Publishing, 2017)

**OTHER USEFUL DESIGN THINKING FRAMEWORKS AND METHODOLOGIES:**

- Human-Centered Design Toolkit (IDEO); <https://www.ideo.com/post/design-kit>
- Design Thinking Boot Camp Bootleg (Stanford D-School); <https://dschool.stanford.edu/resources/the-bootcamp-bootleg>
- Collective Action Toolkit (frogdesign); [https://www.frogdesign.com/wpcontent/uploads/2016/03/CAT\\_2.0\\_English.pdf](https://www.frogdesign.com/wpcontent/uploads/2016/03/CAT_2.0_English.pdf)
- Design Thinking for Educators (IDEO); <https://designthinkingforeducators.com/>



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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>ENGLISH (HS1201)</b>					

### Introduction

The course is designed to train students in receptive (listening and reading) as well as productive and interactive (speaking and writing) skills by incorporating a comprehensive, coherent and integrated approach that improves the learners' ability to effectively use English language in academic/ workplace contexts. The shift is from *learning about the language* to *using the language*. On successful completion of the compulsory English language course/s in B.Tech., learners would be confident of appearing for international language qualification/proficiency tests such as IELTS, TOEFL, or BEC, besides being able to express themselves clearly in speech and competently handle the writing tasks and verbal ability component of campus placement tests. Activity based teaching-learning methods would be adopted to ensure that learners would engage in actual use of language both in the classroom and laboratory sessions.

### Course Objectives

- Facilitate effective listening skills for better comprehension of academic lectures and English spoken by native speakers
- Focus on appropriate reading strategies for comprehension of various academic texts and authentic materials
- Help improve speaking skills through participation in activities such as role plays, discussions and structured talks/oral presentations
- Impart effective strategies for good writing and demonstrate the same in summarizing, writing well organized essays, record and report useful information
- Provide knowledge of grammatical structures and vocabulary and encourage their appropriate use in speech and writing

### Learning Outcomes

At the end of the module, the learners will be able to

- understand social or transactional dialogues spoken by native speakers of English and identify the context, topic, and pieces of specific information
- ask and answer general questions on familiar topics and introduce oneself/others
- employ suitable strategies for skimming and scanning to get the general idea of a text and locate specific information
- recognize paragraph structure and be able to match beginnings/endings/headings with paragraphs
- form sentences using proper grammatical structures and correct word forms

### Unit 1:

**Lesson-1: A Drawer full of happiness** from “**Infotech English**”, Maruthi Publications

**Lesson-2: Deliverance by Premchand** from “**The Individual Society**”, Pearson Publications.

(Non-detailed)

**Listening:** Listening to short audio texts and identifying the topic. Listening to short audio texts and identifying the context and specific pieces of information to answer a series of questions both in speaking and writing.



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**Speaking:** Asking and answering general questions on familiar topics such as home, family, work, studies and interests. Self introductions and introducing others.

**Reading:** Skimming text to get the main idea. Scanning to look for specific pieces of information.

**Reading for Writing:** Paragraph writing (specific topics) using suitable cohesive devices; linkers, sign posts and transition signals; mechanics of writing - punctuation, capital letters.

**Vocabulary:** Technical vocabulary from across technical branches (20) GRE Vocabulary (20) (Antonyms and Synonyms, Word applications) Verbal reasoning and sequencing of words.

**Grammar:** Content words and function words; word forms: verbs, nouns, adjectives and adverbs; nouns: countables and uncountables; singular and plural basic sentence structures; simple question form - wh-questions; word order in sentences.

**Pronunciation:** Vowels, Consonants, Plural markers and their realizations

**Unit 2:**

**Lesson-1: Nehru's letter to his daughter Indira on her birthday** from "Infotech English", Maruthi Publications

**Lesson-2: Bosom Friend by Hira Bansode** from "The Individual Society", Pearson Publications. (Non-detailed)

**Listening:** Answering a series of questions about main idea and supporting ideas after listening to audio texts, both in speaking and writing.

**Speaking:** Discussion in pairs/ small groups on specific topics followed by short structured talks. Functional English: Greetings and leave takings.

**Reading:** Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together.

**Reading for Writing:** Summarizing - identifying main idea/s and rephrasing what is read; avoiding redundancies and repetitions.

**Vocabulary:** Technical vocabulary from across technical branches (20 words). GRE Vocabulary Analogies (20 words) (Antonyms and Synonyms, Word applications)

**Grammar:** Use of articles and zero article; prepositions.

**Pronunciation:** Past tense markers, word stress-di-syllabic words

**Unit 3:**



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**Lesson-1: Stephen Hawking-Positivity ‘Benchmark’** from “Infotech English”, Maruthi Publications

**Lesson-2: Shakespeare’s Sister by Virginia Woolf** from “The Individual Society”, Pearson Publications. (Non-detailed)

**Listening:** Listening for global comprehension and summarizing what is listened to, both in speaking and writing.

**Speaking:** Discussing specific topics in pairs or small groups and reporting what is discussed. Functional English: Complaining and Apologizing.

**Reading:** Reading a text in detail by making basic inferences - recognizing and interpreting specific context clues; strategies to use text clues for comprehension. Critical reading.

**Reading for Writing:** Summarizing - identifying main idea/s and rephrasing what is read; avoiding redundancies and repetitions. Letter writing-types, format and principles of letter writing. E-mail etiquette, Writing CV’s.

**Vocabulary:** Technical vocabulary from across technical branches (20 words). GRE Vocabulary (20 words) (Antonyms and Synonyms, Word applications) Association, sequencing of words

**Grammar:** Verbs - tenses; subject-verb agreement; direct and indirect speech, reporting verbs for academic purposes.

**Pronunciation:** word stress-poly-syllabic words

**Unit 4:**

**Lesson-1: Liking a Tree, Unbowed: Wangari Maathai-biography** from “Infotech English”, Maruthi Publications

**Lesson-2: Telephone Conversation-Wole Soyinka** from “The Individual Society”, Pearson Publications. (Non-detailed)

**Listening:** Making predictions while listening to conversations/ transactional dialogues without video (only audio); listening to audio-visual texts.

**Speaking:** Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions. Functional English: Permissions, Requesting, Inviting.

**Reading:** Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicative process or display complicated data.

**Reading for Writing:** Information transfer; describe, compare, contrast, identify significance/trends based on information provided in figures/charts/graphs/tables. Writing SOP, writing for media.





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**Vocabulary:** Technical vocabulary from across technical branches (20 words) GRE Vocabulary (20 words) (Antonyms and Synonyms, Word applications) Cloze Encounters.

**Grammar:** Quantifying expressions - adjectives and adverbs; comparing and contrasting; degrees of comparison; use of antonyms

**Pronunciation:** Contrastive Stress

**Unit 5:**

**Lesson-1: Stay Hungry-Stay foolish** from “**Infotech English**”, Maruthi Publications

**Lesson-2: Still I Rise** by **Maya Angelou** from “**The Individual Society**”, Pearson Publications. (Non-detailed)

**Listening:** Identifying key terms, understanding concepts and interpreting the concepts both in speaking and writing.

**Speaking:** Formal oral presentations on topics from academic contexts - without the use of PPT slides. Functional English: Suggesting/Opinion giving.

**Reading:** Reading for comprehension. RAP Strategy Intensive reading and Extensive reading techniques.

**Reading for Writing:** Writing academic proposals- writing research articles: format and style.

**Vocabulary:** Technical vocabulary from across technical branches (20 words) GRE Vocabulary (20 words) (Antonyms and Synonyms, Word applications) Coherence, matching emotions.

**Grammar:** Editing short texts – identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement)

**Pronunciation:** Stress in compound words

**Prescribed text books for theory:**

1. “**Infotech English**”, Maruthi Publications. (Detailed)
2. “**The Individual Society**”, Pearson Publications. (Non-detailed)

**Reference books:**

1. Bailey, Stephen. Academic writing: A handbook for international students. Routledge, 2014.
2. Chase, Becky Tarver. Pathways: Listening, Speaking and Critical Thinking. Heinley ELT; 2nd Edition, 2018.
3. Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.
4. Hewings, Martin. Cambridge Academic English (B2). CUP, 2012.



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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>MATHEMATICS-III (BS1203)</b> (Common to ALL Branch's of I Year B. Tech.)					

**Course Objectives:**

- To familiarize the techniques in partial differential equations.
- To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real world applications.

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

- Interpret the physical meaning of different operators such as gradient, curl and divergence (L5)
- Estimate the work done against a field, circulation and flux using vector calculus (L5)
- Apply the Laplace transform for solving differential equations (L3).
- Find or compute the Fourier series of periodic signals (L3)
- Know and be able to apply integral expressions for the forwards and inverse Fourier transform to a range of non-periodic waveforms (L3)
- Identify solution methods for partial differential equations that model physical processes (L3)

**UNIT I: Vector calculus: (10 hrs)**

Vector Differentiation: Gradient — Directional derivative — Divergence — Curl — Scalar Potential.  
 Vector Integration: Line integral — Work done — Area — Surface and volume integrals — Vector integral theorems: Greens, Stokes and Gauss Divergence theorems (without proof).

**UNIT II:Laplace Transforms: (10 hrs)**

Laplace transforms of standard functions — Shifting theorems — Transforms of derivatives and integrals —  
 Unit step function — Dirac's delta function — Inverse Laplace transforms — Convolution theorem (without proof).  
 Applications: Solving ordinary differential equations (initial value problems) using Laplace transforms.

**UNIT III:Fourier series and Fourier Transforms: (10 hrs)**

Fourier Series: Introduction — Periodic functions — Fourier series of periodic function — Dirichlet's conditions — Even and odd functions — Change of interval — Half-range sine and cosine series.

Fourier Transforms: Fourier integral theorem (without proof) — Fourier sine and cosine integrals — Sine and cosine transforms — Properties — inverse transforms — Finite Fourier transforms.

**UNIT IV:PDE of first order: (8 hrs)**

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions — Solutions of first order linear (Lagrange) equation and nonlinear (standard types) equations.



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**UNIT V: Second order PDE and Applications:**

**(10 hrs)**

Second order PDE: Solutions of linear partial differential equations with constant coefficients — RHS term of the type  $e^{ax+by}$ ,  $\sin(ax+by)$ ,  $\cos(ax+by)$ ,  $x^m y^n$

Applications of PDE: Method of separation of Variables — Solution of One dimensional Wave, Heat and two-dimensional Laplace equation.

**Text Books:**

1. **B.S. Grewal**, Higher Engineering Mathematics, 43<sup>rd</sup> Edition, Khanna Publishers.
2. **B. V. Ramana**, Higher Engineering Mathematics, 2007 Edition, Tata Mc. Graw Hill Education.

**Reference Books:**

1. **Erwin Kreyszig**, Advanced Engineering Mathematics, 10<sup>th</sup> Edition, Wiley-India.
2. **Dean. G. Duffy**, Advanced Engineering Mathematics with MATLAB, 3<sup>rd</sup> Edition, CRC Press.
3. **Peter O' Neil**, Advanced Engineering Mathematics, Cengage.
4. **Srimantha Pal, S C Bhunia**, Engineering Mathematics, Oxford University Press.



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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>ENGINEERING CHEMISTRY (BS1210)</b>					

Knowledge of basic concepts of Chemistry for Engineering students will help them as professional engineers later in design and material selection, as well as utilizing the available resources.

**Learning Objectives:**

- **Importance** of usage of plastics in household appliances and composites (FRP) in aerospace and automotive industries.
- **Outline** the basics for the construction of electrochemical cells, batteries and fuel cells. Understand the mechanism of corrosion and how it can be prevented.  
**Express** the increase in demand as wide variety of advanced materials are introduced; which have excellent engineering properties.  
**Classify and discuss** the materials used in major industries like steel industry, metallurgical industries and construction industries and electrical equipment manufacturing industries. Lubrication is also **summarized**.
- **Relate** the need of fuels as a source of energy to any industry, particularly industries like thermal power stations, steel industry, fertilizer industry etc., and hence introduced.
- **Explain** the importance and usage of water as basic material in almost all the industries; **interpret** drawbacks of steam boilers and also how portable water is supplied for drinking purposes.

**UNIT I: POLYMER TECHNOLOGY**

**Polymerisation:-** Introduction-methods of polymerization (emulsion and suspension)-physical and mechanical properties.

**Plastics:** Compounding-fabrication (compression, injection, blown film, extrusion) - preparation, properties and applications of PVC, polycarbonates and Bakelite-mention some examples of plastic materials used in electronic gadgets, recycling of e-plastic waste.

**Elastomers:-** Natural rubber-drawbacks-vulcanization-preparation, properties and applications of synthetic rubbers (Buna S, thiokol and polyurethanes).

**Composite materials:** Fiber reinforced plastics-conducting polymers-biodegradable polymers-biopolymers-biomedical polymers.

**Learning Outcomes: At the end of this unit, the students will be able to**

- **Outline** the properties of polymers and various additives added and different methods of forming plastic materials.
- **Explain** the preparation, properties and applications of some plastic materials.
- **Interpret** the mechanism of conduction in conducting polymers .
- **Discuss** natural and synthetic rubbers and their applications.



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**UNIT II: ELECTROCHEMICAL CELLS AND CORROSION**

Single electrode potential-Electrochemical series and uses of series-standard hydrogen electrode, calomel electrode-concentration cell-construction of glass electrode-Batteries: Dry cell, Ni-Cd cells, Ni-Metal hydride cells, Li ion battery, zinc air cells–Fuel cells: H<sub>2</sub>-O<sub>2</sub>, CH<sub>3</sub>OH-O<sub>2</sub>, phosphoric acid, molten carbonate.

**Corrosion:**-Definition-theories of corrosion (chemical and electrochemical)-galvanic corrosion, differential aeration corrosion, stress corrosion, waterline corrosion-passivity of metals-galvanic series-factors influencing rate of corrosion-corrosion control (proper designing, cathodic protection)-Protective coatings: Surface preparation, cathodic and anodic coatings, electroplating, electroless plating (nickel). Paints (constituents, functions, special paints).

**Learning Outcomes: At the end of this unit, the students will be able to**

- **Explain** the theory of construction of battery and fuel cells.
- **Categorize** the reasons for corrosion and study some methods of corrosion control.

**UNIT III: CHEMISTRY OF MATERIALS**

**Part- A:**

**Nano materials:-** Introduction-sol-gel method-characterization by BET, SEM and TEM methods-applications of graphene-carbon nanotubes and fullerenes:Types, preparation and applications

**Thermal analysis techniques:** Instrumentation and applications of thermogravimetric analysis (TGA), differential thermal analysis (DTA), differential scanning calorimetry (DSC).

**Part-B:**

**Refractories:** - Definition, classification, properties (refractoriness, refractoriness under load, porosity and thermal spalling), failure of refractories.

**Lubricants:** - Definition, mechanism of lubricants and properties (definition and importance).

**Cement:** - Constituents, manufacturing, parameters to characterize the clinker formation: lime saturation factor (LSF), silica ratio (SR) and alumina ratio (AR), chemistry of setting and hardening, deterioration of cement.

**Learning Outcomes: At the end of this unit, the students will be able to**

- **Outline** the awareness of materials like nanomaterials and fullerenes and their uses.
- **Explain** the techniques that detect and measure changes of state of reaction.
- **Illustrate** the commonly used industrial materials.

**UNIT IV: FUELS**

Introduction-calorific value-HCV and LCV-problems using Dulong's formula-proximate and ultimate analysis of coal sample-significance of these analyses-problems-Petroleum (refining-cracking)-Synthetic petrol (Fischer Tropsch and Bergius)-petrol knocking-diesel knocking-octane and cetane ratings-anti-knock agents-Introduction to alternative fuels (Bio-diesel, ethanol, methanol, Natural gas, LPG, CNG)-Flue gas analysis by Orsat apparatus-Rocket fuels.

**Learning Outcomes: At the end of this unit, the students will be able to**

- **Differentiate** petroleum, petrol, synthetic petrol and have knowledge how they are produced.
- **Study** alternate fuels.
- **Analyse** flue gases.



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**UNIT V: WATER TECHNOLOGY**

Hardness of water-determination of hardness by complexometric method-boiler troubles (priming and foaming, scale formation, boiler corrosion, caustic embrittlement)-internal treatments-softening of hard water (zeolite process and related sums, ion exchange process)-treatment of industrial waste water

Portable water and its specifications-steps involved in purification of water-chlorination, break point chlorination-reverse osmosis and electro dialysis.

**Learning Outcomes: At the end of this unit, the students will be able to**

- **Explain** the impurities present in raw water, problems associated with them and how to avoid them are understood.

**Standard Books:**

- |    |  |   |
|----|--|---|
| 1. | Dhanpat Rai Publicating Co. Latest edition | Engineering Chemistry by Jain and Jain;       |
| 2. | Cambridge University Press, 2019 edition.  | Engineering Chemistry by Shikha Agarwal;      |
| 3. | Dara; S. Chand & Co Ltd., Latest Edition   | A text book of engineering Chemistry by S. S. |
| 4. | Dhanpat Rai Publicating Co. Latest edition | Engineering Chemistry by Shashi Chawla;       |



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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>PROGRAMMING FOR PROBLEM SOLVING USING C (ES1201)</b>					

**COURSE OBJECTIVES:**

**The objectives of Programming for Problem Solving Using C are**

- 1) To learn about the computer systems, computing environments, developing of a computer program and Structure of a C Program
- 2) To gain knowledge of the operators, selection, control statements and repetition in C
- 3) To learn about the design concepts of arrays, strings, enumerated structure and union types. To learn about their usage.
- 4) To assimilate about pointers, dynamic memory allocation and know the significance of Preprocessor.
- 5) To assimilate about File I/O and significance of functions

**UNIT I**

**Introduction to Computers:** Creating and running Programs, Computer Numbering System, Storing Integers, Storing Real Numbers

**Introduction to the C Language:** Background, C Programs, Identifiers, Types, Variable, Constants, Input/output, Programming Examples, Scope, Storage Classes and Type Qualifiers.

**Structure of a C Program:** Expressions Precedence and Associativity, Side Effects, Evaluating Expressions, Type Conversion Statements, Simple Programs, Command Line Arguments.

**UNIT II**

**Bitwise Operators:** Exact Size Integer Types, Logical Bitwise Operators, Shift Operators.

**Selection & Making Decisions:** Logical Data and Operators, Two Way Selection, Multiway Selection, More Standard Functions

**Repetition:** Concept of Loop, Pretest and Post-test Loops, Initialization and Updating, Event and Counter Controlled Loops, Loops in C, Other Statements Related to Looping, Looping Applications, Programming Examples

**UNIT III**

**Arrays:** Concepts, Using Array in C, Array Application, Two Dimensional Arrays, Multidimensional Arrays, Programming Example – Calculate Averages

**Strings:** String Concepts, C String, String Input / Output Functions, Arrays of Strings, String Manipulation Functions String/ Data Conversion, A Programming Example – Morse Code

**Enumerated, Structure, and Union:** The Type Definition (Type def), Enumerated Types, Structure, Unions, and Programming Application

**UNIT IV**

**Pointers:** Introduction, Pointers to pointers, Compatibility, L value and R value

**Pointer Applications:** Arrays, and Pointers, Pointer Arithmetic and Arrays, Memory Allocation Function, Array of Pointers, Programming Application

**Processor Commands:** Processor Commands



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**UNIT V**

**Functions:** Designing, Structured Programs, Function in C, User Defined Functions, Inter-Function Communication, Standard Functions, Passing Array to Functions, Passing Pointers to Functions, Recursion

**Text Input / Output:** Files, Streams, Standard Library Input / Output Functions, Formatting Input / Output Functions, Character Input / Output Functions

**Binary Input / Output:** Text versus Binary Streams, Standard Library, Functions for Files, Converting File Type.

**TEXT BOOKS:**

1. Programming for Problem Solving, Behrouz A. Forouzan, Richard F. Gilberg, CENGAGE
2. The C Programming Language, Brian W. Kernighan, Dennis M. Ritchie, 2e, Pearson

**REFERENCES:**

1. Computer Fundamentals and Programming, Sumithabha Das, Mc Graw Hill
2. Programming in C, Ashok N. Kamthane, Amit Kamthane, Pearson
3. Computer Fundamentals and Programming in C, Pradip Dey, Manas Ghosh, OXFORD

**COURSE OUTCOMES:**

Upon the completion of the course the student will learn

- 1) To write algorithms and to draw flowcharts for solving problems
- 2) To convert flowcharts/algorithms to C Programs, compile and debug programs
- 3) To use different operators, data types and write programs that use two-way/ multi-way selection
- 4) To select the best loop construct for a given problem
- 5) To design and implement programs to analyze the different pointer applications
- 6) To decompose a problem into functions and to develop modular reusable code
- 7) To apply File I/O operations





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**DEPARTMENT OF CIVIL ENGINEERING**

<b>I Year - II Semester</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>1</b>	<b>0</b>	<b>3</b>	<b>2.5</b>
<b>COMPUTER AIDED ENGINEERING DRAWING (ES1207)</b>					

**Course Objective:** To enhance the student's knowledge and skills in engineering drawing and to introduce drafting packages and commands for computer aided drawing and modeling.

**UNIT-I:**

**Objective:** The knowledge of projections of solids is essential in 3D modeling and animation. The student will be able to draw projections of solids. The objective is to enhance the skills they already acquired in their earlier course in drawing of projection.

**PROJECTIONS OF SOLIDS:** Projections of Regular Solids inclined to both planes – Auxiliary Views.

**UNIT-II:**

The knowledge of sections of solids and development of surfaces is required in designing and manufacturing of the objects. Whenever two or more solids combine, a definite curve is seen at their intersection.

**SECTIONS OF SOLIDS:** Sections and Sectional views of Right Regular Solids – Prism, Cylinder, Pyramid, Cone – Auxiliary views.

**DEVELOPMENT AND INTERPENETRATION OF SOLIDS:** Development of Surfaces of Right Regular Solids – Prism, Cylinder, Pyramid, Cone and their parts.

**UNIT-III:**

The intersection of solids also plays an important role in designing and manufacturing. The objective is to impart this knowledge through this topic. A perspective view provides a realistic 3D View of an object. The objective is to make the students learn the methods of Iso and Perspective views.

**INTERPENETRATION OF RIGHT REGULAR SOLIDS:** Intersection of Cylinder Vs Cylinder, Cylinder Vs Prism, Cylinder Vs Cone, Prism Vs Cone.

**PERSPECTIVE PROJECTIONS:** Perspective View: Points, Lines, Plane Figures and Simple Solids,

Vanishing Point Methods (General Method only).

*In part B computer aided drafting is introduced.*



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**UNIT IV:**

The objective is to introduce various commands in AutoCAD to draw the geometric entities and to create 2D and 3D wire frame models.

**INTRODUCTION TO COMPUTER AIDED DRAFTING:** Generation of points, lines, curves, polygons, dimensioning. Types of modeling : object selection commands – edit, zoom, cross hatching, pattern filling, utility commands, 2D wire frame modeling, 3D wire frame modeling,.

**UNIT V:**

By going through this topic the student will be able to understand the paper-space environment thoroughly.

**VIEW POINTS AND VIEW PORTS:** view point coordinates and view(s) displayed, examples to exercise different options like save, restore, delete , joint , single option.

**UNIT VI:**

The objective is to make the students create geometrical model of simple solids and machine parts and display the same as an Isometric, Orthographic or Perspective projection.

**COMPUTER AIDED SOLID MODELING:** Isometric projections, orthographic projections of isometric projections, Modeling of simple solids, Modeling of Machines & Machine Parts.

**TEXT BOOKS :**

1. Engineering drawing by N.D Bhatt , Charotar publications.
2. Engineering Graphics, K.C. john, PHI Publications

**REFERENCES:**

1. Mastering Auto CAD 2013 and Auto CAD LT 2013 – George Omura, Sybex
2. Auto CAD 2013 fundamentals- Elisemoss, SDC Publ.
3. Engineering Drawing and Graphics using Auto Cad – T Jeyapoovan, vikas
4. Engineering Drawing + AutoCAD – K Venugopal, V. Prabhu Raja, New Age
5. Engineering Drawing – RK Dhawan, S Chand
6. Engineering Drawing – MB Shaw, BC Rana, Pearson
7. Engineering Drawing – KL Narayana, P Kannaiah, Scitech
8. Engineering Drawing – Agarwal and Agarwal, Mc Graw Hill
9. Engineering Graphics – PI Varghese, Mc Graw Hill
10. Text book of Engineering Drawing with auto-CAD , K.venkata reddy/B.S . publications.
11. Engineering Drawing with Auto CAD/ James D Bethune/Pearson Publications
12. Engineering Graphics with Auto CAD/Kulkarni D.M, Rastogi A.P, Sarkar A.K/PHI Publications



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End Semester examination shall be conducted for **Four** hours with the following pattern:

- a) Two hours – Conventional drawing
- b) Two hours – Computer Aided Drawing

**Course outcomes:**

1. Student get exposed on working of sheet metal with help of development of surfaces.
2. Student understands how to know the hidden details of machine components with the help of sections and interpenetrations of solids.
3. Student shall exposed to modeling commands for generating 2D and 3D objects using computer aided drafting tools which are useful to create machine elements for computer aided analysis.



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<b>I Year - II Semester</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>
<b>PROGRAMMING FOR PROBLEM SOLVING USING C LAB (ES1202)</b>				

**Course Objectives:**

- 1) Apply the principles of C language in problem solving.
- 2) To design flowcharts, algorithms and knowing how to debug programs.
- 3) To design & develop of C programs using arrays, strings pointers & functions.
- 4) To review the file operations, preprocessor commands.

**Exercise 1:**

1. Write a C program to print a block F using hash (#), where the F has a height of six characters and width of five and four characters.
2. Write a C program to compute the perimeter and area of a rectangle with a height of 7 inches and width of 5 inches.
3. Write a C program to display multiple variables.

**Exercise 2:**

1. Write a C program to calculate the distance between the two points.
2. Write a C program that accepts 4 integers p, q, r, s from the user where r and s are positive and p is even. If q is greater than r and s is greater than p and if the sum of r and s is greater than the sum of p and q print "Correct values", otherwise print "Wrong values".

**Exercise 3:**

1. Write a C program to convert a string to a long integer.
2. Write a program in C which is a Menu-Driven Program to compute the area of the various geometrical shape.
3. Write a C program to calculate the factorial of a given number.

**Exercise 4:**

1. Write a program in C to display the n terms of even natural number and their sum.
2. Write a program in C to display the n terms of harmonic series and their sum.  
 $1 + 1/2 + 1/3 + 1/4 + 1/5 \dots 1/n$  terms.
3. Write a C program to check whether a given number is an Armstrong number or not.

**Exercise 5:**

1. Write a program in C to print all unique elements in an array.
2. Write a program in C to separate odd and even integers in separate arrays.
3. Write a program in C to sort elements of array in ascending order.

**Exercise 6:**

1. Write a program in C for multiplication of two square Matrices.
2. Write a program in C to find transpose of a given matrix.

**Exercise 7:**

1. Write a program in C to search an element in a row wise and column wise sorted matrix.
2. Write a program in C to print individual characters of string in reverse order.

**Exercise 8:**

1. Write a program in C to compare two strings without using string library functions.
2. Write a program in C to copy one string to another string.



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**Exercise 9:**

1. Write a C Program to Store Information Using Structures with Dynamically Memory Allocation
2. Write a program in C to demonstrate how to handle the pointers in the program.

**Exercise 10:**

1. Write a program in C to demonstrate the use of & (address of) and \*(value at address) operator.
2. Write a program in C to add two numbers using pointers.

**Exercise 11:**

1. Write a program in C to add numbers using call by reference.
2. Write a program in C to find the largest element using Dynamic Memory Allocation.

**Exercise 12:**

1. Write a program in C to swap elements using call by reference.
2. Write a program in C to count the number of vowels and consonants in a string using a pointer.

**Exercise 13:**

1. Write a program in C to show how a function returning pointer.
2. Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using malloc( ) function.

**Exercise 14:**

1. Write a C program to find sum of n elements entered by user. To perform this program, allocate memory dynamically using calloc( ) function. Understand the difference between the above two programs
2. Write a program in C to convert decimal number to binary number using the function.

**Exercise 15:**

1. Write a program in C to check whether a number is a prime number or not using the function.
2. Write a program in C to get the largest element of an array using the function.

**Exercise 16:**

1. Write a program in C to append multiple lines at the end of a text file.
2. Write a program in C to copy a file in another name.
3. Write a program in C to remove a file from the disk.

**Course Outcomes:**

**By the end of the Lab, the student**

- 1) Gains Knowledge on various concepts of a C language.
- 2) Able to draw flowcharts and write algorithms.
- 3) Able design and development of C problem solving skills.
- 4) Able to design and develop modular programming skills.
- 5) Able to trace and debug a program



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<b>I Year - II Semester</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>
<b>ENGINEERING CHEMISTRY LAB (BS1211)</b>					

Introduction to Chemistry laboratory – Molarity, normality, primary, secondary standard solutions, volumetric titrations, quantitative analysis

1. Determination of HCl using standard  $\text{Na}_2\text{CO}_3$  solution.
2. Determination of alkalinity of a sample containing  $\text{Na}_2\text{CO}_3$  and NaOH.
3. Determination of Mn (II) using standard oxalic acid solution.
4. Determination of ferrous iron using standard  $\text{K}_2\text{Cr}_2\text{O}_7$  solution.
5. Determination of copper (II) using standard hypo solution.
6. Determination of temporary and permanent hardness of water using standard EDTA solution.
7. Determination of iron (III) by a colorimetric method.
8. Determination of the concentration of acetic acid using sodium hydroxide (pH-metry method).
9. Determination of the concentration of strong acid vs strong base (by conductometric method).
10. Determination of strong acid vs strong base (by potentiometric method).
11. Determination of  $\text{Mg}^{+2}$  present in an antacid.
12. Determination of  $\text{CaCO}_3$  present in an egg shell.
13. Estimation of Vitamin C.
14. Determination of phosphoric content in soft drinks.
15. Adsorption of acetic acid by charcoal.
16. Preparation of nylon-6, 6 and Bakelite (demonstration only).

**Of the above experiments at-least 10 assessment experiments should be completed in a semester.**

**Outcomes:** The students entering into the professional course have practically very little exposure to lab classes. The experiments introduce volumetric analysis; redox titrations with different indicators; EDTA titrations; then they are exposed to a few instrumental methods of chemical analysis. Thus at the end of the lab course, the student is exposed to different methods of chemical analysis and use of some commonly employed instruments. They thus acquire some experimental skills.

**Reference Books**

1. A Textbook of Quantitative Analysis, Arthur J. Vogel.



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		<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>
<b>COMMUNICATION SKILLS LAB (ES1203)</b>					

**UNIT I:**

Oral Activity: JAM, Hypothetical Situations, Self/Peer Profile  
 Common Errors in Pronunciation, Neutralising Accent

**UNIT II:**

Oral Activity: Telephonic Etiquette, Role Plays  
 Poster Presentations

**UNIT III:**

Oral Activity: Oral Presentation skills, Public speaking  
 Data Interpretation

**UNIT IV:**

Oral Activity: Group Discussions: Do's and Don'ts- Types, Modalities

**UNIT V:**

Oral Activity: Interview Skills: Preparatory Techniques, Frequently asked questions, Mock Interviews.  
 Pronunciation: Connected speech (Pausing, Tempo, Tone, Fluency etc.,)

**References:**

1. Infotech English, Maruthi Publications (with Compact Disc).
2. Exercises in Spoken English Part 1,2,3,4, OUP and CIEFL.
3. English Pronunciation in use- Mark Hancock, Cambridge University Press.
4. English Phonetics and Phonology-Peter Roach, Cambridge University Press.
5. English Pronunciation in use- Mark Hewings, Cambridge University Press.
6. English Pronunciation Dictionary- Daniel Jones, Cambridge University Press.
7. English Phonetics for Indian Students- P. Bala Subramanian, Mac Millan Publications.
8. Technical Communication- Meenakshi Raman, Sangeeta Sharma, Oxford University Press.
9. Technical Communication- Gajendra Singh Chauhan, Smita Kashiramka, Cengage Publications.



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		<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>
<b>WORKSHOP PRACTICE LAB (ES1219)</b>					

**Course Objective: To impart hands-on practice on basic engineering trades and skills.**

**Note: At least two exercises to be done from each trade.**

**Trade:**

- |                       |  |
|-----------------------|--|
| <b>1.Carpentry</b>    | <ol style="list-style-type: none"> <li>1. T-Lap Joint</li> <li>2. Cross Lap Joint</li> <li>3. Dovetail Joint</li> <li>4. Mortise and Tenon Joint</li> </ol>  |
| <b>2.Fitting</b>      | <ol style="list-style-type: none"> <li>1. Vee Fit</li> <li>2. Square Fit</li> <li>3. Half Round Fit</li> <li>4. Dovetail Fit</li> </ol>  |
| <b>3.Black Smithy</b> | <ol style="list-style-type: none"> <li>1. Round rod to Square</li> <li>2. S-Hook</li> <li>3. Round Rod to Flat Ring</li> <li>4. Round Rod to Square headed bolt</li> </ol>                                     |
| <b>4.House Wiring</b> | <ol style="list-style-type: none"> <li>1. Parallel / Series Connection of three bulbs</li> <li>2. Stair Case wiring</li> <li>3. Florescent Lamp Fitting</li> <li>4. Measurement of Earth Resistance</li> </ol> |
| <b>5.Tin Smithy</b>   | <ol style="list-style-type: none"> <li>1. Taper Tray</li> <li>2. Square Box without lid</li> <li>3. Open Scoop</li> <li>4. Funnel</li> </ol>   |
| <b>6.IT Workshop</b>  | <ol style="list-style-type: none"> <li>1.Assembly &amp; Disassembly of Computer</li> </ol>   |





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<b>I Year - II Semester</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>ENVIRONMENTAL SCIENCE(MC1201)</b>					

**Learning Objectives:**

The objectives of the course are to impart:

- Overall understanding of the natural resources.
- Basic understanding of the ecosystem and its diversity.
- Acquaintance on various environmental challenges induced due to unplanned anthropogenic activities.
- An understanding of the environmental impact of developmental activities.
- Awareness on the social issues, environmental legislation and global treaties.

**UNIT-I:**

**Multidisciplinary nature of Environmental Studies:** Definition, Scope and Importance – Sustainability: Stockholm and Rio Summit–Global Environmental Challenges: Global warming and climate change, acid rains, ozone layer depletion, population growth and explosion, effects;. Role of information technology in environment and human health.

**Ecosystems:** Concept of an ecosystem. - Structure and function of an ecosystem; Producers, consumers and decomposers. - Energy flow in the ecosystem - Ecological succession. - Food chains, food webs and ecological pyramids; Introduction, types, characteristic features, structure and function of Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems.

**UNIT-II:**

**Natural Resources:** Natural resources and associated problems.

Forest resources: Use and over – exploitation, deforestation – Timber extraction – Mining, dams and other effects on forest and tribal people.

Water resources: Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems.

Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources.

Food resources: World food problems, changes caused by non-agriculture activities-effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity.

Energy resources: Growing energy needs, renewable and non-renewable energy sources use of alternate energy sources.

Land resources: Land as a resource, land degradation, Wasteland reclamation, man induced landslides, soil erosion and desertification; Role of an individual in conservation of natural resources; Equitable use of resources for sustainable lifestyles.

**UNIT-III:**

**Biodiversity and its conservation:** Definition: genetic, species and ecosystem diversity-classification - Value of biodiversity: consumptive use, productive use, social-Biodiversity at national and local levels. India as a mega-diversity nation - Hot-spots of biodiversity - Threats to biodiversity: habitat loss, man-wildlife conflicts. - Endangered and endemic species of India – Conservation of biodiversity: conservation of biodiversity.



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**UNIT – IV Environmental Pollution:** Definition, Cause, effects and control measures of Air pollution, Water pollution, Soil pollution, Noise pollution, Nuclear hazards. Role of an individual in prevention of pollution. - Pollution case studies, Sustainable Life Studies. Impact of Fire Crackers on Men and his well being.

**Solid Waste Management:** Sources, Classification, effects and control measures of urban and industrial solid wastes. Consumerism and waste products, Biomedical, Hazardous and e – waste management.

**UNIT – V Social Issues and the Environment:** Urban problems related to energy -Water conservation, rain water harvesting-Resettlement and rehabilitation of people; its problems and concerns. Environmental ethics: Issues and possible solutions. Environmental Protection Act -Air (Prevention and Control of Pollution) Act. –Water (Prevention and control of Pollution) Act -Wildlife Protection Act -Forest Conservation Act-Issues involved in enforcement of environmental legislation. -Public awareness.

**Environmental Management:** Impact Assessment and its significance various stages of EIA, preparation of EMP and EIS, Environmental audit. Ecotourism, Green Campus – Green business and Green politics.

The student should Visit an Industry / Ecosystem and submit a report individually on any issues related to Environmental Studies course and make a power point presentation.

**Text Books:**

1. Environmental Studies, K. V. S. G. Murali Krishna, VGS Publishers, Vijayawada
2. Environmental Studies, R. Rajagopalan, 2<sup>nd</sup> Edition, 2011, Oxford University Press.
3. Environmental Studies, P. N. Palanisamy, P. Manikandan, A. Geetha, and K. Manjula Rani; Pearson Education, Chennai

**Reference:**

1. Text Book of Environmental Studies, Deeshita Dave & P. Udaya Bhaskar, Cengage Learning.
2. A Textbook of Environmental Studies, Shaashi Chawla, TMH, New Delhi
3. Environmental Studies, Benny Joseph, Tata McGraw Hill Co, New Delhi
4. Perspectives in Environment Studies, Anubha Kaushik, C P Kaushik, New Age International Publishers, 2014



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**DEPARTMENT OF CIVIL ENGINEERING**

<b>II Year - I Semester</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>Complex Variables and Statistical Methods</b>					

**Course Objectives:**

- To familiarize the complex variables.
- To familiarize the students with the foundations of probability and statistical methods.
- To equip the students to solve application problems in their disciplines.

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

- apply Cauchy-Riemann equations to complex functions in order to determine whether a given continuous function is analytic (L3)
- find the differentiation and integration of complex functions used in engineering problems (L5)
- make use of the Cauchy residue theorem to evaluate certain integrals (L3)
- apply discrete and continuous probability distributions (L3)
- design the components of a classical hypothesis test (L6)
- infer the statistical inferential methods based on small and large sampling tests (L4)

**UNIT – I: Functions of a complex variable and Complex integration:**

Introduction – Continuity – Differentiability – Analyticity – Properties – Cauchy-Riemann equations in Cartesian and polar coordinates – Harmonic and conjugate harmonic functions – Milne – Thompson method.

Complex integration: Line integral – Cauchy’s integral theorem – Cauchy’s integral formula – Generalized integral formula (all without proofs).

**UNIT – II: Series expansions and Residue Theorem:**

Radius of convergence – Expansion in Taylor’s series, Maclaurin’s series and Laurent series.

Types of Singularities: Isolated – pole of order m – Essential – Residues – Residue theorem

( without proof) – Evaluation of real integral of the type  $\int_{-\infty}^{\infty} f(x)dx$



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**UNIT – III: Probability and Distributions:**

Review of probability and Baye's theorem – Random variables – Discrete and Continuous random variables – Distribution function – Mathematical Expectation and Variance – Binomial, Poisson, Uniform and Normal distributions.

**UNIT – IV: Sampling Theory:**

Introduction – Population and samples – Sampling distribution of Means and Variance (definition only) – Central limit theorem (without proof) – Introduction to t,  $\chi^2$  and F-distributions – Point and Interval estimations – Maximum error of estimate.

**UNIT – V: Tests of Hypothesis:**

Introduction – Hypothesis – Null and Alternative Hypothesis – Type I and Type II errors – Level of significance – One tail and two-tail tests – Tests concerning one mean and two means (Large and Small samples) – Tests on proportions.

**Text Books:**

1. **B. S. Grewal**, Higher Engineering Mathematics, 43<sup>rd</sup> Edition, Khanna Publishers.
2. **Miller and Freund's**, Probability and Statistics for Engineers, 7/e, Pearson, 2008.

**Reference Books:**

1. **S. C. Gupta and V. K. Kapoor**, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand & Sons Publications, 2012.
2. **Jay I. Devore**, Probability and Statistics for Engineering and the Sciences, 8<sup>th</sup> Edition, Cengage.
3. **Shron L. Myers, Keying Ye, Ronald E Walpole**, Probability and Statistics Engineers and the Scientists, 8<sup>th</sup> Edition, Pearson 2007.
4. **Sheldon, M. Ross**, Introduction to probability and statistics Engineers and the Scientists, 4<sup>th</sup> Edition, Academic Foundation, 2011



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<b>II Year - I Semester</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>STRENGTH OF MATERIALS - I</b>					

**Course Learning Objectives:**

- To impart preliminary concepts of Strength of Material and Principles of Elasticity and Plasticity Stress conditions and to develop diagrams of variation of various stresses across the length.
- To give concepts of stresses developed in the cross section and bending equations calculation of section modulus of sections with different crosssections
- The concepts above will be utilized in measuring deflections in beams under various loading and supportconditions
- To classify cylinders based on their thickness and to derive equations for measurement of stresses across the cross section when subjected to external pressure.

**Course Outcomes:**

- The student will be able to understand the basic materials behavior underthe influence of different external loading conditions and the supportconditions
- The student will be able to draw the diagrams indicating the variation of the key performance features like bending moment and shearforces
- The student will have knowledge of bending concepts and calculation of section modulus and for determination of stresses developed in the beams and deflections due to various loadingconditions
- The student will be able to assess stresses across section of the thin and thick cylinders to arrive at optimum sections to withstand the internal pressure using Lamé's equation.

**SYLLABUS:**

**UNIT – I: Simple Stresses And Strains :** Elasticity and plasticity – Types of stresses and strains – Hooke's law – stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio and volumetric strain – Elastic moduli and the relationship between them – Bars of varying section – stresses in composite bars – Temperature stresses.

**Strain Energy** – Resilience – Gradual, sudden, impact and shock loadings – simple applications.

**UNIT – II: Shear Force and Bending Moment:** Definition of beam – Types of beams – Concept of shear force and bending moment – Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of a beam; S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, uniformly distributed loads, uniformly varying loads, partial uniformly distributed loads, couple and combination of these loads.

**UNIT – III: Flexural and shear Stresses in beams**

**Flexural Stresses:** Theory of simple bending – Assumptions – Derivation of bending equation:  $M/I = f/y = E/R$ , Neutral axis – Determination bending stresses – section modulus of rectangular and circular sections (Solid and Hollow), I, T, Angle and Channel sections – Design of simple beam sections.

**Shear Stresses:** Derivation of formula – Shear stress distribution across various beam sections like rectangular, circular, I, T Angle sections.



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**UNIT – IV: Deflection of Beams:** Bending into a circular arc – slope, deflection and radius of curvature – Differential equation for the elastic curve of a beam – Double integration and Macaulay’s methods – Determination of slope and deflection for cantilever, simply supported and overhanging beams subjected to point loads, uniformly distributed loads, uniformly varying loads, partial uniformly distributed loads, couple and combination of these loads. Mohr’s theorems – Moment area method – application to simple cases of cantilever.

**UNIT – V: Thin and Thick Cylinders:**

**Thin cylindrical shells** – Derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and volumetric strains – changes in diameter, and volume of thin cylinders.

**Thick cylinders:** Introduction: Lames theory for thick cylinders, Derivation of Lames formulae, distribution of hoop and radial stresses across the thickness, compound cylinders-distribution of stresses.

**TEXT BOOKS:**

1. A Textbook of Strength of Materials, by R. K. Rajput, 7e (Mechanics of Solids) SI Units S. Chand & Co, NewDelhi
2. Strength of materials by R. K. Bansal, LakshmiPublications.

**REFERENCES:**

1. Mechanics of Materials- by R. C.Hibbler, Pearson publishers
2. Mechanics of Solids – E P Popov, Prentice Hall.
3. Strength of Materials by B.S.Basavarajaiah and P. Mahadevappa, 3<sup>rd</sup> Edition,Universities Press
4. Mechanics of Structures Vol – I by H.J.Shah and S.B.Junnarkar, Charotar Publishing House Pvt. Ltd.



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**DEPARTMENT OF CIVIL ENGINEERING**

<b>II Year - I Semester</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>FLUID MECHANICS</b>					

**Course Learning Objectives:**

- To understand the properties of fluids and fluid statics
- To derive the equation of conservation of mass and its application
- To solve kinematic problems such as finding particle paths and streamlines
- To use important concepts of continuity equation, Bernoulli's equation and turbulence, and apply the same to problems
- To analyze laminar and turbulent flows
- To understand the various flow measuring devices
- To study in detail about boundary layers theory

**Course Outcomes:**

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

- Understand the various properties of fluids and their influence on fluid motion and analyse a variety of problems in fluid statics and dynamics.
- Calculate the forces that act on submerged planes and curves.
- Ability to analyse various types of fluid flows.
- Apply the integral forms of the three fundamental laws of fluid mechanics to turbulent and laminar flow through pipes and ducts in order to predict relevant pressures, velocities and forces.
- Able Measure the quantities of fluid flowing in pipes, tanks and channels.

**Syllabus:**

**UNIT I**

**Introduction:** Dimensions and units – Physical properties of fluids - specific gravity, viscosity, surface tension, vapour pressure and their influences on fluid motion, pressure at a point, Pascal's law, Hydrostatic law -atmospheric, gauge and vacuum pressures- measurement of pressure. Pressure gauges, Manometers: Differential and Micro Manometers.

**Hydrostatics:** Hydrostatic forces on submerged plane, Horizontal, Vertical, inclined and curved surfaces – Center of pressure.

**UNIT – II**

**Fluid Kinematics:** Description of fluid flow, Stream line, path line and streak line and stream tube. Classification of flows: Steady, unsteady, uniform, non-uniform, laminar, turbulent, rotational and irrotational flows – Equation of continuity for one, two , three dimensional flows – stream and velocity potential functions, flow net analysis.

**Fluid Dynamics:** Surface and body forces – Euler's and Bernoulli's equations for flow along a stream line - Momentum equation and its application – forces on pipe bend.



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**UNIT – III**

**Laminar Flow and Turbulent Flows:** Reynold's experiment – Characteristics of Laminar & Turbulent flows, Shear and velocity distributions, Laws of Fluid friction, Hagen-Poiseulle Formula, Flow between parallel plates, Flow through long tubes, hydrodynamically smooth and rough flows.

**Closed Conduit Flow:** Darcy-Weisbach equation, Minor losses – pipes in series – pipes in parallel – Total energy line and hydraulic gradient line, variation of friction factor with Reynold's number – Moody's Chart, Pipe network problems, Hazen-Williams formula, Hard-Cross Method,

**UNIT – IV**

**Measurement of Flow:** Pitot tube, Venturi meter and Orifice meter – classification of orifices, small orifice and large orifice, flow over rectangular, triangular, trapezoidal and Stepped notches, Broad crested weirs and Ogee weirs.

**UNIT – V**

**Boundary Layer Theory:** Boundary layer (BL) – concepts, Prandtl contribution, Characteristics of boundary layer along a thin flat plate, Vonkarman momentum integral equation, laminar and turbulent Boundary layers (no deviations)- BL in transition, separation of BL, Control of BL, flow around submerged objects-Drag and Lift- Magnus effect.

**Text Books:**

1. Modi P.N and Seth S.M.(2018), "Fluid mechanics", Standard book house, New Delhi
2. AtextofFluidmechanicsandhydraulicmachines,R.K.Bansal-LaxmiPublications (P) ltd., New Delhi

**References:**

1. K.Subramanyam, Fluid mechanics and hydraulic machines Mc graw hill education, IInd edition
2. Fluid Mechanics and Machinery, C.S.P. Ojha, R. Berndtsson and P.N. Chandramouli, Oxford Higher Education.
3. Principle of fluid mechanics and fluid machines III edition, university press





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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>SURVEYING AND GEOMETRICS</b>					

**Course Objectives:**

The object of the course student should have the capability to:

- Know the principle and methods of surveying.
- Measure horizontal and vertical- distances and angles
- Recording of observation accurately
- Perform calculations based on the observation
- Identification of source of errors and rectification methods
- Apply surveying principles to determine areas and volumes and setting out curves
- Use modern surveying equipment's for accurate results

**Course Outcomes:** Course will enable the student to:

- Apply the knowledge to calculate angles, distances and levels
- Identify data collection methods and prepare field notes
- Understand the working principles of survey instruments, measurement errors and corrective measures
- Interpret survey data and compute areas and volumes, levels by different type of equipment and relate the knowledge to the modern equipment and methodologies

**SYLLABUS**

**UNIT - I**

**Introduction and Basic Concepts:** Introduction, Objectives, classification and principles of surveying, Surveying accessories. Introduction to Compass, levelling and Plane table surveying.

**Measurement of Distances and Directions**

**Linear distances-** Approximate methods, Direct Methods- Chains- Tapes, ranging, Tape corrections.

**Prismatic Compass-** Bearings, included angles, Local Attraction, Magnetic Declination, and dip – W.C.B systems and Q.B. system of locating bearings.

**UNIT - II**

**Leveling-** Types of levels, temporary and permanent adjustments, methods of levelling, booking and Determination of levels, Effect of Curvature of Earth and Refraction.

**Contouring-** Characteristics and uses of Contours, methods of contour surveying.

**Areas -** Determination of areas consisting of irregular boundary and regular boundary.

**Volumes -**Determination of volume of earth work in cutting and embankments for level section, volume of borrow pits, capacity of reservoirs.

**UNIT - III**

**Theodolite Surveying:** Types of Theodolites, temporary adjustments, measurement of horizontal angle by repetition method and reiteration method, measurement of vertical Angle, Trigonometrical levelling when base is accessible and inaccessible.

**Traversing:** Methods of traversing, traverse computations and adjustments, Introduction to Omitted measurements.



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**UNIT - IV**

**Curves:** Types of curves and their necessity, elements of simple, compound, reverse curves.

**Tacheometric Surveying:** Principles of Tacheometry, stadia and tangential methods of Tacheometry,

**Modern Surveying Methods:** Principle and types of E.D.M. Instruments, Total station- advantages and Applications. Introduction to Global Positioning System.

**UNIT - V**

**Photogrammetry Surveying:**

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

**TEXT BOOKS:**

1. Surveying (Vol – 1, 2 & 3), by B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain - Laxmi Publications (P) ltd., New Delhi.
2. Chandra A M, “Plane Surveying and Higher Surveying”, New age International Pvt. Ltd., Publishers, New Delhi.
3. Duggal S K, “Surveying (Vol – 1 & 2), Tata McGraw Hill Publishing Co. Ltd. New Delhi.

**REFERENCES:**

1. Arthur R Benton and Philip J Taety, Elements of Plane Surveying, McGraw Hill.
2. Surveying and levelling by R. Subramanian, Oxford university press, New Delhi
3. Arora K R “Surveying Vol 1, 2 & 3), Standard Book House, Delhi.



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<b>II Year - I Semester</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>BUILDING METEERIALS, CONSTRUCTION AND PLANNING</b>					

**I. Objectives of theCourse:**

- Initiating the student with the knowledge of basic building materials and their properties.
- Imparting the knowledge of course pattern in masonry construction and flat roofs and techniques of forming foundation, columns, beams, walls, sloped and flatroofs.
- The student is to be exposed to the various patterns of floors, walls, different types of paints andvarnishes.
- Imparting the students with the techniques of formwork and scaffolding.
- The students should be exposed to classification of aggregates, moisture content of the aggregate.

**II. Course Outcomes:**

Upon the successful completion of the course:

- The student should be able to identify different building materials and their importance in building construction.
- The student is expected to differentiate brick masonry, stone masonry construction and use of lime and cement in various constructions.
- The student should have learnt the importance of building components and finishings.
- The student is expected to know the classification of aggregates, sieve analysis and moisture content usually required in building construction.

**UNIT I: Stones, Bricks and Tiles:** Properties of building stones – relation to their structural requirements, classification of stones – stone quarrying – precautions in blasting, dressing of stone, composition of good brick earth, various methods of manufacturing of bricks. Characteristics of good tile - manufacturing methods, types of tiles. Uses of materials like Aluminium, Gypsum, Glass and Bituminous materials

**UNIT II Masonry:** Types of masonry, English and Flemish bonds, Rubble and Ashlar Masonry. Cavity and partition walls. Wood: Structure – Properties- Seasoning of timber- Classification of various types of woods used in buildings- Defects in timber. Alternative materials for wood – Galvanized Iron, Fiber Reinforced Plastics, Steel, Aluminium.

**UNIT III: Lime and Cement:** Lime: Various ingredients of lime – Constituents of lime stone – classification of lime – various methods of manufacture of lime.

Cement: Portland cement- Chemical Composition – Hydration, setting and fineness of cement. Various types of cement and their properties. Various field and laboratory tests for Cement. Various ingredients of cement concrete and their importance – various tests for concrete.



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**UNIT IV: Building Components:** Lintels, arches, vaults, stair cases – types. Different types of floors – Concrete, Mosaic, Terrazzo floors, Pitched, flat roofs. Lean to roof, Coupled Roofs. Trussed roofs – King and Queen post Trusses. R.C.C Roofs, Madras Terrace and Pre fabricated roofs.

**UNITV: Finishings and Aggregates:** Damp Proofing and water proofing materials and uses – Plastering Pointing, white washing and distempering. Paints: Constituents of a paint – Types of paints – Painting of new/old wood- Varnish. Form Works and Scaffoldings.

**Aggregates** - Classification of aggregate – Coarse and fine aggregates- particle shape and texture – Bond and Strength of aggregate – Specific gravity – Bulk Density, porosity and absorption – Moisture content of Aggregate- Bulking of sand – Sieve analysis.

**Text Books:**

1. Building Materials, S. S. Bhavikatti, Vices publications House private ltd.
2. Building Construction, S. S. Bhavikatti, Vices publications House private ltd.
3. Building Materials, B. C. Punmia, Laxmi Publications private ltd.
4. Building Construction, B.C. Punmia, Laxmi Publications (p)ltd.

**References:**

1. Building Materials, S. K. Duggal, New Age International Publications.
2. Building Materials, P. C. Verghese, PHI learning (P)ltd.
3. Building Materials, M. L. Gambhir, Tata McGraw Hill Publishing Co. Ltd. New Delhi.
4. Building construction, P. C. Verghese, PHI Learning (P)Ltd.
5. Building Materials, Construction and Planning, S. Mahaboob Basha, Anuradha Publications, Chennai.

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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>TRANSPORTATION ENGINEERING – I</b>					

**Course Learning Objectives:**

The objectives of this course are:

- To impart different concepts in the field of Highway Engineering.
- To acquire design principles of Highway Geometrics and Pavements
- To acquire design principles of Intersections

**Course Outcomes:**

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

- Plan highway network for a given area.
- Determine Highway alignment and design highway geometrics.
- Design Intersections and prepare traffic management plans
- Judge suitability of pavement materials and design flexible and rigid pavements

**SYLLABUS:**

**UNIT I Highway Planning and Alignment:** Highway development in India; Classification of Roads; Road Network Patterns; Necessity for Highway Planning; Different Road Development Plans – First, second, third road development plans, road development vision 2021, Rural Road Development Plan – Vision 2025; Planning Surveys; Highway Alignment- Factors affecting Alignment- Engineering Surveys – Drawings and Reports.

**UNIT – II Highway Geometric Design:** Importance of Geometric Design- Design controls and Criteria- Highway Cross Section Elements- Sight Distance Elements- Stopping sight Distance, Overtaking Sight Distance and Intermediate Sight Distance- Design of Horizontal Alignment- Design of Super elevation and Extra widening- Design of Transition Curves- Design of Vertical alignment- Gradients- Vertical curves.

**UNIT – III Traffic Engineering:** Basic Parameters of Traffic- Volume, Speed and Density- Traffic Volume Studies; Speed studies – spot speed and speed & delay studies; Parking Studies; Road Accidents- Causes and Preventive measures - Condition Diagram and Collision Diagrams; PCU Factors, Capacity of Highways – Factors Affecting; LOS Concepts; Road Traffic Signs; Road markings; Types of Intersections; At-Grade Intersections – Design of Plain, Flared, Rotary and Channelized Intersections; Design of Traffic Signals – Webster Method – IRC Method.

**UNIT – IV Highway Materials:** Subgrade soil: classification – Group Index – Subgrade soil strength – California Bearing Ratio – Modulus of Subgrade Reaction. Stone aggregates: Desirable properties – Tests for Road Aggregates – Bituminous Materials: Types – Desirable properties – Tests on Bitumen – Bituminous paving mixes: Requirements – Marshall Method of Mix Design.



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**UNIT – V Design Of Pavements:** Types of pavements; Functions and requirements of different components of pavements; Design Factors

**Flexible Pavements:** Design factors – Flexible Pavement Design Methods – CBR method – IRC method – Burmister method – Mechanistic method – IRC Method for Low volume Flexible pavements.

**Rigid Pavements:** Design Considerations – wheel load stresses – Temperature stresses –Frictional stresses – Combination of stresses – Design of slabs – Design of Joints – IRC method – Rigid pavements for low volume roads – Continuously Reinforced Cement Concrete Pavements – Roller Compacted Concrete Pavements.

**TEXT BOOKS:**

1. Highway Engineering, Khanna S. K., Justo C. E. G and Veeraragavan A, Nem Chand Bros., Roorkee.
2. Traffic Engineering and Transportation Planning, Kadiyali L. R, Khanna Publishers, New Delhi.

**REFERENCES:**

1. Principles of Highway Engineering, Kadiyali L. R, Khanna Publishers, New Delhi
2. Principles of Transportation Engineering, Partha Chakroborthy and Animesh Das, PHI Learning Private Limited, Delhi



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**DEPARTMENT OF CIVIL ENGINEERING**

<b>II Year - I Semester</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>
<b>STRENGTH OF MATERIALS LAB</b>					

**Experiments**

1. Tension test on Mild steelbar
2. Bending test on (Steel / Wood) Cantileverbeam.
3. Bending test on simply supportedbeam.
4. Torsiontest
5. Hardnesstest
6. Spring test
7. Compression test on wood orconcrete
8. Impacttest (Charpy and Izod impact test)
9. Sheartest (on UTM)
10. Verification of Maxwell’s Reciprocal theorem onbeams.
11. Use of Electrical resistance straingauges
12. Continuous beam – deflection test.

**List of Major Equipment:**

1. Universal Testing Machine
2. Torsion testingmachine
3. Brinnell’s / Rock well’s hardness testingmachine
4. Setup for springtests
5. Compression testingmachine
6. Izod Impactmachine
7. Shear testingmachine
8. Beam setup for Maxwell’s theoremverification.
9. Electrical Resistance gauges



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<b>II Year - I Semester</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>
<b>SURVEYING FILED WORK - I</b>					

**List of Field Works:**

1. Survey by chain survey of road profile with offsets in case of roadwidening.
2. Survey in an area by chain survey (Closedcircuit)
3. Determination of distance between two inaccessible points by usingcompass.
4. Finding the area of the given boundary using compass (ClosedTraverse)
5. Plane table survey; finding the area of a given boundary by the method ofRadiation
6. Plane table survey; finding the area of a given boundary by the method of intersection.
7. Two Point Problem by the plane tablesurvey.
8. Fly levelling : Height of the instrument method ( differentiallevelling)
9. Fly levelling: rise and fallmethod.
10. Fly levelling: closed circuit/ opencircuit.
11. Fly levelling; Longitudinal Section and Cross sections of a given roadprofile.
12. Fly levelling and Fly chaining (complete field work).

**Note: Any 10 field work assignments must be completed.**

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**DEPARTMENT OF CIVIL ENGINEERING**

II Year - I Semester	L	T	P	C
	2	0	0	0
<b>CONSTITUTION OF INDIA</b>				

**Course Objectives:**

- To Enable the student to understand the importance of constitution
- To understand the structure of executive, legislature and judiciary
- To understand philosophy of fundamental rights and duties
- To understand the autonomous nature of constitutional bodies like Supreme Court and high court controller and auditor general of India and election commission of India.
- To understand the central and state relation financial and administrative.

**UNIT-I**

Introduction to Indian Constitution: Constitution meaning of the term, Indian Constitution - Sources and constitutional history, Features - Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.

**Learning outcomes:**

After completion of this unit student will

- Understand the concept of Indian constitution
- Apply the knowledge on directive principle of state policy
- Analyze the History, features of Indian constitution
- Evaluate Preamble Fundamental Rights and Duties

**UNIT-II**

Union Government and its Administration Structure of the Indian Union: Federalism, Centre- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha, The Supreme Court and High Court: Powers and Functions;

**Learning outcomes:-**After completion of this unit student will

- Understand the structure of Indian government
- Differentiate between the state and central government
- Explain the role of President and Prime Minister
- Know the Structure of supreme court and High court

**UNIT-III**

State Government and its Administration Governor - Role and Position - CM and Council of ministers, State Secretariat: Organisation, Structure and Functions

**Learning outcomes:-**After completion of this unit student will

- Understand the structure of state government
- Analyze the role Governor and Chief Minister
- Explain the role of state Secretariat
- Differentiate between structure and functions of state secretariat



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**UNIT-IV**

A. Local Administration - District's Administration Head - Role and Importance, Municipalities - Mayor and role of Elected Representative - CEO of Municipal Corporation Pachayati Raj: Functions PRI: Zila Panchayat, Elected officials and their roles, CEO Zila Panchayat: Block level Organizational Hierarchy - (Different departments), Village level - Role of Elected and Appointed officials - Importance of grass root democracy

**Learning outcomes:-** After completion of this unit student will

- Understand the local Administration
- Compare and contrast district administration role and importance
- Analyze the role of Mayor and elected representatives of Municipalities
- Evaluate Zilla Panchayat block level organisation

**UNIT-V**

Election Commission: Election Commission- Role of Chief Election Commissioner and Election Commissionerate State Election Commission:, Functions of Commissions for the welfare of SC/ST/OBC and women

**Learning outcomes:-** After completion of this unit student will

- Know the role of Election Commission apply knowledge
- Contrast and compare the role of Chief Election commissioner and Commissionerate
- Analyze role of state election commission
- Evaluate various commissions of viz SC/ST/OBC and women

**References:**

1. Durga Das Basu, Introduction to the Constitution of India, Prentice – Hall of India Pvt. Ltd., New Delhi
2. Subash Kashyap, Indian Constitution, National Book Trust
3. J.A. Siwach, Dynamics of Indian Government & Politics
4. D.C. Gupta, Indian Government and Politics
5. H.M. Sreevai, Constitutional Law of India, 4th edition in 3 volumes (Universal Law Publication)
6. J.C. Johari, Indian Government and Politics Hans
7. J. Raj Indian Government and Politics
8. M.V. Pylee, Indian Constitution Durga Das Basu, Human Rights in Constitutional Law, Prentice – Hall of India Pvt. Ltd., New Delhi
9. Noorani, A.G., (South Asia Human Rights Documentation Centre), Challenges to Civil Right), Challenges to Civil Rights Guarantees in India, Oxford University Press 2012

**resources:**

1. [nptel.ac.in/courses/109104074/8](http://nptel.ac.in/courses/109104074/8)
2. [nptel.ac.in/courses/109104045/](http://nptel.ac.in/courses/109104045/)
3. [nptel.ac.in/courses/101104065/](http://nptel.ac.in/courses/101104065/)
4. [www.hss.iitb.ac.in/en/lecture-details](http://www.hss.iitb.ac.in/en/lecture-details)
5. [www.iitb.ac.in/en/event/2nd-lecture-institute-lecture-series-indian-constitution](http://www.iitb.ac.in/en/event/2nd-lecture-institute-lecture-series-indian-constitution)



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**DEPARTMENT OF CIVIL ENGINEERING**

**Course Outcomes:**

At the end of the semester/course, the student will be able to have a clear knowledge on the following:

- Understand historical background of the constitution making and its importance for building a democratic India.
- Understand the functioning of three wings of the government i.e., executive, legislative and judiciary.
- Understand the value of the fundamental rights and duties for becoming good citizen of India.
- Analyze the decentralization of power between central, state and local self-government.
- Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy.
  1. Know the sources, features and principles of Indian Constitution.
  2. Learn about Union Government, State government and its administration.
  3. Get acquainted with Local administration and Panchayati Raj.
  4. Be aware of basic concepts and developments of Human Rights.
  5. Gain knowledge on roles and functioning of Election Commission



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<b>II Year – II Semester</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>STRENGTH OF MATERIALS - II</b>				

**Course Learning Objectives:**

- To give concepts of Principal stresses and strains developed in cross section of the beams on the cross section and stresses on any inclined plane. To impart concepts of failures in the material considering different theories
- To give concepts of torsion and governing torsion equation, and there by calculate the power transmitted by shafts and springs and design the cross section when subjected to loading using different theories of failures.
- To classify columns and calculation of load carrying capacity and to assess stresses due to axial and lateral loads for different edge conditions and to calculate combined effect of direct and bending stresses on different engineering structures.
- Introduce the concept of unsymmetrical bending in beams Location of neutral axis Deflection of beams under unsymmetrical bending.

**Course Outcomes:**

Upon successful completion of this course,

- The student will be able to understand the basic concepts of Principal stresses developed in a member when it is subjected to stresses along different axes and design these sections.
- The student can assess stresses in different engineering applications like shafts, springs, columns and struts subjected to different loading conditions

**SYLLABUS:**

**UNIT- I Principal Stresses and Strains And Theories of Failures:** Introduction – Stresses on an inclined section of a bar under axial loading – compound stresses – Normal and tangential stresses on an inclined plane for biaxial stresses – Two perpendicular normal stresses accompanied by a state of simple shear – Mohr’s circle of stresses – Principal stresses and strains – Analytical and graphical solutions.

**Theories of Failures:** Introduction – Various Theories of failures like Maximum Principal stress theory – Maximum Principal strain theory – Maximum shear stress theory – Maximum strain energy theory – Maximum shear strain energy theory.

**UNIT – II Torsion of Circular Shafts and Springs:** Theory of pure torsion – Derivation of Torsion equations:  $T/J = q/r = N\phi/L$  – Assumptions made in the theory of pure torsion – Torsional moment of resistance – Polar section modulus – Power transmitted by shafts – Combined bending and torsion and end thrust – Design of shafts according to theories of failure.

**Springs:** Introduction – Types of springs – deflection of close and open coiled helical springs under axial pull and axial couple – springs in series and parallel.

**UNIT – III Columns and Struts:** Introduction – Types of columns – Short, medium and long columns – Axially loaded compression members – Crushing load – Euler’s theorem for long columns- assumptions- derivation of Euler’s critical load formulae for various end conditions – Equivalent length of a column – slenderness ratio – Euler’s critical stress – Limitations of Euler’s theory – Rankine – Gordon formula – Long columns subjected to eccentric loading – Secant formula – Empirical formulae – Straight line formula – Prof. Perry’s formula.



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**UNIT – IV Direct and Bending Stresses:** Stresses under the combined action of direct loading and B.M. Core of a section – determination of stresses in the case of chimneys, retaining walls and dams – conditions for stability – stresses due to direct loading and B.M. about both axis.

**UNIT – V Unsymmetrical Bending and Shear Centre**

**Un-symmetrical Bending:** Introduction – Centroidal principal axes of section – Graphical method for locating principal axes – Moments of inertia referred to any set of rectangular axes – Stresses in beams subjected to unsymmetrical bending – Principal axes  
– Resolution of bending moment into two rectangular axes through the centroid – Location of neutral axis Deflection of beams under unsymmetrical bending.

**Shear Centre:** Introduction Shear center for symmetrical and unsymmetrical sections (channel, I, T and L sections)

**TEXT BOOKS:**

1. A Textbook of Strength of Materials, by R. K. Rajput, 7e (Mechanics of Solids) SI Units S. Chand & Co, NewDelhi
2. Strength of materials by R. K. Bansal, LakshmiPublications.

**REFERENCES:**

1. Mechanics of Materials- by R. C.Hibbler, Pearson publishers
2. Mechanics of Solids – E P Popov, Prentice Hall.
3. Strength of Materials by B.S.Basavarajaiah and P. Mahadevappa, 3<sup>rd</sup> Edition,Universities Press,
4. Mechanics of Structures Vol – I by H.J.Shah and S.B.Junnarkar, Charotar Publishing House Pvt. Ltd.



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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>HYDRAULICS AND HYDRAULIC MACHINERY</b>					

**Course Learning Objectives:**

- To study about uniform and non uniform flows in open channel and also to learn about the characteristics of hydraulic jump
- To introduce dimensional analysis for fluid flow problems
- To understand the working principles of various types of hydraulic machines and Pumps.

**Course Outcomes:**

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

- Solve uniform and non uniform open channel flow problems.
- Apply the principals of dimensional analysis and similitude in hydraulic model testing.
- Understand the working principles of various hydraulic machineries and pumps.

**UNIT – I : UNIFORM FLOW IN OPEN CHANNEL:**

Types of channels –Types of flows - Velocity distribution – Energy and momentum correction factors – Chezy's, and Manning's formulae for uniform flow – Most Economical sections, Critical flow: Specific energy-critical depth – computation of critical depth

**UNIT II : NON-UNIFORM FLOW IN OPEN CHANNELS:** Steady Gradually Varied flow-Dynamic equation, Mild, Critical, Steep, horizontal and adverse slopes-surface profiles-direct step method- Rapidly varied flow, hydraulic jump, energy dissipation.

**UNIT – III : HYDRAULIC SIMILITUDE:** Dimensional analysis-Rayleigh's method and Buckingham's pi theorem-study of Hydraulic models – Geometric, kinematic and dynamic similarities-dimensionless numbers – model and prototype relations.

**UNIT – IV: BASICS OF TURBO MACHINERY:** Hydrodynamic force of jets on stationary and moving flat, inclined and curved vanes, jet striking centrally and at tip, velocity triangles at inlet and outlet, expressions for work done and efficiency-Angular momentum principle.

**UNIT – V**

**HYDRAULIC TURBINES – I:** Layout of a typical Hydropower installation – Heads and efficiencies - classification of turbines. Pelton wheel - Francis turbine - Kaplan turbine - working, working proportions, velocity diagram, work done and efficiency, hydraulic design, draft tube – theory and efficiency. Governing of turbines-surge tanks-unit and specific quantities, selection of turbines, performance characteristics-geometric similarity-cavitation.



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**PUMPS :**

**CENTRAIFUGAL-PUMPS:** Pump installation details-classification-work done- Manometric head-minimum starting speed-losses and efficiencies-specific speed, multistage pumps-pumps in parallel and series - performance of pumps-characteristic curves- NPSH- Cavitation.

**RECIPROCATING PUMPS:** Introduction, classification, components, working, discharge, indicator diagram, work done and slip.

**Text Books:**

1. Open Channel flow, K. Subramanya, Tata McGraw Hill Publishers
2. Fluid mechanics and hydraulic machines, Rajput, A.K(2018) , S chand ,NewDelhi
3. Fluid Mechanics, Modi and Seth, Standard bookhouse.

**References:**

1. Fluid Flow in Pipes and Channels, G.L. Asawa,CBS
2. Fluid Mechanics and Machinery, C.S.P. OJHA, R. BERNDTSSON and P.N. Chandramouli, Oxford Higher Education.
3. Fluid Mechanics and Machinery, Md. Kaleem Khan, Oxford Higher Education.
4. Fluid mechanics and Hydraulic machines, R.K. Bansal, Laxmi publications ,New Delhi.



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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>ENGINEERING GEOLGOY</b>					

**Course Learning Objectives:**

The objective of this course is:

- To introduce the course: Engineering Geology to the Civil Engineering graduates.
- To enable the students, understand what minerals and rocks are and their formation and identification.
- To highlight significance/ importance/ role of Engineering Geology in construction of Civil Engineering structures.
- To enable the student, realise its importance and applications of Engineering Geology in Civil Engineering constructions.

**Course Outcomes:**

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

- Identify and classify the geological minerals
- Measure the rock strengths of various rocks
- Classify and measure the earthquake prone areas to practice the hazard zonation
- Classify, monitor and measure the Landslides and subsidence
- Prepares, analyses and interpret the Engineering Geologic maps
- Analyses the ground conditions through geophysical surveys.
- Test the geological material and ground to check the suitability of civil engineering project construction.
- Investigate the project site for mega/mini civil engineering projects. Site selection for mega engineering projects like Dams, Tunnels, disposal sites etc.

**UNIT-I:**

**Introduction:** Branches of Geology, Importance of Geology in Civil Engineering with case studies.

**Weathering:** Weathering of rocks, Geological agents, weathering process of Rock, Rivers and geological work of rivers.

**UNIT-II**

**Mineralogy and Petrology:** Definitions of mineral and rock-Different methods of study of mineral and rock. Physical properties of minerals and rocks for megascopic study for the following minerals and rocks. Common rock forming minerals: Feldspar, Quartz Group, Olivine, Augite, Hornblende, Mica Group, Asbestos, Talc, Chlorite, Kyanite, Garnet, Calcite and ore forming minerals are Pyrite, Hematite, Magnetite, Chlorite, Galena, Pyrolusite, Graphite, Chromite, Magnetite and Bauxite. Classification, structures, textures and forms of Igneous rocks, Sedimentary rocks, Metamorphic rocks, and their megascopic study of granite varieties, (pink, gray, green). Pegmatite, Dolerite, Basalt etc., Shale, Sand Stone, Lime Stone, Laterite, Quartzite, Gneiss, Schist, Marble, Khondalite and Slate.

**UNIT-III**





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**Structural Geology:** Strike, Dip and Outcrop study of common geological structures associating with the rocks such as Folds, Faults, Joints and Unconformities- parts, types, mechanism and their importance in Civil Engineering.

**UNIT-IV**

**Ground Water:** Water table, Cone of depression, Geological controls of Ground Water Movement, Ground Water Exploration Techniques.

**Earthquakes and Land Slides:** Terminology, Classification, causes and effects, Shield areas and Seismic bells, Richter scale intensity, Precautions of building constructions in seismic areas. Classification of Landslides, Causes and Effects, measures to be taken prevent their occurrence at Landslides.

**Geophysics:** Importance of Geophysical methods, Classification, Principles of Geophysical study by Gravity method, Magnetic method, Electrical methods, Seismic methods, Radiometric method and Electrical resistivity, Seismic refraction methods and Engineering properties of rocks.

**UNIT-V**

**Geology of Dams, Reservoirs and Tunnels:** Types and purpose of Dams, Geological considerations in the selection of a Dam site. Geology consideration for successful constructions of reservoirs, Life of Reservoirs. Purpose of Tunnelling, effects, Lining of Tunnels. Influence of Geology for successful Tunnelling.

**TEXT BOOKS:**

1. 'Engineering Geology' by Subinoy Gangopadhyay, Oxford University press.
2. 'Engineering Geology' by D. Venkat Reddy, Vikas Publishing House pvt. Ltd, 2013.
3. 'Engineering Geology' by N. Chenn kesavulu, Trinity Press (Laxmi Publications), 2<sup>nd</sup> Edition, 2014.
4. 'Engineering Geology' by Vasudev Kanithi, University Press.

**REFERENCES:**

1. 'Engineering Geology for Civil Engineers' by P.C. Varghese, PHI learning pvt. Ltd.
2. 'Geology for Engineers and Environmental Society' by Alan E Kehew, person publications, 3<sup>rd</sup> edition
3. 'Fundamentals of Engineering Geology' by P.G.Bell, B.S.P. Publications, 2012.
4. 'Engineering Geology' by V.Parthesarathi et al., Wiley Publications
5. 'Environmental Geology' by K.S.Valdiya, McGraw Hill Publications, 2<sup>nd</sup> ed.

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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>TRANSPORTATION ENGINEERING – II</b>					

**Course Learning Objectives:**

The objective of this course is:

1. To know various components and their functions in a railway track
2. To acquire design principles of geometrics in a railway track.
3. To know various techniques for the effective movement of trains.
4. To acquire design principles of airport runway geometrics and pavements.
5. To know the planning, construction and maintenance of Docks and Harbours.

**Course Outcomes:**

At the end of course, Student will be able to

- a. Design geometrics in a railway track.
- b. Plan track layouts and control movement of trains
- c. Design airport geometrics and airfield pavements.
- d. Plan, construct and maintain Docks and Harbours.

**SYLLABUS:**

**A. RAILWAY ENGINEERING**

**UNIT – I**

**Components of Railway Engineering:** Permanent way components – Railway Track Gauge - Cross Section of Permanent Way - Functions of various Components like Rails, Sleepers and Ballast –Rail Fastenings – Creep of Rails- Theories related to creep – Adzing of Sleepers- Sleeper density – Rail joints.

**UNIT – II**

**Geometric Design of Railway Track:** Alignment – Engineering Surveys - Gradients- Grade Compensation- Cant and Negative Super elevation- Cant Deficiency – Degree of Curve – safe speed on curves – Transition curve – Compound curves – Reverse curves – Extra clearance on curves – widening of gauge on curves – vertical curves – cheek rails on curves.

**UNIT – III**

**Turnouts & Controllers:** Track layouts – Switches – Design of Tongue Rails – Crossings – Turnouts – Layout of Turnout – Double Turnout – Diamond crossing – Scissors crossing.  
 Signal Objectives – Classification – Fixed signals – Stop signals – Signalling systems – Mechanical signalling system – Electrical signalling system – System for Controlling Train Movement – Interlocking – Modern signalling Installations.



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**B. AIRPORT ENGINEERING**

**UNIT – IV**

**Airport Planning & Design:** Airport Master plan – Airport site selection – Air craft characteristics – Zoning laws – Airport classification – Runway orientation – Wind rose diagram – Runway length – Taxiway design – Terminal area and Airport layout – Visual aids and Air traffic control.

**Runway Design:** Various Design factors – Design methods for Flexible pavements – Design methods for Rigid pavements – LCN system of Pavement Design – Airfield Pavement Failures – Maintenance and Rehabilitation of Airfield pavements – Evaluation & Strengthening of Airfield pavements – Airport Drainage – Design of surface and subsurface drainage.

**C. DOCKS & HARBOURS**

**UNIT – V**

**Planning, Layout, Construction and Maintenance Of Docks and Harbours:** Classification of ports – Requirement of a good port – classification of Harbours – Docks - Dry & wet docks – Transition sheds and workhouses – Layouts; Quays – construction of Quay walls – Wharves – Jetties – Tides - Tidal data and Analysis – Break waters – Dredging – Maintenance of Ports and Harbours – Navigational aids.

**TEXT BOOKS:**

1. Railway Engineering by Satish Chandra and Agarwal M.M., Oxford University Press, New Delhi
2. Airport Engineering by Khanna & Arora - Nemchand Bros, New Delhi.
3. Docks and Harbour Engineering by Bindra S.P. - Dhanpathi Rai & Sons, New Delhi.

**REFERENCES:**

1. 'Highway, Railway, Airport and Harbour Engineering' by Subramanian KP, Scitech Publications (India) Pvt Limited, Chennai
2. A Text book of Transportation Engineering by S.P.Chandola, S. Chand & Company pvt. Ltd., New Delhi.



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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>ENVIRONMENTAL ENGINEERING- I</b>					

**Course Learning Objectives:**

The course will address the following:

- Outline planning and the design of water supply systems for a community/town/city
- Provide knowledge of water quantity requirements and methods of piping
- Impart understanding of importance of protection of water source quality and methods of treatment of converting raw water into product water of required quality
- Design of water treatment plant for a village/city
- Impart knowledge on design of water distribution network

**Course Outcomes:**

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

- Estimation of design population and water demand
- Identify the water source and select proper intake structure
- Characterization of water for drinking, industry and construction
- Design of water treatment plant for a village/city
- Selection and design of an ideal distribution system

**UNIT-I Introduction:** Importance and Necessity of Protected Water Supply systems, Water borne diseases, Flow chart of public water supply system, Role of Environmental Engineer. Evolution of water supply system.

**Water Demand and Quantity Estimation:** Estimation of water demand for a town or city, Per capita Demand and factors influencing it - Types of water demands and its variations- factors affecting water demand, Design Period, Factors affecting the Design period, Population forecasting.

**UNIT-II Sources of Water:** Lakes, Rivers, Impounding Reservoirs, comparison of sources with reference to quality, quantity and other considerations- Capacity of storage reservoirs, Mass curve analysis. Groundwater sources of water: Types of water bearing formations, springs, Wells and Infiltration galleries, Yields from infiltration galleries.

**Collection and Conveyance of Water:** Factors governing the selection of the intake structure, Types of Intakes. Conveyance of Water: Gravity and Pressure conduits, Types of Pipes, Pipe Materials, Pipe joints, Design aspects of pipe lines, laying of pipelines

**UNIT-III Quality and Analysis of Water:** Characteristics of water– Physical, Chemical and Biological. Analysis of Water – Physical, Chemical and Biological characteristics. Comparison of sources with reference to quality- IS 10500 2012 and WHO guidelines for drinking water - Water quality standards for Agriculture, Industries and Construction



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**UNIT–IV Treatment of Water:** Treatment methods: Theory and Design of Sedimentation, Coagulation, Sedimentation with Coagulation, Filtration

**Disinfection:** Theory of disinfection-Chlorination and other Disinfection methods, Softening of Water, Removal of color and odors- Removal of Iron and Manganese - Adsorption- Fluoridation and defluoridation– Aeration–Reverse Osmosis- Ion exchange– Ultra filtration

**UNIT–V Distribution of Water:** Requirements- Methods of Distribution system, Layouts of Distribution networks, Pressures in the distribution layouts, Analysis of Distribution networks: Hardy Cross and equivalent pipe methods -Components of Distribution system: valves such as sluice valves, air valves, scour valves and check valves, hydrants, and water meters– Laying and testing of pipe lines- selection of pipe materials, pipe joints. Ideal water supply system. Case studies.

**Text Books**

1. Rural, Municipal and Industrial Water Management, KVSG Murali Krishna, Reem Publications, New Delhi, 2012
2. Elements of Environmental Engineering – K. N. Duggal, S. Chand & Company Ltd., New Delhi, 2012.

**References**

1. Environmental Engineering – Howard S. Peavy, Donald R. Rowe, George Tchobanoglous – McGraw-Hill Book Company, New Delhi, 1985.
2. Water Supply Engineering – P. N. Modi.
3. Water Supply Engineering – B. C. Punmia
4. Water Supply and Sanitary Engineering – G. S. Birdie and J. S. Birdie
5. Environmental Engineering, D. Srinivasan, PHI Learning Private Limited, New Delhi, 2011.



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II Year – II Semester		L	T	P	C
		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>
<b>Engineering Geology Lab</b>					

**Course Learning Objectives:**

The objective of this course is:

- To identify the Megascopic types of Ore minerals & Rock forming minerals.
- To identify the Megascopic types of Igneous, Sedimentary, Metamorphic rocks.
- To identify the topography of the site & material selection.

**Course Outcomes:**

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

- Identify Megascopic minerals & their properties.
- Identify Megascopic rocks & their properties.
- Identify the site parameters such as contour, slope & aspect for topography.
- Know the occurrence of materials using the strike & dip problems.

**SYLLABUS:**

**LIST OF EXPERIMENTS**

1. Physical properties of minerals: Mega-scopic identification of
  - a. Rock forming minerals – Quartz group, Feldspar group, Garnet group, Mica group & Talc, Chlorite, Olivine, Kyanite, Asbestos, Tourmelene, Calcite, Gypsum, etc...
  - b. Ore forming minerals – Magnetite, Hematite, Pyrite, Pyralusite, Graphite, Chromite, etc...
2. Megascopic description and identification of rocks.
  - a) Igneous rocks – Types of Granite, Pegmatite, Gabbro, Dolerite, Syenite, Granite Poryphery, Basalt, etc.
  - b) Sedimentary rocks – Sand stone, Ferrugineous sand stone, Lime stone, Shale, Laterite, Conglamorate, etc.
  - c) Metamorphic rocks – Biotite – Granite Gneiss, Slate, Muscovite & Biotiteschist, Marble, Khondalite, etc.
3. Interpretation and drawing of sections for geological maps showing tilted beds, faults, unconformities etc.
4. Simple Structural Geology problems.
5. Bore hole data.
6. Strength of the rock using laboratory tests.
7. Field work – To identify Minerals, Rocks, Geomorphology & Structural Geology.



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**LAB EXAMINATION PATTERN:**

1. Description and identification of FOUR minerals
2. Description and identification of FOUR (including igneous, sedimentary and metamorphic rocks)
3. ONE Question on Interpretation of a Geological map along with a geological section.
4. TWO Questions on Simple strike and Dip problems.
5. Bore hole problems.
6. Project report on geology.

**REFERENCES:**

1. 'Applied Engineering Geology Practicals' by M T Mauthesha Reddy, New Age International Publishers, 2<sup>nd</sup> Edition.
2. 'Foundations of Engineering Geology' by Tony Waltham, Spon Press, 3<sup>rd</sup> edition, 2009.

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II Year – II Semester		L	T	P	C
		0	0	3	1.5
<b>Transportation Engineering Lab</b>					

**Course Learning Objectives:**

The objectives of this course are:

1. To test crushing value, impact resistance, specific gravity and water absorption, attrition value, abrasion value, flakiness index and elongation index for the given road aggregates.
2. To know penetration value, ductility value, softening point, flash and fire point, viscosity and stripping for the given bitumen grade.
3. To test the stability for the given bituminous mix
4. To carry out surveys for traffic volume, speed and parking.

**Course outcomes:**

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

- a. Test aggregates and judge the suitability of materials for the road construction
- b. Test the given bitumen samples and judge their suitability for the road construction
- c. Obtain the optimum bitumen content for Bituminous Concrete
- d. Determine the traffic volume, speed and parking characteristics.
- e. Draw highway cross sections and intersections.

**SYLLABUS:**

**I. ROAD AGGREGATES:**

1. Aggregate Crushing value Test
2. Aggregate Impact Test.
3. Specific Gravity and Water Absorption Test
4. Attrition Test
5. Abrasion Test.
6. Shape tests

**II. BITUMINOUS MATERIALS:**

1. Penetration Test.
2. Ductility Test.
3. Softening Point Test.
4. Flash and fire point tests.
5. Stripping Test
6. Viscosity Test.

**III. BITUMINOUS MIX:**

1. Marshall Stability test.





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**IV. TRAFFIC SURVEYS:**

1. Traffic volume study at mid blocks.
2. Traffic Volume Studies (Turning Movements) at intersection.
3. Spot speed studies.
4. Parking study.

**V. DESIGN & DRAWING**

1. Earthwork calculations for road works
2. Drawing of road cross sections
3. Rotary intersection design

**LIST OF EQUIPMENT:**

1. Apparatus for aggregate crushing test.
2. Aggregate Impact testing machine
3. Pycnometers
4. Los angles Abrasion test machine
5. Deval's Attrition test machine
6. Elongation and thickness gauges
7. Bitumen penetration test setup.
8. Bitumen Ductility test setup.
9. Ring and ball apparatus
10. Viscometer.
11. Marshal Mix design apparatus.
12. Enoscope for spot speed measurement.
13. Stop Watches

**TEXT BOOKS:**

1. 'Highway Material Testing Manual' by S.K. Khanna, C.E.G Justo and A.Veeraraghavan, Neam Chan Brothers New Chand Publications, New Delhi.
2. Highway Material Testing & Quality Control by Rao Wiley India pvt. Ltd., Noida, New Delhi

**REFERENCE BOOKS:**

1. IRC Codes of Practice
2. Asphalt Institute of America Manuals
3. Code of Practice of B.I.S.



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II Year – II Semester		L	T	P	C
		<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>
<b>Fluid Mechanics and Hydraulic Machinery Lab</b>					

**List of Experiments**

1. Calibration of Venturi meter & Orifice meter
2. Determination of Coefficient of discharge for a small orifice and mouth piece by a constant head and variable head method.
3. Calibration of contracted Rectangular Notch and /or Triangular Notch
4. Determination of Coefficient of loss of head in a sudden contraction and friction factor.
5. Verification of Bernoulli's equation.
6. Impact of jet on vanes
7. Study of Hydraulic jump.
8. Performance test on Pelton wheel turbine
9. Performance test on Francis turbine.
10. Efficiency test on centrifugal pump.
11. Efficiency test on reciprocating pump.

**List of Equipment:**

1. Venturi meter setup.
2. Orifice meter setup.
3. Small orifice setup.
4. External mouth piece setup.
5. Rectangular and Triangular notch setups.
6. Friction factor test setup.
7. Bernoulli's theorem setup.
8. Impact of jets.
9. Hydraulic jump test setup.
10. Pelton wheel, Francis turbine and kalpan turbines
11. Centrifugal and Reciprocating pumps.



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II Year – II Semester		L	T	P	C
		2	0	0	0
<b>Essence of Indian Knowledge Traditional / Professional Ethics and Human Values</b>					

**Essence of Indian Knowledge Tradition**

**Course Objectives**

The course is introduced

- To get a knowledge in Indian Philosophical Foundations.
- To Know Indian Languages and Literature and the fine arts in India & Their Philosophy.
- To explore the Science and Scientists of Medieval and Modern India

**Course Outcomes**

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

1. Understand philosophy of Indian culture.
2. Distinguish the Indian languages and literature among different traditions.
3. Learn the philosophy of ancient, medieval and modern India.
4. Acquire the information about the fine arts in India.
5. Know the contribution of scientists of different eras.
6. The essence of Yogic Science for Inclusiveness of society.

**UNIT – I**

**Introduction to Indian Philosophy:** Basics of Indian Philosophy, culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian culture, Ancient Indian, Medieval India, Modern India.

**UNIT – II**

**Indian Philosophy & Literature:** Vedas Upanishads, schools of Vedanta, and other religious Philosophical Literature. Philosophical Ideas the role of Sanskrit, significance of scriptures to current society, Indian Philosophies, literature of south India.

Indian languages and Literature-II: Northern Indian languages & Philosophical & cultural & literature.

**UNIT – III**

**Religion and Philosophy:** Religion and Philosophy in ancient India, Religion and Philosophy in Medieval India, Religious Reform Movements in Modern India (selected movements only)

**UNIT – IV**

**Indian Fine Arts & Its Philosophy (Art, Technology & Engineering):** Indian Painting, Indian handicrafts, Music, divisions of Indian classic music, modern Indian music, Dance and Drama, Indian Architecture (ancient, medieval and modern), Science and Technology in Indian, development of science in ancient, medieval and modern Indian.



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**UNIT – V**

**Education System in India:** Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Scientists of Medieval India, Scientists of Modern India. The role Gurukulas in Education System, Value based Education.

**Suggested Readings:**

1. Kapil Kapoor, “Text and Interpretation: The India Tradition”, ISBN: 81246033375,2005
2. “Science in Samskrit”, Samskrita Bharti Publisher,ISBN-13:978-8187276333,2007
3. NCERT, “Position paper on Arts, Music, Dance and Theatre”, ISBN 81-7450-494-X,2006
4. S. Narain, “Examination in Ancient India”, Arya Book Depot,1993
5. Satya Prakash, “Founders of Sciences in Ancient India”, Vijay Kumar Publisher,1989
6. M.Hiriyanna, “Essentials of Indian Philosophy”, Motilal Banarsidass Publishers, ISBN-13: 978- 8120810990,2014
7. Chatterjee. S & Dutta “An Introduction to IndianPhilosophy”

(or)

**PROFESSIONAL ETHICS AND HUMAN VALUES**

**Course Objectives:** To give basic insights and inputs to the student to inculcate Human values to grow as a responsible human beings with proper personality. Professional Ethics instills the student to maintain ethical conduct and discharge their professional duties.

**UNIT I: Human Values:**

Morals, Values and Ethics – Integrity –Trustworthiness - Work Ethics – Service Learning – Civic Virtue – Respect for others – Living Peacefully – Caring – Sharing – Honesty –Courage – Value Time – Co-operation – Commitment – Empathy – Self-confidence – Spirituality- Character.

**Principles for Harmony:**

Truthfulness – Customs and Traditions -Value Education – Human Dignity – Human Rights – Fundamental Duties - Aspirations and Harmony (I, We & Nature) – Gender Bias - Emotional Intelligence – Salovey – Mayer Model – Emotional Competencies – Conscientiousness.

**UNIT II: Engineering Ethics and Social Experimentation:**

History of Ethics - Need of Engineering Ethics - Senses of Engineering Ethics- Profession and Professionalism —Self Interest - Moral Autonomy – Utilitarianism – Virtue Theory - Uses of Ethical Theories - Deontology- Types of Inquiry –Kohlberg’s Theory - Gilligan’s Argument –Heinz’s Dilemma - Comparison with Standard Experiments — Learning from the Past –Engineers as Managers – Consultants and Leaders – Balanced Outlook on Law - Role of Codes – Codes and Experimental Nature of Engineering.

**UNIT III: Engineers’ Responsibilities towards Safety and Risk:**

Concept of Safety - Safety and Risk – Types of Risks – Voluntary v/sInvoluntary Risk – Consequences - Risk Assessment – Accountability – Liability - Reversible Effects - Threshold Levels of Risk - Delayed v/sImmediate Risk - Safety and the Engineer – Designing for Safety – Risk-Benefit Analysis-Accidents.



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**UNIT IV: Engineers' Duties and Rights:**

Concept of Duty - Professional Duties – Collegiality - Techniques for Achieving Collegiality – Senses of Loyalty - Consensus and Controversy - Professional and Individual Rights – Confidential and Proprietary Information - Conflict of Interest-Ethical egoism - Collective Bargaining – Confidentiality - Gifts and Bribes - Problem solving-Occupational Crimes- Industrial Espionage-Price Fixing-Whistle Blowing.

**UNIT V: Global Issues:**

Globalization and MNCs –Cross Culture Issues - Business Ethics – Media Ethics - Environmental Ethics – Endangering Lives - Bio Ethics - Computer Ethics - War Ethics – Research Ethics - Intellectual Property Rights.

- Related Cases Shall be dealt where ever necessary.

**Course Outcomes:** It gives a comprehensive understanding of a variety issues that are encountered by every professional in discharging professional duties.It provides the student the sensitivity and global outlook in the contemporary world to fulfill the professional obligations effectively.

**TEXT BOOKS:**

1. Professional Ethics by R. Subramaniam – Oxford Publications, New Delhi.
2. Ethics in Engineering by Mike W. Martin and Roland Schinzinger - Tata McGraw-Hill – 2003.

**REFERENCE BOOKS:**

3. Professional Ethics and Morals by Prof.A.R.Aryasri, DharanikotaSuyodhana - Maruthi Publications.
4. Engineering Ethics by Harris, Pritchard and Rabins, Cengage Learning, New Delhi.
5. Human Values & Professional Ethics by S. B. Gogate, Vikas Publishing House Pvt. Ltd., Noida.
6. Engineering Ethics & Human Values by M.Govindarajan, S.Natarajan and V.S.SenthilKumar-PHI Learning Pvt. Ltd – 2009.
7. Professional Ethics and Human Values by A. Alavudeen, R.Kalil Rahman and M. Jayakumaran – University Science Press.
8. Professional Ethics and Human Values by Prof.D.R.Kiran-Tata McGraw-Hill – 2013  
Human Values And Professional Ethics by Jayshree Suresh and B. S. Raghavan, S.Chand Publication



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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>STRUCTURAL ANALYSIS</b>					

**Course Learning Objectives:**

- To give preliminary concepts of assessment of bending moment and shear force in Propped cantilevers, fixed beams and continuous beams due to various loading conditions.
- To impart concepts of Bending Moment and Shear force for beams with different boundary and loading conditions
- The procedure for development of slope deflection equations and to solve application to continuous beams with and without settlement of supports.
- The concepts of moving loads and influence lines are imparted for assessment of maximum SF and BM at a given section when loads of varying spans rolling loads of Pratt and Warren trusses.

**Course Outcomes:**

Upon successful completion of this course the student will be able to,

- Distinguish between the determinate and indeterminate structures.
- Identify the behaviour of structures due to the expected loads, including the moving loads, acting on the structure.
- Estimate the bending moment and shear forces in beams for different fixity conditions.
- Analyze the continuous beams using various methods -, three moment method, slope deflection method, energy theorems.
- Draw the influence line diagrams for various types of moving loads on beams/bridges.
- Analyze the loads in Pratt and Warren trusses when loads of different types and spans are passing over the truss.

**Syllabus:**

**UNIT – I Propped Cantilever and Fixed beams**

**Propped Cantilevers:** Introduction -Degree of Static and Kinematic indeterminacy of Beams, frames and trusses. Analysis of propped cantilevers-shear force and Bending moment diagrams-Elastic curve - Deflection of propped cantilever beams.

**Fixed Beams** – Introduction to statically indeterminate beams with U. D. load, central point load, eccentric point load, number of point loads, uniformly varying load, couple and combination of loads - shear force and Bending moment diagrams-Elastic curve - Deflection of fixed beams including effect of sinking of support, effect of rotation of a support.



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**UNIT – II Analysis of Continuous beams and Portal Frames**

**Slope-Deflection Method:** Introduction, derivation of slope deflection equation, application to continuous beams with and without settlement of supports. Analysis of Single bay single storey portal frames without sway. Shear force and Bending moment diagrams, Elastic curve.

**Moment distribution method:** Application to continuous beams with and without settlement of supports. Analysis of Single bay single storey portal frames without sway. Shear force and Bending moment diagrams, Elastic curve.

**UNIT III Analysis of Pin-Jointed Plane Frames:** Determination of Forces in members of plane pin-jointed (determinate) perfect trusses by (i) method of joints (ii) method of sections and (iii) Method of Tension coefficients. Analysis of various types of cantilever and simply supported trusses by method of joints, method of sections and Tension coefficients.

**UNIT – IV Moving Loads And Influence Lines:** Introduction maximum SF and BM at a given section and absolute maximum S.F. and B.M due to single concentrated load, U. D load longer than the span, U. D load shorter than the span, two point loads with fixed distance between them and several point loads-Equivalent uniformly distributed load-Focal length. Definition of influence line for SF, Influence line for BM- load position for maximum SF at a section-Load position for maximum BM at a sections, single point load, U.D. load longer than the span, U.D. load shorter than the span- Influence lines for forces in members of Pratt and Warren trusses.

**UNIT – V MATRIX METHODS OF ANALYSIS:** Introduction to Flexibility and Stiffness matrix methods of analyses using 'system approach' upto three degree of indeterminacy– Analysis of continuous beams including settlement of supports using flexibility and stiffness methods - Analysis of pin-jointed determinate plane frames using flexibility and stiffness methods- Analysis of single bay single storey portal frames using only stiffness method - Shear force and bending moment diagrams - Elastic curve.

**Text Books:**

1. Structural Analysis by R.C. Hibbeler, Pearson, NewDelhi.
2. Basic Structural Analysis, K U Muthu et. al., IK International Publishing house pvt. Ltd.

**References**

1. Indeterminate Structural Analysis, K U Muthu et. al., IK International Publishing house pvt. Ltd.
2. Analysis of Structures- Vol. I and II, V. N. Vazirani and M. M. Ratwani, Khanna Publishers, New Delhi.
3. Mechanics of Structures Vol – II by H.J.Shah and S.B.Junnarkar, Charotar Publishing House Pvt. Ltd.
4. Structural Analysis by Devdas Menon, Narosa Publishing Housing Pvt. Ltd.
5. Structural Analysis: A Matrix Approach, G.S.Pandit and S.P.Gupta, Mc Graw Hill Pvt. Ltd.



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		<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>
<b>CONCRETE TECHNOLOGY</b>					

**Course Learning Objectives:**

- To learn concepts of Concrete production and behaviour in various environments.
- To learn test procedures for determination of properties of concrete.
- To understand durability properties of concrete in various environments.

**Course Outcomes:**

Upon successful completion of this course, student will be able to

- understand basic concepts of concrete.
- realize importance of quality of concrete.
- familiarize basic ingredients of concrete and their role in concrete and their behaviour in the field.
- test fresh concrete properties and hardened concrete properties.
- evaluate ingredients of concrete through lab tests. design concrete mix by IS method.
- familiarize basic concepts of special concrete and their production and applications. understand the behaviour of concrete in various environments.

**UNIT I : Ingredients of Concrete :**

Portland cement – Chemical composition – Hydration, Setting times, Fineness, Structure – Tests on cement for physical properties – Grades of cements – Admixtures – Mineral and chemical admixtures – accelerators, retarders, air entrainers, plasticizers, super plasticizers, fly ash and silica fume.

**Aggregates:** Classification – Particle shape & texture – Bond, strength & other mechanical properties – Specific gravity, Bulk density, porosity, adsorption & moisture content – Bulking of sand – Deleterious substance – Soundness – Alkali aggregate reaction – Thermal properties – Sieve analysis – Fineness modulus – Grading curves – Grading of fine & coarse Aggregates – Gap graded and well graded aggregate as per relevant IS code – Maximum aggregate size. Quality of mixing water.

**UNIT – II : Mix Design and Fresh Concrete**

**Mix Design:** Factors affecting mix proportions – Durability of concrete

– Quality Control of concrete – Statistical methods – Acceptance criteria – Concepts Proportioning of concrete mixes by IS method.

**Fresh Concrete:** Production of Concrete – mix proportion, mixing, placing, compaction, finishing, curing – including various types in each stage. Properties of fresh concrete - Workability – Factors affecting workability – Measurement of workability by different tests, Setting times of concrete,





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Effect of time and temperature on workability – Segregation & bleeding – Mixing and vibration of concrete, Ready mixed concrete, Shotcrete

**UNIT – III : Hardened Concrete:** Water - Cement ratio – Abram’s Law – Gel space ratio – strength of concrete –Maturity concept – Strength in tension & compression – Factors affecting strength – Relation between compression & tensile strength – Curing, Testing of Hardened Concrete: Compression tests – Tension tests – Factors affecting strength – Flexure tests –Splitting tests – Non-destructive testing methods – code provisions for NDT.

**UNIT – IV : Elasticity, Creep & Shrinkage,** Modulus of elasticity, Dynamic modulus of elasticity, Poisson’s ratio, Creep of concrete and factors influencing creep, Relation between creep & time, Nature of creep, Effects of creep – Shrinkage –types of shrinkage.

**UNIT – V : Special Concretes:** Ready mixed concrete, Shotcrete, Light weight aggregate concrete, Cellular concrete, No-fines concrete, High density concrete, Fibre reinforced concrete, Different types of fibres, Factors affecting properties of FRC, Polymer concrete, Types of Polymer concrete, Properties of polymer concrete, High performance concrete–Self compacting concrete, SIFCON, self healing concrete.

**Text Books:**

1. Concrete Technology, M. S. Shetty. – S. Chand & Company
2. Concrete Technology, A. R. Santhakumar, Oxford University Press, New Delhi

**References :**

1. Properties of Concrete, A. M. Neville – Pearson – 5th edition
2. Concrete, Microstructure, Properties and Materials by P.K.Mehta and Moterio, McGraw Hill
3. Concrete Technology, M.L. Gambhir. – Tata Mc. Graw Hill Publishers, New Delhi



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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>WATER RESOURCES ENGINEERING - I</b>					

**Course Learning Objectives:**

The course is designed to

- Understand the hydrologic cycle and its relevance to Civil Engineering
- make the students understand physical processes in hydrology and, components of the hydrologic cycle
- appreciate concepts and theory of physical processes and interactions
- learn measurement and estimation of the components hydrologic cycle.
- provide an overview and understanding of Unit Hydrograph theory and its analysis
- understand flood frequency analysis, design flood, flood routing
- appreciate the concepts of groundwater movement and well hydraulics

**Course Outcomes**

At the end of the course the students are expected to

- be able to quantify major hydrologic components and apply key concepts to several practical areas of engineering hydrology and related design aspects
- develop Intensity-Duration-Frequency and Depth-Area Duration curves to design hydraulic structures.
- ability to develop design storms and carry out frequency analysis
- be able to determine storage capacity and life of reservoirs and develop unit hydrograph and synthetic hydrograph.
- be able to estimate flood magnitude and carry out flood routing.
- be able to determine aquifer parameters and yield of wells.
- Ability to develop the hydrological models.

**UNIT I**

**Introduction:** Engineering hydrology and its applications, Hydrologic cycle, hydrological data-sources of data.

**Precipitation:** Types and forms, measurement, rain gauge network, presentation of rainfall data, average rainfall, continuity and consistency of rainfall data, frequency of rainfall, Intensity-Duration-Frequency (IDF) curves, Depth-Area-Duration (DAD) curves, Probable Maximum Precipitation (PMP), design storm

**UNIT-II Abstractions from Precipitation:** Initial abstractions.

**Evaporation:** factors affecting, measurement, reduction

**Evapotranspiration:** factors affecting, measurement, control

**Infiltration:** factors affecting, Infiltration capacity curve, measurement, infiltration indices, inter



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flow

**UNIT-III Runoff:** Catchment characteristics, Factors affecting runoff, components, computation-empirical formulae, tables and curves, stream gauging, rating curve, flow mass curve and flow duration curve.

**Hydrograph analysis:** Components of hydrograph, separation of base flow, effective rainfall hyetograph and direct runoff hydrograph, unit hydrograph, assumptions, derivation of unit hydrograph, unit hydrographs of different durations, principle of superposition and S-hydrograph methods, limitations and applications of unit hydrograph, synthetic unit hydrograph.

**Hydrological models:** Rainfall – Run off modeling, conceptual methods.

**UNIT-IV Floods:** Causes and effects, frequency analysis- Gumbel's and Log-Pearson type III distribution methods, Standard Project Flood (SPF) and Probable Maximum Flood (MPF), flood control methods and management.

**Flood Routing:** Hydrologic routing, channel and reservoir routing-Muskingum and Puls methods of routing.

**UNIT-V Groundwater:** Occurrence, types of aquifers, aquifer parameters, porosity, specific yield, permeability, transmissivity and storage coefficient, types of wells, Darcy's law, Dupuit's equation-steady radial flow to wells in confined and unconfined aquifers, yield of a open well-recuperation test.

**Text Books:**

1. Engineering Hydrology, Jayarami Reddy, P., Laxmi Publications Pvt. Ltd., (2013), NewDelhi
2. Irrigation and Water Power Engineering, B. C. Punmia, Pande B. B. Lal, Ashok Kumar Jain and Arun Kumar Jain, Lakshmi Publications (P)Ltd.
3. Sharma , S.K (2016) “ Irrigation Engineering”, S.chand publisher New Delhi.

**References:**

1. Engineering Hydrology Subramanya, K, Tata McGraw-Hill Education PvtLtd, (2013),New Delhi.
2. Irrigation Engineering and Hydraulic Structure, Santosh Kumar Garg, Khanna Publishers.
3. Chow , V.T.Maidment,D.K and Mays L.W(2011). “Applied hydrology”,Tata McGraw Hills Education Pvt ltd, New Delhi.
4. Mays L.W, Wiley India Pvt. Ltd,(2013). “Water Resources Engineering” Wiley India Pvt.Ltd.



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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>ENVIRONMENTAL ENGINEERING - II</b>					

**Course Learning Objectives:**

The objective of this courses:

- Outline planning and the design of wastewater collection, conveyance and treatment systems for a community/town/city
- Provide knowledge of characterization of wastewater generated in a community
- Impart understanding of treatment of sewage and the need for its treatment.
- Summarize the appurtenance in sewerage systems and the irnecessity
- Teach planning, and design of septic tank and imhoff tank and the disposal of the effluent from these low cost treatment systems
- Effluent disposal method and realise the importance of regulations in the disposal of effluents in rivers

**Course Outcomes:**

By the end of successful completion of this course, the students will be able to:

- Plan and design the sewerage systems by estimating the flow
- Design of Plumbing for an apartment, Gated community or Hotels or Individual houses and Select the appropriate appurtenances in the sewerage systems
- Estimation of BOD and COD and Suggest a suitable disposal method with respect to effluent standards, and Identify the critical point of pollution in a river for a specific amount of pollutant disposal into the river
- Analyze sewage and design suitable treatment system for sewage treatment for a village/City.
- Design of sewage treatment systems like Septic tank soak pit system and FAB reactor for buildings and understanding tertiary treatment of sewage.

**UNIT – I: Introduction to Sanitation** – Systems of sanitation – relative merits & demerits – collection and conveyance of wastewater – sewerage – classification of sewerage systems- Estimation of sewage flow and storm water drainage – fluctuations – types of sewers - Hydraulics of sewers and storm drains– design of sewers.



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**UNIT – II: Sewer appurtenances** – cleaning and ventilation of sewers. **Pumping of wastewater:** Pumping stations – location – components– types of pumps and their suitability with regard to wastewaters.

**House Plumbing:** Systems of plumbing-sanitary fittings and other accessories– one pipe and two pipe systems – Design of drainage in Gate communities, Apartments and Hotels.

**UNIT – III: Sewage characteristics** – Sampling and analysis of wastewater - Physical, Chemical and Biological Examination-Measurement of BOD and COD – BOD equations. ThOD and Nitrogen Oxygen Demand. **Ultimate Disposal of sewage:** Methods of disposal – disposal into water bodies-Oxygen Sag Curve- Disposal into sea, disposal on land, Crown corrosion, Sewage sickness. Effluent standards.

**UNIT – IV: Treatment of Sewage: Primary treatment-** Screens- Grit chambers- Grease traps– floatation– Sedimentation – Design of preliminary and primary treatment units. **Secondary treatment:** Aerobic and anaerobic treatment process-comparison. **Suspended growth process:** Activated Sludge Process, principles, designs, and operational problems, modifications of Activated Sludge Processes, Oxidation ponds, Aerated Lagoons. **Attached Growth Process:** Trickling Filters – mechanism of impurities removal – classification – design, operation and maintenance problems. RBCs, Fluidized bed reactors.

**UNIT V: Miscellaneous Treatment Methods:** Nitrification and Denitrification-Removal of Phosphates – UASB–Membrane reactors- Integrated fixed film reactors. Anaerobic Processes: Septic Tanks and Imhoff tanks- working Principles and Design– Reuse and disposal of septic tank effluent, FAB Reactors. **Bio-solids (Sludge) management:** Characteristics-SVI, handling and treatment of sludge-thickening – anaerobic digestion of sludge, Sludge Drying Beds. Centrifuge. Case studies.

**Text Books**

1. Wastewater Engineering Treatment and Reuse, Metcalf & Eddy, Tata McGraw-Hill edition.
2. Elements of Environmental Engineering, K. N. Duggal, S. Chand & Company Ltd. New Delhi, 2012.



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**References**

1. Industrial Water and Wastewater Management, K.V.S.G. Murali Krishna.
2. Environmental Engineering, Howard S. Peavy, Donald R. Rowe, Teorge George Tchobanoglus – Mc-Graw-Hill Book Company, New Delhi, 1985
3. Wastewater Treatment for Pollution Control and Reuse, Soli. J Arceivala, Sham R Asolekar, Mc-GrawHill, New Delhi; 3<sup>rd</sup>Edition
4. Environmental Engineering –II: Sewage disposal and Air Pollution Engineering, Garg, S. K., Khanna Publishers
5. Sewage treatment and disposal, P. N. Modi & Seth.
6. Environmental Engineering, Ruth F. Weiner and Robin Matthews – 4th Edition Elsevier, 2003
7. Environmental Engineering, D. Srinivasan, PHI Learning Private Limited, New Delhi, 2011.



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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>PROGRAM ELECTIVE – I a). Repair &amp; Rehabilitation of Buildings</b>					

**Course Objective:**

- a. Study the assessment, maintenance and repair techniques of concrete structures.
- b. Different case studies are analyzed to define the best strategy to maintain and repair the structure.
- c. Identify scope of rehabilitation work for dilapidated / obsolete buildings.
- d. Identify and apply appropriate structural and construction technologies to rectify maintenance problems.
- e. Prepare short and long term maintenance plans.
- f. Identify / apply appropriate standards and statutory controls for maintenance and rehabilitation work. Understand the use of Building Information Modelling (BIM) for maintenance planning.

**Course Outcomes:**

Upon completion of the course, the student will be able to

1. Recognize the mechanisms of degradation of concrete structures and to design durable concrete structures.
2. Conduct field monitoring and non-destructive evaluation of concrete structures.
3. Design and suggest repair strategies for deteriorated concrete structures including repairing with composites.
4. Understand the methods of strengthening methods for concrete structures
5. Assessment of the serviceability and residual life span of concrete structures by Visual inspection and in situ tests
6. Evaluation of causes and mechanism of damage
7. Evaluation of actual capacity of the concrete structure Maintenance strategies
8. Repair / Rehabilitate / Strengthening techniques by using traditional and advanced materials and techniques.

**Syllabus**

**UNIT-I**

Materials for repair and rehabilitation -Admixtures- types of admixtures- purposes of using admixtures- chemical composition- Natural admixtures- Fibres- wraps- Glass and Carbon fibre wraps- Steel Plates- Non destructive evaluation: Importance- Concrete behavior under corrosion, disintegrated mechanisms- moisture effects and thermal effects – Visual investigation- Acoustical emission methods- Corrosion activity measurement- chloride content – Depth of carbonation- Impact echo methods- Ultrasound pulse velocity methods- Pull out tests.

**UNIT- II**

Strengthening and stabilization- Techniques- design considerations- Beam shear capacity strengthening- Shear Transfer strengthening- stress reduction techniques- Column strengthening- flexural strengthening- Connection stabilization and strengthening, Crack stabilization.



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**UNIT- III**

Bonded installation techniques- Externally bonded FRP- Wet layup sheet, bolted plate, near surface mounted FRP, fundamental debonding mechanisms-intermediate crack debonding- CDC debonding- plate end debonding- strengthening of floor of structures.

**UNIT- IV**

Fibre reinforced concrete- Properties of constituent materials- Mix proportions, mixing and casting methods-Mechanical properties of fiber reinforced concrete- applications of fibre reinforced concretes-Light weight concrete- properties of light weight concrete- No fines concrete- design of light weight concrete- Flyash concrete- Introduction- classification of flyash- properties and reaction mechanism of flyash- Properties of flyash concrete in fresh state and hardened state- Durability of flyash concretes.

**UNIT- V**

High performance concretes- Introduction- Development of high performance concretes- Materials of high performance concretes- Properties of high performance concretes- Self Consolidating concrete- properties- qualifications.

**REFERENCES:**

1. Concrete technology- Neville & Brooks
2. Special Structural concrete- Rafat Siddique
3. Concrete repair and maintenance illustrated- Peter H Emmons
4. Concrete Technology-M S Shetty





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<b>PROGRAM ELECTIVE – I b) Environmental Impact Assessment</b>					

**Course Learning Objectives:**

The objective of this course is:

1. To impart knowledge on different concepts of Environmental Impact Assessment
2. To know procedures of risk assessment
3. To learn the EIA methodologies and the criterion for selection of EIA methods
4. To know pre-requisites for ISO 14001 certification
5. To know the procedures for environmental clearances and audit
6. To appreciate the importance of stakeholder participation in EIA

**Course Learning Outcomes**

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

- a) Prepare EMP, EIS and EIA report, estimate cost benefit ratio of a project
- b) Selection of an appropriate EIA methodology
- c) Evaluation of impacts on environment
- d) Evaluation of risk assessment
- e) Know the latest acts and guidelines of MoEF & CC

**SYLLABUS:**

**UNIT-I: Basic concepts of EIA:** Elements of EIA-factors affecting EIA-Initial environmental Examination- life cycle analysis preparation of Environmental Base map- Classification of environmental parameters – role of stakeholders in the EIA preparation – stages in EIA, Environmental economics, Cost/benefit Analysis - EIS and EMP. Identification of activities-application of remote sensing and GIS for EIA.

**UNIT-II: EIA Methodologies:** Introduction, Criteria for the selection of EIA Methodology, E I A methods, Ad-hoc methods, matrix methods, Network method Environmental Media Quality Index method, overlay methods.

**Impact of Developmental Activities and Land use:** Introduction and Methodology for the assessment of soil and ground water, Delineation of study area.

**UNIT-III** Procurement of relevant soil quality, Impact prediction, Assessment of Impact significance, Identification and Incorporation of mitigation measures - E I A with reference to surface water, Air and Biological environment: Methodology for the assessment of Impacts on



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surface water environment, Generalized approach for assessment of Air pollution Impact.

**UNIT-IV:** Assessment of Impact of development Activities on Vegetation and wildlife, environmental Impact of Deforestation.

Environmental Risk Assessment and Risk management in EIA: Risk assessment and treatment of uncertainty-key stages in performing an Environmental Risk Assessment- Advantages of Environmental Risk Assessment

**UNIT-V EIA: MoEF&CC Acts, Notifications and Guidelines:** Provisions in the EIA notification, procedure for environmental clearance, procedure for conducting environmental impact assessment report- evaluation of EIA report. Environmental legislation objectives, evaluation of Audit data and preparation of Audit report. Post Audit activities, Concept of ISO and ISO14000. Environmental compliance reports. Case studies and preparation of EIA statement for various Industries.

**Text Books:**

- 1.Environmental Impact Assessment, Canter Larry W., McGraw-Hill education Edi (1996)
- 2.Environmental Impact Assessment Methodologies, Y. Anjaneyulu, B. S. Publication, Sultan Bazar, Hyderabad.

**References:**

1. Environmental Science and Engineering, J. Glynn and Gary W. Hein Ke – Prentice Hall Publishers
2. Environmental Science and Engineering, Suresh K. Dhaneja, S. K. Katania& Sons Publication., New Delhi.
3. Environmental Pollution and Control, H. S. Bhatia, Galgotia Publication (P) Ltd, Delhi



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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>PROGRAM ELECTIVE – I c). Reinforced Soil Structures</b>					

**Course objectives:**

1. To understand the history and mechanism of reinforced soil
2. To know the various types of geo-synthetics, their functions and applications.
3. To enable the design of reinforced soil retaining structures.

**Expected Outcomes:**

The students will

- a) Understand the history and mechanism of reinforced soil
- b) Become aware about situations where geo-synthetics can be used.
- c) Know about various types of geo-synthetics and their functions
- d) Be able to do simple design of reinforced soil retaining walls and reinforced earth beds.

**Unit I:**

Introduction -history –ancient and modern structures- Types of geo-synthetics, advantages, disadvantages. Functions of geo-synthetics and application areas where these functions are utilized such as in retaining walls, slopes, embankments, railway tracks, pavements etc. (general overview). Raw materials used for geo-synthetics, manufacturing process of woven and non-woven geotextiles, geo-membranes, geo-grids.

**Unit II:**

Properties of geo-synthetics. Creep and long term performance. Reinforced soil - Advantages and disadvantages. Fills, Types of facings, Factors affecting the performance and behaviour of reinforced soil. Mechanism of reinforcement action - Equivalent Confining Stress Concept, Pseudo Cohesion Concept, Concept of Expanding soil mass. – Simple problems.

**Unit III:**

Design and analysis of vertically faced reinforced soil retaining walls- External stability and Internal stability – Tie back wedge analysis and coherent gravity analysis with metallic strip and continuous geo-synthetic reinforcements. Assumptions, limitations and numerical problems. Construction methods of reinforced retaining walls. Geo-synthetics in pavements, function and benefits.

**Unit IV:**

Bearing capacity improvement using soil reinforcement – Binqet and Lee’s analysis – Assumptions, failure mechanisms. Simple problems in bearing capacity. Geo-synthetics for short term stability of



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embankments on soft soils. Natural geotextiles, Advantages and disadvantages, functions, erosion control- types of erosion control products, installation methods.

Unit V:

Prefabricated vertical drains along with design principles and installation method Concept of Geo-cells, Gabion Walls, encased stone columns, geo-composites, soil nailing, geo-tubes, geo-bags (only basic concepts), Natural geotextiles using coir and jute with relative advantages and disadvantages, application areas, application in landfills.

**Text Books:**

1. Jones, C.J.F.P. (1985). Earth reinforcement and soil structures. Butterworth, London.
2. Rao, G.V. (2007). Geo-synthetics – An Introduction. Sai Master Geo-environmental Services Pvt. Ltd., Hyderabad

**References:**

1. Koerner, R.M. (1999). Designing with Geosynthetics, Prentice Hall, New Jersey, USA, 4th edition.
2. Rao, G.V., Kumar, S. J. and Raju, G.V.S.S. (Eds.). Earth Reinforcement – Design and Construction. Publication No. 314, Central Board of Irrigation and Power, New Delhi, 2012.
3. Sivakumar Babu, G.L. (2006). An introduction to Soil reinforcement and geosynthetics. United Press (India) Pvt. Ltd. COURSE



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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>PROGRAM ELECTIVE – I d). Traffic Engineering</b>					

**Course Learning Objectives:**

The objective of this course is:

1. To determine various components and characteristics of traffic.
2. To apply various traffic control devices and principles of highway safety.
3. To understand the detrimental effects of traffic on environment
4. To carry out highway capacity and level of service analysis.
5. To learn about intelligent vehicle highway systems.

**Course Outcomes:**

At the end of course, Students will be able to

- a. Determine traffic speed, volume, travel time and density.
- b. Design traffic signals
- c. Determine highway capacity and LOS

**UNIT- I**

**Components Of The Traffic System:** Human-Vehicle–Environment System; characteristics of Road users, Vehicles, Highways and their classification; Traffic Studies: Inventories; Volume studies; Speed, Travel time and Delay studies; Intersection studies; Pedestrian studies; Parking studies; Accident studies.

**UNIT- II**

**Traffic Characteristics:** Microscopic and macroscopic flow characteristics: Time headways; Temporal, spatial and model flow patterns; Interrupted and Un interrupted traffic. Microscopic and macroscopic speed characteristics: Vehicular speed Trajectories; Speed characteristics – Mathematical distribution; Speed and travel time variations; Travel time and delay studies. Microscopic and Macroscopic density characteristics: Distance headway characteristics; Car-following theories; Density measurement techniques; Density contour maps.

**UNIT- III**

**Traffic Control Devices & Highway Safety:** Traffic signs & Markings; Signal Warrants; Signal phasing and Development of phase plans; Fixed and Vehicle activated signals; Webster method; ARRB method; Drew’s Method; IRC method; Signal coordination; Area Traffic control. Accident characteristics – Road – Driver – Vehicle; Accident recording and Analysis; Highway Safety Improvement Program; Safety Audit.



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**UNIT- IV**

**Highway Capacity And Level Of Service:** Capacity and level of service; Factors affecting Capacity and LOS; Capacity of Rural Highways, Capacity of Urban Roads; HCM and IRC standards.

**UNIT- V**

**Intelligent Vehicle – Highway Systems:** Traffic surveillance and monitoring; IVHS programs, Role of IVHS, IVHS categories, Benefits and Costs of IVHS, Categories of ITS.

**TEXT BOOKS**

1. 'Traffic Engineering: Theory and Practice' by Pignataro L.J., Prentice hall, Inc
2. 'Traffic and Transport planning' by Kadiyali L.R., Khanna Publishers

**REFERENCES:**

1. 'Traffic Engineering' by Rogu P. Roess, Elena S. Prassas and William R. Mc Shane, Pearson India Education Services pvt. Ltd.
2. Traffic and Highway Engineering by Garber and Hoel, Cengage Learning India pvt. Ltd., Noida, New Delhi.



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	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>PROGRAM ELECTIVE – I e). Construction Technology &amp; Management</b>				

**Course Learning Objectives:**

The objective of this course is:

1. to introduce to the student, the concept of project management including network drawing and monitoring
2. to introduce various equipment's like earth moving equipment, trucks and handling equipment, aggregate production and construction equipment and machinery, related to construction.
3. to introduce the importance of safety in construction projects

**Course Outcomes:**

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

- a) appreciate the importance of construction planning
- b) understand the functioning of various earth moving equipment
- c) know the methods of production of aggregate products and concreting and usage of machinery required for the works.
- d) apply the gained knowledge to project management and construction techniques

**SYLLABUS:**

**UNIT- I** Construction project management and its relevance – qualities of a project manager – project planning – coordination –scheduling - monitoring – bar charts – milestone charts – critical Path Method – Applications

**UNIT -II** Project Evaluation and Review Technique – cost analysis - updating – crashing for optimum cost – crashing for optimum resources – allocation of resources

**UNIT- III** Construction equipment – economical considerations – earthwork equipment – Trucks and handling equipment – rear dump trucks – capacities of trucks and handling equipment – calculation of truck production – compaction equipment – types of compaction rollers

**UNIT -IV** Concreting equipment – crushers – jaw crushers – gyratory crushers – impact crushers – selection of crushing equipment - screening of aggregate – concrete mixers – mixing and placing of concrete – consolidating and finishing

**UNIT –V** Construction methods – earthwork – piling – placing of concrete – form work – fabrication and erection – quality control and safety engineering



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**Text Books:**

1. Construction Planning Equipment and Methods, Peurifoy and Schexnayder , Shapira, Tata Mcgraw hill
2. Construction Project Management Theory and Practice, Kumar NeerajJha (2011), Pearson.
3. Construction Technology, Subir K. Sarkar and Subhajit Saraswati, Oxford University press.
4. Project Planning and Control with PERT and CPM, B. C. Punamia and K K Khandelwal, Laxmi Publications Pvt Ltd. Hyderabad.

**References:**

1. Construction Project Management - An Integrated Approach, Peter Fewings , Taylor and Francis
2. Construction Management Emerging Trends and Technologies, Trefor Williams, Cengagelearning.
3. Hand Book of Construction Management, P. K. Joy, Trinity Press Chennai, New Delhi.





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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>OPEN ELECTIVE – I (Choose any One out of Nine Courses)</b>					



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		<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>
<b>CONCRETE TECHNOLOGY LAB</b>					

**Course Learning Objectives:**

- To study basic properties ingredients of concrete, fresh and hardened concrete properties

**Course Outcomes:**

Upon successful completion of this course, student will be able to

- Determine consistency and fineness of cement.
- Determine setting times of cement.
- Determine specific gravity and soundness of cement.
- Determine compressive strength of cement.
- Determine workability of cement concrete by compaction factor, slump and Vee – Bee tests
- Determine specific gravity of coarse aggregate and fine aggregate by Sieve analysis.
- Determine flakiness and elongation index of aggregates.
- Determine bulking of sand.
- Understand non-destructive testing procedures on concrete.

**List of Experiments:** At least 10 experiments must be conducted (at least one for each property)

1. Determination of normal Consistency and fineness of cement.
2. Determination of initial setting time and final setting time of cement.
3. Determination of specific gravity and soundness of cement.
4. Determination of compressive strength of cement.
5. Determination of grading and fineness modulus of Coarse aggregate by sieve analysis.
6. Determination of specific gravity of coarse aggregate
7. Determination of grading and fineness modulus of fine aggregate (sand) by sieve analysis.
8. Determination of bulking of sand.
9. Determination of workability of concrete by compaction factor method.
10. Determination of workability of concrete by slump test
11. Determination of workability of concrete by Vee-bee test.
12. Determination of compressive strength of cement concrete and its young's modulus
13. Determination of split tensile strength of concrete.
14. Non-Destructive testing on concrete (for demonstration)



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**List of Equipment:**

1. Standard set of sieves for coarse aggregate and fine aggregate
2. Vicat's apparatus
3. Specific gravity bottle.
4. Lechatlier's apparatus.
5. Slump Test Apparatus.
6. Compaction Factor Test Apparatus.
7. Vee- Bee test apparatus
8. Longitudinal compresso-meter
9. Universal testing Machine (UTM)/Compression Testing Machine (CTM).
10. Rebound hammer, Ultrasonic pulse velocity machine, micro cover meter etc.

**Reference:**

- 1) Concrete Manual by M.L. Gambhir



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		<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>
<b>SURVEYING FIELD WORK – II</b>					

**List of Experiments**

1. Theodolite Survey: Determining the Horizontal and Vertical Angles by the method of repetition method.
2. Theodolite Survey: Finding the distance between two inaccessible points.
3. Theodolite Survey: Finding the height of far object.
4. Tacheometric Survey: Heights and distance problems using tachometric principles.
5. One Exercise on Curve setting.
6. One Exercise on contours.
7. Total Station: Introduction to total station and practicing setting up, levelling up and elimination of parallax error.
8. Total Station: Determination of area using total station.
9. Total Station: Traversing
10. Total Station: Contouring
11. Total Station: Determination of Remote height.
12. Total Station: distance between two inaccessible points.

**Note:** Any 10 field work assignments must be completed.



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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>DESIGN AND DRAWING OF REINFORCED CONCRETE STRUCTURES</b>					

**Course Learning Objectives:**

The objective of this course is:

- Familiarize Students with different design philosophies
- Equip student with design of members in flexural and shear
- Understand bond and torsion
- Familiarize with design of compression members under different types of loading
- Understand different types of footings and design

**Course Outcomes:**

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

- Work on different types of design methods
- Carry out analysis and design of flexural members and detailing
- Design structures subjected to shear, bond and torsion
- Design different type of compression members and footings

**SYLLABUS:**

**UNIT –I Design Methods**

**Working stress method:** Elastic theory: design constants, modular ratio, neutral axis depth and moment of resistance - balanced, under-reinforced and over-reinforced sections. Design of singly and doubly reinforced beams, IS Code Provisions.

**Limit State Design:** Basic statistical principles – Characteristic strength – Characteristic loads - Partial load and safety factors – stress-strain curves for HYSD bars and MS bars. Assumptions – stress block parameters – Moment of Resistance.

**All units i.e. from unit II to unit V are to be taught in Limit State Design.**

**UNIT –II Design for Flexure and Shear:** Design of singly reinforced beams- effective depth- Moment of Resistance- Doubly reinforced and flanged (T) beams- Minimum depth - Minimum and Maximum Flexural Tension Reinforcement - Design of Flanged Sections (T & L)- Effective width of flange - Analysis and Design Problems.

**Design for Shear and Torsion:** Analysis and design of sections for shear and torsion – bond, anchorage and development length, I.S. code provisions. Design examples in simply supported and continuous beams, detailing.



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**UNIT – III Slabs and Serviceability:** Classification of slabs, design of one - way slabs, one way continuous slab using IS Coefficients (Conventional) –Design of two - way slabs - simply supported slabs and slabs with various edge conditions using IS Coefficients. Design of Stair case  
**Limit state of serviceability:** Deflection, cracking and IS code provisions for beams and slabs.

**UNIT – 1V Design of Compression members:** Effective length, Braced and un-braced columns – IS Code provisions, Design of short and long columns under axial loads, uniaxial bending and biaxial bending (Demonstration using SP 16)

**UNIT –V**

**Footings:** Types of footings – Design of isolated footings – pedestal, square, rectangular and circular footings subjected to axial loads, uni-axial bending moment.

**NOTE:** All the designs to be taught in Limit State Method Following plates should be prepared by the students.

1. Reinforcement detailing of T-beams, L-beams and continuousbeams.
2. Reinforcement detailing of columns and isolatedfootings.
3. Detailing of one-way, two-way and continuous slabs and waist-slab staircase.

**FINAL EXAMINATION PATTERN:**

The end examination paper should consist of Part A and Part B. Part A consists of two questions in Design and Drawing out of which one question is to be answered. Part B should consist of five questions and design out of which three are to be answered. Weightage for Part – A is 40% and Part- B is 60%.

**Text Books:**

1. Limit State Design, A. K.Jain, Nem Chand Brothers
2. Reinforced Concrete Structures, N. Krishna Raju & R. N. Pranesh, New Age Publications.
3. Structural Design and Drawing byN.Krishna Raju, Universities Press

**References:**

1. R C C Design, B.C Punmia, A. K. Jain and A. K Jain. LakshmiPublications
2. Reinforced Concrete Structures, S. Unnikrishna Pillai &Devdas Menon, Tata c.Graw Hill, New Delhi.
3. Design of Reinforced concrete Structures, N.Subrahmanian, Oxford University Press.
4. Limit state design of reinforced concrete structures by P C Varghese, PHI Learning pvt. Ltd.



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**IS Codes: (Permitted to use in examination hall)**

- 2) IS -456-2000 Code of practice for Reinforced Concrete Structures
- 3) IS – 875 (Parts 1 and 2)
- 3) SP-16
- 4) SP 34





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<b>Water Resources Engineering – II</b>					

**Course Learning Objectives:**

The course is designed to

- introduce the types of irrigation systems
- introduce the concepts of planning and design of irrigation systems
- discuss the relationships between soil, water and plant and their significance in planning an irrigation system
- understand design methods of erodible and non-erodible canals
- know the principles of design of hydraulic structures on permeable foundations
- know the concepts for analysis and design principles of storage and diversion head works
- learn design principles of canal structures

**Course Outcomes**

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

- be able to estimate irrigation water requirements
- ability to design irrigation canals and canal network
- plan an irrigation system
- design irrigation canal structures
- plan and design diversion head works
- analyse stability of gravity and earth dams
- design ogee spillways and energy dissipation works

**UNIT-I**

**Irrigation:** Necessity and importance, principal crops and crop seasons, types, methods of application, soil-water-plant relationship, soil moisture constants, consumptive use, estimation of consumptive use, crop water requirement, duty and delta, factors affecting duty, depth and frequency of irrigation, irrigation efficiencies, water logging and drainage, standards of quality for irrigation water, crop rotation.

**UNIT-II**

**Canals:** Classification, design of non-erodible canals - methods of economic section and maximum permissible velocity, economics of canal lining, design of erodible canals -Kennedy's silt theory and Lacey's regime theory, balancing depth ofcutting.



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**Canal Structures:**

**Falls:** Types and location, design principles of Sarda type fall and straight glacis fall.

**Regulators:** Head and cross regulators, design principles

**Cross Drainage Works:** Types, selection, design principles of aqueduct, siphon aqueduct and superpassage.

**Outlets:** types, proportionality, sensitivity and flexibility

**UNIT-III**

**Diversion Head Works:** Types of diversion head works, weirs and barrages, layout of diversion head works, components. causes and failures of weirs on permeable foundations, Bligh's creep theory, Khosla's theory, design of impervious floors for subsurface flow, exit gradient.

**UNIT-IV**

**Reservoir Planning:** Investigations, site selection, zones of storage, yield and storage capacity of reservoir, reservoir sedimentation.

**Dams:** Types of dams, selection of type of dam, selection of site for a dam.

**Gravity dams:** Forces acting on a gravity dam, causes of failure of a gravity dam, elementary profile and practical profile of a gravity dam, limiting height of a dam, stability analysis, drainage galleries grouting.

**UNIT-V**

**Earth Dams:** Types, causes of failure, criteria for safe design, seepage, measures for control of seepage-filters, stability analysis-stability of downstream slope during steady seepage and upstream slope during sudden drawdown conditions.

**Spillways:** Types, design principles of Ogee spillways, types of spillways crest gates. Energy dissipation below spillways-stilling basin and its appurtenances.

**Text Books:**

1. Garg, S.K (2015), "Irrigation Engineering and Hydraulic Structures", Khanna Book house PvtLtd , New Delhi.
2. Sharma,S.K.(2016). "Irrigation Engineering and Hydraulic Structures." S.Chand& company Pvt.Ltd, New Delhi. Pp1174.

**References:**

1. Asawa G L (2013) : "Irrigation and Water Resources Engineering, New Age InternationalPublishers", New Delhi.
2. Modi, P. N (2011), "Irrigation Water Resources and Water Power Engineering", Standard Book House, New Delhi



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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>Geotechnical Engineering - I</b>					

**Course Learning Objectives:**

The Objectives of this course are:

1. To enable the student to determine the index properties of the soil and classify it.
2. To impart the concept of seepage of water through soils and determine the discharge of water through soils.
3. To impart the principles of compaction and consolidation of soils and determine the magnitude and the rate of consolidation settlement.
4. To enable the student to understand the concept of shear strength of soils, determine the shear parameters of sands and clays and the areas of their application.

**Course Outcomes:**

Upon the successful completion of this course

- a. The student must know the definition of the various quantities related to soil mechanics and establish their inter-relationships.
- b. The student should be able to know the methods of determination of the various index properties of the soils and classify the soils.
- c. The student should be able to know the importance of the different engineering properties of the soil such as compaction, permeability, consolidation and shear strength and determine them in the laboratory.
- d. The student should be able to apply the above concepts in day-to-day civil engineering practice.

**UNIT – I**

**Introduction:** Soil formation – soil structure and clay mineralogy – Adsorbed water – Mass- volume relationship –Relative density

**Index Properties of Soils:** Grain size analysis – Sieve and Hydrometer methods – consistency limits and indices – Various Types of soil Classifications – Unified soil classification and I.S. Soil classification.

**UNIT –II**

**Permeability:** Soil water – capillary rise – One dimensioned flow of water through soils – Darcy’s law- permeability – Factors affecting –laboratory determination of coefficient of permeability – Permeability of layered systems.

**Geostatic Stresses:** Total, neutral and effective stresses –quick sand condition



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**Seepage:** 2-D flow and Laplace's equation - Seepage through soils –Flow nets: Characteristics and Uses.



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**UNIT – III**

**Stress Distribution In Soils:** Stresses induced by applied loads - Boussinesq's and Westergaard's theories for point loads and areas of different shapes- Newmark's influence chart – 2:1 stress distribution method.

**UNIT – IV**

**Compaction:** Mechanism of compaction – factors affecting – effects of compaction on soil properties - compaction control.

**Consolidation:** Compressibility of soils – e-p and e-log p curves – Stress history – Concept of consolidation - Spring Analogy - Terzaghi's theory of one-dimensional Consolidation – Time rate of consolidation and degree of consolidation – Determination of coefficient of consolidation ( $c_v$ ) - Over consolidated and normally consolidated clays.

**UNIT – V**

**Shear Strength of Soils:** Basic mechanism of shear strength -Mohr – Coulomb Failure theories – Stress-Strain behavior of Sands - Critical Void Ratio – Stress-Strain behavior of clays – Shear Strength determination- various drainage conditions.

**TEXT BOOKS:**

1. Gopal Ranjan and A.S.R.Rao, “Basic and Applied Soil Mechanics”, New Age International Publishers.
2. V.N.S.Murthy, “Soil Mechanics and Foundation Engineering”, CBS publishers
3. M.Palani Kumar, “Soil Mechanics”, PHI Learning

**REFERENCES:**

1. D.W.Taylor, “Fundamentals of Soil Mechanics”, Wiley.
2. Holtz and Kovacs, “An introduction to Geotechnical Engineering” Prentice Hall
3. Donald P. Coduto, Man-chu Ronald Young and William A. Kitch, “



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<b>III Year - II Semester</b>	<b>MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>(Common to all Branches)</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Course Objectives:**

- The Learning objectives of this paper are to understand the concept and nature of Managerial Economics and its relationship with other disciplines and also to understand the Concept of Demand and Demand forecasting.
- To familiarize about the Production function, Input Output relationship, Cost-Output relationship and Cost-Volume-Profit Analysis.
- To understand the nature of markets, Methods of Pricing in the different market structures and to know the different forms of Business organization and the concept of Business Cycles.
- To learn different Accounting Systems, preparation of Financial Statement and uses of different tools for performance evaluation.
- Finally, it is also to understand the concept of Capital, Capital Budgeting and the techniques used to evaluate Capital Budgeting proposals.

**Unit-I**

**Introduction to Managerial Economics and demand Analysis:**

Definition of Managerial Economics –Scope of Managerial Economics and its relationship with other subjects –Concept of Demand, Types of Demand, Determinants of Demand- Demand schedule, Demand curve, Law of Demand and its limitations- Elasticity of Demand, Types of Elasticity of Demand and Measurement- Demand forecasting and Methods of forecasting, Concept of Supply and Law of Supply.

**Unit – II:**

**Theories of Production and Cost Analyses:**

Theories of Production function- Law of Variable proportions-Isoquants and Isocosts and choice of least cost factor combination-Concepts of Returns to scale and Economies of scale-Different cost concepts: opportunity costs, explicit and implicit costs-Fixed costs, Variable Costs and Total costs –Cost –Volume-Profit analysis-Determination of Breakeven point(problems)-Managerial significance and limitations of Breakeven point.

**Unit – III:**

**Introduction to Markets, Theories of the Firm & Pricing Policies:**

Market Structures: Perfect Competition, Monopoly, Monopolistic competition and Oligopoly – Features – Price and Output Determination – Managerial Theories of firm: Marris and Williamson's models – other Methods of Pricing: Average cost pricing, Limit Pricing, Market Skimming Pricing, Internet Pricing: (Flat Rate Pricing, Usage sensitive pricing) and Priority Pricing, Business Cycles : Meaning and Features – Phases of a Business Cycle. Features and Evaluation of Sole Trader, Partnership, Joint Stock Company – State/Public Enterprises and their forms.

**Unit – IV:**

**Introduction to Accounting & Financing Analysis:**

Introduction to Double Entry System, Journal, Ledger, Trail Balance and Preparation of Final Accounts with adjustments – Preparation of Financial Statements-Analysis and Interpretation of Financial Statements-Ratio Analysis – Preparation of Funds flow and cash flow analysis (Problems)



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**Unit – V:**

**Capital and Capital Budgeting:** Capital Budgeting: Meaning of Capital-Capitalization-Meaning of Capital Budgeting-Time value of money- Methods of appraising Project profitability: Traditional Methods(pay back period, accounting rate of return) and modern methods(Discounted cash flow method, Net Present Value method, Internal Rate of Return Method and Profitability Index)

**Course Outcomes:**

- The Learner is equipped with the knowledge of estimating the Demand and demand elasticities for a product.
- The knowledge of understanding of the Input-Output-Cost relationships and estimation of the least cost combination of inputs.
- The pupil is also ready to understand the nature of different markets and Price Output determination under various market conditions and also to have the knowledge of different Business Units.
- The Learner is able to prepare Financial Statements and the usage of various Accounting tools for Analysis.
- The Learner can able to evaluate various investment project proposals with the help of capital budgeting techniques for decision making.

**TEXT BOOKS:**

A R Aryasri, Managerial Economics and Financial Analysis, The McGraw – Hill companies.

**REFERENCES:**

1. Varshney R.L, K.L Maheswari, Managerial Economics, S. Chand & Company Ltd,
2. JL Pappas and EF Brigham, Managerial Economics, Holt, R & W; New edition edition
3. N.P Srinivasn and M. SakhivelMurugan, Accounting for Management, S. Chand & Company Ltd,
4. Maheswari S.N, An Introduction to Accountancy, Vikas Publishing House Pvt Ltd
5. I.M Pandey, Financial Management , Vikas Publishing House Pvt Ltd
6. V. Maheswari, Managerial Economics, S. Chand & Company Ltd,



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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>PROGRAM ELECTIVE – II a). Pre-stressed Concrete</b>					

**Course Learning Objectives:**

The objective of this course is:

- Familiarize Students with concepts of prestressing
- Equip student with different prestressing systems and devices
- Understand losses of prestress including short and long term losses
- Familiarize students with analysis and design of prestressed concrete members under flexure, shear and torsion

**Course Outcomes:**

- At the end of this course the student will be able to
- Understand different methods of prestressing
- Estimate effective prestress including short and long term losses
- Analyze and design prestressed concrete beams under flexure and shear
- Understand the relevant IS Code provisions for prestressed concrete

**SYLLABUS:**

**UNIT-I Introduction & Methods and Systems of prestressing** Historic development- General principles of prestressing pretensioning and post tensioning- Advantages and limitations of Prestressed concrete- General principles of PSC- Classification and types of prestressing- Materials- high strength concrete and high tensile steel their characteristics. Pretensioning and Posttensioning methods and systems of prestressing like Hoyer system, Magnel Blaton system, Freyssinet system and Gifford- Udall System- Lee McCall system

**Flexure:** Analysis of sections for flexure- beams prestressed with straight, concentric, eccentric, bent and parabolic tendons, Line of Thrust – Pressure Line, Load Balancing Concept.

**UNIT-II Losses of Pre-stressing-** Loss of Pre-stress in pre-tensioned and post tensioned members - Elastic shortening, shrinkage, and creep of concrete; Relaxation of steel, slip in anchorage, and frictional losses- Total loss and allowable loss of prestress for design





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**UNIT-III** Design for Flexure - Types of failure – Code procedures - Design for flexure using IS Code (IS 1343 -2012) Cable profile in two span continuous members.

**UNIT-IV Deflections:** Importance of control of deflections- Factors influencing deflections – Short term deflections of uncracked beams- prediction of long time deflections- IS code requirements.

**Composite Beams:** Different Types- Propped and Unpropped- stress distribution- Differential shrinkage- Analysis of composite beams- Deflection of determinate composite beam.

**UNIT-V** Design for Shear and Torsion- Shear and Principal Stresses- Design of Shear reinforcement - Code Provisions- Design for Torsion, Design for Combined bending, shear and torsion, Control of deflections- Factors influencing Deflection- Prediction of short term and long term deflections.

**Text Books:-**

1. Prestressed Concrete by N.Krishna Raju, 6e Tata Mc Graw Hill Book co.
2. Prestressed Concrete by K.U.Muthu PHI Learning Pvt. Ltd.

**References:**

1. Design of prestress concrete structures by T.Y. Lin and Burn, John Wiley, New York.
2. Prestressed Concrete by N. Rajagopalan Narosa Publishing House.
3. Prestressed concrete by S. Ramamrutham Dhanpat Rai & Sons, Delhi.
4. IS 1343:2012



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	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>PROGRAM ELECTIVE – II b). Watershed Management</b>				

**Course Learning Objectives**

The course is designed to:

- Introduce the concept of watershed management
- Understand the watershed characteristics
- Learn the principles of soil erosion and measures to control erosion
- Appreciate various water harvesting techniques.
- Learn land management practices for various land use/land cover.
- Introduce concepts of watershed modelling.

**Course outcomes**

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

- Calculate watershed parameters and analyse watershed characteristics to take appropriate management action.
- Quantify soil erosion and design control measures.
- Apply land grading techniques for proper land management .
- Suggest suitable harvesting techniques for better watershed management.
- Apply appropriate models for watershed management.

**SYLLABUS**

**UNIT-I: Introduction:** Concept of watershed development, objectives of watershed development, need for watershed development, Characteristics of Watersheds: Size, shape, physiography, slope, climate, drainage, land use, vegetation, geology and soils, hydrology and hydrogeology, socio-economic characteristics.

**UNIT-II : Principles of Erosion:** Types and causes of erosion, factors affecting erosion, estimation of soil loss due to erosion- Universal soil loss equation. Measures to Control Erosion: Contour techniques, ploughing, furrowing, trenching, bunding, terracing, gully control, check dams, rock-fill dams, brushwood dam, Gabion.

**UNIT-III: Water Harvesting:** Techniques of rain water harvesting- rain water harvesting from roof top, surface flow harvesting, subsurface flow harvesting, stop dams, farm ponds and dugout ponds, percolation tanks.

**UNIT-IV: Land Management:** Land use and Land capability classification, management of forest, agricultural, grassland and wild land, land grading operation, Reclamation of saline and alkaline soils.



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UNIT-V: Watershed Modelling: Data of watershed for modelling, application and comparison of watershed models, model calibration and validation, advances of watershed models. Integrated and multidisciplinary approach for watershed management.

**TEXT BOOKS**

1. 'Watershed Management' by Das MM and M.D Saikia, PHI Learning Pvt. Ltd, 2013.
2. 'Land and Water Management' by Murthy.VVN, Kalyani Publications, 2007.
3. 'Watershed Management' by Murthy J V S, New Age International Publishers, 2006.

**REFERENCES**

1. 'Water Resource Engineering' by Wurbs R A and James R A, Prentice Hall Publishers, 2002.
2. 'Watershed Hydrology' by Black P E, Prentice Hall, 1996.



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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>PROGRAM ELECTIVE – IIc). Advanced Foundation Engineering</b>					

**Course Learning Objectives:**

The objective of this course is:

1. To enable the student to appreciate how Meyerhof's general bearing capacity equations are important over Terzaghi's bearing capacity equation.
2. To teach the student special methods of computation of settlements and the corrections to be applied to settlements.
3. To enable the student to understand the advanced concepts of design of pile foundations.
4. To teach the student the problems posed by expansive soils and the foundation practices appropriate to expansive soils.
5. To enable the student to learn the difference between isolated and combined footings, the determination of bearing capacity of mats and proportioning of footings.

**Course Outcomes:**

Upon successful completion of this course, student will be able to

- a. compute the safe bearing capacity of footings subjected to vertical and inclined loads.
- b. understand the advanced methods of settlement computations and proportion foundation footings.
- c. appreciate the methods of computing the pull-out capacity and negative skin friction of piles and compute the settlements of pile groups in clays.
- d. appreciate the problems posed by expansive soils and the different foundation practices devised.
- e. appreciate the difference between isolated footings and combined footings and mat foundations.

**UNIT-I**

**Bearing capacity & settlement analysis of foundations:**

Bearing capacity of Foundations using general bearing capacity equation - Meyerhof's, Brinch Hansen's and Vesic's methods – Bearing capacity of Layered soils - Strong layer over weak layer, weak layer on strong layer – Bearing capacity of foundations on a top of slope – Bearing capacity of foundations at the edge of the slope.

Settlement analysis: Immediate settlement of footings resting on granular soils - Schmertmann & Hartman method - De Beer and Martens method - Immediate settlement in clays - Janbu's method - correction for consolidation settlement using Skempton and Bjerrum's method - Correction for construction period.



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**UNIT-II**

**Mat foundations:**

Mat foundations – Purpose and types of isolated and combined footings – Mats/ Rafts – Proportioning of footings – Ultimate bearing capacity of mat foundations – allowable bearing capacity of mats founded in clays and granular soils – compensated rafts.

**UNIT-III**

**Earth retaining structures:**

Earth-retaining structures – cantilever sheet piles – anchored bulkheads – fixed and free earth support methods – design of anchors – braced excavations – function of different components – forces in ties – stability against bottom heave.

**UNIT-IV**

**Pile foundations:**

Pile foundations – single pile versus group of piles – load-carrying capacity of pile groups – negative skin friction (NSF) -settlement of pile groups in sands and clays –laterally loaded piles in granular soils – Reese and Matlock method – laterally loaded piles in cohesive soils – Davisson and Gill method – Broms' analysis.

**UNIT-V**

**Foundation in expansive soils:**

Foundations in expansive soils – definitions of swell potential and swelling pressure – determination of free swell index – factors affecting swell potential and swelling pressure – foundation practices – sand cushion method – CNS layer - drilled piers and belled piers – under-reamed piles – moisture control methods.

**TEXT BOOKS:**

1. 'Basic and applied soil mechanics' by Gopal Ranjan and ASR Rao, New Age Publishers
2. 'Soil Mechanics and Foundation Engineering' by VNS Murthy, CBS Publishers
3. 'Principles of Foundation Engineering' by BM Das, Thomson Brooks/Cole

**REFERENCE BOOKS:**

1. 'Foundation Analysis and Design' by JE Bowles, John Wiley
2. 'Foundation Design' by WC Teng, Prentice Hall Publishers



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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>PROGRAM ELECTIVE – II d). Urban Transportation Planning</b>					

**Course Learning Objectives:**

The objective of this course is:

1. To appreciate urban transportation problems and procedures for travel demand estimation
2. To appreciate data collection techniques for OD data.
3. To estimate trip generation, trip distribution, mode choice and traffic assignment.
4. To develop alternative urban transport network plans
- 5.

**Course Outcomes:**

At the end of course, Student will be able to

- a. Estimate travel demand for an urban area
- b. Plan the transportation network for a city
- c. Identify the corridor and plan for providing good transportation facilities.
- d. Evaluate various alternative transportation proposals

**SYLLABUS:**

**UNIT -I**

**Urban Transportation Problems & Travel Demand:** Urban Issues, Travel Characteristics, Evolution of Planning Process, Supply and Demand – Systems approach; Trends, Overall Planning process, Long term Vs Short term planning, Demand Function, Independent Variables, Travel Attributes, Assumptions in Demand Estimation, Sequential, and Simultaneous Approaches, Aggregate and Disaggregate Techniques.

**UNIT -II**

**Data Collection And Inventories:** Collection of data – Organisation of surveys and Analysis, Study Area, Zoning, Types and Sources of Data, Road Side Interviews, Home Interview Surveys, Commercial Vehicle Surveys, Sampling Techniques, Expansion Factors, Accuracy Checks, Use of Secondary Sources, Economic data – Income – Population – Employment – Vehicle Owner Ship.

**UNIT -III**

**Trip Generation & Distribution:**UTPS Approach, Trip Generation Analysis: Zonal Models, Category Analysis, Household Models, Trip Attraction models, Commercial Trip Rates; Trip Distribution: Growth Factor Methods, Gravity Models, Opportunity Models, Time Function Iteration Models.



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**UNIT -IV**

**Mode Choice Analysis:** Mode Choice Behaviour, Competing Modes, Mode Split Curves, Aggregate and Disaggregate Approaches; Discrete Choice Analysis, Choice sets, Maximum Utility, Probabilistic Models: Binary Logit, Multinomial Logit Model – IIA property; Aggregation.

**Traffic Assignment:** Diversion Curves; Basic Elements of Transport Networks, Coding, Route Properties, Path Building Criteria, Skimming Tree, All-or-Nothing Assignment, Capacity Restraint Techniques, Reallocation of Assigned Volumes, Equilibrium Assignment.

**UNIT -V**

**Corridor Identification, Plan Preparation & Evaluation:** Master plans, Selection of Corridor, Corridor Identification, Corridor deficiency Analysis; Travel Forecasts to Evaluate Alternative Improvements, Impacts of New Development on Transportation Facilities. Pivot Point Analysis, Environmental and Energy Analysis; Case studies.

**TEXT BOOKS:**

1. 'Transportation Engineering - An Introduction' by Khisty C.J., B. Kent Lall, Pearson India Education Services pvt. Ltd.
2. Transportation Engineering and Planning by C S Papacostas and P.D. Prevedours; Pearson India Education Services pvt. Ltd.

**REFERENCES:**

1. 'Urban Transportation Planning: A decision oriented Approach' by Mayer M and Miller E, McGraw Hill
2. 'Traffic Engineering and Transportation Planning' by Kadiyali.L.R., Khanna Publishers, New Delhi.



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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>PROGRAM ELECTIVE – II e). Architecture and Town Planning</b>					

**Course Learning Objectives:**

The objectives of this course are:

1. Initiating the students to different architectures of the world. The distinctions between the eastern and western architecture styles are focused.
2. The salient features of Egyptian, Greek, Roman, Indian Vedic, Indus valley civilization, Buddhist, Hindu and Indo-Sarsanic Architecture are introduced.
3. Architectural design concepts, principles of planning and composition are imparted.
4. Enabling the student to understand town planning from ancient times to modern times.
5. To impart the concepts of town planning standards, land scaping and expansion of towns.

**Course Outcomes:**

Upon the successful completion of this course:

- a. The student should be able to distinguish architectural styles of eastern and western world.
- b. The student should understand the importance of Orders of architecture.
- c. Should be able to compose spaces of buildings using design concepts, planning principles.
- d. Should understand the town planning standards, landscaping features and regulations controlling expansion of the towns and the cities.

**SYLLABUS:**

**UNIT – I**

**History of Architecture:** Western Architecture: Egyptian, Greek, Roman Architectures- Orders. Indian Architecture: Vedic age, Indus valley civilization.

**Temples of religions:** Buddhist period: Stambas, Stupas, Toranas, Chaityas, Viharas – Hindu temples: Dravidian and Indo Aryan Styles-Temple of Aihole, Madurai, Bhuvaneshwar, Mount Abu. Indo Sarsanic (Islamic) Architecture: Mosque - Palace - Fort - Tomb.

**UNIT - II**

**Principles of designing and Planning:** Principles of planning a residence- site selection, site orientation- aspect, prospect, grouping, circulation, privacy, furniture requirements, services and other factors.

**Post-classic Architecture:** Introduction of post-classic architecture- contribution of eminent architects to modern period-Edward Lutyens, Le Corbusier, Frank Lloyd Wrigt, Walter Groping.





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**UNIT – III**

**Historical Back Ground of Town Planning:** Town planning in India –Town plans of mythological Manasa-Town plans of ancient towns: Harappa, Mohenjodaro, Pataliputra, Delhi, Acropolis (Greece), Jerusalem, Mecca, Rome, London.

**UNIT – IV**

**Modern Town Planning:** Zoning- Roads and road traffic- Housing- Slums, Parks, Play grounds- Public Utility Services- Surveys and maps for planning- Neighborhood Planning.

**Standards of Town planning:** Planning new towns, planning standards and specifications, national and regional planning, town planning and legislation-planning regulations and limitations.

**UNIT - V**

**Land Scaping and Expansion of Towns:** Land scaping for the towns, horizontal and vertical expansion of towns- garden cities, satellite towns-floating towns- sky scrapers-pyramidal cities.

**TEXTBOOKS:**

1. 'The great ages of World Architecture' by G.K. Hiraskar.
2. 'Planning and Design of Buildings by Section of Architecture' by Y. S. Sane.
3. 'Professional Practice' by G.K.Krishnamurthy, S.V.Ravindra, PHI Learning, New Delhi.
4. 'Indian Architecture – Vol. I & II' by Percy Brown, Taraporevala Publications, Bombay.
5. 'Fundamentals of Town Planning' by G.K.Haraskar.

**REFERENCES:**

1. 'Drafting and Design for Architecture' by Hepler, Cengage Learning
2. 'Architect's Portable Handbook' by John Patten Guthrie – McGraw.Hill International Publications.
3. 'Mordern Ideal Homes for India' by R. S. Deshpande.
4. 'Town and County Planning' by A.J.Brown and H.M.Sherrard.
5. 'Town Design' by Federik Glbbard, Architectural press, London.



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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>OPEN ELECTIVE – II</b> <b>(Choose any One out of Nine Courses which was not studied earlier)</b>					



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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>CAD LAB</b>					

**Course Objectives: The objectives of the course are to**

1. **Learn** the usage of any fundamental software for design
2. **Create** geometries using pre-processor
3. **Analyse** and Interpret the results using post processor
4. **Design** the structural elements

**Course Outcomes**

**After the completion of the course student should be able to**

- a) **Model** the geometry of real-world structure Represent the physical model of structural element/structure
- b) Perform **analysis**
- c) **Interpret** from the Post processing results
- d) **Design** the structural elements and a system as per IS Codes

**LIST OF EXPERIMENTS**

1. Analysis & Design determinate structures using a software
2. Analysis & Design of fixed & continuous beams using a software
3. Analysis & Design of Plane Frames
4. Analysis & Design of space frames subjected to DL & LL
5. Analysis & Design of residential building subjected to all loads (DL,LL,WL,EQL)
6. Analysis & Design of Roof Trusses
7. Design and detailing of built up steel beam
8. Developing a design programme for foundation using EXCEL Spread Sheet
9. Detailing of RCC beam and RCC slab
10. Detailing of Steel built up compression member

**Note:** Drafting of all the exercises is to be carried out using commercially available designing software's.



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	<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>
<b>ENVIRONMENTAL ENGINEERING LAB</b>				

**Course Learning Objectives:**

The course will address the following:

- Estimation of important characteristics of water and wastewater in the laboratory
- Inference with reference to the significance of the characteristics of the water and wastewater

**Course Outcomes:**

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

- Estimate some important characteristics of water, wastewater and soil in the laboratory
- Draw some conclusion and decide whether the water is suitable for Drinking/Construction / Agriculture/ Industry.
- Estimate Chloride, EC and Salinity of Soil and suggest their suitability for Construction/Agriculture
- Estimation of the strength of the sewage in terms of BOD and COD and Decide whether the water body is polluted or not with reference to the stated parameters in the list of experiments
- Demonstration of various instruments used in testing of water and soil and study of Drinking water standards, WHO guidelines, Effluent standards and standards for Construction/ Agriculture/ Industry.

**List of Experiments**

1. Determination of pH and Electrical Conductivity (Salinity) of Water and Soil.
2. Determination and estimation of Total Hardness–Calcium & Magnesium.
3. Determination of Alkalinity/Acidity
4. Determination of Chloride in water and soil
5. Determination and Estimation of total solids, organic solids and inorganic solids and Settleable Solids by Imhoff Cone.
6. Determination of Iron.
7. Determination of Dissolved Oxygen with D.O. Meter & Wrinklers Method and BOD.
8. Determination of N, P, K values in solid waste
9. Physical parameters – Temperature, Color, Odor, Turbidity, Taste.
10. Determination of C.O.D.



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11. Determination of Optimum coagulant dose- with and without coagulant aids
12. Determination of Chlorine residue and demand
13. Presumptive Coliformtest.

**NOTE:** Atleast 10 of the experiments enlisted are to be conducted.

**List of Equipments**

- 1) pH meter
- 2) Turbiditymeter
- 3) Conductivitymeter
- 4) Hot airoven
- 5) Mufflefurnace
- 6) Dissolved Oxygenmeter
- 7) U–V visiblespectrophotometer
- 8) COD RefluxApparatus
- 9) Jar TestApparatus
- 10) BOD Incubator
- 11) Autoclave
- 12) Laminar flowchamber
- 13) Hazen’s Apparatus
- 14) Chloroscope

**Text Books**

1. Standard Methods for Analysis of Water and Waste Water –APHA
2. Chemical Analysis of Water and Soil by KVSG Murali Krishna, Reem Publications, NewDelhi, 2010.

**Reference**

1. Relevant IS Codes.
2. Chemistry for Environmental Engineering by Sawyer and Mc.Carty.



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**Socially Relevant Project**

**Preamble:**

There is lot of scientific and technological changes in the nation during last few decades in almost all the sectors. The state and central governments are introducing many schemes to all classes of people of the nation to increase the productivity in various sectors. India is a rural centric nation and the fruits of the scientific inventions and new technology shall be shared among all remote corners of the nation. With this aim, a socially relevant project is newly introduced in the curriculum with an objective of taking up the projects relevant to the societal needs.

**Objectives:**

- (1) The student(s) shall explore the technological needs of society
- (2) The student(s) shall understand the technological problems of society

**General guidelines:**

- A socially relevant project shall be a community service based project and it shall be innovative.
- A student has to pursue the socially relevant project to solve real life and pressing problems of society.
- The pursued socially relevant projects shall contribute to national development goals and priorities.
- Socially relevant project can be carried out by an individual student or by a team of maximum 5 of concerned department.
- The student(s) shall visit the society (Villages/Hospitals/Social Service Organizations etc) to identify the problem and conduct literature survey and provide a feasible solution.
- The socially relevant project selected shall be in the broad area of concerned discipline of course. Preference shall be given to rural societal problems.
- Each team shall work under the supervision of a faculty member of the concerned department.
- If the course is offered in II Year I Semester, the student or team of students shall complete this project during the vacation after I Year and so on.
- The duration of the project is about 15 to 20 hrs in total and students may split total duration into 2 to 3 hrs per day based convenience. The attendance shall be maintained by the supervisor.

**Sample Projects (but not limited to):**

(i) Energy Auditing in a rural village (ii) Smart starting and control of motors in agriculture and aqua fields (iii) TV Remote Operated Domestic Appliances Control (iv) Solar Powered Auto Irrigation System (v) Auto Intensity Control of Street Lights (vi) Hidden Active Cell Phone Detector (vii) Railway Track Security System (viii) Solar Power Charge Controller (ix) Home Automation System Using Digital Control (x) Intelligent Overhead Tank Water Level Indicator (xi) Pre Stampede Monitoring and Alarm System (xii) Detect Rash Driving Speed Checker System on Highways

**Outcomes**

- (1) The student(s) are be able to provide a solutions the technological problems of society
- (1) The student(s) is able suggest technological changes which suits current needs of society
- (2) The student(s) are able to explain new technologies available for problems of the society.

**Reference:**

- (1) Web Link: <http://iitk.ac.in/new/socially-relevant-research>
- (2) <https://csie.iitm.ac.in/SocialProjectsIITM.html>
- (3) [http://www.iitkgp.ac.in/files/csr/csr\\_education.pdf](http://www.iitkgp.ac.in/files/csr/csr_education.pdf)



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**DEPARTMENT OF CIVIL ENGINEERING**

<b>III Year – II Semester</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>2</b>	<b>0</b>
<b>Employability Skills</b>					

**Preamble:** This course is introduced to enhance the soft and hard skills of students based on industry needs and helping the student to get the employment in the competitive industrial environment.

**Course Objective:** In the this course the student should understand:

- (i) Aptitude skill, (ii) Soft skills, (iii) Skills required for campus placement interview

**Unit 1: Aptitude Skills**

**Quantitative Aptitude:**

Numbers, HCF and LCM, Problems on ages, Averages, Ratio and Proportion, Percentages, Profit and Loss, Partnership, Interest calculations, Time and Work, Time and Distance, Pipes and Cisterns, Mensuration

**Reasoning:**

Number and Letter Analogy, Coding and decoding, Odd Man out, Symbols and Notations, Permutations and Combinations, Probability, Data Interpretation, Data Sufficiency, Clocks and Calendars, Deductions, Logical Connectives, Venn Diagrams, Cubes, Binary Logic, Ordering and Sequencing, Blood relations – Syllogisms - Seating arrangement, Analytical Reasoning

**Unit 2: Skills - I**

**Soft Skills:** An Introduction – Definition and Significance of Soft Skills; Process, Importance and Measurement of Soft Skill Development. **Self-Discovery:** Discovering the Self; Setting Goals; Beliefs, Values, Attitude, Virtue. Goal Setting-Vision Vs Mission Vs Goals, SMART Technique to Goal Setting, SWOT Analysis. **Self Esteem:** Types of Self Esteem, Causes of Low Self Esteem, Merits of Positive Self Esteem and Steps to build a positive Self Esteem; Art of Compromise, Learn to Say: 'I Don't Know', Being organized, Showing Self-awareness, Self-Assessment for Attainable Career Objectives. **Attitude & Confidence:** Attitude Vs Skills Vs Knowledge, Attitude Vs Behaviour, Developing Positive Attitude and Confidence; Fear- Public Speaking, Steps to Overcome Fear, developing Positive Thinking and Attitude; Driving out Negativity; Meaning and Theories of Motivation; Enhancing Motivation Levels, Adjusting Your Attitude-Arrogance has no Place in the Workplace, Cultural Sensitivity in the Workplace, Corporate Culture: Learning How to Fit in. **Motivational Talk:** Team Work, Team Vs Group, Stages in Team Building, Mistakes to avoid and Lessons to Learn.

**Unit 3: Skills – II:**

**Interpersonal Communication:** Interpersonal relations; communication models, process and barriers; team communication; developing interpersonal relationships through effective communication; essential formal writing skills; corporate communication styles – assertion, persuasion, negotiation. **Listening:** Listening Vs Hearing, Possible reasons for why people do not Listen at times, Active Listening Vs Passive Listening, Listening effect on relationships. **Public Speaking:** Skills, Methods, Strategies and Essential tips for effective public speaking. **Group Discussion:** Importance, Planning, Elements, Skills assessed; Effectively disagreeing, Initiating, Summarizing and Attaining the Objective. **Non-Verbal Communication:** Importance and Elements;



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Body Language-Postures, gestures, eye contact. **Teamwork and Leadership Skills:** Concept of Teams; Building effective teams; Concept of Leadership and honing Leadership skills. **Presentation Skills:** Types, Content, Audience Analysis, Essential Tips – Before, During and After, Overcoming Nervousness. **Etiquette and Manners:** Social and Business. **Time Management** – Concept, Essentials, Tips.

**Unit 4: Personality Development:** Meaning, Nature, Features, Stages, Models; Learning Skills; Adaptability Skills. **Decision-Making and Problem-Solving Skills:** Meaning, Types and Models, Group and Ethical Decision-Making, Problems and Dilemmas in application of these skills. **Conflict Management:** Conflict - Definition, Nature, Types and Causes; Methods of Conflict Resolution. **Stress Management:** Stress - Definition, Nature, Types, Symptoms and Causes; Stress Analysis Models and Impact of Stress; Measurement and Management of Stress. **Leadership and Assertiveness Skills:** A Good Leader; Leaders and Managers; Leadership Theories; Types of Leaders; Leadership Behaviour; Assertiveness Skills. **Emotional Intelligence:** Meaning, History, Features, Components, Intrapersonal and Management Excellence; Strategies to enhance Emotional Intelligence.

**Unit 5:** Group Discussions (GD):

Stages of a GD, GD Vs Debate, Skills assessed in a GD, Blunders to be avoided, Dos & Don'ts, GD-Practice: Conducting practice sessions and Brain Storming Sessions, Evaluation, feedback on their performance

**Resume Preparation:** Resume Templates, Steps followed for resume preparation, Common mistakes in a resume; Covering letter

**Campus Placements Skills:** Stages of Campus Placement, Skills assessed in Campus Placements, Changing scenario and its Challenges & How to get ready, Motivational Talk on Positive Thinking: Beliefs, Thoughts, Actions, Habits & Results (Success);

**Interview Skills:** Types of Interview, Interviewer and Interviewee – in-depth perspectives; Before, During and After the Interview; Tips for Success, Dress code and Grooming, Dos & Don'ts, Skills assessed in an Interview, Mistakes to be avoided, How to equip oneself to excel; How to handle the Typical Interview Questions; Mock Interviews: Unconventional HR questions, Practice sessions with Feedback, **Simulated Testing:** Previous model papers of companies,

**Business Terminology:** Financial Terms such as Debt, Equity, Share, Working Capital, Turnover, Net worth etc; Vision, Mission, Objectives, Goals, Targets

**Course Outcomes:** After studying this course the student should able to

(i) solve aptitude and reasoning problems, (ii) apply the soft skills in dealing the issues related to employability, (iii) successful in getting employment in campus placement interview

**References:**

- 1) B. K. Mitra, Personality Development and Soft Skills, Oxford University Press, 2011.
- 2) S.P. Dhanavel, English and Soft Skills, Orient Blackswan, 2010.
- 3) R.S. Aggarwal, A Modern Approach to Verbal & Non-Verbal Reasoning, S.Chand & Company Ltd., 2018.
- 4) Raman, Meenakshi & Sharma, Sangeeta, Technical Communication Principles and Practice, Oxford University Press, 2011.





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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>Design &amp; Drawing of Steel Structures</b>					

**Course Learning Objectives:**

The objective of this course is to:

- Familiarize Students with different types of Connections and relevant IScodes
- Equip student with concepts of design of flexural members
- Understand Design of tension and compression members intrusses
- Familiarize students with types of Columns, column bases and their Design
- Familiarize students with Plate girder and Gantry Girder and their Design

**Course Outcomes:**

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

- Work with relevant IScodes
- Carryout analysis and design of flexural members and detailing
- Design compression members of different types with connection detailing
- Design Plate Girder and Gantry Girder with connection detailing
- Produce the drawings pertaining to different components of steel structures

**UNIT – I** Types of structural steel – Mechanical properties of steel – Concepts of plasticity – yield strength - Loads and Stresses – Local buckling behavior of steel. Concepts of limit State Design – Different Limit States – Load combinations for different Limit states - Design Strengths- deflection limits – serviceability – stability check.;

**Connections:** Design of Connections– Different types of connections – Bolted connections –Design strength – efficiency of joint

**Welded connections:** Advantages and disadvantages - Strength of welds-Butt and fillet welds: Permissible stresses – IS Code requirements. Design of fillet weld subjected to in-plane moment acting in the plane and at right angles to the plane of the joints.

**All units i.e. from unit II to unit-VI to be taught in Limit State Design and in Welded connections only.**

**UNIT – II**

*Plastic Analysis;* Plastic moment – Plastic section modulus - Plastic analysis of continuous beams

**Beams:** Allowable stresses, design requirements as per IS Code-Design of simple and compound beams-Curtailment of flange plates, Beam to beam connection, check for deflection, shear, buckling, check for bearing, laterally unsupported beams.



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**UNIT –III Compression and Tension Members:** Effective length - Slenderness ratio – permissible stresses. Design of compression members, and struts. Built up compression members – Design of lacings and battens. Design Principles of Eccentrically loaded columns, Splicing of columns.

**Roof Truss Element:** Different types of trusses – Design loads – Load combinations as per IS Codes –Design of simple roof trusses involving design of purlins, rafters and joints – tubular trusses.

**UNIT – IV Design of Column Foundations:** Design of slab base and gusseted base. Column bases subjected moment.

**UNIT – V Design of Plate Girder:** Design consideration – I S Code recommendations Design of plate girder - Welded – Curtailment of flange plates, stiffeners – splicing and connections. **Design of Gantry Girder:** impact factors - longitudinal forces, Design of Gantry girders.

**NOTE:** Welding connections should be used in Units II – VI. The students should prepare the following plates.

Plate 1 Detailing of simple beams,

Plate 2 Detailing of Compound beams including curtailment of flange plates. Plate 3 Detailing of Column including lacing and battens,

Plate 4 Detailing of Column bases – slab base and gusseted base,

Plate 5 Detailing of steel roof trusses including joint details and

Plate 6 Detailing of Plate girder including curtailment, splicing and stiffeners.

**FINAL EXAMINATION PATTERN:**

The end examination paper should consist of Part A and Part B. Part A consist of two questions in Design and Drawing out of which one question is to be answered. Part B should consist of five questions and design out of which three are to be answered. Weightage for Part – A is 40% and Part-B is 60%.

**TEXT BOOKS**

1. Steel Structures Design and Practice, N. Subramanian, Oxford University Press.
2. Limit State Design of steel structures, S. K. Duggal, Tata Mc Graw Hill, New Delhi

**REFERENCES**

1. Structural Design in Steel, Sarwar Alam Raz, New Age International Publishers, New Delhi
2. Structural Design and Drawing by N. Krishna Raju, Universities Press
3. Design of Steel Structures by K.S. Sai Ram, Person India Education Services

**IS Codes:**

- 1) IS 800:2007, Indian Standard Code for General Construction in Steel, 3<sup>rd</sup> revision, Indian Standards Institution, New Delhi, 2008.
- 2) IS – 875, Code of practice for design loads (other than earth quake) for buildings and structures (Part-1-Part 5), Bureau of Indian standards.
- 3) Steel Tables.

**These codes and steel tables are permitted to use in the examinations.**



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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>Geotechnical Engineering – II</b>					

**Course Learning Objectives:**

The objective of this course is:

1. To impart to the student knowledge of types of shallow foundations and theories required for the determination of their bearing capacity.
2. To enable the student to compute immediate and consolidation settlements of shallow foundations.
3. To impart the principles of important field tests such as SPT and Plate bearing test.
4. To enable the student to imbibe the concepts of pile foundations and determine their load carrying capacity.

**Course Outcomes:**

Upon the successful completion of this course:

- a. The student must be able to understand the various types of shallow foundations and decide on their location based on soil characteristics.
- b. The student must be able to compute the magnitude of foundation settlement and decide on the size of the foundation accordingly.
- c. The student must be able to use the field test data and arrive at the bearing capacity.
- d. The student must be able to apply the principles of bearing capacity of piles and design them accordingly.

**UNIT – I**

**Soil Exploration:** Need – Methods of soil exploration – Boring and Sampling methods – Field tests – Penetration Tests – Pressure meter – planning of Programme and preparation of soil investigation report.

**UNIT – II**

**Earth And Earth-Retaining Structures:** Infinite and finite earth slopes in sand and clay – types of failures – factor of safety of infinite slopes – stability analysis by Swedish arc method, standard method of slices – Taylor’s Stability Number-Stability of slopes of dams and embankments - different conditions.

Rankine’s & Coulomb’s theory of earth pressure – Culmann’s graphical method - earth pressures in layered soils.

**UNIT-III**

**Shallow Foundations – Bearing Capacity Criteria:** Types of foundations and factors to be considered in their location - Bearing capacity – criteria for determination of bearing capacity –



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factors influencing bearing capacity – analytical methods to determine bearing capacity – Terzaghi's theory - IS Methods.

**UNIT-IV**

**Shallow Foundations – Settlement Criteria:** Safe bearing pressure based on N- value – allowable bearing pressure; safe bearing capacity and settlement from plate load test – Types of foundation settlements and their determination - allowable settlements of structures.

**UNIT -V**

**Deep Foundations:**

**Pile Foundation:** Types of piles – Load carrying capacity of piles based on static pile formulae – Dynamic pile formulae– Pile load tests - Load carrying capacity of pile groups in sands and clays.

**Well Foundations:** Types – Different shapes of well – Types of caissons – Components of well - functions – forces acting on well foundations - Design Criteria – Determination of steining thickness and plug - construction and Sinking of wells – Tilt and shift.

**TEXT BOOKS:**

1. 'Principles of Foundation Engineering' by Das, B.M., - (2011) –6th edition (Indian edition) Cengage learning
2. 'Basic and Applied Soil Mechanics' by Gopal Ranjan& ASR Rao, New Age International Pvt. Ltd, (2004).
3. Soil mechanics & foundation engineering by Arora

**REFERENCES:**

1. Foundation Analysis and Design' by Bowles, J.E., (1988) – 4th Edition, McGraw-Hill Publishing Company, Newyork.
2. 'Theory and Practice of Foundation Design' by N.N.SOM & S.C.DAS PHI Learning Private limited.



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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>REMOTE SENSING AND GIS</b>					

**Course Learning Objectives:**

The course is designed to

1. Introduce the basic principles of Remote Sensing and GIS techniques.
2. learn various types of sensors and platforms
3. learn concepts of visual and digital image analyses
4. understand the principles of spatial analysis
5. appreciate application of RS and GIS to Civil Engineering

**Course outcomes**

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

- a. Be familiar with ground, air and satellite based sensor platforms.
- b. interpret the aerial photographs and satellite imageries
- c. create and input spatial data for GIS application
- d. apply RS and GIS concepts for application in Civil Engineering

**UNIT – I**

**Introduction to Remote sensing:** Basic concepts of remote sensing, electromagnetic radiation, electromagnetic spectrum, interaction with atmosphere, energy interaction with the earth surfaces, characteristics of remote sensing systems, types of resolutions - advantages & limitations

**Sensors and platforms:** Introduction, types of sensors, airborne remote sensing, spaceborne remote sensing, image data characteristics, digital image data formats-band interleaved by pixel, band interleaved by line, band sequential, IRS, LANDSAT, SPOT & Recent satellite.

**UNIT – II**

**Image analysis:** Introduction, elements of visual interpretations, digital image processing- image pre-processing, image enhancement, image classification, supervised classification, unsupervised classification. : Overlay function-vector overlay operations; raster overlay operations, network analysis.

**UNIT – III**

**Geographic Information System:** Basic Principles, components, application areas of GIS, map projections.

**Data entry and preparation:** spatial data structures, raster and vector data formats, data inputs, data manipulation, data retrieval, data analysis and data display.

**UNIT – IV**

**RS and GIS applications General:** Land cover and land use, agriculture, forestry, geology, geomorphology, urban & transportation applications,



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**UNIT - V**

**Application to Hydrology and Water Resources:** Flood zoning and mapping, groundwater prospects, groundwater quality monitoring and potential recharge zones, watershed management.

**TEXT BOOKS:**

1. Bhatta B (2008), 'Remote sensing and GIS', Oxford University Press
2. Lillesand, T.M, R.W. Kiefer and J.W. Chipman (2013) 'Remote Sensing and Image Interpretation', Wiley India Pvt. Ltd., New Delhi
3. Schowenger, R. A (2006) 'Remote Sensing' Elsevier publishers.
4. 'Fundamentals of Remote Sensing' by George Joseph, Universities Press, 2013.
5. 'Fundamentals of Geographic Information Systems' by Demers, M.N, Wiley India Pvt. Ltd, 2013.

**REFERENCES:**

1. 'Remote Sensing and its Applications' by Narayan LRA, Universities Press, 2012.
2. 'Concepts and Techniques of Geographical Information System' by Chor Pang Lo and A K W Yeung, Prentice Hall (India), 2006



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<b>IV Year – I Semester</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>PROGRAM ELECTIVE – III a). Bridge Engineering</b>					

**Course Learning Objectives:**

The objective of this course is:

- Familiarize Students with different types of Bridges and IRC standards
- Equip student with concepts and design of Slab Bridges, T Beam Bridges
- Understand concepts of design of Plate Girder Bridges
- Familiarize with different methods of inspection of bridges and maintenance

**Course Outcomes:**

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

- Explain different types of Bridges with diagrams and Loading standards
- Carry out analysis and design of Slab bridges, T Beam bridges and suggest structural detailing
- Carry out analysis and design of Plate girder bridges
- Organize for attending inspections and maintenance of bridges and prepare reports.

**SYLLABUS:**

**UNIT-I** Introduction- Bridges- Types- Slab bridges, T Beam, Arch bridges, Cable Stayed bridges, prestressed concrete bridges, Truss Bridges, Culverts, - Nomenclature- Selection of Bridge Site- Economical span- Abutments pier and end connections- types of foundations- Open, Pile, Well Foundations, Bearings – Types- Introduction to Loading standards- Railway and IRC Loading

**UNIT-II** Slab bridges- Wheel load on slab- effective width method- slabs supported on two edges- cantilever slabs- dispersion length- Design of interior panel of slab- Guyon's – Massonet Method – Hendry- Jaeger Methods- Courbon's theory- Pigeaud's method

**UNIT-III** T-Beam bridges- Analysis and design of various elements of bridge –Design of deck slab, Longitudinal girders, Secondary beams- Reinforcement detailing

**UNIT-IV Plate Girder Bridges:** Elements of plate girder and their design-web- flange- intermediate stiffener- vertical stiffeners- bearing stiffener- Splices, Design problem with detailing

**UNIT-V Sub Structure-** Abutments- Stability analysis of abutments- piers- loads on piers- Analysis of piers- Wing walls- Design problems.



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**Text Book**

1. Essentials of Bridge Engineering, Jhonson VictorD
2. Design of Bridge Structures, T. R. Jagadeesh, M.A. Jayaram, PHI
3. Design of Bridges, N. Krishna Raju, Tata McGraw Hill

**References:**

1. Design of Concrete Bridges, Aswini, Vazirani, Ratwani
2. Design of Steel Structures, B. C. Punmai, Jain & Jain, Lakshmi Publications
3. Design of R C Structures, B. C. Punmai, Jain & Jain, Lakshmi Publications





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	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>PROGRAM ELECTIVE – IIIb) Industrial Wastewater Treatment</b>				

**Course Learning Objectives:**

The course will address the following:

1. Enables the student to distinguish between the quality of domestic and industrial water requirements and wastewater quantity generation.
2. To impart knowledge on selection of treatment methods for industrial wastewater.
3. To know the common methods of treatment in different industries
4. To acquire knowledge on operational problems of effluent treatment plant.

**Course Outcomes:**

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

- a. Know the quality and quantity of water for various industries and Advanced water treatment methods
- b. Learn the common methods of treatment of wastewaters and Biological treatment methods
- c. Study of methods to reduce impacts of disposal of wasters into environment and CETPs.
- d. Study of methods of treatment of wastewaters from specific industries like steel plants, refineries, and power plants, that imply biological treatment methods
- e. Study of methods of treatment of wastewaters from industries like Aqua, dairy, sugar plants, and distilleries that imply biological treatment methods

**UNIT – I**

Industrial water Quantity and Quality requirements: Boiler, Cooling, Domestic/Canteen and Process waters for Textiles, Food processing, Dairy, Aqua industry, Sugar mills, Brewery and distillery Industries, Fertilizer industry, Power plants. Advanced water treatment - Adsorption, Reverse Osmosis, Ion Exchange, Ultra filtration, Freezing, elutriation, Removal of Iron and Manganese, Removal of Colour and Odour. Use of Municipal wastewater in Industries.

**UNIT – II**

Basic theories of Industrial Wastewater Management: Industrial waste survey - Measurement of industrial wastewater Flow-generation rates – Industrial wastewater sampling and preservation of samples for analysis - Wastewater characterization- Toxicity of industrial effluents- Common methods of Treatment of wastewaters - Unit operations and processes- Volume and Strength reduction –Neutralization – Equalization and proportioning- recycling, reuse and resources recovery. Miscellaneous Treatment: Biological treatment of sewage- Primary, secondary and Tertiary treatment of sewage.



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**UNIT – III**

Industrial wastewater disposal management: Discharges into Sewers, Streams- Oxygen sag curve, Lakes-eutrophication and oceans and associated problems, Land treatment – sewage sickness, Common Effluent Treatment Plants: advantages and suitability, Limitations and challenges- Recirculation of Industrial Wastewaters- Effluent Disposal Method.

**UNIT – IV**

Process and Treatment of specific Industries-1: Manufacturing Process and origin, characteristics, effects and treatment methods of liquid waste from Steel plants, Fertilizers, Textiles, Paper and Pulp industries, Oil Refineries, Coal and Gas based Power Plants. Case studies.

**UNIT – V**

Process and Treatment of specific Industries-2: Manufacturing Process and origin, characteristics, effects and treatment methods of liquid waste from Tanneries, Sugar Mills, Distillers, Dairy and Food Processing industries, Aqua industry, Pharmaceutical Plants. Case studies.

**Text books**

1. Industrial Wastewater Treatment by KVSG Murali Krishna, Paramount Publishers, Visakhapatnam, 2019
2. Wastewater Treatment by M.N. Rao and A.K. Dutta, Oxford & IBH, New Delhi.
3. Industrial Wastewater treatment by A.D. Patwardhan, PHI Learning, Delhi
4. Wastewater Treatment for Pollution Control and Reuse, by Soli. J Arceivala, Shyam R Asolekar, Mc-Graw Hill, New Delhi; 3<sup>rd</sup> Edition

**References**

1. Industrial Water Pollution Control by W. Wesley Eckenfelder, Mc- GrawHill, Third Edition
2. Wastewater Engineering by Metcalf and Eddy Inc, Tata McGrawhill Co., New Delhi
3. Wastewater Treatment- Concepts and Design Approach by G.L. Karia & R.A. Christian, Prentice Hall of India.
4. Unit Operations and Processes in Environmental Engineering by Reynolds. Richard, Cengage Learning.



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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>PROGRAM ELECTIVE – III c). Earth &amp; Rockfill Dams</b>					

Course Objectives:

1. Suitability of materials for earth and rock fill dams
2. causes of failures
3. to determine slope stability

Course Outcomes:

- a) Able to design earth and rock fill dams
- b) get familiarity with slope stability calculations,
- c) prevention techniques for slope failures

**SYLLABUS**

**Unit-I :**

Earth and Rock fill Dams: General features, Selection of site; Merits and demerits of the earth and rock fill dams, Classification of earth dams, Materials of construction and requirements, Causes of failure, Safe design criteria. Instrumentation in earth dams: Pore pressure measurements, Settlement gauges, Inclinometers, Stress measurements, Seismic measurements.

**Unit-II :**

Failures, Damages and Protection of Earth Dams: Nature and importance of failure, Piping through embankment and foundations, Methods of seepage control through embankments and foundations, Design Criteria for filters, Treatment of upstream and downstream of slopes, Drainage control, Filter design.

**Unit-III :**

Slope Stability Analysis: Types of Failure: Failure surfaces – Planar surfaces, Circular surfaces, Non-circular surfaces, Limit equilibrium methods, Total stress analysis versus effective Stress analysis, Use of Bishop's pore pressure parameters, Short term and Long term stability in slopes.

**Unit-IV :**

Methods of Slope Stability: Taylor Charts, Method of Slices, Effect of Tension Cracks, Vertical Cuts. Bishop's Analysis, Bishop and Morgenstern Analysis, Non-circular Failure Surfaces: Morgenstern and Price Analysis, Janbu Analysis, Spencer Analysis, Sliding Block Analysis, Seismic stability, Stabilization of slopes: Drainage measures, Soil reinforcement (geosynthetics/soil nailing/micro piles



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etc), soil treatment (cement/lime/thermal treatment), surface protection (vegetation/erosion control mats/shotcrete).

Unit-V :

Rock fill Dams: Requirements of compacted rock fill, Shear strength of rock fill, Rock fill mixtures, Rock fill embankments, Earth-core Rock fill dams, Stability, Upstream & Downstream slopes.

**TEXT BOOKS:**

1. Christian, K. Earth & Rock fill Dams – Principles of Design and Construction, CRC Press, 1997.
2. Sowers, G.F. – Earth and Rock fill Dam Engineering, Asia Publishing House, 1962.

**REFERENCES:**

1. Bharat Singh and Sharma, H. D. – Earth and Rock fill Dams, 1999
2. Abramson, L. W., Lee, T. S. and Sharma, S. – Slope Stability and Stabilisation methods – John Wiley & sons. (2002)
3. Sherard, Woodward, Gizienki and Clevenger. Earth and Earth-Rock Dams. John Wiley & Sons. 1963.
4. US Army Corp of Engineers, Earth and Rock-fill Dams, General Design and construction Considerations, University Press of the Pacific (2004)
5. Bromhead, E. N. (1992). The Stability of Slopes, Blackie academic and professional, London.



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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>PROGRAM ELECTIVE – III d). Intelligent Transportation Systems</b>					

**Course Learning Objectives:**

1. To know the fundamentals of ITS
2. To study sensor technologies and Data requirements of ITS
3. To know ITS functional areas and user services
4. To study various kinds of ITS architecture
5. To study ITS applications in various fields of transportation engineering

**Course Outcomes:**

- a) Identify the benefits of ITS from various types
- b) Determine various sensor applications and ITS data collection techniques
- c) Identify ITS user services and functional areas
- d) Determine various ITS models, evaluation methods and ITS planning.
- e) Determine the suitable ITS technology and assess its effectiveness to solve transportation problems

**SYLLABUS**

**UNIT-I**

**Fundamentals of ITS:** Definition of ITS, The historical context of ITS from both public policy and market economic perspectives, Types of ITS; Historical Background, Benefits of ITS.

**UNIT-II**

**Sensor technologies and Data requirements of ITS:** Importance of telecommunications in the ITS system, Information Management, Traffic Management Centres (TMC). Application of sensors to Traffic management; Traffic flow sensor technologies; Transponders and Communication systems; Data fusion at traffic management centres; Sensor plan and specification requirements; Elements of Vehicle Location and Route Navigation and Guidance concepts; ITS Data collection techniques – Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), GIS, video data collection.

**UNIT-III**

**ITS functional areas** – Advanced Traffic Management systems (ATMS), Advanced Traveler



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Information systems (ATIS), Commercial Vehicle Operations (CVO), Advanced Vehicle Control systems (AVCS), Advanced Public Transportation systems (APTS), Advanced Rural Transportation systems (ARTS).

ITS User Needs and Services – Travel and Traffic management, Public Transportation Management, Electronic Payment, Commercial Vehicle Operations, Emergency Management, Advanced Vehicle safety systems, Information Management.

**UNIT-IV**

**ITS Architecture** – Regional and Project ITS architecture; Concept of operations; ITS Models and Evaluation Methods; Planning and human factor issues for ITS, Case studies on deployment planning and system design and operation; ITS and safety, ITS and security, ITS as a technology deployment program, research, development and business models, ITS planning.

**UNIT-V**

**ITS applications:** Traffic and incident management systems; ITS and sustainable mobility, travel demand management, electronic toll collection, ITS and road-pricing.; Transportation network operations; commercial vehicle operations and intermodal freight; public transportation applications; ITS and regional strategic transportation planning, including regional architectures: ITS and changing transportation institutions Automated Highway Systems- Vehicles in Platoons – Integration of Automated Highway Systems. ITS Programs in the World – Overview of ITS implementations in developed countries, ITS in developing countries

**TEXT BOOKS:**

1. Fundamentals of intelligent transportation systems planning By Mashrur A. Chowdhury, Adel Wadid Sadek
2. ITS Hand Book 2000: Recommendations for World Road Association (PIARC) by Kan Paul Chen, John Miles.

**REFERENCES:**

1. Sussman, J. M., Perspective on ITS, Artech House Publishers, 2005.
2. National ITS Architecture Documentation, US Department of Transportation, 2007



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	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>PROGRAM ELECTIVE – III e). Building Services</b>				

**Course Objectives:**

To familiarize the students,

1. with fundamentals of air conditioning,
2. firefighting and vertical Transport systems in building services, and
3. integration with architectural design.

**Course Outcomes:**

At the end course the student able to know the requirements of building services such as

- a) Types of air conditioning,
- b) Types of transportation system,
- c) Firefighting, electrical services,
- d) Concepts of green building and energy efficient systems

**SYLLABUS**

**Unit I**

**Introduction to Building Services:**

Definitions - Objective and uses of services - Applications of services for different types building considering - Classification of services- Types of services and selection of services- Natural and artificial lighting principles and factors- Arrangement of luminaries, Distribution of illumination, Utilization factors- Necessity of Ventilation Types – Natural and Mechanical Factors to be considered in the design of Ventilation.

**Unit II**

**Electrical Services and Layout:**

Electrical services in the building -Technical terms and symbols for electrical installations and Accessories of wiring- Systems of wiring like wooden casing, cleat wiring, CTS wiring conduit wiring - Types of insulation- electrical layout for residence, small work shop, show room, school building, etc.





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Unit III

**Mechanical Services in Buildings:**

Introduction of mechanical services - Lift - Definition, Types of Lifts, Design Considerations, Location, Sizes, Component parts - Lift Well, Travel, Pit, Hoist Way, Machine, Buffer, Door Locks, Suspended Rope, Lift Car. Elevators & Escalators -Different types of elevators and Escalators - Freight Elevators-Passenger elevators –Hospital elevators -Uses of different types of elevators and Escalators.

Air Conditioning- Definition, Purpose, Principles, Temperature Control, Air Velocity Control, Humidity Control, Air Distribution system, Cleaners, Filters, Spray washers, Electric preceptors, Types of Air Conditioners (Central type, Split Unit).

Unit IV

Fire Protection, Acoustic and Sound Insulations: Introduction- Causes of fire and Effects of fire- General Requirements of Fire Resisting building as per IS and NBC 2005-Characteristics of Fire resisting materials- Maximum Travel Distance- Fire Fighting Installations for Horizontal Exit, Roof Exit / Fire Lifts, External Stairs- Requirement of good Acoustic -Various sound absorbent- Factors to be followed for noise control in residential building

Unit V

Miscellaneous Services and Green Buildings Provisions: Rain water Harvesting for buildings- Concept of GREEN buildings -Components of GREEN building -Introduction and Significance to Grey water- Components of Grey water system -Management of Grey water system

**Text Books:**

1. A text book on Building Services by R. Udaykumar, Eswar Press, Chennai
2. Building Services by S. M. Patil, Seema Publication, Mumbai Revised edition
3. Heating, Ventilating and Air Conditioning: Analysis and Design, 6th Edition”, Faye C. McQuiston, Jerald D. Parker and Jeffrey D. Spitler, John Wiley & Sons

**Reference Books:**

1. SP 7: 2005 National Building Code of India, Bureau of Indian Standards, BIS, New Delhi
2. Building Construction by B. C. Punmia, Laxmi Publications (P) Ltd., New Delhi
3. IS 3534: 1976 “Outline dimensions of electric lifts”
4. IS1860: 1980 “Code of Practice for Installation, Operation and Maintenance of Electric Passenger and Goods Lifts”



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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>OPEN ELECTIVE – III</b> <b>(Choose any One out of Nine Courses which was not studied earlier)</b>					



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	<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>
<b>Remote Sensing &amp; GIS Lab</b>				

**Learning Objectives:**

The course is designed to

1. Understand the process Geo-referencing, Preparation of Base map from of Toposheet.
2. Digitization, creation of thematic maps from toposheets.
3. Developing Digital Elevation model
4. Interpretation and Estimation of features of Land Use/land cover details from satellite imagery.
5. Learn to apply GIS software to simple problems in water resources, transportation engineering and Agriculture

**Outcomes**

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

- a. Work comfortably on GIS software
- b. Digitize and create thematic map and extract important features
- c. Develop digital elevation model
- d. Interpretation and Estimation of features from satellite imagery.
- e. Analyze and Modelling using GIS software.

**SYLLABUS:**

**GIS:**

**SOFTWARES:**

1. Arc GIS 10.1
2. ERDAS Imagine 13
3. MapInfo 6.5
4. ILWIS or Any one or Equivalent.

**EXERCISES IN GIS:**

1. Geo-referencing of Toposheet.
2. Preparation of Base map from topo sheet including legend, scale and annotation
- 3 Digitization of Map/Toposheet
4. Developing Digital Elevation model
5. Interpretation of Land Use/land cover detail from satellite imagery
6. Creation of thematic maps.
7. Estimation of features and interpretation
8. Simple applications of Remote Sensing & GIS in water Resources
9. Simple applications of Remote Sensing & GIS in Transportation
10. Simple applications of Remote Sensing & GIS in Agriculture

**TEXT BOOK:**

1. Concept and Techniques of GIS' by C.P.L.O. Albert, K.W. Yong, Printice Hall Publishers
2. Software Manuals.



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		<b>0</b>	<b>0</b>	<b>3</b>	<b>1.5</b>
<b>Geotechnical Engineering Lab</b>					

**Learning Objectives:**

The objective of this course is:

- To determine the index properties for soil classification – Grain size distribution & Atterberg's limits.
  - To determine the engineering properties – Permeability, Compaction, consolidation, shear strength parameters & CBR value.
  - To find the degree of swelling by DFS test.
1. To impart knowledge of determination of index properties required for classification of soils.
  2. To teach how to determine compaction characteristics and consolidation behaviour from relevant lab tests; to determine permeability of soils.
  3. To teach how to determine shear parameters of soil through different laboratory tests.

**Outcomes:**

Upon successful completion of this course, student will be able to

- a. Determine index properties of soil and classify them.
- b. Determine permeability of soils.
- c. Determine Compaction, Consolidation and shear strength characteristics.

**SYLLABUS:**

**LIST OF EXPERIMENTS**

1. Specific gravity, G
2. Atterberg's Limits.
3. Field density-Core cutter and Sand replacement methods
4. Grain size analysis by sieving
5. Permeability of soil - Constant and Variable head tests
6. Compaction test
7. Consolidation test (to be demonstrated)
8. Direct Shear test
9. Triaxial Compression test
10. Unconfined Compression test
11. Vane Shear test
12. Differential free swell (DFS)
13. Field Plate Load Test demo
14. Field CBR demo

At least **Eight** experiments shall be conducted.

**LIST OF EQUIPMENT:**

1. Casagrande's liquid limit apparatus.



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2. Apparatus for plastic and shrinkage limits
3. Field density apparatus for
  - a) Core cutter method
  - b) Sand replacement method
4. Set of sieves: 4.75mm, 2mm, 1mm, 0.6mm, 0.42mm, 0.3mm, 0.15mm, and 0.075mm.
5. Hydrometer
6. Permeability apparatus for
  - a) Constant head test
  - b) Variable head test
7. Universal auto compactor for I.S light and heavy compaction tests.
8. Shaking table, funnel for sand raining technique.
9. Apparatus for CBR test
10. 10 tons loading frame with proving rings of 0.5 tons and 5 tons capacity
11. One dimensional consolidation test apparatus with all accessories.
12. Triaxial cell with provision for accommodating 38 mm dia specimens.
13. Box shear test apparatus
14. Laboratory vane shear apparatus.
15. Hot air ovens (range of temperature 50<sup>0</sup> - 150<sup>0</sup>C)

**References:**

1. 'Determination of Soil Properties' by J. E. Bowles.
2. IS Code 2720 – relevant parts.



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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>Estimation Specifications and Contract</b>					

**Course Learning Objectives:**

The objective of this course is to enable the students to:

- Understand the quantity calculations of different components of the buildings.
- Understand the rate analysis of different quantities of the buildings components.
- Learn various specifications and components of the buildings.

**Course Outcomes:**

Upon the successful completion of this course:

- The student should be able to determine the quantities of different components of buildings.
- The student should be in a position to find the cost of various building components.
- The student should be capable of finalizing the value of structures.

**SYLLABUS:**

**UNIT – I** General items of work in Building – Standard Units Principles of working out quantities for detailed and abstract estimates – Approximate method of Estimating.

**UNIT – II** Rate Analysis – Working out data for various items of work over head and contingent charges.

**UNIT-III** Earthwork for roads and canals, Reinforcement bar bending and bar requirement schedules.

**UNIT – IV** Contracts – Types of contracts – Contract Documents – Conditions of contract, Valuation of buildings Standard specifications for different items of building construction.

**UNIT-V** Detailed Estimation of Buildings using individual wall and center line method

**FINAL EXAMINATION PATTERN:**

The end examination paper should consist of SIX questions from Unit 1 to Unit 4, out of which THREE are to be answered (60% weight-age) & ONE mandatory question (40% weight-age) from Units 5 & 6 is to be answered.



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**Text Books:**

1. Estimating and Costing, B.N. Dutta, UBS publishers,2000.
2. Civil Engineering Contracts and Estimates, B. S. Patil, Universities Press (India) Pvt. Ltd., Hyd.
3. Construction Planning and Technology, Rajiv Gupta, CBS Publishers & Distributors Pvt. Ltd. NewDelhi.
4. Estimating and Costing, G.S.Birdie.

**References:**

1. Standard Schedule of rates and standard data book, Public worksdepartment.
2. IS 1200 (Parts I to XXV-1974/ Method of Measurement of Building & Civil Engg Works –B.I.S.
3. Estimation, Costing and Specifications, M. Chakraborti; Laxmipublications.
4. National BuildingCode



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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>PROGRAM ELECTIVE – IVa). Finite Element Methods</b>					

**Course Learning Objectives:**

The objective of this course is:

Equip students with fundamentals of Finite Element Analysis

- Enable students to formulate design problems into FEA.
- Enable students to solve Boundary value problems using FEM

**Course Outcomes:**

Upon completion of the course, the student will be able to

- Solve simple boundary value problems using Numerical technique of Finite element method
- Develop finite element formulation of one and two dimensional problems and solve.
- Assemble Stiffness matrices, apply boundary conditions and solve for displacements
- Compute Stresses and Strains and interpret the result.

**SYLLABUS:**

**UNIT-I Introduction:**

**Principles of Elasticity-** Equilibrium Equations- Strain Displacement relationships- Constitutive relationship for plane stress, plane strain and axis-symmetric bodies of revolution with axis-symmetric loading.

Stiffness method- Principle of Stationary potential energy- Potential energy of an elastic body- Rayleigh-Ritz method of functional approximation.

**UNIT-II: Finite Element formulation of truss element:** Stiffness matrix- properties of stiffness matrix – Selection of approximate displacement functions- solution of a plane truss- transformation matrix- Galerkin's method for 1-D truss – Computation of stress in a truss element.

**UNIT-III Finite element formulation of Beam elements:** Beam stiffness- beam stiffness matrix- Examples on Analysis of beams Subjected to Concentrated and Distributed loading.

**UNIT-IV** Finite element formulation for plane stress and plane strain problems- Derivation of CST and LST stiffness matrix and equations-treatment of body and surface forces





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**UNIT-V Iso-parametric Formulation:** Isoparametric bar element- plane bilinear isoparametric element – quadratic plane element - shape functions, evaluation of stiffness matrix, consistent nodal load vector - Gauss quadrature for performing numerical integrations.

**Text Books**

1. Introduction to Finite Elements in Engineering, Tirupati R. Chandrupatla, Ashok D. Belgundu, PHIpublications.
2. A first course in the Finite Element Method, Dary L. Logan, ThomsonPublications.

**Références:**

1. Concepts and applications of Finite Element Analysis, Robert D. Cook, Michael E Plesha, John Wiley & sonsPublication
2. Introduction to Finite Element Method, Desai & Abel CBSPublications



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	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>PROGRAM ELECTIVE – IV b). Design &amp; Drawing of Irrigation Structures</b>				

**Course Learning Objectives:**

To understand design principle of various irrigation structures

**Course Outcomes:**

At the end of the course the student will be able to To design various irrigation structures.

**SYLLABUS:**

**Design and drawing of**

1. Surplusweir
2. Tank sluice with a towerhead
3. Canal drop-Notchtype
4. Canalregulator
5. Undertunnel
6. Syphon aqueduct type III

Final Examination pattern: Any two question of the above six designs may be asked out of which the candidated has to answer one question. The duration of the examination is three hours.

**Text Books:**

1. Water Resources Engineering – Principles and Practice by C. Satyanarayana Murthy, New age International Publishers.

**Reference:**

1. Irrigation Engineering and Hydraulic Structures, S. K. Garg, Standard BookHouse.
2. Irrigation and Water Power Engineering, B. C Punmia& Lal, Lakshmi Publications Pvt. Ltd., NewDelhi.



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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>PROGRAM ELECTIVE – IV c). Soil Dynamics and Machine Foundations</b>					

**Course Learning Objectives:**

The basic course in soil mechanics/geotechnical engineering generally introduces the fundamental concepts, principles and applications of soil as engineering material with properties under static loading.

This course on ‘Soil Dynamics’ discusses

1. To calculate the fundamental vibration parameters.
2. To analyse the vibrations of machine foundations.
3. To determine the dynamic properties of soils.
4. To decide the suitable type of machine foundation and its design aspects.
5. To select the suitable vibration isolation method for machine foundations and liquefaction mitigation methods.

**Course Outcomes:**

On successful completion of these course, the student able to

- a. Use theory of vibrations to find the behavior of soil under dynamic loading.
- b. Design machine foundations under different loads and soil conditions.
- c. Understand the liquefaction phenomena.
- d. Conduct various laboratory and filed tests to determine the dynamic soil prosperities and its interpretation.
- e. Design vibration isolators under any vibratory machines.

**SYLLABUS:**

**UNIT-I**

Introduction: Types of motion- SHM- Fundamental definitions- SDOF systems- Free and forced vibration with and without damping - Constant force and rotating mass type excitation –Types of damping-Equivalent stiffness of springs in series and parallel. – Resonance and its effect - magnification-logarithmic decrement –Transmissibility.

**UNIT-II**

Theories of Vibration Analysis- EHS Theory and lumped parameter model- Different modes of vibration- Natural frequency of foundation soil system – Barkan and IS methods – Pressure bulb concept – Reisner Theory – Limitations of Reisner theory – Sung’s solutions -- Pauw’s Analogy – Heigh’s Theory.



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**UNIT-III**

Dynamic properties of soils, Determination of E, G and Poissons ratio from field and laboratory tests, recommendations of Indian codes- Stress waves in bounded elastic medium- Use of wave theory in the determination of elastic properties, Elastic coefficients of soils and their determination- damping factor from free and forced vibration tests.– Block vibration test – Determination of Damping factor.

**UNIT-IV**

Types of machine foundations – general requirements design – criteria for machine foundations, permissible amplitudes and bearing pressure

Design data, design criteria, IS code provisions for the design foundations of reciprocating machines.

Design data, design criteria, IS code provisions for the design foundations of Impact type of machines.

**UNIT-V**

Vibration Isolation: Transmissibility, Principles of isolation- Methods of isolation- Vibration isolators- Types and their characterizes

Special Topics: Liquefaction of soils, CSR, CRR, Factor of safety against liquefaction - Dynamic bearing capacity, Earth retaining structures under dynamic loads

**TEXT BOOK:**

1. ‘Vibrations of Soils and Foundations’ by Richart Hall and Woods

**REFERENCES:**

1. ‘Vibration Analysis and Foundation Dynamics’ by NSV Kameswara Rao, Wheeler Publishing, New Delhi.
2. ‘Foundations of Machines- Analysis and Design’ by Prakash and Puri



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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>PROGRAM ELECTIVE – IV d). Road Safety Engineering</b>					

**Course Objectives:**

1. This module on the fundamental of traffic engineering & some of the statistics methods to analysis the traffic safety.
2. The accident interrogations & risk involved with measures to identity the causes are dealt.
3. The role of road safety in planning the urban infrastructures design is discussed.
4. The various traffic management systems for safety & safety improvement strategies are dealt.

**Course Outcomes:**

The student is able to

- a) To understand fundamental of Traffic Engg.
- b) To investigate & determine the collective factors & remedies of accident involved.
- c) To design & planning various road geometrics.
- d) To massage the traffic system from road safety point of view.

**SYLLABUS**

**UNIT I**

**Introduction to safety:**

Road accidents, Trends, causes, Collision diagrams; Highway safety; Human factors and road user limitations; Speed and its effect on road safety; Vehicle factors; Highway safety in India. Multi-causal dynamic systems approach to safety; Crash Vs Accident; Road safety improvement strategies; Elements of a road safety plan, Safety data Needs; Safe vehicle design.

**UNIT II**

**Statistical Interpretation and Analysis of Crash Data:**

Before-after methods in crash analysis, Recording of crash data; Accident Investigation and Analysis; Statistical testing and the role of chance; Black Spot Identification and Investigations, Case Studies.

**UNIT III**

**Road Safety Audits:**

Key elements of a road safety audit, Road Safety Audits & Investigations, Work zone safety audit; Crash investigation and analysis, Methods for identifying hazardous road locations, Case Studies.

**UNIT IV**

**Crash Reconstruction:**

Describe the basic information that can be obtained from the roadway surface, Understand basic physics related to crash reconstruction, speed for various skid, friction, drag, and



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acceleration scenarios, variables involved in jump and flip crashes, variables involved in pedestrian crashes, Case Studies.

**UNIT V**

**Mitigation Measures:**

Accident prevention by better planning, Accident prevention by better design of roads, Crash Countermeasures, Highway operation and accident control measures, Highway Safety Measures during construction, Highway geometry and safety; Safety in urban areas; Public transport and safety; Road safety policy making, Stakeholders involvement; Road safety law.

**TEXT BOOKS:**

1. Institute of Transportation Engineers (ITE), The Traffic Safety Toolbox: A Primer on Traffic Safety, ITE, 1999.  
Towards Safe Roads in Developing country, TRL – ODA, 2004.

**REFERENCES:**

1. Athelstan Popkess, Traffic Control and Road Accident Prevention, Chapman and Hall, 1997 (Digitized 2008)
2. Ezra Hauer, Observational Before-After Studies in Road Safety, Pergamon Press, 1997 (reprinted 2002).
3. Geetam Tiwari and Dinesh Mohan, Transport Planning and Traffic Safety: Making Cities, Roads, and Vehicles Safer, CRC Press, 2016.



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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>PROGRAM ELECTIVE – IV e). Disaster Management &amp; Mitigation</b>					

**Course Objectives:**

The objectives of the course are

1. To Understand basic concepts in Disaster Management
2. To Understand Definitions and Terminologies used in Disaster Management
3. To Understand Types and Categories of Disasters
4. To Understand the Challenges posed by Disasters
5. To understand Impacts of Disasters Key Skills

**Course Outcomes:**

The student will develop competencies in

- a) the application of Disaster Concepts to Management
- b) Analyzing Relationship between Development and Disasters.
- c) Ability to understand Categories of Disasters and
- d) realization of the responsibilities to society

**SYLLABUS**

**UNIT I:**

**Introduction** - Concepts and definitions: disaster, hazard, vulnerability, resilience, risks severity, frequency and details, capacity, impact, prevention, mitigation.

**UNIT II**

**Disasters**- Disasters classification; natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.); manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills, transportation accidents, terrorist strikes, etc.); hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility.

**UNIT III**

**Disaster Impacts**- Disaster impacts (environmental, physical, social, ecological, economic, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate change and urban disasters.

**UNIT IV**

**Disaster Risk Reduction (DRR)** - Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post disaster environmental response (water, sanitation, food safety, waste management, disease control, security, communications); Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.



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**UNIT V**

**Disasters, Environment and Development-** Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, landuse changes, urbanization etc.), sustainable and environmental friendly recovery; reconstruction and development methods.

**Text Books:**

1. Pradeep Sahni, 2004, Disaster Risk Reduction in South Asia, Prentice Hall.
2. Singh B.K., 2008, Handbook of Disaster Management: Techniques & Guidelines, Rajat Publication.
3. Ghosh G.K., 2006, Disaster Management, APH Publishing Corporation

**Reference Books:**

1. <http://ndma.gov.in/> (Home page of National Disaster Management Authority)
2. <http://www.ndmindia.nic.in/> (National Disaster management in India, Ministry of Home Affairs).
3. Disaster Medical Systems Guidelines. Emergency Medical Services Authority, State of California, EMSA no.214, June 2003
4. Inter Agency Standing Committee (IASC) (Feb. 2007). IASC Guidelines on Mental Health and Psychosocial Support in Emergency Settings. Geneva: IASC





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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>PROGRAM ELECTIVE – Va). Advanced Structural Analysis</b>					

**Course Learning Objectives:**

The objective of this courses:

- Familiarize Students with Different types of Structures
- Equip student with concepts of Arches
- Understand Concepts of lateral Load analysis
- Familiarize Cables and Suspension Bridges
- Understand Analysis methods Moment Distribution, Kani's Method and Matrix methods

**Course Outcomes:**

At the end of this course; the student will be able to

- Differentiate Determinate and Indeterminate Structures
- Carryout lateral Load analysis of structures
- Analyze Cable and Suspension Bridge structures
- Analyze structures using Moment Distribution, Kani's Method and Matrix methods

**SYLLABUS:**

**UNIT – I Energy Theorems:** Introduction-Strain energy in linear elastic system, expression of strain energy due to axial load, bending moment and shear forces - Castigliano's first theorem-Deflections of simple beams and pin jointed plane trusses.

**INDETERMINATE TRUSSES:** Determination of static and kinematic indeterminacies – Analysis of trusses having single and two degrees of internal and external indeterminacies –Castigliano's second theorem.

**UNIT II**

**Three Hinged Arches:** Elastic theory of arches – Eddy's theorem – Determination of horizontal thrust, bending moment, normal thrust and radial shear – effect of temperature. Hinges with supports at different levels.

**Two Hinged Arches:** Determination of horizontal thrust, bending moment, normal thrust and radial shear – Rib shortening and temperature stresses, Tied arches – Fixed arches – (No analytical question).



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**UNIT-III Approximate Methods of Analyses:** Application to building frames. (i) Portal Method (ii) Cantilever Method (iii) Substitute frame method for approximate analysis of multi-storey frames subjected to gravity loads and lateral loads. Shear force and bending moment diagrams - Elastic curve.

**UNIT – IV Cable Structures and Suspension Bridges:** Introduction, characteristics of cable, analysis of cables subjected to concentrated and uniformly distributed loads, anchor cable, temperature stresses, analysis of simple suspension bridge, three hinged and two hinged stiffening girder suspension bridges.

**UNIT – V Moment Distribution Method:** Analysis of Portal frames – including Sway-Substitute frame analysis by two cycle. Slope deflection method: Analysis of Portal frames – including Sway. Analysis of inclined frames. Shear force and bending moment diagrams - Elastic curve.

**Kani's Method:** Analysis of continuous beams – including settlement of supports and single bay portal frames with and without side sway. Shear force and bending moment diagrams - Elastic curve.

**Text Books:**

1. Structural Analysis by R.C. Hibbeler, Pearson, NewDelhi.
2. Basic Structural Analysis, K U Muthu et. al., IK International Publishing house pvt. Ltd.

**References:**

1. Indeterminate Structural Analysis, K U Muthu et. al., IK International Publishing house pvt. Ltd.
2. Analysis of Structures- Vol. I and II, V. N. Vazirani and M. M. Ratwani, Khanna Publishers, New Delhi.
3. Mechanics of Structures Vol – II by H.J.Shah and S.B.Junnarkar, Charotar Publishing House Pvt. Ltd.
4. Structural Analysis by Devdas Menon, Narosa Publishing Housing Pvt. Ltd.
5. Structural Analysis: A Matrix Approach, G.S.Pandit and S.P.Gupta, Mc Graw Hill Pvt. Ltd.



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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>PROGRAM ELECTIVE – V b). Urban Hydrology</b>					

**Course Learning Objectives:**

The course is designed to:

- appreciate the impact of urbanization on catchment hydrology
- understand the importance of short duration rainfall runoff data for urban hydrology studies.
- learn the techniques for peak flow estimation for storm water drainage system design.
- understand the concepts in design of various components of urban drainage systems
- learn some of the best management practices in urban drainage.
- understand the concepts of preparation master urban drainage system

**Course Outcomes**

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

- develop intensity duration frequency curves for urban drainage systems
- develop design storms to size the various components of drainage systems.
- apply best management practices to manage urban flooding.
- prepare master drainage plan for an urbanized area.

**SYLLABUS:**

**UNIT I**

**Introduction:** Urbanisation and its effect on water cycle – urban hydrologic cycle – trends in urbanisation – Effect of urbanisation on hydrology

**Precipitation Analysis:** Importance of short duration of rainfall and runoff data, methods of estimation of time of concentration for design of urban drainage systems, Intensity-Duration - Frequency (IDF) curves, design storms for urban drainage systems.

**UNIT II**

**Approaches to urban drainage:** Time of concentration, peak flow estimation approaches, rational method, NRCS curve number approach, runoff quantity and quality, wastewater and stormwater reuse, major and minor systems.

**UNIT III**

**Elements of drainage systems:** Open channel, underground drains, appurtenances, pumping, source control.



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**UNIT IV**

**Analysis and Management:** Stormwater drainage structures, design of stormwater network- Best Management Practices–detention and retention facilities, swales, constructed wetlands, models available for stormwater management.

**UNIT V**

**Master drainage plans:** Issues to be concentrated upon – typical urban drainage master plan, interrelation between water resources investigation and urban planning processes, planning objectives, comprehensive planning , use of models in planning

**Text Books:**

1. Geiger W.F., Marsalek, W.J. Rawls and F. C. Zuidema, (1987 - 2 volumes), UNESCO, Manual on Drainage in Urbanised Area
2. Hall M J (1984), Elsevier Applied Science Publisher. Urban Hydrology
3. Wanielista M P and Eaglin (1997), Wiley and Sons, Hydrology – Quantity and Quality Analysis,
4. Akan A.O and R.L. Houghtalen (2006), Wiley International, Urban Hydrology, Hydraulics and Stormwater Quality: Engineering Applications and Computer Modelling,

**References:**

1. Stormwater Detention for Drainage, Stahre P and Urbonas B (1990), Water Quality and CSO Management, Prentice Hall.
2. Urban water cycle processes and interactions, Marsalek et. al. (2006), Publication No. 78, UNESCO, Paris (<http://www.bvsde.paho.org/bvsacd/cd63/149460E.pdf>)
3. Frontiers in Urban Water Management – Deadlock or Hope, by Maksimovic C and J A Tejada-Guibert (2001), IWA Publishing



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	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>PROGRAM ELECTIVE – V c). Ground Improvement Techniques</b>				

**Course Learning Objectives:**

The objective of this course is:

1. To make the student appreciate the need for different ground improvement methods adopted for improving the properties of remoulded and in-situ soils by adopting different techniques such as in situ densification and dewatering methods.
2. To make the student understand how the reinforced earth technology and soil nailing can obviate the problems posed by the conventional retaining walls.
3. To enable the students to know how geotextiles and geosynthetics can be used to improve the engineering performance of soils.
4. To make the student learn the concepts, purpose and effects of grouting.

**Course Outcomes:**

- a. By the end of the course, the student should be able to possess the knowledge of various methods of ground improvement and their suitability to different field situations.
- b. The student should be in a position to design a reinforced earth embankment and check its stability.
- c. The student should know the various functions of Geosynthetics and their applications in Civil Engineering practice.
- d. The student should be able to understand the concepts and applications of grouting.

**SYLLABUS:**

**UNIT- I**

In situ densification methods- in situ densification of granular soils- vibration at ground surface and at depth, impact at ground and at depth – in situ densification of cohesive soils – pre loading – vertical drains – sand drains and geo drains – stone columns.

**UNIT -II**

Dewatering – sumps and interceptor ditches – single and multi stage well points – vacuum well points – horizontal wells – criteria for choice of filler material around drains – electro osmosis

**UNIT- III**

Stabilization of soils – methods of soil stabilization – mechanical – cement – lime – bitumen and polymer stabilization – use of industrial wastes like fly ash and granulated blast furnace slag.  
 Grouting – objectives of grouting – grouts and their applications – methods of grouting – stage of grouting – hydraulic fracturing in soils and rocks – post grout tests. Introduction to Liquefaction & its effects & applications.



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**UNIT- IV**

Reinforce earth – principles – components of reinforced earth – design principles of reinforced earth walls – stability checks – soil nailing.

**UNIT- V**

Geosynthetics – geotextiles – types – functions , properties and applications – geogrids , geomembranes and gabions - properties and applications.

**TEXT BOOKS:**

1. 'Ground Improvement Techniques' by Purushotham Raj, Laxmi Publications, New Delhi.
2. 'Ground Improvement Techniques' by NiharRanjanPatro ,Vikas Publishing House (p) limited , New Delhi.
3. 'An introduction to Soil Reinforcement and Geosynthetics' by G.L.Siva Kumar Babu, Universities Press.

**REFERENCE BOOKS:**

1. 'Ground Improvement' by MP Moseley , Blackie Academic and Professional, USA.
2. 'Designing with Geosynthetics' by RM Koerner , Prentice Hall



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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>PROGRAM ELECTIVE – V d). Pavement Management Systems</b>					

**Course Learning Objectives:**

1. To know various components and functions of pavement management systems
2. To know various pavement serviceability concepts and deterioration models
3. To know various functional and structural evaluation methods
4. To study design alternatives, rehabilitation and maintenance of pavements
5. To study the role of expert systems in pavement management

**Course Outcomes:**

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

- a) Understand the features and functions of pavement management systems
- b) Assess pavement performance by observing different models
- c) Evaluate the pavement functionally and structurally
- d) Identify and select suitable design strategies and decide the maintenance and rehabilitation measures required for a given pavement
- e) Acquire knowledge of expert systems for managing pavements

**SYLLABUS**

**UNIT-I**

**Introduction:** Definition -Components of Pavement Management Systems, Essential features. Pavement Management Levels and functions: Ideal PMS- Network and Project levels of PMS- Influence Levels- PMS Functions- Function of Pavement evaluation.

**UNIT-II**

**Pavement Performance:** Serviceability Concepts- roughness-Roughness Components-Equipment- IRI -modeling techniques, structural condition deterioration models, mechanistic and empirical models, HDM and other models, comparison of different deterioration models.

**UNIT-III**

**Pavement Evaluation:**

**Functional Evaluation:** Functional and Structural deterioration models, unevenness prediction models and other models, comparison. Case studies. Equipments

**Structural Evaluation:** - Basics- NDT and Analysis—Condition Surveys-Distress-Destructive Structural Analysis- Application in Network and Project Levels



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**UNIT-IV**

**Design Alternatives, Rehabilitation and Maintenance:** Design objectives and constraints, basic structural response models, physical design inputs, alternate pavement design strategies and economic evaluation, life cycle costing, analysis of alternate pavement strategies based on distress and performance, case studies. Equipment's, Identification of Alternatives-Deterioration Modeling-Priority Programming Methods.

**UNIT-V**

**Expert Systems and Pavement Management:** Role of computers in pavement management, applications of expert systems for managing pavements, expert system for pavement evaluation and rehabilitation, knowledge-based expert systems, case studies.

**TEXT BOOKS:**

1. Ralph Haas and Ronald W. Hudson, 'Pavement Management System', McGraw Hill Book Co. 1978
2. Ralph Haas, Ronald Hudson Zanieswki. 'Modern Pavement Management, Kreiger Publications.

**REFERENCES:**

1. Proceedings of North American Conference on Managing Pavement.
2. Proceedings of International Conference on Structural Design of Asphalt Pavements NCHRP, TRR and TRB Special Reports





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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>PROGRAM ELECTIVE – V e). Low-Cost Housing</b>					

**SYLLABUS**

**UNIT – I**

**Housing Scenario** Status of urban housing- Status of Rural Housing,  
 Housing Finance: Introducing- Existing finance system in India- Government role as facilitator  
 Status at Rural Housing Finance- Impedimently in housing finance and related issues

**UNIT- II**

**Land Use and Physical Planning for Housing:**

Planning of urban land- Urban land ceiling and regulation act- Effectincey of building bye laws - Residential Densities

**Housing the Urban Poor:** Living conditions in slums- Approaches and strategies for housing urban poor

**UNIT-III**

**Development and Adopt on of Low-Cost Housing Technology**

Adoption of innovative cost effective construction techniques- Adoption of precast elements in partial prefabrication- Adopting of total prefabrication of mass housing in India- General remarks on pre cast rooting/flooring systems- Economical wall system- Single Brick thick loading bearing wall- 19cm thick load bearing masonry walls- Half brick thick load bearing wall-Fly ash, gypsum thick for masonry- Stone Block masonry- Adoption of precast R.C. plank and join system for roof/floor in the building

**Alternative Building Materials for Low Cost Housing:** Substitute for scarce materials- Ferro cement- Gypsum boards- Timber substitutions- Industrial wastes- Agricultural wastes

**UNIT- IV**

**Low Cost Infrastructure Services**

Present status- Technological options- Low cost sanitation's- Domestic wall- Water supply energy

**Rural Housing:** Introduction- traditional practice of rural housing continuous- Mud Housing technology- Mud roofs- Characteristics of mud- Fire resistant treatment for thatched roof- Soil stabilization- Rural Housing programs

**UNIT-V**

**Housing in Disaster Prone Areas**

Earthquake- Damages to houses- Traditional Houses in disaster prone areas Type of Damages and Railways of non-engineered buildings- Repair and restore action of earthquake Damaged non-engineered buildings recommendations for future constructions- Requirements of structural safety of thin precast roofing units against - Earthquake forces- Status of R&D in earthquake strengthening measures- Floods- cyclone- future safety



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**TEXT BOOKS:**

1. Building materials for low –income houses – International council for building research studies and documentation.
2. Modern trends in housing in development countries – A.G. Madhava Rao, D.S. Ramachandra Murthy & G. Annamalai
3. Light weight concrete- Academic Kiado- Rudhai. G – Publishing home of Hungarian Academy of Sciences 1963.

**REFERENCE BOOKS:**

1. Building Systems for Low Income Housing, Ashok Kumar Jain; Management Publishing House, 1992
2. Hand book of low-cost housing - by A. K. Lal – Newage international publishers.
3. Low Cost Housing in Developing Countries, Guru Charan Mathur; For Centre for Science & Technology of the Non-Aligned and Other Developing Countries, Oxford & IBH Publishing Company, 1993



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		<b>0</b>	<b>0</b>	<b>16</b>	<b>8</b>
<b>PROJECT WORK</b>					

**The main objective of the Project work is**

- To enable the student, apply engineering knowledge that has been taught all through the programme for solving practical engineering problem.
- To enable the student capable for problem solving / problem shooting.
- To instill and inculcate team spirit/ team work in to the minds of the students.
- To enable/ train the students report making/documentation.
- To provide students an opportunity to use any civil engineering software for their project work.

**Outcomes of the Project work.**

Up on completion of the Project work, the student will be able to

- Apply all levels of Engineering knowledge in solving the Engineering problems.
- Work together with team spirit.
- Use Civil Engineering software at least one.
- Document the projects



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**ALL OPEN ELECTIVES**

		L	T	P	C
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>a) DISASTER MANAGEMENT</b>					

**Course Learning Objectives:**

The objective of this course is:

1. Develop an understanding of why and how the modern disaster manager is involved with pre-disaster and post-disaster activities.
2. Develop an awareness of the chronological phases of natural disaster response and refugee relief operations. Understand how the phases of each are parallel and how they differ.
3. Understand the ‘relief system’ and the ‘disaster victim.’
4. Describe the three planning strategies useful in mitigation.
5. Identify the regulatory controls used in hazard management.
6. Describe public awareness and economic incentive possibilities.
7. Understand the tools of post-disaster management.

**Course Outcomes:**

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

- a. Affirm the usefulness of integrating management principles in disaster mitigation work
- b. Distinguish between the different approaches needed to manage pre- during and post- disaster periods
- c. Explain the process of risk management
- d. Relate to risk transfer

**SYLLABUS:**

**UNIT-I**

**Natural Hazards and Disaster Management:** Introduction of DM – Inter disciplinary nature of the subject– Disaster Management cycle – Five priorities for action. Case study methods of the following: Vegetal Cover floods, droughts – Earthquakes – landslides – global warming, cyclones & Tsunamis – Post Tsunami hazards along the Indian coast.

**UNIT-II**

**Man Made Disaster and Their Management Along With Case Study Methods Of The Following:** Fire hazards – transport hazard dynamics – solid waste management – post disaster – bio terrorism -threat in mega cities, rail and aircraft accidents, ground water, industries - Emerging infectious diseases and Aids and their management.

**UNIT-III**

**Risk and Vulnerability:** Building codes and land use planning – Social Vulnerability – Environmental vulnerability – Macro-economic management and sustainable development, Climate change risk rendition – Financial management of disaster – related losses.



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**UNIT-IV**

**Role of Technology in Disaster Managements:** Disaster management for infra structures, taxonomy of infra structure – treatment plants and process facilities-electrical substations- roads and bridges- mitigation programme for earth quakes – flowchart, geospatial information in agriculture drought assessment - Multimedia Technology in disaster risk management and training - Transformable Indigenous Knowledge in disaster reduction – Role of RS & GIS.

**UNIT-V**

**Multi-sectional Issues, Education and Community Preparedness:** Impact of disaster on poverty and deprivation - Climate change adaptation and human health - Exposure, health hazards and environmental risk-Forest management and disaster risk reduction -The Red cross and red crescent movement - Corporate sector and disaster risk reduction- Education in disaster risk reduction- Essentials of school disaster education - Community capacity and disaster resilience-Community based disaster recovery - Community based disaster management and social capital-Designing resilience- building community capacity for action.

**TEXT BOOKS:**

1. An Introduction of Disaster Management- Natural Disasters & Vulnerable Hazards– S.Vaidyanathan: CBS Publishers & Distributors Pvt. Ltd.
2. Natural Hazards & Disaster Management, Vulnerability and Mitigation by RB Singh- Rawat Publications
3. ‘Disaster Science & Management’ by Tushar Bhattacharya, Tata McGraw Hill Education Pvt. Ltd., New Delhi.
4. ‘Disaster Management – Future Challenges and Opportunities’ by Jagbir Singh (2007), I K International Publishing House Pvt. Ltd.

**REFERENCE BOOKS:**

1. ‘Disaster Management’ edited by H K Gupta (2003), Universities press.
2. ‘Disaster Management – Global Challenges and Local Solutions’ by Rajib shah & R R Krishnamurthy (2009), Universities press.
3. R. Nishith , Singh AK, “ Disaster Management in India : Perspectives, Issues and strategies” New Royal Book Company.”



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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>b) ENVIRONMENTAL POLLUTION &amp; CONTROL</b>					

**Course Learning Objectives:**

The objective of this course is:

1. Impart knowledge on fundamental aspects of air pollution & control, noise pollution, and solid waste management.
2. Provide basic knowledge on sustainable development.
3. Introduces some basics of sanitation methods essential for protection of community health.
4. Provide basic knowledge on solid waste management.

**Course Learning Outcomes:**

By the end of successful completion of this course, the students will be able to:

- a. Identify the air pollutant control devices
- b. Have knowledge on the NAAQ standards and air emission standards
- c. Differentiate the treatment techniques used for sewage and industrial wastewater treatment methods.
- d. Understand the fundamentals of solid waste management, practices adopted in his town/village and its importance in keeping the health of the city.
- e. Appreciate the methods of environmental sanitation and the management of community facilities without spread of epidemics.
- f. Appreciate the importance of sustainable development while planning a project or executing an activity.

**SYLLABUS:**

**UNIT – I**

**Air Pollution:** Air pollution Control Methods–Particulate control devices – Methods of Controlling Gaseous Emissions – Air quality standards.

**Noise Pollution:** Noise standards, Measurement and control methods – Reducing residential and industrial noise – ISO14000.

**UNIT –II**

**Industrial Wastewater Management:** – Strategies for pollution control - Volume and Strength reduction – Neutralization – Equalization – Proportioning – Common Effluent Treatment Plants - Recirculation of industrial wastes – Effluent standards.

**UNIT – III**

**Solid Waste Management:** Solid waste characteristics – basics of on-site handling and collection – separation and processing – Incineration-Composting-Solid waste disposal methods – fundamentals of Land filling.



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**UNIT – IV**

**Environmental Sanitation:** Environmental Sanitation Methods for Hostels and Hotels, Hospitals, Swimming pools and public bathing places, social gatherings (melas and fares), Schools and Institutions, Rural Sanitation-low cost waste disposal methods.

**UNIT- V**

**Sustainable Development:** Definition- elements of sustainable developments -Indicators of sustainable development- Sustainability Strategies- Barriers to Sustainability–Industrialization and sustainable development – Cleaner production in achieving sustainability- sustainable development.

**TEXT BOOKS:**

1. Environmental Engineering, by Ruth F. Weiner and Robin Matthews – 4th Edition Elsevier, 2003.
3. Environmental Science
- 4.
5. and Engineering by J.G. Henry and G.W. Heinke – Pearson Education.
3. Environmental Engineering by Mackenzie L Davis & David A Cornwell. McGraw Hill Publishing.

**REFERENCES:**

1. Air Pollution and Control by M.N. Rao & H.N. Rao
2. Solid Waste Management by K. Sasi Kumar, S.A. Gopi Krishna. PHI New Delhi.
3. Environmental Engineering by Gerard Kiley, Tata McGraw Hill.
4. Industrial Water Pollution Control by Nemerow Jr., McGraw Hill Publishing.
5. Unit Operations and Processes in Environmental Engineering by Reynolds. Richard – Cengage Learning.
6. Environmental Engineering by D. Srinivasan, PHI Learning Private Limited, New Delhi, 2011.
7. Environmental Engineering – Howard S. Peavy, Donald R. Rowe, Teorge George Tchobanoglus – Mc-Graw-Hill Book Company, New Delhi, 1985.



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		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>c) ELEMENTS OF CIVIL ENGINEERING</b>					

**COURSE OBJECTIVES:**

The objectives of this course are to make students to learn about

1. basics of Civil Engineering concepts
2. the surveying, elevations and mapping
3. the construction materials and elements
4. water resource development

**COURSE OUTCOMES:**

At the end of the course the student is familiar

- a) basics of Civil Engineering concepts
- b) the surveying the elevations and mapping
- c) the construction materials and elements
- d) water resource development and
- e) overall infrastructure development

**SYLLABUS**

**Unit I**

Scope of Civil Engineering: Introduction: Impact of Infrastructural Development on the Economy of a Country, Role of Civil Engineers, Importance of Planning, Scheduling and Construction Management.

**Surveying:**

**Introduction:** Surveying and levelling, Object and uses, Primary divisions, Fundamental principles, Classification of surveying, Plans and maps, Scales, Units of measure.

**Unit II:**

**Compass surveying:**

Types and uses of compass, Bearings, Whole Circle Bearings, and Reduced Bearings, Computation of angles; Meridians; declinations and dip of needle; Local attraction; compass surveying field work.

**Elevation measurements:**

Levelling, object and uses, terms used in levelling, levelling instruments, methods of levelling, recording and methods of reducing, errors in levelling, contours; characteristics and applications.

**Modern Tools of Surveying and Mapping:**

Introduction to Theodolite, Electronic Distance Measurement Instruments, Total Station, Global Positioning System, Remote Sensing and Geographic Information System.





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Unit III:

Construction Materials

Requirement, types, uses, properties and importance of Civil Engineering materials like Stone, Bricks, Lime, Cement, Ferrous and Non Ferrous Metals, Ceramic Materials, Timber, Sand, Aggregate, Mortar and Concrete, Paints and Varnishes, Glass, Plastic, Conducting, Magnetic, and Miscellaneous Materials

Unit IV:

Elements of Building Construction

**Planning:**

Elementary principles and basic requirements of a building planning, layout of residential & industrial buildings.

**Construction:**

Classification of buildings based upon occupancy and structure, Design Loads, Common building components, their functions, and nominal dimensions. Elements of building drawing. Introduction to building byelaws.

Unit V

Water Resources Development

Elementary Hydrology, Sources of water, Watershed Development, water requirements and its conservation, Hydraulic Structures of Storage, Water Conveyance System: Canals; Water Conduits.

Books:

1. Surveying Vol. I & II, Dr. B. C. Punamia Laxmi Publication, Delhi
2. Building Construction, Dr. B. C. Punamia Laxmi Publication, Delhi
3. Engineering Material, Dr. S.C. Rangwal, Charotar Pub. House
4. Irrigation Engineering and Hydraulic Structures, Santoshkumar Garg, : Khanna Publishers Delhi
5. Civil Engineering Material, Jakson and Dhir, ELBS Publishing London
6. Civil Engg. Drawing, S. C. Rangwal, Charotar Pub. House Anand
7. Elements of Civil Engineering (IV Edition) by S.S. Bhavikatti, New Age International Publisher, New Delhi, 3rd edition



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<b>d) GREEN TECHNOLOGY</b>					

**Course Learning Objectives:**

The objective of this course is:

1. To present different concepts of green technologies.
2. To acquire principles of Energy efficient technologies.
3. To impart knowledge on the methods of reducing CO<sub>2</sub> levels in atmosphere.
4. To gain knowledge of the importance of life cycle assessment
5. To learn the importance of green fuels and its impact on environment.

**Course Learning Outcomes**

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

- Enlist different concepts of green technologies in a project
- Understand the principles of Energy efficient technologies
- Estimate the carbon credits of various activities
- Identify the importance of life cycle assessment
- Recognize the benefits of green fuels with respect to sustainable development.

**SYLLABUS:**

**UNIT- I**

Introduction: Green Technology – definition- Importance – Historical evolution – advantages and disadvantages of green technologies-factors affecting green technologies- Role of Industry, Government and Institutions – Industrial Ecology – role of industrial ecology in green technology.

Cleaner Production (CP): Definition – Importance – Historical evolution - Principles of Cleaner Production–Benefits–Promotion – Barriers – Role of Industry,

**UNIT- II**

Cleaner Production Project Development and Implementation:

Government and Institutions – clean development mechanism, reuse, recovery, recycle, raw material substitution-Wealth from waste, case studies.

Overview of CP Assessment Steps and Skills, Process Flow Diagram, Material Balance, CP Option Generation – Technical and Environmental Feasibility analysis – Economic valuation of alternatives - Total Cost Analysis – CP Financing – Preparing a Program Plan – Measuring Progress- ISO 14000.

**UNIT- III**

Pollution Prevention and Cleaner Production Awareness Plan – Waste audit – Environmental Statement, carbon credit, carbon sequestration, carbon trading, Life Cycle Assessment - Elements of LCA – Life Cycle Costing – Eco Labelling.

**UNIT -IV**

Availability and need of conventional energy resources, major environmental problems related to the conventional energy resources, future possibilities of energy need and availability. Non-conventional energy sources: Solar Energy-solar energy conversion technologies and devices, their principles, working and application.



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**UNIT- V**

Green Fuels – Definition-benefits and challenges – comparison of green fuels with conventional fossil fuels with reference to environmental, economical and social impacts- public policies and market-driven initiatives.

Biomass energy: Concept of biomass energy utilization, types of biomass energy, conversion processes, Wind Energy, energy conversion technologies, their principles, equipment and suitability in Indian context; tidal and geothermal energy.

**TEXT BOOKS:**

1. 'Pollution Prevention: Fundamentals and Practice' by Paul L Bishop (2000), McGraw Hill International.
2. 'Cleaner Production Audit' by Prasad Modak, C.Visvanathan and Mandar Parasnis (1995), Environmental System Reviews, No.38, Asian Institute of Technology, Bangkok
3. 'Non-conventional Energy Sources' by Rai G.D.

**REFERENCES:**

1. 'Pollution Prevention and Abatement Handbook – Towards Cleaner Production' by World Bank Group (1998), World Bank and UNEP, Washington D.C.
2. 'Handbook of Organic Waste Conversion' by Bewik M.W.M.
3. 'Energy, The Solar Hydrogen Alternative' by Bokris J.O.
4. 'Solar Energy' by Sukhatme S.P.
5. 'Waste Energy Utilization Technology' by Kiang Y. H.



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<b>e) SMART CITIES</b>					

**Course Objectives:**

The course aims towards

1. developing a sensitization
2. skills to understand
3. applicability of Inclusive urban planning and
4. improving towards the sustainable development.

**Course Outcome:**

After learning the course

The students should be able to:

- a) Understand the importance
- b) practicing the concept of inclusive urban planning
- c) will have sensitization towards implementing contributions in sustainable development.

**SYLLABUS**

**Unit – I Understanding Inclusive Planning:**

Definition and components; urban consultations; basic principles of urban consultation, process of urban consultations; urban strategic planning, good urban governance, subsidiarity, equity, efficiency, transparency and accountability, civic engagement and citizenship, security; valuing difference and working with diversity; liveable cities;

**Unit – II Stakeholders profile and needs, access to shelter, services and livelihoods:**

Urban Poor, Informal Sector, Gender, Children, Elderly, Disabled, Displaced people, etc.; Slums - dimensions, causative factors, determinants, location characteristics of settlements; Informal sector - growth, characteristics, functions, economic contributions, linkages with formal sector, impact on Urban Development

**Unit – III Participatory Planning Process and Policies, Programmes and Legislation:**

Methods, role of stakeholders (including civil society organizations), etc.; Related Acts, Five year plans, policies and programmes at various levels.

**Unit- IV Smart Cities:**

Innovation economy (Innovation in industries, clusters, districts of a city; Knowledge workforce: Education and employment; Creation of knowledge-intensive companies); Urban Infrastructure (Transport, Energy/ Utilities, protection of the environment and safety); Governance (Administration services to citizens, participatory and direct democracy, services to the citizen, quality of life)



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**Unit – V Planning interventions:**

Inclusive zoning, development and building regulations, Slum Improvement; drafting strategic urban development plans – objectives and key actors; planning framework for actions, process of drafting the plan, key considerations; urban design and decision-making; city transport for all; water supply and sanitation, urban disaster management, management through decentralization,

**Reference Books:**

1. Jo Beall (1997); “A city for all: valuing differences and working with diversity”; Zed books limited, London
2. UN-Habitat; “Inclusive and sustainable urban planning: a guide for municipalities”; Volume 3: Urban Development Planning (2007); United Nations Human Settlements Programme
3. Arup Mitra; “Insights into inclusive growth, employment and wellbeing in India”; Springer (2013), New Delhi
4. William J. V. Neill (2004); “Urban Planning and cultural identity”; Routledge, London
5. John S. Pipkin, Mark E. La Gory, Judith R. Balu (Editors); “Remaking the city: Social science perspective on urban design”; State University of New York Press, Albany
6. Giffinger, Rudolf; Christian Fertner; Hans Kramar; Robert Kalasek; Nataša Pichler-Milanovic; Evert Meijers (2007). "Smart cities – Ranking of European medium-sized cities". Smart Cities. Vienna: Centre of Regional Science
7. "Draft Concept Note on Smart City Scheme". Government of India - Ministry of Urban Development  
 ([http://indiainsmartcities.in/downloads/CONCEPT\\_NOTE\\_3.12.2014\\_\\_REVISED\\_AND\\_LATEST\\_.pdf](http://indiainsmartcities.in/downloads/CONCEPT_NOTE_3.12.2014__REVISED_AND_LATEST_.pdf))

**List of Open Source Software/learning website:**

- Google books and publications on inclusive urban planning  
 ([https://www.google.co.in/search?q=inclusive+urban+planning&btnG=Search+Books&tbo=bks&tbo=1&gws\\_rd=ssl](https://www.google.co.in/search?q=inclusive+urban+planning&btnG=Search+Books&tbo=bks&tbo=1&gws_rd=ssl))
- MoUD, GOI Website (<http://indiainsmartcities.in/site/index.aspx>)



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<b>f) PROJECT MANAGEMENT</b>					

**Course Learning Objectives:**

The objective of this course is:

1. To introduce to the student, the concept of project management including network drawing and monitoring
2. to introduce the various equipment related to construction like earth moving equipment, trucks and handling equipment, aggregate production and construction equipment and machinery
3. to introduce the importance of safety in construction projects

**Course Outcomes:**

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

- a) appreciate the importance of construction planning
- b) understand the functioning of various earth moving equipment
- c) know the methods of production of aggregate products and concreting
- d) apply the gained knowledge to project management and construction techniques

**SYLLABUS:**

**UNIT- I**

Construction project management and its relevance – qualities of a project manager – project planning – coordination –scheduling - monitoring – bar charts – milestone charts – critical path method

**UNIT -II**

Project evaluation and review technique – cost analysis - updating – crashing for optimum cost – crashing for optimum resources – allocation of resources introduction to softwares for construction management project management using PRIMAVERA (or) equivalent.

**UNIT- III**

Construction equipment – economical considerations – earthwork equipment – Trucks and handling equipment – rear dump trucks – capacities of trucks and handling equipment – calculation of truck production – compaction equipment – types of compaction rollers

**UNIT -IV**

Hoisting and earthwork equipment – hoists – cranes – tractors - bulldozers – graders – scrapers– draglines - clamshell buckets

Concreting equipment — concrete mixers – Batching plants, mobile using plants like “Ajax” etc. mixing and placing of concrete – consolidating and finishing



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**UNIT -V**

Construction methods – earthwork – piling – placing of concrete – form work – fabrication and erection – quality control and safety engineering

BIM for Civil Engineers (Building Information Modelling)

**TEXT BOOKS:**

1. 'Construction Planning, Equipment and Methods' by Peurifoy and Schexnayder , Shapira, Tata Mcgrawhill
2. 'Construction Project Management Theory and Practice' by Kumar Neeraj Jha (2011), Pearson.
3. 'Construction Technology' by Subir K. Sarkar and Subhajit Saraswati, Oxford University press

**REFERENCES:**

1. 'Construction Project Management - An Integrated Approach' by Peter Fewings , Taylor and Francis
2. 'Construction Management Emerging Trends and Technologies' by Trefor Williams , Cengage learning



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<b>g) TRAFFIC SAFETY</b>					

**Course Objectives:**

- 1) This module on the fundamentals of traffic engg. & some of the statistical methods to analyse the traffic safety.
- 2) The accident interrogations and risk involved with measures to identify the causes are dealt.
- 3) The role of road safety in planning the urban infrastructures design is discussed.
- 4) Various mitigation measures to prevent the road accidents are dealt.

**Course Outcomes:** The student is able to

- a) To understand fundamentals of Traffic Engg.
- b) To investigate and determine the collective factors & remedies of accident involved.
- c) To design and plan various road geometrics.
- d) To manage the traffic system from road safety point of view.

**UNIT I**

**Fundamentals of Traffic Engineering:**

Basic Characteristics of Motor-Vehicle Traffic, Highway Capacity, Applications of Traffic Control Devices, Traffic Design of Parking Facilities, Traffic Engineering Studies; Statistical Methods in Traffic Safety Analysis – Regression Methods, Poisson Distribution, Chi- Squared Distribution, Statistical Comparisons.

**UNIT II**

**Accident Investigations and Risk Management:**

Collection and Analysis of Accident Data, Condition and Collision Diagram, Causes and Remedies, Traffic Management Measures and Their Influence on Accident Prevention, Assessment of Road Safety, Methods to Identify and Prioritize Hazardous Locations and Elements, Determine Possible Causes of Crashes, Crash Reduction Capabilities and Countermeasures, Effectiveness of Safety Design Features, Accident Reconstruction.





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**UNIT III**

**Road Safety in Planning and Geometric Design:**

Vehicle And Human Characteristics, Road Design and Road Equipments, Redesigning Junctions, Cross Section Improvements, Reconstruction and Rehabilitation of Roads, Road Maintenance, Traffic Control, Vehicle Design and Protective Devices, Post Accident Care.

**UNIT IV**

**Role of Urban infrastructure design in safety:**

Geometric Design of Roads; Design of Horizontal and Vertical Elements, Junctions, At Grade and Grade Separated Intersections, Road Safety in Urban Transport, Sustainable Modes and their safety.

**UNIT V**

**Mitigation Measures:**

Accident prevention by better planning, Accident prevention by better design of roads, Crash Countermeasures, Highway operation and accident control measures, Highway Safety Measures during construction, Highway geometry and safety; Safety in urban areas; Public transport and safety; Road safety policy making, Stakeholders involvement; Road safety law, Road safety audit.

**TEXT BOOKS:**

1. Institute of Transportation Engineers (ITE), The Traffic Safety Toolbox: A Primer on Traffic Safety, ITE, 1999.  
Towards Safe Roads in Developing country, TRL – ODA, 2004.
2. Traffic Engineering and Transportation Planning – L.R. Kadiyali, Khanna Publishers
3. Fundamentals of Traffic Engineering, Richardo G Sigua

**REFERENCES:**

1. Athelstan Popkess, Traffic Control and Road Accident Prevention, Chapman and Hall, 1997 (Digitized 2008)
2. Handbook of Road Safety measures, second Edition, Rune Elvik, Alena Hoye, TrulsVaa, Michael Sorenson
3. Ezra Hauer, Observational Before-After Studies in Road Safety, Pergamon Press, 1997 (reprinted 2002).
4. Geetam Tiwari and Dinesh Mohan, Transport Planning and Traffic Safety: Making Cities, Roads, and Vehicles Safer, CRC Press, 2016
5. Fundamentals of Transportation Engineering – C.S. Papacostas, Prentice Hall India.
6. Transportation Engineering – An Introduction, C.Jotinkhisty, B. Kent Lall
7. Handbook of Road Safety measures, second Edition, Rune Elvik, Alena Hoye, Truls Vaa, Michael Sorenson



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8. Road Safety by NCHRP.

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<b>h) GEO-SPATIAL TECHNOLOGIES</b>					

**Course Objectives:**

1. Understand the various spatial and non-spatial data types, and data base management
  - a. techniques
2. Develop the concepts and professional skills in utility of geospatial techniques
3. Improve the working knowledge of geospatial techniques in field problems

**Course Outcomes:**

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

- a) Understand the geospatial technology relating to the data acquiring and processing that is associated with geographic locations
- b) Apply Geospatial techniques in the decision support systems useful for decision makers and community services.
- c) Ability to solve the problems related to the natural resource management, environment, urban planning and Infrastructure development, etc.
- d) Able to generate the thematic maps using Geospatial techniques
- e) Apply the concept of Geospatial Techniques to the Civil Engineering problems

**SYLLABUS**

**UNIT –I**

**Introduction** – Basic concepts, socioeconomic challenges, fundamentals of geographical information systems (GIS), history of geographical information system, components of geographical information systems.

**Projections and Coordinate Systems** – Map definitions, representations of point, line, polygon, common coordinate system, geographic coordinate system, map projections, transformations, map analysis.

**UNIT –II**

**Data Acquisition:**Data Types, Spatial, Non-Spatial (Attribute) Data, Data Format – Vector and Raster Data, Manual Digitizing, Scanner, Aerial Photographic Data, Remotely Sensed Data, Digital Data, Cartographic Database, Digital Elevation Data.

**Data Management:**Data Storage and Maintenance, Data Compression, Data Quality and Standards, Precision, Accuracy, Error – Geometric errors and corrections, Radiometric errors and corrections, types of Systematic and Non-systematic errors.



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**UNIT –III**

**Data Modeling:** Spatial Data Analysis, Data Retrieval Query, Simple Analysis, Recode Overlay, Vector Data Model, Raster Data Model, Digital Elevation Model, Cost and Path Analysis, Knowledge Based System.

**GIS Analysis and Functions:** Organizing data for analysis, analysis function, maintenance and analysis of spatial data, buffer analysis, overlay analysis, transformations, conflation, edge matching and editing, maintenance and analysis of spatial and non-spatial data.

**UNIT –IV**

**Applications of GIS:** Environmental and Natural Resource Management, Soil and Water Resources, Agriculture, Land Use Planning, Geology and Municipal Applications, Urban Planning and Project Management, GIS for decision making under Uncertainty, standard GIS packages, Introduction to Global Positioning Systems (GPS) and its applications.

**UNIT – V**

**Introduction to Remote Sensing:** General background of Remote Sensing Technology, Objectives and Limitations of Remote Sensing, Electro-Magnetic Radiation, Characteristics, Interaction with Atmosphere and Earth Surface, Remote Sensing Platforms and Sensors, Satellite Characteristics, Digital Image Processing, IRS Series and High Resolution Satellites, Remote Sensing Applications to Watershed Modeling, Environmental Modeling, Urban Planning and Management.

**Textbook:**

1. Demers, M.N, (2013). *Fundamentals of Geographic Information Systems* Wiley India Pvt. Ltd.,
2. Burrough, P. A., and McDonnell R. A. (1998). *Principles of Geographical Information Systems*. Oxford University Press, New York.
3. Kang-tsung Chang. (2006). *Introduction to Geographical Information Systems*. Tata McGraw-Hill Publishing Company Ltd., Third Edition, New Delhi.
4. George Joseph, (2013). *Fundamentals of Remote Sensing* Universities Press.

**References:**

1. Sabins F.F. Jr. (1978). *Remote Sensing Principles and Interpretations*. W.H. Freeman and Company, San Francisco.
2. Tor Bernhardsen. (2002). *Geographical Information System*. Wiley India (P) Ltd., Third Edition, New Delhi.
3. Hoffman-Wellenhof, B, et al. (1997). *GPS Theory and Practice*. Fourth Edition, Springer Wein, New York.
4. Lilysand T.M., and Kiefer R.W. (2002). *Remote Sensing and Image Interpretation*. John Wiley and Sons, Fourth Edition, New York.
5. Choudhury S., Chakrabarti, D., and Choudhury S. (2009). *An Introduction to Geographic Information Technology*. I.K. International Publishing House (P) Ltd, New Delhi.



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<b>i) WASTEWATER TREATMENT</b>					

**Course Learning Objectives:**

The course will address the following:

1. Enables the student to distinguish between the quality of domestic and industrial water requirements and wastewater quantity generation.
2. To impart knowledge on selection of treatment methods for industrial wastewater.
3. To know the common methods of treatment in different industries
4. To acquire knowledge on operational problems of effluent treatment plant.

**Course Outcomes:**

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

- a) Know the quality and quantity of water for various industries and Advanced water treatment methods
- b) Learn the common methods of treatment of wastewaters and Biological treatment methods
- c) Study of methods to reduce impacts of disposal of wasters into environment and CETPs.
- d) Study of methods of treatment of wastewaters from specific industries like steel plants, refineries, and power plants, that imply biological treatment methods
- e) Study of methods of treatment of wastewaters from industries like Aqua, dairy, sugar plants, and distilleries that imply biological treatment methods

**SYLLABUS:**

**UNIT – I**

Industrial water Quantity and Quality requirements: Boiler, Cooling, Domestic/Canteen and Process waters for Textiles, Food processing, Dairy, Aqua industry, Sugar mills, Brewery and distillery Industries, Fertilizer industry, Power plants. Advanced water treatment - Adsorption, Reverse Osmosis, Ion Exchange, Ultra filtration, Freezing, elutriation, Removal of Iron and Manganese, Removal of Colour and Odour. Use of Municipal wastewater in Industries.

**UNIT – II**

Basic theories of Industrial Wastewater Management: Industrial waste survey - Measurement of industrial wastewater Flow-generation rates – Industrial wastewater sampling and preservation of samples for analysis - Wastewater characterization- Toxicity of industrial effluents- Common methods of Treatment of wastewaters - Unit operations and processes- Volume and Strength reduction –Neutralization – Equalization and proportioning- recycling, reuse and resources recovery. Miscellaneous Treatment: Biological treatment of sewage- Primary, secondary and Tertiary treatment of sewage.



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**UNIT – III**

Industrial wastewater disposal management: Discharges into Sewers, Streams- Oxygen sag curve, Lakes-eutrophication and oceans and associated problems, Land treatment – sewage sickness, Common Effluent Treatment Plants: advantages and suitability, Limitations and challenges- Recirculation of Industrial Wastewaters- Effluent Disposal Method.

**UNIT – IV**

Process and Treatment of specific Industries-1: Manufacturing Process and origin, characteristics, effects and treatment methods of liquid waste from Steel plants, Fertilizers, Textiles, Paper and Pulp industries, Oil Refineries, Coal and Gas based Power Plants. Case studies.

**UNIT – V**

Process and Treatment of specific Industries-2: Manufacturing Process and origin, characteristics, effects and treatment methods of liquid waste from Tanneries, Sugar Mills, Distillers, Dairy and Food Processing industries, Aqua industry, Pharmaceutical Plants. Case studies.

**Text books**

1. Industrial Wastewater Treatment by KVSG Murali Krishna, Paramount Publishers, Visakhapatnam, 2019
2. Wastewater Treatment by M.N. Rao and A.K. Dutta, Oxford & IBH, NewDelhi.
3. Industrial Wastewater treatment by A.D. Patwardhan, PHI Learning, Delhi
4. Wastewater Treatment for Pollution Control and Reuse, by Soli. J Arceivala, Shyam R Asolekar, Mc-Graw Hill, New Delhi; 3<sup>rd</sup> Edition

**References**

1. Industrial Water Pollution Control by W. Wesley Eckenfelder, Mc- GrawHill, Third Edition
2. Wastewater Engineering by Metcalf and EddyInc., Tata McGrawhillCo., New Delhi
3. Wastewater Treatment- Concepts and Design Approach by G.L. Karia & R.A. Christian, Prentice Hall of India.
4. Unit Operations and Processes in Environmental Engineering by Reynolds. Richard, Cengage Learning.