



## Departmental Curriculum Structure

### 1<sup>st</sup> Semester

Curriculum Structure Semester I (First year)							
Sl. No.	Category	Code	Course Title	Hours per week			Credits
				L	T	P	
<b>Theory</b>							
1	Basic Science courses	BS-PH101	Physics-I	3	1	0	4
2	Engineering Science Courses	BS-M102	Mathematics –IB	3	1	0	4
3	Engineering Science Courses	ES-EE101	Basic Electrical Engineering	3	1	0	4
<b>Theory credits</b>							<b>12</b>
<b>Practical/ Sessional</b>							
1	Basic Science courses	BS-PH191	Physics-I Laboratory	0	0	3	1.5
2	Engineering Science Courses	ES-EE191	Basic Electrical Engineering Laboratory	0	0	2	1
3	Engineering Science Courses	ES-ME192	Workshop/Manufacturing Practices	1	0	4	3
<b>Practical credits</b>							<b>5.5</b>
<b>Total credits</b>							<b>17.5</b>



## 2<sup>nd</sup> Semester

Curriculum Structure Semester II (First year)							
Sl. No.	Category	Code	Course Title	Hours per week			Credits
				L	T	P	
<b>Theory</b>							
1	Basic Science courses	BS-CH201	Chemistry-I	3	1	0	4
2	Basic Science courses	BS-M202	Mathematics –II	3	1	0	4
3	Engineering Science Courses	ES-CS201	Programming for Problem Solving	3	0	0	3
4	Humanities and Social Sciences including Management course	HM-HU201	English	2	0	0	2
<b>Theory credits</b>							<b>13</b>
<b>Practical/ Sessional</b>							
1	Basic Science courses	BS-CH291	Chemistry-I Laboratory	0	0	3	1.5
2	Engineering Science Courses	ES-CS291	Programming for Problem Solving	0	0	4	2
3	Engineering Science Courses	ES-ME291	Engineering Graphics & Design	1	0	4	3
4	Humanities and Social Sciences including Management course	HM-HU291	Language Laboratory	0	0	1	1
<b>Practical credits</b>							<b>7.5</b>
<b>Total credits</b>							<b>20.5</b>



## 3<sup>rd</sup> Semester

Curriculum Structure Semester III (Second year)							
Sl. No.	Category	Code	Course Title	Hours per week			Credits
				L	T	P	
<b>Theory</b>							
1	Basic Science courses	CE(BS)301	Biology for Engineers	2	1	0	3
2	Engineering Science Courses	CE(ES)301	Engineering Mechanics	3	1	0	4
3	Engineering Science Courses	CE(ES)302	Energy Science & Engineering	1	1	0	2
4	Basic Science courses	CE(BS)301	Mathematics-III (Transform & Discrete Mathematics)	2	0	0	2
5	Humanities and Social Sciences including Management courses	CE(HS)301	Humanities-I (Effective Technical Communication)	3	0	0	3
6	Humanities and Social Sciences including Management courses	CE(HS)302	Introduction to Civil Engineering	1	1	0	2
<b>Theory credits</b>							<b>16</b>
<b>Practical/ Sessional</b>							
1	Engineering Science Courses	CE(ES)391	Basic Electronics	1	0	2	2
2	Engineering Science Courses	CE(ES)392	Computer-aided Civil Engineering Drawing	1	0	2	2
3	Engineering Science Courses	CE(ES)393	Life Science	1	0	2	2
<b>Practical credits</b>							<b>6</b>
<b>Total credits</b>							<b>22</b>



## 4<sup>th</sup> Semester

Curriculum Structure Semester IV (Second year)							
Sl. No.	Category	Code	Course Title	Hours per week			Credits
				L	T	P	
<b>Theory</b>							
1	Engineering Science Courses	CE(ES)401	Introduction to Fluid Mechanics	2	0	0	2
2	Engineering Science Courses	CE(ES)402	Introduction to Solid Mechanics	2	0	0	2
3	Professional Core courses	CE(PC)401	Soil Mechanics – I	2	1	0	3
4	Professional Core courses	CE(PC)402	Environmental Engineering -I	2	1	0	3
5	Professional Core courses	CE(PC)403	Surveying & Geomatics	2	1	0	3
6	Professional Core courses	CE(PC)404	Concrete Technology	2	1	0	3
7	Humanities and Social Sciences including Management courses	CE(HS)401	Civil Engineering - Societal & Global Impact	2	0	0	2
8	Mandatory Courses (non-credit)	CE(MC)401	Management I (Organizational Behavior)	2	0	0	0
<b>Theory credits</b>							<b>18</b>
<b>Practical/ Sessional</b>							
1	Professional Core courses	CE(ES)491	Fluid Mechanics Laboratory	0	0	2	1
2	Professional Core courses	CE(ES)492	Solid Mechanics Laboratory	0	0	2	1
3	Professional Core courses	CE(ES)493	Engineering Geology Laboratory	0	0	2	1
4	Professional Core courses	CE(PC)493	Surveying & Geomatics	0	0	2	1
5	Professional Core courses	CE(PC)494	Concrete Technology Laboratory	0	0	2	1
<b>Practical credits</b>							<b>5</b>
<b>Total credits</b>							<b>23</b>



## 5<sup>th</sup> Semester

Curriculum Structure Semester V (Third year)							
Sl. No.	Category	Code	Course Title	Hours per week			Credits
				L	T	P	
<b>Theory</b>							
1	Professional Core courses	CE(PC)501	Design of RC Structures	2	1	0	3
2	Professional Core courses	CE(PC)502	Engineering Hydrology	2	1	0	3
3	Professional Core courses	CE(PC)503	Structural Analysis – I	2	1	0	3
4	Professional Core courses	CE(PC)504	Soil Mechanics – II	2	1	0	3
5	Professional Core courses	CE(PC)505	Environmental Engineering – II	2	1	0	3
6	Professional Core courses	CE(PC)506	Transportation Engineering	2	1	0	3
7	Mandatory courses (non-credit)	CE(MC)501	Constitution of India/ Essence of Indian Knowledge Tradition	-	-	-	0
<b>Theory credits</b>							<b>18</b>
<b>Practical/ Sessional</b>							
1	Professional core courses	CE(PC)591	RC Design Sessional	0	0	2	1
2	Professional core courses	CE(PC)594	Soil Mechanics Laboratory	0	0	2	1
3	Professional core courses	CE(PC)595	Environmental Engineering Laboratory	0	0	2	1
4	Professional core courses	CE(PC)596	Transportation Engineering Laboratory	0	0	2	1
5	Professional core courses	CE(PC)597	Computer Application in CE	0	0	2	1
<b>Practical credits</b>							<b>5</b>
<b>Total credits</b>							<b>23</b>



## 6<sup>th</sup> Semester

Curriculum Structure Semester VI (Third year)							
Sl. No.	Category	Code	Course Title	Hours per week			Credits
				L	T	P	
<b>Theory</b>							
1	Professional Core courses	CE(PC)601	Construction Engineering & Management	2	0	0	2
2	Professional Core courses	CE(PC)602	Engineering Economics, Estimation & Costing	2	0	0	2
3	Professional Core courses	CE(PC)603	Water Resources Engineering	2	0	0	2
4	Professional Core courses	CE(PC)604	Design of Steel Structures	2	0	0	2
5	Professional Elective courses	CE(PE)601	<b>Elective-I</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>
		CE(PE)601A	Stability of Slopes				
		CE(PE)601B	Foundation Engineering				
		CE(PE)601C	Ground Improvement Technique				
6	Professional Elective courses	<b>CE(PE)602</b>	<b>Elective-II</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>
		CE(PE)602A	Building Construction Practice				
		CE(PE)602B	Structural Analysis-II				
		CE(PE)602C	Industrial Structures				
7	Open Elective courses	<b>CE(OE)601</b>	<b>Open Elective-I (Humanities)</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>
		CE(OE)601A	Soft Skills and Interpersonal Communication – I				
		CE(OE)601B	Introduction to Philosophical Thoughts				
<b>Theory credits</b>							<b>14</b>
<b>Practical/ Sessional</b>							
1	Professional Core courses	CE(PC)693	Water Resource Engineering Laboratory	0	0	2	1
2	Professional Core courses	CE(PC)694	Steel Structure Design Sessional	0	0	2	1
3	Professional Core courses	CE(PC)695	Quantity Survey Estimation and Valuation Sessional	0	1	2	2
<b>Practical credits</b>							<b>4</b>
<b>Total credits</b>							<b>18</b>



## 7<sup>th</sup> Semester

Curriculum Structure Semester VII (Fourth year)							
Sl. No.	Category	Code	Course Title	Hours per week			Credits
				L	T	P	
<b>Theory</b>							
1	Open Elective courses	<b>CE(OE)701</b>	<b>Open Elective-II</b>	2	0	0	2
		CE(OE)701A	Metro Systems & Engineering				
		CE(OE)701B	ICT for Development				
		CE(OE)701C	Cyber Law & Ethics				
2	Professional Elective courses	<b>CE(PE)701</b>	<b>Elective III</b>	2	1	0	3
		CE(PE)701A	Computational Hydraulics				
		CE(PE)701B	Disaster Preparedness and Planning				
		CE(PE)701C	Hydraulic Structure				
3	Professional Elective courses	<b>CE(PE)702</b>	<b>Elective IV</b>	2	1	0	3
		CE(PE)702A	Pre-stressed Concrete				
		CE(PE)702B	Repairs & Rehabilitation of Structures				
		CE(PE)702C	Finite Element Method				
4	Professional Elective courses	<b>CE(PE)703</b>	<b>Elective V</b>	2	1	0	3
		CE(PE)703A	Air and Noise Pollution and Control				
		CE(PE)703B	Physico-Chemical Processes for Water and Wastewater Treatment				
		CE(PE)703C	Water and Air Quality Modelling				
5	Professional Elective courses	<b>CE(PE)704</b>	<b>Elective-VI</b>	2	1	0	3
		CE(PE)704A	Structural Dynamics				
		CE(PE)704B	Advanced Structural Analysis				
		CE(PE)704C	Coastal Hydraulics and Sediment Transport				
6	Professional Elective courses	<b>CE(PE)705</b>	<b>Elective-VII</b>	2	0	0	2
		CE(PE)705A	Railway and Airport Engineering				
		CE(PE)705B	Pavement Design				
		CE(PE)705C	Transport System Planning				
<b>Theory credits</b>							<b>16</b>
<b>Practical/ Sessional</b>							
1	Internship	CE(IN)791	Industrial Internship (after sixth semester)				1
2	Project	CE(PROJ)792	Project-1 (Project work)	0	0	10	5
<b>Practical credits</b>							<b>6</b>
<b>Total credits</b>							<b>22</b>



## 8<sup>th</sup> Semester

Curriculum Structure Semester VIII (Fourth year)							
Sl. No.	Category	Code	Course Title	Hours per week			Credits
				L	T	P	
<b>Theory</b>							
1	Humanities and Social Sciences including Management courses	CE(HS)801	Professional Practice, law & Ethics	2	0	0	2
2	Professional Elective Courses	<b>CE(PE)801</b>	<b>Elective VIII</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>
		CE(PE)801A	GIS & Remote Sensing				
		CE(PE)801B	Rock Mechanics				
		CE(PE)801C	Environmental laws and Policy				
		CE(PE)801D	Pavement Materials and Design				
3	Open Elective courses	<b>CE(OE)801</b>	<b>Open Elective-III</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>2</b>
		CE(OE)801A	Human Resource Development and Organizational Behavior				
		CE(OE)801B	Bridge Engineering				
		CE(OE)801C	Deep Foundations				
		CE(OE)801D	Groundwater Contamination				
4	Open Elective courses	<b>CE(OE)802</b>	<b>Open Elective-IV</b>	<b>2</b>	<b>0</b>	<b>2</b>	<b>2</b>
		CE(OE)802A	Soft Skills and Personality Development				
		CE(OE)802B	Earthquake Engineering				
		CE(OE)802C	Urban Transport Planning				
		CE(OE)802D	Environmental Impact Assessment and Life cycle Analysis				
<b>Theory credits</b>							<b>8</b>
<b>Practical/ Sessional</b>							
1	Comprehensive Viva Voce	CE(CV)882	Comprehensive Viva Voce				1
2	Project	CE(PROJ)8 81	Project-2 (Continued from VII)	0	0	10	5
<b>Practical credits</b>							<b>6</b>
<b>Total credits</b>							<b>14</b>



## Syllabus & Course Outcomes

1<sup>st</sup> Semester

### BS-PH101: Physics-I

Course Code – BS-PH101	Physics-I	3L+1T+0P	4 Credits
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>Students will be able to Learn basic concepts of quantum physics, simple quantum mechanics calculations; Macrostate, Microstate, Density of states, Qualitative treatment of MB, FD and BE statistics.</li> <li>Students will be able to Solve problems including constraints &amp; friction. Basic ideas of vector calculus and partial differential equations. Harmonic oscillator. Damped harmonic motion forced oscillations and Resonance. Motion of a rigid body.</li> <li>Students will be able to Learn the application of wave properties of light Interference, Diffraction and Polarization; Lasers: Principles and working of laser</li> <li>Students will be able to Learn Maxwell's equations. Polarization, Dielectrics; Magnetization, magnetic-hysteresis.</li> </ol>
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### Syllabus

Sl No.	Course Content	Total Hours
Module 1	<p><b>Mechanics</b></p> <p>Problems including constraints &amp; friction. Basic ideas of vector calculus and partial differential equations. Potential energy function <math>F = -\text{grad } V</math>, equipotential surfaces and meaning of gradient. Conservative and non-conservative forces. Conservation laws of energy &amp; momentum. Non-inertial frames of reference. Harmonic oscillator; Damped harmonic motion forced oscillations and resonance. Motion of a rigid body in a plane and in 3D. Angular velocity vector. Moment of inertia..</p>	7L
Module 2	<p><b>Optics</b></p> <p>Distinction between interference and diffraction, Fraunhofer and Fresnel diffraction, Fraunhofer diffraction at single slit, double slit, and multiple slits (only the expressions for max;min, &amp; intensity and qualitative discussion of fringes); diffraction grating(resolution formulac only), characteristics of diffraction grating and its applications.</p> <p>Polarisation: Introduction, polarisation by reflection, polarisation by double reflection, scattering of light, circular and elliptical polarisation, optical activity.</p>	5L



	Lasers: Principles and working of laser: population inversion, pumping, various modes, threshold population inversion with examples.	
Module 3	<p><b>Electromagnetism and Dielectric Magnetic Properties of Materials</b></p> <p>Maxwell's equations. Polarisation, permeability and dielectric constant, polar and non-polar dielectrics, internal fields in a solid, Clausius-Mossotti equation (expression only), applications of dielectrics.</p> <p>Magnetisation, permeability and susceptibility, classification of magnetic materials, ferromagnetism, magnetic domains and hysteresis, applications.</p>	8L
Module 4	<p><b>Quantum Mechanics</b></p> <p>Introduction to quantum physics, black body radiation, explanation using the photon concept, Compton effect, de Broglie hypothesis, wave-particle duality, verification of matter waves, uncertainty principle, Schrodinger wave equation, particle in box, quantum harmonic oscillator, hydrogen atom.</p>	16L
Module 5	<p><b>Statistical Mechanics</b></p> <p>Macrostate, Microstate, Density of states, Qualitative treatment of Maxwell Boltzmann, Fermi-Dirac and Bose-Einstein statistics.</p>	8L

## Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	Introduction to Electrodynamics	David J. Griffiths	Pearson Education India Learning Private Limited
	2	Principles of Physics	, David Halliday, Robert Resnick Jearl Walker ,	Wiley.
	3	Electricity, Magnetism, and Light	Wayne M. Saslow	Academic Press
	4	Engineering Mechanics (In SI Units)	S. Timoshenko, D.H. Young,	
	5	Classical mechanics	Narayan Rana, Pramod Joag	McGraw Hill Education
	6	Introduction to Classical Mechanics	R Takwale, P Puranik,	McGraw Hill Education
	7	Engineering Mechanics	M.K. Harbola	Cengage India
	8	An Introduction to Mechanics	David Kleppner, Robert Kolenkow,	McGraw Hill Education



## CO-PO Mapping

### CO-PO Mapping

#### Physics-I

(Course Code – BS-PH101)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	3	3	3	2	2	1	2	-	-	2	1	2	2	1	2
<b>CO2</b>	3	3	3	2	2	1	2	-	-	2	1	2	2	2	3
<b>CO3</b>	3	3	3	3	2	1	2	-	-	2	1	2	3	2	1
<b>CO4</b>	3	3	3	2	2	1	2	-	-	2	1	2	1	2	2
<b>Avg.</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2.25</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>-</b>	<b>-</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>1.75</b>	<b>2</b>

## BS-M102: Mathematics –IB

Course Code – BS-M102	Mathematics –IB	3L+1T+0P	4 Credits
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>Students will be able to Apply the concept and techniques of differential and integral calculus to determine curvature and evaluation of different types of improper integrals.</li> <li>Students will be able to Understand the domain of applications of mean value theorems to engineering problems.</li> <li>Students will be able to Learn the tools of power series and Fourier series to analyze engineering problems and apply the concept of convergence of infinite series in many approximation techniques in engineering disciplines.</li> <li>Students will be able to Apply the knowledge for addressing the real life problems which comprise of several variables or attributes and identify extremum points of different surfaces of higher dimensions.</li> <li>Students will be able to Learn and apply the concept of rank-nullity, eigen values, eigen vectors, diagonalization and orthogonalization of matrices for understanding physical and engineering problems.</li> </ol>
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### Syllabus

Sl No.	Course Content	Total Hours
Module 1	<b>Calculus (Integration):</b> Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.	8
Module 2	<b>Calculus (Differentiation):</b> Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin's theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.	6
Module 3:	<b>Sequence and Series:</b> Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and logarithm functions; Fourier series: Half range sine and cosine series, Parseval's theorem.	11
Module 4:	<b>Multivariate Calculus:</b> Limit, continuity and partial derivatives, Directional derivatives, Total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, Curl and Divergence.	9



Module 5:	<b>Matrices:</b> Inverse and rank of a matrix, Rank-nullity theorem; System of linear equations; Symmetric, Skew-symmetric and Orthogonal matrices; Determinants; Eigenvalues and Eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.	8
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## Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	Engineering Mathematics-I	Reena Garg.	Khanna Publishers
	2	Advanced Engineering Mathematics	Erwin Kreyszig	John Wiley & Sons
	3	Advanced Engineering Mathematics	Michael Greenberg	Pearson.
	4	Mathematical Methods of Science and Engineering	Kanti B. Dutta	Cenage Learning

## CO-PO Mapping

### CO-PO Mapping

#### Mathematics –IB

(Course Code – BS-M102)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	3	3	3	2	2	2	2	-	-	1	2	2	1	2	1
<b>CO2</b>	3	3	2	2	2	2	-	-	2	-	1	2	3	2	3
<b>CO3</b>	3	3	3	2	2	-	2	-	2	1	-	1	2	2	3
<b>CO4</b>	3	3	2	2	3	2	-	-	-	-	2	2	3	3	3
<b>CO5</b>	3	3	2	2	2	2	1	-	1	1	2	1	3	2	3
	<b>3</b>	<b>3</b>	<b>2.4</b>	<b>2</b>	<b>2.2</b>	<b>2</b>	<b>1.67</b>	-	<b>1.67</b>	<b>1</b>	<b>1.75</b>	<b>1.6</b>	<b>2.4</b>	<b>2.2</b>	<b>2.6</b>

## ES-EE101: Basic Electrical Engineering

Course Code – ES-EE101	Basic Electrical Engineering	3T+1L+0P	4 Credits
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### Course Outcome (CO)

Course Outcome (CO)	<ol style="list-style-type: none"> <li>Students will be able to describe fundamentals of DC and AC circuits</li> <li>Students will be able to explain the operating principle of transformer</li> <li>Students will be able to illustrate construction, working of Electrical Machines</li> <li>Students will be able to classify different power converters and installation process</li> </ol>
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### Syllabus

SI No.	Course Content	Total Hours
Module 1	<b>DC Circuits</b> Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits	8
Module 2	<b>AC Circuits</b> Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections	8
Module 3	<b>Transformers</b> Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections	6
Module 4	<b>Electrical Machines</b> Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction	8



	and working of synchronous generators.	
Module 5	<b>Power Converters</b> DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.	6
Module 6	<b>Electrical Installations</b> Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.	6

## Books

<b>Books</b>	Sl.	Book Name	Author	Publishing House
	1	Basic Electrical Engineering	Ritu Sahdev	Khanna Book Publishing Co. (P) Ltd
	2	Basic Electrical Engineering	D. P. Kothari and I. J. Nagrath	Tata McGraw Hill
	3	Basic Electrical Engineering	D. C. Kulshreshtha	McGraw Hill
	4	Fundamentals of Electrical Engineering	L. S. Bobrow	Oxford University Press
	5	Electrical and Electronics Technology	E. Hughes	Pearson
	6	Electrical Engineering Fundamentals	V. D. Toro	Prentice Hall India

## CO-PO Mapping

### CO-PO Mapping

#### Basic Electrical Engineering

(Course Code – ES-EE101)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PsO3
<b>CO1</b>	3	2	2	2	2	2	1	-	2	2	2	3	2	1	2
<b>CO2</b>	3	2	2	2	2	2	1	-	2	2	2	3	1	1	2
<b>CO3</b>	3	2	2	2	2	2	1	-	2	2	2	3	2	3	1
<b>CO4</b>	3	2	2	2	2	2	1	-	2	2	2	3	1	2	3
<b>Avg.</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>-</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>1.5</b>	<b>1.75</b>	<b>2</b>

## BS-PH191: Physics-I Laboratory

Course Code – BS-PH191	Physics-I Laboratory	0T+0L+3P	1.5 Credits
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### Course Outcome (CO)

Course Outcome (CO)	<ol style="list-style-type: none"> <li>Students will have the Ability to increase power of observation and reasoning and to think and work with precision and accuracy in daily life. Use Slide callipers and screw gauge, familiar with concept of Band gap of semiconductor and dielectric constant</li> <li>Students will be able to Get the opportunity to verify the validity of various laws taught in curriculum, Familiar with dispersive power of the material of a prism, Newton's ring, Planck constant</li> <li>Students will be able to get Familiar with Hall coefficient of a semiconductor Electron spin resonance spectrometer, Young's modulus, Poiseuille's capillary flow method for viscosity measurement.</li> </ol>
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### Syllabus

Sl No.	Course Content	Total Hours
<b>Choose 10 experiments including at least one from Optics, Electricity and Magnetism and Quantum Mechanics and at least a total of six from these three groups.</b>		
Experiment – 1	<b>Experiments in Optics</b> <ul style="list-style-type: none"> <li>Determination of dispersive power of the material of a prism</li> <li>Determination of wavelength of a monochromatic light by Newton's ring</li> <li>Determination of wavelength of a monochromatic light by Fresnel's bi-prism</li> <li>Determination of wavelength of the given laser source by diffraction method</li> </ul>	
Experiment – 2	<b>Electricity &amp; Magnetism experiments</b> <ul style="list-style-type: none"> <li>Determination of thermo electric power of a given thermocouple.</li> <li>Determination of specific charge (e/m) of electron by J.J. Thompson's method.</li> <li>Determination of dielectric constant of a given dielectric material.</li> <li>Determination of Hall coefficient of a semiconductor by four probe method.</li> <li>To study current voltage characteristics, load response, areal characteristic and spectral response of a photovoltaic solar cell.</li> <li>Determination of resistance of ballistic galvanometer by half deflection method and study of variation of logarithmic decrement with series resistance.</li> </ul>	





	<ul style="list-style-type: none"> <li>• Determination of unknown resistance using Carey Foster's bridge</li> <li>• Study of Transient Response in LR, RC and LCR circuits using expeyes</li> <li>• Generating sound from electrical energy using expeyes</li> </ul>	
Experiment – 3	<b>Experiments in Quantum Physics</b> <ul style="list-style-type: none"> <li>• Determination of Stefan-Boltzmann constant.</li> <li>• Determination of Planck constant using photocell.</li> <li>• Determination of Lande-g factor using Electron spin resonance spectrometer.</li> <li>• Determination of Rydberg constant by studying Hydrogen spectrum.</li> <li>• Determination of Band gap of semiconductor.</li> <li>• To study current voltage characteristics, load response, areal characteristic and spectral response of a photovoltaic solar cell.</li> </ul>	
Experiment – 4	<b>Miscellaneous experiments</b> <ul style="list-style-type: none"> <li>• Determination of Young's modulus of elasticity of the material of a bar by the method of flexure</li> <li>• Determination of bending moment and sheer force of a rectangular beam of uniform cross-section</li> <li>• Determination of modulus of rigidity of the material of a rod by static method</li> <li>• Determination of rigidity modulus of the material of a wire by dynamic method</li> <li>• To determine the moment of inertia of a body about an axis passing through its centre of gravity and to determine the modulus of rigidity of the material of the suspended wire</li> <li>• Determination of coefficient of viscosity by Poiseulle's capillary flow method</li> </ul>	

## Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	Introduction to Electrodynamics	David J. Griffiths	Pearson Education India Learning Private Limited
	2	Principles of Physics	, David Halliday, Robert Resnick Jearl Walker ,	Wiley.
	3	Electricity, Magnetism, and Light	Wayne M. Saslow	Academic Press
	4	Engineering Mechanics (In SI Units)	S. Timoshenko, D.H. Young,	



## CO-PO Mapping

### CO-PO Mapping

#### Physics-I Laboratory

( Course Code – BS-PH191)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	3	3	3	3	3	1	2	-	-	2	1	2	2	1	2
<b>CO2</b>	3	3	3	3	3	1	2	-	-	2	1	2	2	2	3
<b>CO3</b>	3	3	3	3	3	1	2	-	-	2	1	2	3	2	1
<b>CO4</b>	3	3	3	3	3	1	2	-	-	2	1	2	2.33	1.67	2

## ES-EE191: Basic Electrical Engineering Laboratory

Course Code – ES-EE191	Basic Electrical Engineering Laboratory	0T+0L+2P	1 Credits
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>1. Students will be able to Demonstrate the characteristics of carbon, tungsten &amp; florescent lamps.</li> <li>2. Students will be able to Verify the different electrical parameters obtained using network theorems.</li> <li>3. Students will be able to perform Experiment on R-L-C series &amp; parallel circuits</li> </ol>
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### Syllabus

Sl No.	Course Content	Total Hours
Experiments	<ul style="list-style-type: none"> <li>• First activity: Introduction to basic safety precautions and mentioning of the do's and Don'ts. Noting down list of experiments to be performed, and instruction for writing the laboratory reports by the students. Group formation. Students are to be informed about the modalities of evaluation.</li> <li>• Introduction and uses of following instruments:               <ol style="list-style-type: none"> <li>1. Voltmeter</li> <li>2. Ammeter</li> <li>3. Multimeter</li> <li>4. Oscilloscope</li> </ol> </li> <li>• Demonstration of real life resistors, capacitors with color code, inductors and autotransformer.</li> <li>• Demonstration of cut-out sections of machines: DC machine, Induction machine, Synchronous machine and single phase induction machine.</li> <li>• Calibration of ammeter and Wattmeter.</li> <li>• Determination of steady state and transient response of R-L, R-C and R-L-C circuit to a step change in voltage.</li> <li>• Determination of steady state response of R-L and R-C and R-L-C circuit and calculation of impedance and power factor.</li> <li>• Determination of resonance frequency and quality factor of series and parallel R-L-C circuit.</li> <li>• Open circuit and short circuit test of a single-phase transformer</li> <li>• Load test of the transformer and determination of efficiency and regulation</li> <li>• Demonstration of three phase transformer connections. Voltage and current relationship, phase shifts between the primary and secondary side.</li> <li>• Measurement of power in a three phase unbalanced circuit by two wattmeter method.</li> <li>• Determination of Torque –Speed characteristics of separately excited DC motor.</li> <li>• Determination of Torque speed characteristics and observation</li> </ul>	3L+1T



	<p>of direction reversal by change of phase sequence of connection of Induction motor.</p> <ul style="list-style-type: none"> <li>• Determination of operating characteristics of Synchronous generator.</li> <li>• Demonstration of operation of (a) DC-DC converter (b) DC-AC converter (c) DC-AC converter for speed control of an Induction motor</li> <li>• Demonstration of components of LT switchgear.</li> </ul>	
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## Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	Basic Electrical Engineering	Ritu Sahdev	Khanna Book Publishing Co. (P) Ltd
	2	Basic Electrical Engineering	D. P. Kothari and I. J. Nagrath	Tata McGraw Hill
	3	Basic Electrical Engineering	D. C. Kulshreshtha	McGraw Hill
	4	Fundamentals of Electrical Engineering	L. S. Bobrow	Oxford University Press
	5	Electrical and Electronics Technology	E. Hughes	Pearson
	6	Electrical Engineering Fundamentals	V. D. Toro	Prentice Hall India

## CO-PO Mapping

### CO-PO Mapping

#### Basic Electrical Engineering Laboratory

(Course Code - ES-EE191)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	3	2	2	2	2	2	1	-	2	2	2	3	2	2	3
<b>CO2</b>	3	2	2	2	2	2	1	-	2	2	2	3	2	1	3
<b>CO3</b>	3	2	2	2	2	2	1	-	2	2	2	3	2	2	3
<b>Avg.</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>-</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>1.67</b>	<b>3</b>

## ES-ME192: Workshop/Manufacturing Practices

<b>Course Code – ES-ME192</b>	<b>Workshop/Manufacturing Practices</b>	<b>1L+0T+4P</b>	<b>3 Credits</b>
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>1. The Students will be able to Gain basic knowledge of Workshop Practice and Safety useful for our daily living.</li> <li>2. The Students will be able Identify Instruments of a pattern shop like Hand Saw, Jack Plain, Chisels etc. and performing operations like such as Marking, cutting etc used in manufacturing processes.</li> <li>3. The Students will be able Gain knowledge of the various operations in the Fitting Shop using Hack Saw, various files, Scriber, etc. to understand the concept of tolerances applicable in all kind of manufacturing.</li> <li>4. The Students will be able Get hands on practice of in Welding and various machining processes which give a lot of confidence to manufacture physical prototypes in project works.</li> </ol>
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### Syllabus

SI No.	Course Content	Total Hours
Module 1	<p><b>Machine shop:</b></p> <p>Typical jobs that may be made in this practice module:</p> <p>To make a pin from a mild steel rod in a lathe.</p> <p>To make rectangular and vee slot in a block of cast iron or mild steel in a shaping and / or milling machine.</p>	8
Module 2	<p><b>Fitting shop</b></p> <p>Typical jobs that may be made in this practice module:</p> <p>To make a Gauge from MS plate</p>	8
Module 3	<p><b>Carpentry</b></p> <p>Typical jobs that may be made in this practice module:</p> <p>To make wooden joints and/or a pattern or like.</p>	8
Module 4	<p><b>Welding shop</b></p> <p>Typical jobs that may be made in this practice module:</p> <p>ARC WELDING: To join two thick (approx. 6mm) MS plates by manual metal arc welding.</p> <p>GAS WELDING: To join two thin mild steel plates or sheets by gas welding</p>	8 Arc welding 4 hours + Gas welding 4 hours



Module 5	<p><b>Casting</b></p> <p>Typical jobs that may be made in this practice module:</p> <p>One/ two green sand moulds to prepare, and a casting be demonstrated</p>	8
Module 6	<p><b>Smithy (4 hours)</b></p> <p>Typical jobs that may be made in this practice module:</p> <p>A simple job of making a square rod from a round bar or like</p>	4
Module 7	<p><b>Plastic moulding &amp; Glass cutting</b></p> <p>Typical jobs that may be made in this practice module:</p> <p>For plastic moulding, making at least one simple plastic component should be made.</p> <p>For glass cutting, three rectangular glass pieces may be cut to make a kaleidoscope using a black color diamond cutter, or similar other components may be made.</p>	4
	<p><b>Electrical &amp; Electronics</b></p> <p>Familiarization with LT switchgear elements, making its sketches and noting down its specification. KitKat fuse, Glass cartridge fuse, Plastic fuse holders (optional), Iron clad isolators, MCB style isolators, Single phase MCB, Single-phase wire, wiring cable.</p> <p>Demonstration of domestic wiring involving two MCB, two piano key switches, one incandescent lamp, one LED lamp and plug point.</p> <p>Simple wiring exercise to be executed to understand the basic electrical circuit.</p> <p>Simple soldering exercises to be executed to understand the basic process of soldering.</p> <p>Fabrication of a single-phase full wave rectifier with a step down transformer using four diodes and electrolytic capacitor and to find its volt-ampere characteristics to understand basic electronic circuit fabrication.</p>	8

## Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	Elements of Workshop Technology	Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar	Media promoters and publishers private
	2	Manufacturing Engineering and Technology	Kalpakkian S. and Steven S. Schmid	Pearson Education India Edition
	3	Manufacturing Technology – I	Gowri P. Hariharan and A. Suresh Babu	Pearson Education



## CO-PO Mapping

### CO-PO Mapping

#### Workshop/Manufacturing Practices

(Course Code – ES-ME192)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	2	1	-	-	-	2	-	1	3	-	1	1	1	3	-
<b>CO2</b>	2	2	1	1	1	1	1	2	1	1	-	-	-	2	1
<b>CO3</b>	2	-	2	-	-	1	-	1	1	1	1	2	1	2	3
<b>CO4</b>	1	1	1	2	1	3	1	3	2	-	-	1	-	2	3
	<b>1.75</b>	<b>1.33</b>	<b>1.33</b>	<b>1.5</b>	<b>1</b>	<b>1.75</b>	<b>1</b>	<b>1.75</b>	<b>1.75</b>	<b>1</b>	<b>1</b>	<b>1.33</b>	<b>1</b>	<b>2.25</b>	<b>2.33</b>

## 2<sup>nd</sup> Semester

Course Code – BS-CH201	Chemistry-I	3L+1T+0P	4 Credits
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### Course Outcome (CO)

Course Outcome (CO)	<ol style="list-style-type: none"> <li>Students will be able to Analyze microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces and list major chemical reactions that are used in the synthesis of molecules</li> <li>Students will be able to Rationalize bulk properties and processes using thermodynamic considerations</li> <li>Students will be able to Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques</li> <li>Students will be able to Rationalize periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.</li> </ol>
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### Syllabus

Sl No.	Course Content	Total Hours
Module 1	<b>Atomic and molecular structure</b> Schrodinger equation. Particle in a box solutions and their applications for simple sample. Molecular orbitals of diatomic molecules (e.g.H <sub>2</sub> ). Energy level diagrams of diatomic. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.	10L
Module 2	<b>Spectroscopic techniques and applications</b> Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterisation techniques. Diffraction and scattering.	8L
Module 3	<b>Use of free energy in chemical equilibria</b> First and second laws of thermodynamics and thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion. Use of free energy considerations in metallurgy through Ellingham diagrams..	8L
Module 4	<b>Periodic properties</b>	4L





	Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries	
Module 5	<b>Stereochemistry</b> Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds	4L
Module 6	<b>Organic reactions and synthesis of a drug molecule</b> Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule	4L

## Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	Engineering Chemistry	Satyaprakash	Khanna Book Publishing
	2	University chemistry	B. H. Mahan	
	3	Chemistry: Principles and Applications	M. J. Sienko and R. A. Plane	
	4	Fundamentals of Molecular Spectroscopy	C. N. Banwell	
	5	Engineering Chemistry (NPTEL Web-book)	B. L. Tembe, Kamaluddin and M. S. Krishnan	and Young
	6	Spectroscopy of Organic Compounds	P.S.Kalsi	New Age International Pvt Ltd Publishers



## CO-PO Mapping

### CO-PO Mapping

#### Chemistry-I

(Course Code – BS-CH201)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3	2	3	2	1	2	1	1	2	2	2	1	2
CO2	3	3	3	2	3	3	-	1	1	-	-	3	2	2	3
CO3	3	3	3	3	2	2	2	1	2	3	3	1	1	2	2
CO4	3	3	3	3	1	3	1	-	1	-	1	1	2	1	2
Avg.	2.75	3	3	2.5	1.5	2.25	1.33	1.33	1.25	2.0	2.0	1.75	1.75	1.5	2.25

## BS-M202: Mathematics –IIB

Course Code – BS-M202	Mathematics –IIB	3T+1L+0P	4 Credits
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>Students will be able to Learn the methods for evaluating multiple integrals and their applications to different physical problems.</li> <li>Students will be able to Understand different techniques to solve first and second order ordinary differential equations with its formulation to address the modelling of systems and problems of engineering sciences.</li> <li>Students will be able to Learn different tools of differentiation and integration of functions of a complex variable that are used with various other techniques for solving engineering problems.</li> <li>Students will be able to Apply different types of transformations between two 2-dimensional planes for analysis of physical or engineering problems.</li> </ol>
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### Syllabus

Sl No.	Course Content	Total Hours
1	<p><b>Multivariate Calculus (Integration):</b></p> <p>Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, change of variables (Cartesian to Polar), Applications: Areas and volumes, Center of mass and Gravity (constant and variable densities); Triple integrals (Cartesian), Orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds; Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes.</p>	11
2	<p><b>First order ordinary differential equations:</b></p> <p>Exact, linear and Bernoulli's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.</p>	5
3	<p><b>Ordinary differential equations of higher orders:</b></p> <p>Second order linear differential equations with constant coefficients, Use of D- operators, Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.</p>	9
	<p><b>Complex Variable – Differentiation</b></p> <p>Differentiation of complex functions, Cauchy-Riemann equations,</p>	



4	Analytic functions, Harmonic functions, determination of harmonic conjugate, elementary analytic functions (exponential, trigonometric, logarithmic) and their properties; Conformal mappings, Mobius transformations and their properties.	6
5	<b>Complex Variable – Integration</b> Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy integral formula (without proof), Liouville’s theorem and Maximum-Modulus theorem (without proof); Taylor’s series, Zeros of analytic functions, Singularities, Laurent’s series; Residues, Cauchy residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour.	9

## Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	Engineering Mathematics-I	Reena Garg.	Khanna Publishers
	2	Advanced Engineering Mathematics	Erwin Kreyszig	John Wiley & Sons
	3	Advanced Engineering Mathematics	Michael Greenberg	Pearson.
	4	Mathematical Methods of Science and Engineering	Kanti B. Dutta	Cenage Learning
	5	Higher Engineering Mathematics	B.S. Grewal	Khanna Publishers

## CO-PO Mapping

### CO-PO Mapping

#### Mathematics –IIB

( Course Code – BS-M202)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	3	3	3	2	2	2	2	-	-	1	2	2	2	2	1
<b>CO2</b>	3	3	2	2	2	2	-	-	2	-	1	2	1	3	3
<b>CO3</b>	3	3	1	1	2	-	2	-	2	1	-	1	2	2	2
<b>CO4</b>	3	3	2	2	3	2	-	-	-	-	2	2	2	3	3
	<b>3</b>	<b>3</b>	<b>2</b>	<b>1.75</b>	<b>2.25</b>	<b>2</b>	<b>2</b>	<b>-</b>	<b>2</b>	<b>1</b>	<b>1.67</b>	<b>1.75</b>	<b>1.75</b>	<b>2.5</b>	<b>2.25</b>

## ES-CS201: Programming for Problem Solving

Course Code – ES-CS201	Programming for Problem Solving	3L+0T+0P	3 Credits
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>1. Students will be able to describe the meaning of system of numbers, logic gates and the basic anatomy of a Computer.</li> <li>2. Students will be able to understand the inherent meaning of the basic elements of C Programming Language like; constants, variables, operators, operator precedence etc., and identify the use of data types and C statements and classify the statements.</li> <li>3. Students will be able to organize the statements in appropriate order to prepare a complete program that solves a specific problem and analyze a program to point out the bugs that might be present in it and change it to achieve the goal.</li> <li>4. Students will be able to construct the final program and create the executable module for execution purpose.</li> </ol>
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### Syllabus

Sl No.	Course Content	Total Hours
Module 1	<p><b>Introduction to Programming</b></p> <p>Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.</p> <p>Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples.</p> <p>From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code</p>	4L
Module 2	Arithmetic expressions and precedence	2L
Module 3	<p><b>Conditional Branching and Loops</b></p> <p>Writing and evaluation of conditionals and consequent branching Iteration and loops</p>	6L
Module 4	<p>Arrays</p> <p>Arrays (1-D, 2-D), Character arrays and Strings</p>	3L
Module 5	Basic Algorithms Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)	6L



Module 6	<b>Function</b> Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference	5L
Module 7	<b>Recursion</b> Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.	4-5L
Module 8	<b>Structure</b> Structures, Defining structures and Array of Structures	4L
Module 9	<b>Pointers</b> Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)	2L
Module 10	File handling (only if time is available, otherwise should be done as part of the lab)	-

## Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	Computer Concepts and Programming in C	R. S. Salaria	Khanna Publishers
	2	Schaum's Outline of Programming with C	Byron Gottfried	McGraw-Hill
	3	Programming in ANSI C	E. Balaguruswamy	Tata McGraw-Hill
	4	The C Programming Language	Brian W. Kernighan and Dennis M. Ritchie	Prentice Hall of India



## CO-PO Mapping

CO-PO Mapping															
Programming for Problem Solving															
(Course Code – ES-CS201)															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	3	2	1	-	2	3	1	-	2	2	2	1	2
CO2	1	3	2	2	-	2	-	3	2	3	2	2	3	2	2
CO3	3	2	1	2	-	2	3	2	2	2	2	3	2	2	1
CO4	3	2	3	3	2	2	2	1	2	2	3	-	2	2	2
	2.33	2.33	2.25	2.25	1.5	2.00	2.33	2.25	2.33	2.33	2.25	2.33	2.25	1.75	1.75

## HM-HU201: English

Course Code – HM-HU201	English	2L+0T+0P	2 Credits
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## Course Outcome (CO)

Course Outcome (CO)	<ol style="list-style-type: none"> <li>1. Students will be able to Revise the basic grammar of English language.</li> <li>2. Students will be able to Learn appropriate use of English language to enhance knowledge on building vocabulary and framing sentences.</li> <li>3. Students will be able to Learn and incorporate sensible style in Technical writing.</li> <li>4. Students will be able to Acquire proficiency in English language for comprehensive excellence in reading, listening, writing and speaking.</li> </ol>
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## Syllabus

Sl No.	Course Content	Total Hours
Module 1	<p><b>Vocabulary Building</b></p> <p>The concept of Word Formation: Compounding, Backformation, Clipping, Blending.</p> <p>Root words from foreign languages and their use in English</p> <p>Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.</p> <p>Synonyms, antonyms, and standard abbreviations: Acronyms</p>	
Module 2	<p><b>Basic Writing Skills</b></p> <p>Sentence Structures &amp; Types: Simple, Compound, Complex</p> <p>Use of phrases and clauses in sentences: Transformation of sentences, active, passive, narration</p> <p>Importance of proper punctuation</p> <p>Creating coherence: Arranging paragraphs &amp; Sentences in logical order</p> <p>Creating Cohesion: Organizing principles of paragraphs in documents</p> <p>Techniques for writing precisely.</p>	
Module 3	<p><b>Identifying Common Errors in Writing</b></p> <p>Subject-verb agreement</p> <p>Noun-pronoun agreement</p> <p>3 Misplaced modifiers</p>	





	Articles Prepositions Redundancies Clichés	
Module 4	<b>Nature and Style of sensible Writing</b> Describing Defining Classifying Providing examples or evidence 5 Writing introduction and conclusion	
Module 5	<b>Writing Practices</b> Comprehension Précis Writing Essay Writing Business Letter, Cover Letter & CV; E-mail	

## Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	Effective Communication Skills	Kulbushan Kumar, R S Salaria	Khanna Publishing House
	2	Practical English Usage	Michael Swan	OUP.
	3	Remedial English Grammar	F.T. Wood	Macmillan
	4	On Writing Well	William Zinsser	Harper Resource Book
	5	Study Writing	Liz Hamp-Lyons and Ben Heasley	Cambridge University
	6	Communication Skills	Sanjay Kumar and Pushp Lata	Oxford University Press



## CO-PO Mapping

CO-PO Mapping English (Course Code – HM-HU201)															
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
<b>CO1</b>	-	2	-	-	-	-	-	-	1	3	-	2	1	2	2
<b>CO2</b>	-	2	-	1	-	1	-	-	2	3	-	2	3	1	2
<b>CO3</b>	-	2	-	1	-	1	1	2	1	3	-	2	2	1	2
<b>CO4</b>	-	2	-	1	-	1	1	1	2	3	1	2	3	3	2
<b>Avg.</b>	-	2	-	1	-	1	1	1.5	1.5	3	1	2	2.25	1.75	2

## BS-CH291: Chemistry-I Laboratory

Course Code – BS-CH291	Chemistry-I Laboratory	0L+0T+3P	1.5 Credits
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### Course Outcome (CO)

Course Outcome (CO)	<ol style="list-style-type: none"> <li>Students will be able to Analyze sample by apply instruments like viscometer, pH-meter, Conductometer, Potentiometer etc. to achieve high accuracy.</li> <li>Students will be able to Analyze inorganic salts by semi-micro techniques</li> <li>Students will be able to Analyze quantitative chemicals present in different samples</li> </ol>
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### Syllabus

Sl No.	Course Content	Total Hours
<b>Choose 10 experiments from the following</b>		
Experiments	<ol style="list-style-type: none"> <li>Conductometric titration for determination of the strength of a given HCl solution by titration against a standard NaOH solution.</li> <li>pH- metric titration for determination of strength of a given HCl solution against a standard NaOH solution.</li> <li>Determination of dissolved oxygen present in a given water sample.</li> <li>To determine chloride ion in a given water sample by Argentometric method (using chromate indicator solution)</li> <li>Determination of surface tension and viscosity</li> <li>Thin layer chromatography</li> <li>Ion exchange column for removal of hardness of water</li> <li>Determination of the rate constant of a reaction</li> <li>Determination of cell constant and conductance of solutions</li> <li>Potentiometry - determination of redox potentials and emfs</li> <li>Saponification/acid value of an oil</li> <li>Chemical analysis of a salt</li> <li>Determination of the partition coefficient of a substance between two immiscible liquids</li> <li>Adsorption of acetic acid by charcoal</li> <li>Use of the capillary viscosimeters to the demonstrate of the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg.</li> </ol>	

### Books

Books	Sl.	Book Name	Author	Publishing House
	1	Engineering Chemistry	Satyaprakash	Khanna Book Publishing
	2	University chemistry	B. H. Mahan	



	3	Chemistry: Principles and Applications	M. J. Sienko and R. A. Plane	
	4	Fundamentals of Molecular Spectroscopy	C. N. Banwell	
	5	Engineering Chemistry (NPTEL Web-book)	B. L. Tembe, Kamaluddin and M. S. Krishnan	and Young
	6	Spectroscopy of Organic Compounds	P.S.Kalsi	New Age International Pvt Ltd Publishers

## CO-PO Mapping

<b>CO-PO Mapping</b>															
<b>Chemistry-I Laboratory</b>															
<b>(Course Code – BS-CH291)</b>															
	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>
<b>CO1</b>	3	3	2	3	3	2	2	-	3	2	1	1	2	1	2
<b>CO2</b>	1	3	3	3	-	1	2	-	3	2	2	2	2	2	3
<b>CO3</b>	3	3	3	3	3	2	1	1	2	2	2	2	1	2	2
<b>Avg.</b>	<b>2.3</b>	<b>3</b>	<b>2.6</b>	<b>3</b>	<b>3</b>	<b>1.6</b>	<b>1.6</b>	<b>1</b>	<b>2.6</b>	<b>2</b>	<b>1.6</b>	<b>1.6</b>	<b>1.67</b>	<b>1.67</b>	<b>2.33</b>

## ES-CS291: Programming for Problem Solving

Course Code – ES-CS291	Programming for Problem Solving	0L+0T+4P	2 Credits
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### Course Outcome (CO)

Course Outcome (CO)	<ol style="list-style-type: none"> <li>Students will be able to define the specifications like input and output relating to a particular problem and describe the algorithm that solves the problem.</li> <li>Students will be able to construct each of the modules of a program by restating the steps of the algorithm using functions in the framework of C language.</li> <li>Students will be able to create the program by using the functions and execute the program.</li> <li>Students will be able to point out the bugs if any, and modify the program to solve the problem.</li> </ol>
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### Syllabus

Sl No.	Course Content	Total Hours
Experiment – 1	Tutorial 1: Problem solving using computers: Lab1: Familiarization with programming environment	2
Experiment – 2	Tutorial 2: Variable types and type conversions: Lab 2: Simple computational problems using arithmetic expressions	2
Experiment – 3	Tutorial 3: Branching and logical expressions: Lab 3: Problems involving if-then-else structures	2
Experiment – 4	Tutorial 4: Loops, while and for loops: Lab 4: Iterative problems e.g., sum of series .	2
Experiment – 5	Tutorial 5: 1D Arrays: searching, sorting: Lab 5: 1D Array manipulation .	2
Experiment – 6	Tutorial 6: 2D arrays and Strings Lab 6: Matrix problems, String operations	2
Experiment – 7	Tutorial 7: Functions, call by value: Lab 7: Simple functions	2
Experiment – 8 & 9	Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical integration): Lab 8 and 9: Programming for solving Numerical methods problems	2



Experiment – 10	Tutorial 10: Recursion, structure of recursive calls Lab 10: Recursive functions	2
Experiment – 11	Tutorial 11: Pointers, structures and dynamic memory allocation Lab 11: Pointers and structures	2
Experiment – 12	Tutorial 12: File handling: Lab 12: File operations	2

## Books

<b>Books</b>	Sl.	Book Name	Author	Publishing House
	1	Computer Concepts and Programming in C	R. S. Salaria	Khanna Publishers
	2	Schaum's Outline of Programming with C	Byron Gottfried	McGraw-Hill
	3	Programming in ANSI C	E. Balaguruswamy	Tata McGraw-Hill
	4	The C Programming Language	Brian W. Kernighan and Dennis M. Ritchie	Prentice Hall of India

## CO-PO Mapping

### CO-PO Mapping

#### Programming for Problem Solving

(Course Code – ES-CS291)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	3	3	2	2	2	3	-	-	-	-	2	2	2	1	2
<b>CO2</b>	2	2	-	2		2	2	2		1	2	2	3	2	2
<b>CO3</b>	2	2	2	3	1	3	2	3	1	1	3	2	2	2	1
<b>CO4</b>	1	1	-	1	1	2	-	1	1	1	1	2	2	2	2
<b>Avg.</b>	2	2	2	2	1.33	2.5	2	2	1	1	2	2	2.25	1.75	1.75



## ES-ME291: Engineering Graphics & Design

Course Code – ES-ME291	Engineering Graphics & Design	1L+0T+4P	3 Credits
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>1. Students will be able to Learn basics of drafting and use of drafting tools which develops the fundamental skills of industrial drawings.</li> <li>2. Students will be able to Know about engineering scales, dimensioning and various geometric curves necessary to understand design of machine elements.</li> <li>3. Students will be able to Understand projection of line, surface and solids to create the knowledge base of orthographic and isometric view of structures and machine parts.</li> <li>4. Students will be able to Become familiar with computer aided drafting useful to share the design model to different section of industries as well as for research &amp; development.</li> </ol>
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### Syllabus

SI No.	Course Content	Total Hours
Module 1:	<b>INTRODUCTION TO ENGINEERING DRAWING</b> Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Different types of lines and their use; Drawing standards and codes.	1L+4P
Module 2:	<b>LETTERING, DIMENSIONING, SCALES</b> Plain scale, Diagonal scale and Vernier Scales.	1L+4P
Module 3:	<b>GEOMETRICAL CONSTRUCTION AND CURVES</b> Construction of polygons, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid, Involute, Archimedean Spiral.	1L+4P
Module 4:	<b>PROJECTION OF POINTS, LINES, SURFACES</b> Principles of Orthographic Projections-Conventions - 1st and 3rd angle projection, Projections of Points and lines inclined to both planes; Projections of planes (Rectangle, pentagon, Hexagon etc.) inclined Planes - Auxiliary Planes.	1L+4P
Module 5:	<b>PROJECTION OF REGULAR SOLIDS</b> Regular solids inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale (Cube, Pyramid, Prism, Cylinder, Cone).	1L+4P



Module 6:	<p><b>COMBINATION OF REGULAR SOLIDS, FLOOR PLANS</b></p> <p>Regular solids in mutual contact with each other like Spheres in contact with cones standing on their base. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.</p>	1L+4P
Module 7:	<p><b>ISOMETRIC PROJECTIONS</b></p> <p>Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;</p>	1L+4P
Module 8	<p><b>SECTIONS AND SECTIONAL VIEWS OF RIGHT ANGULAR SOLIDS</b></p> <p>Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone;</p> <p>Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)</p>	1L+4P
Module 9	<p><b>OVERVIEW OF COMPUTER GRAPHICS, CUSTOMISATION &amp; CAD DRAWING</b></p> <p>Listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids]; Set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;</p>	1L+4P
Module 10	<p><b>ANNOTATIONS, LAYERING &amp; OTHER FUNCTIONS</b></p> <p>applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer- aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multiview, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling;</p>	2L+8P
Module 11	<p><b>DEMONSTRATION OF A SIMPLE TEAM DESIGN PROJECT</b></p> <p>Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerance; Use of solid-</p>	2L+8P





	modeling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying color coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modelling (BIM).	
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## Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	Engineering Graphics & Design	Pradeep Jain, Ankita Maheswari, A.P. Gautam	Khanna Publishing House
	2	Engineering Drawing	Bhatt N.D., Panchal V.M. & Ingle P.R	Charotar Publishing House
	3	Engineering Graphics	Agrawal B. & Agrawal C. M	Pearson Education
	4	Text book on Engineering Drawing	Narayana, K.L. & P Kannaiah	Scitech Publishers

## CO-PO Mapping

### CO-PO Mapping

#### Engineering Graphics & Design

(Course Code - ES-ME291)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	2	-	1	2	1	1	1	-	1	-	-	1	2	3	-
<b>CO2</b>	3	-	2	2	-	1	-	-	1	1	1	1	-	2	-
<b>CO3</b>	2	2	2	1	-	1	1	1	1	-	-	1	2	3	1
<b>CO4</b>	1	-	2	2	2	1	-	-	1	1	1	1	1	2	3
<b>Avg.</b>	<b>2</b>	<b>2</b>	<b>1.75</b>	<b>1.75</b>	<b>1.5</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1.25</b>	<b>2.5</b>	<b>2</b>

## HM-HU291: Language Laboratory

Course Code – HM-HU291	Language Laboratory	0L+0T+2P	1 Credits
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### Course Outcome (CO)

Course Outcome (CO)	<ol style="list-style-type: none"> <li>Students will be able to Get introduced to professional application of English Language with emphasis on listening and speaking skills through language lab aids.</li> <li>Students will be able to Practice sessions on pronunciation, intonation, voice modulation, stress, pitch and accent and developing communicative skills with special focus on Group Discussion.</li> <li>Students will be able to Master effective reading and writing style through Language Lab aids.</li> <li>Students will be able to Ensure proficiency in reading, listening comprehension, technical writing and in speaking.</li> </ol>
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### Syllabus

SI No.	Course Content	Total Hours
Experiment 1:	Honing 'Listening Skill' and its sub skills through Language Lab Audio device;	3P
Experiment 2:	Honing 'Speaking Skill' and its sub skills	2P
Experiment 3:	Helping them master Linguistic/Paralinguistic features (Pronunciation/Phonetics/	2P
Experiment 4:	Voice modulation/ Stress/ Intonation/ Pitch & Accent) of connected speech	2P
Experiment 5:	Honing 'Conversation Skill' using Language Lab Audio –Visual input; Conversational Practice Sessions (Face to Face / via Telephone, Mobile phone & Role Play Mode)	2P
Experiment 6:	G D Practice Sessions for helping them internalize basic Principles (turn- taking, creative intervention, by using correct body language, courtesies & other soft skills) of GD	4P
Experiment 7:	Honing 'Reading Skills' and its sub skills using Visual / Graphics/ Diagrams /Chart Display/Technical/ Non-Technical Passages	2P
Experiment 8	Honing 'Writing Skill' and its sub skills by using	2P



	Language Lab Audio –Visual input; Practice Sessions	
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## Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	Effective Communication Skills	Kulbushan Kumar, R S Salaria	Khanna Publishing House
	2	Practical English Usage	Michael Swan	OUP.
	3	Remedial English Grammar	F.T. Wood	Macmillan
	4	On Writing Well	William Zinsser	Harper Resource Book
	5	Study Writing	Liz Hamp-Lyons and Ben Heasley	Cambridge University
	6	Communication Skills	Sanjay Kumar and PushpLata	Oxford University Press

## CO-PO Mapping

### CO-PO Mapping

#### Language Laboratory

(Course Code - HM-HU291)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
<b>CO1</b>	-	-	-	-	1	-	-	-	2	3	-	2	1	2	2
<b>CO2</b>	-	2	-	1	-	1	-	1	3	3	-	2	3	1	2
<b>CO3</b>	-	2	-	1	1	1	1	1	2	3	-	2	2	1	2
<b>CO4</b>	-	2	-	1	1	1	1	1	3	3	-	2	3	3	2
<b>Avg.</b>	-	2	-	1	1	1	1	1	2.5	3	-	2	2.25	1.75	2

## 3<sup>rd</sup> Semester

### CE(BS)301: Biology for Engineers

Course Code – CE(BS)301	Biology for Engineers	2L+1T+0P	3 Credits
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>Students will be able to Describe how biological observations of 18th Century that lead to major discoveries. Convey that classification per se is not what biology is all about but highlight the underlying criteria, such as morphological, biochemical and ecological</li> <li>Students will be able to Highlight the concepts of recessiveness and dominance during the passage of genetic material from parent to offspring</li> <li>Students will be able to Convey that all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine. Classify enzymes and distinguish between different mechanisms of enzyme action.</li> <li>Students will be able to Identify DNA as a genetic material in the molecular basis of information transfer. Analyse biological processes at the reductionistic level. Apply thermodynamic principles to biological systems.</li> <li>Students will be able to Identify and classify microorganisms.</li> </ol>
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### Syllabus

Sl No.	Course Content	Total Hours
Module 1	<p><b>Introduction</b></p> <p>Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology? Discuss how biological observations of 18th Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. These examples will highlight the fundamental importance of observations in any scientific inquiry.</p> <p>Purpose: To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry</p>	2L
Module 2	<p><b>Classification</b></p> <p>Hierarchy of life forms at phenomenological level. A common thread weaves this hierarchy Classification. Discuss classification based on (a) cellularity- Unicellular or multicellular (b) ultrastructure- prokaryotes or eucaryotes. (c) energy and Carbon utilization -Autotrophs,</p>	3L



	<p>heterotrophs, lithotropes (d) Ammonia excretion</p> <p>– aminotelic, uricotelic, ureotelic (e) Habitataaquatic or terrestrial (e)</p> <p>Molecular taxonomy- three major kingdoms of life. A given organism can come under different category based on classification. Model organisms for the study of biology come from different groups. E.coli, S.cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M. musculus</p> <p>Purpose: To convey that classification per se is not what biology is all about. The underlying criterion, such as morphological, biochemical or ecological be highlighted.</p>	
Module 3	<p><b>Genetics</b></p> <p>Mendel’s laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Emphasis to be give not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring. Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes. Discuss about the single gene disorders in humans. Discuss the concept of complementation</p> <p>using human genetics.</p> <p>Purpose: To convey that “Genetics is to biology what Newton’s laws are to Physical Sciences”</p>	4L
Module 4	<p><b>Biomolecules</b></p> <p>Molecules of life. In this context discuss monomeric units and polymeric structures. Discuss about sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA. Two carbon units and lipids.</p> <p>Purpose: To convey that all forms of life has the same building blocks and yet the manifestations are as diverse as one can imagine</p>	4L
Module 5	<p><b>Enzymes</b></p> <p>Enzymology: How to monitor enzyme catalyzed reactions. How does an enzyme catalyzereactions. Enzyme classification. Mechanism of enzyme action. Discuss at least two examples. Enzyme kinetics and kinetic parameters. Why should we know these parameters to understand biology? RNA</p> <p>catalysis.</p> <p>Purpose: To convey that without catalysis life would not have existed on earth</p>	4L
Module 6	<p><b>Information Transfer</b></p> <p>Molecular basis of information transfer. DNA as a genetic material.</p>	4L



	<p>Hierarchy of DNA structure from single stranded to double helix to nucleosomes. Concept of genetic code. Universality and degeneracy of genetic code. Define gene in terms of complementation and recombination.\</p> <p>Purpose: The molecular basis of coding and decoding genetic information is universal</p>	
Module 7	<p><b>Macromolecular analysis</b></p> <p>Proteins- structure and function. Hierarch in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements.</p> <p>Purpose: How to analyses biological processes at the reductionistic level</p>	5L
Module 8	<p><b>Metabolism</b></p> <p>Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergoinc reactions. Concept of Keq and its relation to standard free energy. Spontaneity. ATP as an energy currency. This should include the breakdown of glucose to CO<sub>2</sub> + H<sub>2</sub>O (Glycolysis and Krebs cycle) and synthesis of glucose from CO<sub>2</sub> and H<sub>2</sub>O (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy charge</p> <p>Purpose: The fundamental principles of energy transactions are the same in physical and biological world.</p>	4L
Module 9	<p><b>Microbiology</b></p> <p>Concept of single celled organisms. Concept of species and strains. Identification and classification of microorganisms. Microscopy. Ecological aspects of single celled organisms. Sterilization and media compositions. Growth kinetics.</p>	3L

## Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	Biology: A global approach	Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.;	Pearson Education Ltd
	2	Outlines of Biochemistry	Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H	John Wiley and Sons
	3	Principles of Biochemistry (V Edition)	Nelson, D. L.; and Cox, M. M.W.H	Freeman and Company
	4	Molecular Genetics (Second edition)	Stent, G. S.; and Calender, R. W.H	Freeman and company



	5	Microbiology	Prescott, L.M J.P. Harley and C.A. Klein	
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## CO-PO Mapping

### CO-PO Mapping

#### Biology for Engineers

(Course Code – CE(BS)301)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	1	2	1	2	-	2	-	-	1	-	-	2	2	3	2
<b>CO2</b>	2	2	2	2	-	3	-	-	1	-	-	3	2	1	2
<b>CO3</b>	1	3	1	3	-	2	-	-	2	-	-	2	2	2	2
<b>CO4</b>	2	2	1	3	-	3	-	-	1	-	-	3	1	2	1
<b>CO5</b>	1	2	2	2	-	2	-	-	2	-	-	2	-	2	3
<b>Avg.</b>	<b>1.60</b>	<b>2.2</b>	<b>1.4</b>	<b>2.4</b>	<b>-</b>	<b>2.25</b>	<b>-</b>	<b>-</b>	<b>1.4</b>	<b>-</b>	<b>-</b>	<b>1.4</b>	<b>1.75</b>	<b>2</b>	<b>2</b>

## CE(ES)301: Engineering Mechanics

Course Code – CE(ES)301	Engineering Mechanics	3L+1T+0P	4 credits
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## Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>1. The students will be able to draw free body diagrams and determine the resultant of forces and/or moments.</li> <li>2. The students will be able to determine the centroid and second moment of area of sections.</li> <li>3. The students will be able to apply laws of mechanics to determine efficiency of simple machines with consideration of friction.</li> <li>4. The students will be able to analyze statically determinate planar frames.</li> <li>5. The students will be able to analyze the motion and calculate trajectory characteristics.</li> </ol>
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## Syllabus

SI No.	Course Content	Total Hours
<b>Module 1</b>	<b>Introduction to Engineering Mechanics</b> Force Systems Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminacy	6L
<b>Module 2</b>	<b>Friction</b> Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack;	3L
<b>Module 3</b>	<b>Basic Structural Analysis</b> Equilibrium in three dimensions; Method of Sections; Method of Joints; How to determine if a member is in tension or compression; Simple Trusses; Zero force members; Beams & types of beams; Frames & Machines;	4L
<b>Module 4</b>	<b>Centroid and Centre of Gravity</b> Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Hook.	5L
<b>Module 5</b>	<b>Virtual Work and Energy Method-</b> Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom. Active force diagram, systems with friction, mechanical efficiency.	4L





	Conservative forces and potential energy (elastic and gravitational), energy equation for equilibrium. Applications of energy method for equilibrium. Stability of equilibrium.	
<b>Module 6</b>	<b>Review of particle dynamics-</b> Rectilinear motion; Plane curvilinear motion (rectangular, path, and polar coordinates). 3-D curvilinear motion; Relative and constrained motion; Newton's 2 <sup>nd</sup> law (rectangular, path, and polar coordinates). Work-kinetic energy, power, potential energy. Impulse-momentum (linear, angular); Impact (Direct and oblique).	4L
<b>Module 7</b>	<b>Introduction to Kinetics of Rigid Bodies</b> Basic terms, general principles in dynamics; Types of motion, Instantaneous centre of rotation in plane motion and simple problems; D'Alembert's principle and its applications in plane motion and connected bodies; Work energy principle and its application in plane motion of connected bodies; Kinetics of rigid body rotation;	5L
<b>Module 8</b>	<b>Mechanical Vibrations</b> Basic terminology, free and forced vibrations, resonance and its effects; Degree of freedom; Derivation for frequency and amplitude of free vibrations without damping and single degree of freedom system, simple problems, types of pendulum, use of simple, compound and torsion pendulums;	5L
<b>Tutorials</b>	From the above modules covering, To find the various forces and angles including resultants in various parts of wall crane, roof truss, pipes, etc.; To verify the line of polygon on various forces; To find coefficient of friction between various materials on inclined plan; Free body diagrams various systems including block-pulley; To verify the principle of moment in the disc apparatus; Helical block; To draw a load efficiency curve for a screw jack	6L

## Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	Engineering Mechanics: Principles of Statics and Dynamics	R.C. Hibbler	Pearson Press
	2	Engineering Mechanics	I.H. Shames	Prentice Hall
	3	A Text Book of Engineering Mechanics	R.K. Bansal	Laxmi Publications
	4	Engineering Mechanics	R.S. Khurmi	S.Chand and Co.



## CO-PO Mapping

### CO-PO Mapping

#### Engineering Mechanics

(Course Code – CE(ES)301)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	2	1	-	2	-	1	1	-	-	1	-	3	2	1	2
<b>CO2</b>	3	3	2	3	-	2	3	1	1	-	1	3	3	3	2
<b>CO3</b>	2	1	-	-	2	-	1	-	1	1	-	3	1	1	3
<b>CO4</b>	3	2	3	2	3	1	3	2	2	2	2	3	3	2	3
<b>CO5</b>	2	1	2	1	3	2	3	3	3	3	3	3	3	2	3
	<b>2.4</b>	<b>1.6</b>	<b>2.33</b>	<b>2</b>	<b>2.67</b>	<b>1.5</b>	<b>2.2</b>	<b>2</b>	<b>1.75</b>	<b>1.75</b>	<b>2</b>	<b>3</b>	<b>2.4</b>	<b>1.8</b>	<b>2.6</b>



## CE(ES)302: Energy Science & Engineering

Course Code – CE(ES)302	Energy Science & Engineering	1L+1T+0P	2 Credits
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>1. Students will be able to analyse Comprehension of the sources, utilization technologies, storage and distribution modes of energy that presently power cities, buildings, transportation.</li> <li>2. Students will be able to How alternative energy sources and technologies may disrupt conventional energy utilization behaviors.</li> <li>3. Students will be able to Use knowledge of scientific and technological challenges posed by distributed electricity/power generation with computer simulation to understand energy distribution networks.</li> <li>4. Students will be able to Describe how essential and consumer technologies rely on critical raw materials and have knowledge of the global impact of their extraction, refining, substitution and recovery.</li> </ol>
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### Syllabus

Sl No.	Course Content	Total Hours
Module1	<p>Introduction to Energy Science            Scientific principles and historical interpretation to place energy use in the context of pressing societal, environmental and climate issues;            Introduction to energy systems and resources; Introduction to Energy, sustainability &amp; the environment.</p> <p>Tutorials: Compile a World map showing Energy Reserves by source, Total Energy consumption, Per capita energy consumption and Carbon Footprint</p>	3L
Module2	<p>Energy Sources            Overview of energy systems, sources ,transformations, efficiency, and storage. Fossil fuels(coal, oil, oil-bearing shale and sands, coal gasification) - past, present &amp; future, Remedies &amp;alternativesforfossilfuels-biomass,wind,solar,nuclear,wave,tidalandhydrogen; Sustainability and environmental trade-offs of different energy systems; possibilities for energy storageorregeneration(Ex.Pumpedstoragehydropowerprojects,superconductor-basedenergy storages, high efficiency batteries)</p> <p>Tutorials: Compile a Word Map showing Alternative Energy source usage; Compile a Process diagram for a Pumped Storage project; Collect details of a typical North Sea oil platform.            Compile a map of India showing exiting potential and utilized potential for hydro power. List the pros and consfor Thermal hydro,nuclear and solar power projects.</p>	4L



<b>Module3</b>	<p>Energy &amp; Environment Energy efficiency and conservation; introduction to clean energy technologies and its importance in sustainable development; Carbon footprint, energy consumption and sustainability; introduction to the economics of energy; How the economic system determines production and consumption; linkages between economic and environmental outcomes; How future energy use can be influenced by economic, environmental, trade, and research policy</p> <p>Tutorials: Study the functioning of an Electro Static Precipitator in a thermal power plant; study the uses of coarse and fine FlyAsh from thermal powerplants. Compile the safety provisions In design and construction of arc reactor containment building</p>	5L
<b>Module4</b>	<p>Civil Engineering Projects connected with the Energy Sources Coal mining technologies, Oil exploration offshore platforms, Underground and under-sea oil pipelines, solar chimney project, wave energy caissons, coastal installations for tidal power, wind mill towers; hydropower stations above-ground and underground along with associated dams, tunnels, penstocks, etc.; Nuclear reactor containment buildings and associated buildings, design and construction constraint and testing procedures for reactor containment buildings; Spent Nuclear fuel storage and disposal systems</p> <p>Tutorials: Compile a process diagram for a typical underground hydro power project; Collect Details of a model solar chimney project; collect details of a wave energy project at Vizhinjam; Collect details of the Kalpasar (Tidal energy) project</p>	10L
<b>Module5</b>	<p>Engineering for Energy conservation Concept of Green Building and Green Architecture; Green building concepts (Green building encompasses everything from the choice of building materials to where a building is located, how it is designed and operated); LEED ratings; Identification of energy related enterprises that represent the breath of the industry and prioritizing these candidates; Embodied energy analysis and use as a tool for measuring sustainability. Energy Audit of Facilities and optimization of energy consumption.</p> <p>Tutorials: Draw a typical geometrical orientation of a house in your area to avoid sun's radiation in the bedroom in the evening; Identify typical examples of Indian building shading Various LEED ratings; List various building materials with their embodied energy content. Do an Energy Audit of your Departmental Building in the college</p>	8L

## Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	Energy Technology	O.P, Gupta	Khanna Book Publishing, (2019)
	2	Renewable Energy (2nd edition)	Boyle, Godfrey (2004)	Oxford University Press
	3	Energy Engineering & Management	Chakrabarti	PHI



## CO-PO Mapping

### CO-PO Mapping

#### Energy Science & Engineering

(Course Code –CE(ES)302)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	3	1	1	1	2	3	3	1	1	1	2	3	2	1	2
<b>CO2</b>	3	1	1	2	3	3	3	1	2	1	2	3	3	3	1
<b>CO3</b>	2	1	1	1	3	3	3	1	1	1	1	3	1	1	1
<b>CO4</b>	3	1	2	1	3	3	3	2	1	2	2	3	3	2	3
<b>Avg.</b>	<b>2.75</b>	<b>1</b>	<b>1.25</b>	<b>1.25</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>1.25</b>	<b>1.25</b>	<b>1.25</b>	<b>1.75</b>	<b>3</b>	<b>2.25</b>	<b>1.75</b>	<b>1.75</b>

## CE(BS)301: Mathematics-III (Transform & Discrete Mathematics)

Course Code – CE(BS)301	Mathematics-III (Transform & Discrete Mathematics)	2L+0T+0P	2 Credits
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>1. Students will be able to Apply different types of transformations between two 2-dimensional planes for analysis of physical or engineering problems.</li> <li>2. Students will be able to Understand sets, relations, functions and discrete structures</li> <li>3. Students will be able to Create the ability to determine if a logical argument is valid or invalid in reality with the help of Propositional Calculus.</li> <li>4. Students will be able to Understand the theoretical workings of mathematical approaches like counting technique and solution of recurrence relation.</li> <li>5. Students will be able to Apply the knowledge of graphs and algorithms in solving real life problems appropriate to the discipline.</li> </ol>
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### Syllabus

Sl No.	Course Content	Total Hours
Module 1	<b>Transform Calculus -1</b> Polynomials – Orthogonal Polynomials – Lagrange’s, Chebysev Polynomials; Trigonometric Polynomials; Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions. Finding inverse Laplace transform by different methods, convolution theorem. Evaluation of integrals by Laplace transform, solving ODEs and PDEs by Laplace Transform method.	6 L
Module 2	<b>Transform Calculus-2</b> Fourier transforms, Z-transform and Wavelet transforms: properties, methods, inverses and their applications.	6 L
Module 3	Sets, relations and functions Basic operations on sets, Cartesian products, disjoint union (sum), and power sets. Different types of relations, their compositions and inverses. Different types of functions, their compositions and inverses.	4 L
Module 4	<b>Propositional Logic</b> Syntax and semantics, proof systems, satisfiability, validity, soundness, completeness, deduction theorem, etc. Decision problems of propositional logic. Introduction to first order logic and first order	4 L



	theory.	
Module 5	<b>Partially ordered sets</b> Complete partial ordering, chain, lattice, complete, distributive, modular and complemented lattices. Boolean and pseudo Boolean lattices.	4 L
Module 6	<b>Algebraic Structures</b> Algebraic structures with one binary operation – semigroup, monoid and group. Cosets, Lagrange's theorem, normal subgroup, homomorphic subgroup. Congruence relation and quotient structures. Error correcting code. Algebraic structures with two binary operations- ring, integral domain, and field. Boolean algebra and boolean ring (Definitions and simple examples only).	4 L
Module 7	<b>Introduction to Counting</b> Basic counting techniques – inclusion and exclusion, pigeon-hole principle, permutation, combination, summations. Introduction to recurrence relation and generating functions.	3 L
Module 8	<b>Introduction to Graphs</b> Graphs and their basic properties – degree, path, cycle, subgraph, isomorphism, Eulerian and Hamiltonian walk, trees.	3 L

## Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	Elements of Discrete Mathematics, 2nd Ed	C. L. Liu	Tata McGraw-Hill
	2	Discrete Mathematics: Proof Techniques and Mathematical Structures	R. C. Penner	World Scientific
	3	Concrete Mathematics, 2nd Ed	K. H. Rosen	Addison- Wesley,
	4	Discrete Structures, Logic, and Computability, 3rd Ed	J. L. Hein	Jones and Bartlett
	5	Schaum's Outline of Theory and Problems of Discrete Mathematics,	S. Lipschutz and M. L. Lipson	Tata McGraw-Hill
	6	Discrete Mathematics with Applications to Computer Science	J. P. Tremblay and R. P. Manohar	Tata McGraw-Hill
	7	Advanced Engineering Mathematics, 9th Edition	Erwin Kreyszig	John Wiley & Sons
	8	A text book of Engineering Mathematics	N.P. Bali and Manish Goyal	Laxmi Publications



## CO-PO Mapping

### CO-PO Mapping

#### Mathematics-III (Transform & Discrete Mathematics)

(Course Code – CE(BS)301)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	3	3	3	2	2	2	1	-	2	-	2	2	2	2	3
<b>CO2</b>	3	3	2	1	2	2	2	-	1	-	-	1	2	3	2
<b>CO3</b>	3	3	2	2	2	2	2	-	2	-	2	2	1	2	3
<b>CO4</b>	3	3	2	2	3	2	2	-	-	-	1	2	3	2	2
<b>CO5</b>	3	3	3	2	1	1	-	-	-	-	2	1	2	2	1
<b>Avg.</b>	<b>3</b>	<b>3</b>	<b>2.4</b>	<b>1.8</b>	<b>2</b>	<b>1.8</b>	<b>1.75</b>		<b>1.67</b>		<b>1.75</b>	<b>1.6</b>	<b>2</b>	<b>2.2</b>	<b>2.2</b>



## CE(HS)301: Humanities-I (Effective Technical Communication)

Course Code – CE(HS)301	Humanities-I (Effective Technical Communication)	3T+0L+0P	3 Credits
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### Course Outcome (CO)

Course Outcome (CO)	<ol style="list-style-type: none"> <li>Students will be able to learn information developing and designing through various technical documents.</li> <li>Students will be able to learn appropriate use of English language to enhance knowledge on building vocabulary and framing sentences.</li> <li>Students will be able to learn and incorporating sensible style in Technical writing.</li> <li>Students will be able to acquire proficiency in English language for comprehensive excellence in reading, listening, writing and speaking.</li> </ol>
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### Syllabus

SI No.	Course Content	Total Hours
Module 1	Information Design and Development- Different kinds of technical documents, Information development life cycle, Organization structures, factors affecting information and document design, Strategies for organization, Information design and writing for print and for online media.	4L
Module 2	Technical Writing, Grammar and Editing- Technical writing process, forms of discourse, Writing drafts and revising, Collaborative writing, creating indexes, technical writing style and language. Basics of grammar, study of advanced grammar, editing strategies to achieve appropriate technical style. Introduction to advanced technical communication, Usability, Human factors, Managing technical communication projects, time estimation, Single sourcing, Localization.	8L
Module 3	Self-Development and Assessment- Self assessment, Awareness, Perception and Attitudes, Values and belief, Personal goal setting, career planning, Self-esteem. Managing Time; Personal memory, Rapid reading, Taking notes; Complex problem solving; Creativity	8L
Module 4	Communication and Technical Writing- Public speaking, Group discussion, Oral; presentation, Interviews, Graphic presentation,	8L



	Presentation aids, Personality Development. Writing reports, project proposals, brochures, newsletters, technical articles, manuals, official notes, business letters, memos, progress reports, minutes of meetings, event report.	
Module 5	Ethics- Business ethics, Etiquettes in social and office settings, Email etiquettes, Telephone Etiquettes, Engineering ethics, Managing time, Role and responsibility of engineer, Work-culture in jobs, Personal memory, Rapid reading, Taking notes, Complex problem solving, Creativity.	8L

## Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	Guide to writing as an Engineer	David F. Beer and David McMurrey	John Willey
	2	Pocket Style Manual	Diane Hacker	Bedford Publication
	3	Effective Communication Skills	Kulbhushan Kumar	Khanna Publishing House
	4	You Can Win	Shiv Khera	Macmillan Books
	5	Technical Communications	Raman Sharma	Oxford Publication
	6	Applied Writing for Technicians	Dale Jungk	McGraw Hill

## CO-PO Mapping

### CO-PO Mapping

#### Humanities-I (Effective Technical Communication)

(Course Code - CE(HS)301)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	-	-	2	2	1	1	-	1	2	-	2	3	2	2	1
<b>CO2</b>	-	-	2	3	1	1	-	2	2	-	1	3	1	3	1
<b>CO3</b>	-	-	2	3	1	-	-	2	2	-	2	3	2	1	2
<b>CO4</b>	-	-	3	3	1	-	-	2	2	-	-	3	1	2	2
<b>Avg.</b>	-	-	<b>2.25</b>	<b>2.75</b>	<b>1</b>	<b>1</b>		<b>1.75</b>	<b>2</b>	-	<b>1.67</b>	<b>3</b>	<b>1.5</b>	<b>2</b>	<b>1.5</b>

## CE(HS)302: Introduction to Civil Engineering

Course Code – CE(HS)302	Introduction to Civil Engineering	1L + 1T+0P	2 Credits
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### Course Outcome (CO)

Course Outcome (CO)	<ol style="list-style-type: none"> <li>1. Students will able to understand the knowledge of construction equipment's practices and techniques to be used in the field.</li> <li>2. Students will able to apply theoretical and practical aspects of project management techniques to achieve project goals.</li> <li>3. Students will able to develop basic skills and knowledge regarding various software related to design and drawing of civil engineering works</li> </ol>
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### Syllabus

Sl No.	Course Content	Total Hours
Module 1	<p><b>Basic Understanding:</b> What is Civil Engineering/ Infrastructure? Basics of Engineering and Civil Engineering; Broad disciplines of Civil Engineering; Importance of Civil Engineering, Possible scopes for a career</p> <p><b>Tutorials</b> Develop a matrix of various disciplines and possible roles for engineers in each</p>	1L
Module 2	<p><b>History of Civil engineering:</b> Early constructions and developments over time; Ancient monuments &amp; Modern marvels; Development of various materials of construction and methods of construction; Works of Eminent civil engineers</p> <p><b>Tutorials</b> Identify 10 ancient monuments and ten modern marvels and list the uniqueness of each</p>	1L
Module 3	<p><b>Overview of National Planning for Construction and Infrastructure Development;</b> Position of construction industry vis-à-vis other industries, five-year plan outlays for construction; current budgets for infrastructure works</p> <p><b>Tutorials</b> Develop a Strategic Plan for Civil Engineering works for next ten years based on past investments and identify one typical on-going mega project in each area</p>	1L
Module 4	<p><b>Fundamentals of Architecture &amp; Town Planning:</b> Aesthetics in Civil Engineering, Examples of great architecture, fundamentals of architectural design &amp; town planning; Building Systems (HVAC, Acoustics, Lighting, etc.); LEED ratings; Development of Smart cities</p> <p><b>Tutorials</b> Identify ten best civil engineering projects with high aesthetic appeal with one possible factor for each ;List down the possible systems required for a typical Smart City</p>	1L
Module 5	<p><b>Fundamentals of Building Materials:</b> Stones, bricks, mortars, Plain, Reinforced &amp; Pre-stressed Concrete, Construction Chemicals; Structural Steel, High Tensile Steel, Carbon Composites; Plastics in Construction; 3D printing; Recycling of Construction &amp; Demolition wastes</p> <p><b>Tutorials</b> Identify three top new materials and their potential in construction; Visit a Concrete Lab and make a report</p>	2L
Module 6	<p><b>Basics of Construction Management &amp; Contracts Management:</b> Temporary Structures in Construction; Construction Methods for various types of Structures; Major Construction equipment; Automation &amp; Robotics in Construction; Modern Project management Systems; Advent of Lean Construction; Importance of Contracts Management</p> <p><b>Tutorials</b> Identify 5 typical construction methods and list their advantages/positive features</p>	2L



<b>Module7</b>	<p><b>Environmental Engineering &amp; Sustainability:</b> Water treatment systems; Effluent treatment t systems; Solid waste management; Sustainability in Construction</p> <p><b>Tutorials</b> Sustainability principles, Sustainable built environment, water treatment systems, and good practices of wastewater management. Examples of Solid and hazardous waste management, Air Pollution and control</p>	2L
<b>Module8</b>	<p><b>Geotechnical Engineering:</b> Basics of soil mechanics, rock mechanics and geology; various types of foundations; basics of rock mechanic s&amp; tunneling</p> <p><b>Tutorials</b> ListtopfivetunnelprojectsinIndiaandtheirfeatures;collectandstudygeotechnicalinvestigationreportof anyoneMetroRail(underground)project;Visitaconstructionsiteandmakeasite visit report</p>	2L
<b>Module9</b>	<p><b>Hydraulics, Hydrology &amp; Water Resources Engineering:</b> Fundamentals of fluid flow, basics of water supply systems; Underground Structures; Underground Structures Multi-purpose reservoir projects</p> <p><b>Tutorials</b> Identifythreeriverinterlinkingprojectsandtheirfeatures;visitaHydraulicsLabandmakeareport</p>	1L
<b>Module10</b>	<p><b>Ocean Engineering:</b> Basics of Wave and Current Systems; Sediment transport systems; Ports&amp; Harbors and other marine structures</p> <p><b>Tutorials</b> Identify5typicalportsinIndiaandlistthestructuresavailableinthem;Visitarelated/similarfacility, ifpossible in nearby place and make a report</p>	1L
<b>Module11</b>	<p><b>Power Plant Structures:</b> Chimneys, Natural &amp; Induced Draught Colling towers, coal handling systems, ash handling systems; nuclear containment structures; hydropower projects</p> <p><b>Tutorials</b> Collect the typical layout for a large thermal power plant and a large hydro power plant and identify all the structures and systems falling in them.</p>	1L
<b>Module12</b>	<p><b>Structural Engineering:</b> Types of buildings; tall structures; various types of bridges; Water retaining structures; Other structural systems; Experimental Stress Analysis; Wind tunnel studies;</p> <p><b>Tutorials</b> Identify5unique features for typical buildings, bridges ,tall-structures and large span structures; Visit Structures Testing Lab/facility and make a report</p>	3L
<b>Module13</b>	<p><b>Surveying &amp; Geomatics:</b> Traditional surveying techniques, Total Stations, Development of Digital Terrain Models; GPS, LIDAR;</p> <p><b>Tutorials</b> Collect visual representations prepared by a Total Station and LIDAR and compare; Study typical Google street map and Google Earth Map and study how each can facilitate the other</p>	1L
<b>Module14</b>	<p><b>Traffic &amp; Transportation Engineering:</b> Investments in transport t infrastructure development in India for different modes of transport; Developments and challenges in integrated transport development in India: road, rail, port and harbour and airport sector; PPP in transport sector; Intelligent Transport Systems; Urban Public and Freight Transportation; Road Safety under heterogeneous traffic; Sustainable and resilient pavement materials, design, construction and management; Case studies and examples.</p> <p><b>Tutorials</b> Investments in transport infrastructure; Developments and challenges; Intelligent Transport Systems; Smart Cities, Urban Transport;Road Safety; Sustainable and resilient highway esign principles; Plan a sustainable transport system for acity; Identify key features/ components in the planning and design of a green field highway/airport/port/railway and the cost–economics.</p>	1L
<b>Module15</b>	<p><b>Repairs &amp; Rehabilitation of Structures:</b> Basics of corrosion phenomena and other structural distress mechanisms; some simple system sof rehabilitation of structures; Non-Destructive testing systems; Use of carbon fiber wrapping and carbon composites in repairs.</p> <p><b>Tutorials</b> Collectthehistoryofamajorrehabilitationprojectandlisttheinterestingfeatures</p>	1L
<b>Module16</b>	<p><b>Computational Methods, IT, IoT in Civil Engineering:</b> Typical software used in Civil Engineering- Finite Element Method, Computational Fluid Dynamics; Computational Geotechnical Methods; highway design (MX), Building Information Modelling; Highlighting typical available software systems (SAP, STAAD, ABAQUS, MATLAB, ETAB, NASTRAN, NISA, MIKE21, MODFLOW, REVIT, TEKLA, AUTOCAD, GEOSTUDIO, EDUSHAKE, MSP, PRIMAVERA, ArcGIS, VisSIM.)</p> <p><b>Tutorials</b> VisitanAutoCadlabandprepareareport;IdentifyteninterestingsoftwaresystemsusedinCivilEnggandtheirkeyfeatures</p>	2L



<b>Module17</b>	<b>Industrial lectures:</b> Case studies of large civil engineering projects by industry professionals, covering comprehensive planning to commissioning; <b>Tutorials</b> For each case study list the interesting features	2L
<b>Module18</b>	<b>Basics of Professionalism:</b> Professional Ethics, Entrepreneurial possibilities in Civil Engineering, Possibilities for creative & innovative working, Technical writing Skillsenhancement;FacilitiesManagement;Quality&HSESystemsinConstruction	3L
<b>Tutorials</b>	List5cases of violation of professional ethics and list preventive measures; Identify5interestingprojectsandtheirpositivefeatures; Write400 word reports on One ancient monument and a modern marvel of civil engineering	5L

## Books

Books	Sl.	Book Name	Author	Publishing House
	1	Law of Arbitration and Conciliation	Chandiramani, Neelima	.Avinash Publications Mumbai.
	2	Law of Contract	Avtar singh	Eastern Book Co.
	3	Fundamental concepts in Law of Contract	Meena Rao	3rdEdn.ProfessionalOffset
<b>IS Codes</b>	The National Building Code			BIS,(2017)

## CO-PO Mapping

### CO-PO Mapping

#### Introduction to Civil Engineering

(Course Code –CE(HS)302)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	2	1	2	2	2	1	1	1	2	1	1	3	3	1	2
<b>CO2</b>	1	1	1	3	2	2	3	1	1	1	1	3	3	3	1
<b>CO3</b>	1	1	2	2	2	2	1	2	1	1	2	3	1	2	1
<b>Avg.</b>	<b>1.33</b>	<b>1</b>	<b>1.66</b>	<b>2.33</b>	<b>2</b>	<b>1.66</b>	<b>1.66</b>	<b>1.33</b>	<b>1.33</b>	<b>1</b>	<b>1.33</b>	<b>3</b>	<b>2.33</b>	<b>2</b>	<b>1.33</b>

## CE(ES)391: Basic Electronics

Course Code – CE(ES)391	Basic Electronics	1T+0L+2P	2 Credits
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## Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>1. Students will be able to identify semiconductor materials basic concept, Diodes and their applications.</li> <li>2. Students will be able to explain the operation of BJTs, FETs, MOS, CMOS structure and their applications in the field of Amplification including OP-Amp.</li> <li>3. Student will be able to acquire the proficiency to express binary numbers, different logic operations, design Gates and simple digital circuits using the Gates including different digital logic devices.</li> </ol>
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## Syllabus

Sl No.	Course Content	Total Hours
<b>Theory</b>		
Module 1	Diodes and Applications covering, Semiconductor Diode - Ideal versus Practical,  Resistance Levels, Diode Equivalent Circuits, Load Line Analysis; Diode as a Switch, Diode as a Rectifier, Half Wave and Full Wave Rectifiers with and without Filters; Breakdown Mechanisms, Zener Diode – Operation and Applications; Opto-Electronic Devices – LEDs, Photo Diode and Applications; Silicon Controlled Rectifier (SCR) – Operation, Construction, Characteristics, Ratings, Applications;	4L
Module 2	Transistor Characteristics covering, Bipolar Junction Transistor (BJT) – Construction, Operation, Amplifying Action, Common Base, Common Emitter and Common Collector Configurations, Operating Point, Voltage Divider Bias Configuration; Field Effect Transistor (FET)– Construction, Characteristics of Junction FET, Depletion and Enhancement type Metal Oxide Semiconductor (MOS) FETs, Introduction to CMOS circuits;	4L
Module 3	Transistor Amplifiers and Oscillators covering, Classification, Small Signal Amplifiers – Basic Features, Common Emitter Amplifier, Coupling and Bypass Capacitors, Distortion, AC Equivalent Circuit; Feedback Amplifiers – Principle, Advantages of Negative Feedback, Topologies, Current Series and Voltage Series Feedback Amplifiers; Oscillators – Classification, RC Phase Shift,	4L



	Wien Bridge, High Frequency LC and Non-Sinusoidal type Oscillators;	
Module 4	Operational Amplifiers and Applications covering, Introduction to Op-Amp, Differential Amplifier Configurations, CMRR, PSRR, Slew Rate; Block Diagram, Pin Configuration of 741 Op-Amp, Characteristics of Ideal OpAmp, Concept of Virtual Ground;	4L
<b>Practical</b>		
Module 1	Laboratory Sessions covering, Identification, Specifications, Testing of R, L, C  Components (Colour Codes), Potentiometers, Switches (SPDT, DPDT and DIP), Bread Boards and Printed Circuit Boards (PCBs); Identification, Specifications, Testing of Active Devices – Diodes, BJTs, JFETs, MOSFETs, Power Transistors, SCRs and LEDs;	2
Module 2	Study and Operation of Digital Multi Meter, Function / Signal Generator, Regulated  Power Supply (RPS), Cathode Ray Oscilloscopes; Amplitude, Phase and Frequency of Sinusoidal Signals using Lissajous Patterns on CRO; (CRO);	2
Module 3	Experimental Verification of PN Junction Diode Characteristics in A) Forward Bias B)  Reverse Bias, Zener Diode Characteristics and Zener Diode as Voltage Regulator, Input and Output Characteristics of BJT in Common Emitter (CE) Configuration, Drain and Transfer Characteristics of JFET in Common Source (CS) Configuration;	2
Module 4	Study of Half Wave and Full Wave Rectification, Regulation with Filters, Gain and  Bandwidth of BJT Common Emitter (CE) Amplifier, Gain and Bandwidth of JFET Common Source (CS) Amplifier, Gain and Bandwidth of BJT Current Series and Voltage Series Feedback Amplifiers, Oscillation Frequency of BJT based RC Phase Shift, Hartley and Colpitts Oscillators;	2
Module 5	Op-Amp Applications – Adder, Subtractor, Voltage Follower and Comparator; Op-Amp Applications – Differentiator and Integrator, Square Wave and Triangular Wave Generation, Applications of 555 Timer – Astable and Monostable Multivibrators;	2
Module 6	Truth Tables and Functionality of Logic Gates – NOT, OR, AND, NOR, NAND, XOR  and XNOR Integrated Circuits (ICs); Truth Tables and Functionality of Flip-Flops – SR, JK and D Flip-Flop ICs; Serial-In-Serial-Out and	2



	Serial-In-Parallel-Out Shift operations using 4- bit/8-bit ShiftRegister ICs; Functionality of Up-Down / Decade Counter ICs;	
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## Books

<b>Books</b>	Sl.	Book Name	Author	Publishing House
	1	Laboratory Manual for Electronic Devices and Circuits	David. A. Bell	Prentice Hall
	2	Basic Electronics- Devices, Circuits and IT Fundamentals	Santiram Kal	Prentice Hall, India
	3	Digital Fundamentals	Thomas L. Floyd and R. P. Jain	Pearson Education
	4	Basic Electronics – A Text-Lab	Paul B. Zbar, A.P. Malvino and M.A. Miller	TMH

## CO-PO Mapping

### CO-PO Mapping

#### Basic Electronics

( Course Code – CE(ES)391)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	3	3	1	2	-	-	1	3	2	-	1	3	3	3	2
<b>CO2</b>	3	3	1	2	-	1	-	3	1	1	2	3	3	2	2
<b>CO3</b>	3	3	1	1	1	-	-	3	3	1	1	3	3	3	2
<b>Avg.</b>	<b>3</b>	<b>3</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>2</b>





## CE(ES)392: Computer-aided Civil Engineering Drawing

Course Code – CE(ES)392	Computer-aided Civil Engineering Drawing	1L+0T+2P	2 Credits
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ul style="list-style-type: none"> <li>Students will be able to develop ideas of AutoCAD commands for drawing 2D &amp; 3D building drawings required for different civil Engineering applications.</li> <li>Students will be able to plan and draw Civil Engineering Buildings as per aspect and orientation.</li> <li>Students will be able to presenting drawings as per user requirements and preparation of technical report.</li> <li>Students will learn the basics of Building Information modelling system and perspective view of buildings.</li> </ul>
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### Syllabus

Sl No.	Course Content	Total Hours
Module 1	<b>INTRODUCTION</b> Introduction to concept of drawings, Interpretation of typical drawings, Planning drawings to show information concisely and comprehensively; optimal layout of drawings and Scales; Introduction to computer aided drawing, co-ordinate systems, reference planes. Commands: Initial settings, drawing aids, drawing basic entities, Modify commands, Layers, Text and Dimensioning, Blocks. Drawing presentation norms and standards.	2 L
Module 2	<b>SYMBOLS AND SIGN CONVENTIONS</b> Materials, Architectural, Structural, Electrical and Plumbing symbols. Rebar drawings and structural steel fabrication and connections drawing symbols, welding symbols; dimensioning standards	2 L
Module 3	<b>MASONRY BONDS</b> English Bond and Flemish Bond – Corner wall and Cross walls -One brick wall and one and half brick wall	1 L
Module 4	<b>BUILDING DRAWING</b> Terms, Elements of planning building drawing, Methods of making line drawing and detailed drawing. Site plan, floor plan, elevation and section drawing of small residential buildings. Foundation plan. Roof drainage plans. Depicting joinery, standard fittings & fixtures, finishes. Use of Notes to improve clarity	5 L



Module 5	PICTORIAL VIEW Principles of isometrics and perspective drawing. Perspective view of building. Fundamentals of Building Information Modelling (BIM)	2 L
Drawing 1	Buildings with load bearing walls including details of doors and windows.	6P
Drawing 2	Taking standard drawings of a typical two storeyed building including all MEP, joinery, rebars, finishing and other details and writing out a description of the Facility in about 500-700 words	4P
Drawing 3	RCC framed structures	6P
Drawing 4	Reinforcement drawings for typical slabs, beams, columns and spread footings	6P
Drawing 5	Industrial buildings - North light roof structures – Trusses	4P
Drawing 6	Perspective view of one and two storey buildings	4P

## Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	Civil Engineering Drawing	Subhash C Sharma & Gurucharan Singh	Standard Publishers
	2	Engineering Graphics & Design	Pradeep Jain & A.P. Gautam.	Khanna Publishing House
	3	AUTOCAD for Engineers and Designers	Sham Tickoo Swapna D	Pearson Education India Ltd.
	4	Engineering Drawing and Graphics + AUTOCAD	Venugopal	New Age International Pvt. Ltd.



## CO-PO Mapping

### CO-PO Mapping

#### Computer-aided Civil Engineering Drawing

(Course Code – CE(ES)392)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	3	2	2	2	3	-	-	1	3	1	1	3	3	1	3
<b>CO2</b>	3	2	3	1	3	-	-	-	2	1	1	3	1	2	3
<b>CO3</b>	3	3	3	3	3	1	-	-	3	1	1	3	2	3	3
<b>CO4</b>	3	2	2	2	3	-	1	1	3	3	1	3	2	3	2
<b>Avg.</b>	<b>3</b>	<b>2.25</b>	<b>2.5</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>2.75</b>	<b>1.5</b>	<b>1</b>	<b>3</b>	<b>2</b>	<b>2.25</b>	<b>2.75</b>

## CE(ES)393: Life Science

Course Code – CE(ES)393	Life Science	0T+0L+2P	1 Credits
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## Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>1. Students will be able to Describe how plant physiology helps to absorb water. Convey that how ecosystem works, the components, food chain, ecological pyramids</li> <li>2. Students will be able to Describe basic concepts of population dynamics and how to do environmental management.</li> <li>3. Students will be able to Highlight the concepts of DNA, RNA and operon. Describe animal tissue culture and basic concepts of recombinant DNA technology.</li> <li>4. Students will be able to Convey mean, median, mode concept and basic strategies of data analysis.</li> <li>5. Students will be able to apply Practical approach towards biotechnology and also convey the strategies how to handle environmental impact of mega projects.</li> </ol>
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## Syllabus

Sl No.	Course Content	Total Hours
Module 1A	<b>Plant Physiology</b> Transpiration; Mineral nutrition	3 L
Module 1B	<b>Ecology</b> Ecosystems- Components, types, flow of matter and energy in anecosystem; Community ecology- Characteristics, frequency, life forms, and biological spectrum;Ecosystem structure- Biotic and a-biotic factors, food chain, food web, ecological pyramids;	3 L
Module 2A	<b>Population Dynamics</b> Population ecology- Population characteristics,ecotypes; Population genetics- Concept of gene pool and genetic diversity in populations, polymorphism and heterogeneity;	3 L
Module 2B	<b>Environmental Management</b> Principles: Perspectives, concerns andmanagement strategies; Policies and legal aspects- Environment Protection Acts and modification,International Treaties; Environmental Impact Assessment- Case studies (International Airport,thermal power plant);	3 L
Module 3A	<b>Molecular Genetics</b> Structures of DNA and RNA; Concept of Gene, Generegulation, e.g., Operon concept	3 L



Module 3B	<b>Biotechnology</b> Basic concepts: Totipotency and Cell manipulation; Plant & Animal tissue culture- Methods and uses in agriculture, medicine and health; Recombinant DNA Technology- Techniques and applications	3 L
Module 4	<b>Biostatistics</b> Introduction to Biostatistics:-Terms used, types of data; Measures of Central Tendencies- Mean, Median, Mode, Normal and Skewed distributions; Analysis of Data- Hypothesis testing and ANNOVA (single factor)	4 L
Module 5	<b>Laboratory &amp; Fieldwork Sessions</b>  Comparison of stomatal index in different plants; Study of mineral crystals in plants; Determination of diversity indices in plant communities; To construct ecological pyramids of population sizes in an ecosystem; Determination of Importance Value Index of a species in a plant community; Seminar (with PPTs) on EIA of a Mega-Project (e.g., Airport, Thermal/Nuclear Power Plant/ Oil spill scenario); Preparation and extraction of genomic DNA and determination of yield by UV absorbance; Isolation of Plasmid DNA and its separation by Gel Electrophoresis; Data analysis using Bio-statistical tools;	15 P

## Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	Biology: A global approach	Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B	Pearson Education Ltd
	2	Outlines of Biochemistry	Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H	John Wiley and Sons
	3	Principles of Biochemistry (V Edition)	Nelson, D. L.; and Cox, M. M.W.H	Freeman and Company
	4	Molecular Genetics (Second edition)	Stent, G. S.; and Calender, R. W.H	Freeman and company
	5	Microbiology	Prescott, L.M J.P. Harley and C.A. Klein	



## CO-PO Mapping

### CO-PO Mapping

#### Life Science

(Course Code - CE(ES)393)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	1	2	1	2	2	2	1	-	1	-	1	2	2	2	3
<b>CO2</b>	2	2	2	2	1	3	1-	-	1	-	-2	3	2	1	2
<b>CO3</b>	1	3	1	3	2	2	1	-	2	-	2	2	2	2	1
<b>CO4</b>	2	2	1	3	2	3	1	-	1	-	1	3	2	3	2
<b>CO5</b>	1	2	2	2	3	2	1	-	2	-	2	2	2	2	1
<b>Avg.</b>	<b>1.60</b>	<b>2.2</b>	<b>1.4</b>	<b>2.4</b>	<b>2</b>	<b>2.25</b>	<b>1</b>	<b>-</b>	<b>1.4</b>	<b>-</b>	<b>1.6</b>	<b>1.4</b>	<b>2</b>	<b>2</b>	<b>1.83</b>

## 4<sup>th</sup> Semester

### CE(ES)401: Introduction to Fluid Mechanics

Course Code – CE(ES)401	Introduction to Fluid Mechanics	2L + 0T+0P	2 Credits
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>1. Students will be able to define basic terms, values and laws in the areas of fluids properties, statics, kinematics and dynamics of fluids, and hydraulic design of pipe systems;</li> <li>2. Students will be able to describe methods of implementing fluid mechanics laws and phenomena while analyzing the operational parameters of hydraulic problems;</li> <li>3. Students will be able to practically apply tables and diagrams, and equations that define the associated laws;</li> <li>4. Students will be able to calculate and optimize operational parameters of hydraulic problems;</li> <li>5. Students will be able to explain the correlation between different operational parameters;</li> <li>6. Students will be able to select engineering approach to problem solving based on the acquired physics and mathematical knowledge</li> </ol>
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### Syllabus

Sl No.	Course Content	Total Hours
Module 1	<b>INTRODUCTION</b> Properties of fluids: Fluid – definition, distinction between solid and fluid - Units and dimensions - Properties of fluids - density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapour pressure, capillarity and surface tension.	3 L
Module 2	<b>FLUID STATICS</b> Pressure at a point, basic equation for pressure field, pressure variation in a fluid at rest- incompressible fluid, compressible fluid, absolute pressure, gauge pressure; pressure measurements by manometers – general, inclined, inverted, micro-manometer; pressure and forces on submerged planes and curved surfaces, centre of pressure, buoyancy and floatation, Stability of submerged and floating bodies, metacentric height.	4 L
Module 3	<b>FLUID KINEMATICS</b> The velocity field, Eulerian and Lagrangian flow descriptions, concepts of: - one-, two- and three-dimensional flows, steady and unsteady	6L



	flows, streamlines, streaklines, pathlines; The acceleration field; Control volume and system representation, Continuity Equation, Momentum Equation, Moment-of-momentum equation, applications to pipe bends	
Module 4	<b>FLUID DYNAMICS</b> Application of Newton's Law along a streamline, Bernoulli Equation, Kinetic energy head, potential energy head and pressure energy head, total energy head, Pitot tube, Examples of use of Bernoulli Equation, measurement of flows - venturimeter, energy line and hydraulic grade line	7 L
Module 5	<b>DIMENSIONAL ANALYSIS</b> Buckingham Pi Theorem, determination of Pi terms, correlation of experimental data, examples.	3 L
Module 6	<b>FLOW THROUGH PIPES</b> Laminar flow, Reynolds number, critical velocity, turbulent flow, shear stress at pipe wall, velocity distribution, loss of head for laminar flow, Darcy-Weisbach Formula, friction factor, contraction and expansion head losses. Concept of boundary layer and its growth.	7L
Module 7	<b>PIPELINE SYSTEMS</b> Pipes in series, pipes in parallel, equivalent pipes, branching pipes, pipe networks	7L
Module 8	<b>HYDRAULIC MACHINES</b> : Basics of hydraulic machines, specific speed of pumps and turbines.	3L

## Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	A Textbook of Fluid Mechanics	R. K. Bansal	Laxmi Publications (P) Ltd., New Delhi
	2	Fluid Mechanics	Sadhu Singh.	Khanna Publishing House
	3	Introduction to Fluid Mechanics and Fluid Machines	S. K. Som, G. Biswas and S. Chakraborty	Tata McGraw Hill Education Private Limited, New Delhi, 2012.
	4	Fluid Mechanics and Hydraulic Machines	K. Subramanya	McGraw Hill Education (India)





## CO-PO Mapping

### CO-PO Mapping

#### Introduction to Fluid Mechanics

(Course Code – CE(ES)401)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	3	-	-	1	3	1	1	3	3	3	3
CO2	3	3	3	1	3	-	-	-	2	1	1	3	1	3	3
CO3	3	3	3	3	3	1	-	-	3	1	1	3	2	3	3
CO4	3	3	2	2	3	-	1	1	3	3	1	3	2	3	2
CO5	3	3	3	2	1	1	1	1	3	2	1	3	2	3	3
CO6	3	3	2	2	1	1	1	1	2	1	1	3	2	3	1
	3	3	2.5	2	2.33	1	1	1	2.67	1.5	1	3	2	3	2.50

## CE(ES)402: Introduction to Solid Mechanics

Course Code – CE(ES)402	Introduction to Solid Mechanics	2L+0T+0P	2 credits
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## Course Outcome (CO)

Course Outcome (CO)	<ol style="list-style-type: none"> <li>The students will be able to identify the equilibrium conditions and elastic properties of axially loaded bars through stress-strain and force-displacement curves.</li> <li>The students will be able to identify the principal plane and principal stresses through the Mohr circle.</li> <li>The students will be able to calculate the bending moment, shear force, and deflection of beams for uniformly distributed, concentrated, linearly varying, and external concentrated moment.</li> <li>The students will be able to calculate the member forces in a plane truss using Method of Joint and Method of Section.</li> <li>The students will be able to know the concepts of strain energy due to axial load, bending and shear.</li> </ol>
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## Syllabus

Sl No.	Course Content	Total Hours
<b>Module 1</b>	<b>Review of Basic Concepts of Stress and Strain:</b> Normal stress, Shear stress, bearing stress, Normal strain, shearing strain; Hooke's law; Poisson's ratio; Stress-strain diagram of ductile and brittle materials; Elastic limit; Ultimate stress; Yielding; Modulus of elasticity; Factor of safety, <b>Beam Statics:</b> Support reactions, concepts of redundancy, axial force, shear force and bending moment diagrams for concentrated, uniformly distributed, linearly varying load, concentrated moments in simply supported beams, cantilever and overhanging beams	6L
<b>Module 2</b>	<b>Symmetric Beam Bending:</b> Basic kinematic assumption, moment of inertia, elastic flexure formulae and its application, Bending and shear stress for regular sections, shear centre	3L
<b>Module 3:</b>	<b>Deflection of statically determinate beams:</b> Fundamental concepts: Elastic curve, moment Curvature relationship, governing differential equation, boundary conditions: Direct integration solution	4L
<b>Module 4:</b>	<b>Analysis of determinate plane trusses:</b> Concepts of redundancy, Analysis by method of joints, method of sections	4L
<b>Module 5:</b>	<b>Two Dimensional Stress Problems:</b> Principal stresses, maximum shear stresses, Mohr's circle of stresses, construction of Mohr's circle	3L
<b>Module 6</b>	<b>Introduction to thin cylindrical &amp; spherical shells:</b> Hoop stress and meridional - stress and volumetric changes	3L
<b>Module 7</b>	<b>Torsion:</b> Pure torsion, torsion of circular solid shaft and hollow shafts, torsional equation, torsional rigidity, closed coil helical; springs	4L
<b>Module 8</b>	<b>Columns:</b> Fundamentals, criteria for stability in equilibrium, column buckling theory, Euler's load for columns with different end conditions, limitations of Euler's theory – problems, eccentric load and secant formulae.	3L

## Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	Elements of Strength of Material	S. P. Timoshenko and D. H. Young	EWP Pvt. Ltd
	2	Mechanics of Material	R.C. Hibbeler	Pearson
	3	Strength of Materials	R. Subramanian	OXFORD University Press
	4	Strength of Materials	S S Bhavikatti	Vikas Publishing House Ltd



## CO-PO Mapping

### CO-PO Mapping

#### Introduction to Solid Mechanics

(Course Code – CE(ES)402)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	2	2	3	3	-	-	2	-	-	-	1	3	1	2	1
<b>CO2</b>	2	3	3	2	3	1	2	1	-	2	1	2	3	2	3
<b>CO3</b>	3	2	2	2	3	1	-	1	2	2	3	1	2	2	3
<b>CO4</b>	3	-	2	-	3	2	2	2	-	-	-	2	3	3	3
<b>CO5</b>	3	3	-	2	2	2	3	-	1	1	-	2	3	2	3
	<b>2.6</b>	<b>2.5</b>	<b>2.5</b>	<b>2.25</b>	<b>2.75</b>	<b>1.5</b>	<b>2.25</b>	<b>1.33</b>	<b>1.5</b>	<b>1.67</b>	<b>1.67</b>	<b>2</b>	<b>2.4</b>	<b>2.2</b>	<b>2.6</b>



## CE(PC)401: Soil Mechanics-I

Course Code – CE(PC)401	Soil Mechanics-I	2L+1T+0P	3 Credits
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## Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>1. The students will be able to classify soil as per grain size distribution curve and understand the index properties of soil.</li> <li>2. The students will be able to apply the concept of total stress, effective stress and pore water pressure for solving geotechnical problems.</li> <li>3. The students will be able to assess the permeability of different types of soil and solve flow problems.</li> <li>4. The students will be able to estimate the seepage loss, factor of safety against piping failure using flow net related to any hydraulic structure.</li> <li>5. The students will be able to determine vertical stress on a horizontal plane within a soil mass subjected to different types of loading on the ground surface and also the maximum stressed zone or isobar below a loaded area.</li> </ol>
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## Syllabus

Sl No.	Course Content	Total Hours
Module 1	<p>Properties of Soil: I-situ Density, Moisture Content, Specific Gravity, Relative density, Functional Relationships.</p> <p>Index Properties of Soil</p> <p>Introduction, Particle Size Distribution, Mechanical Analysis - Sieve Analysis, Sedimentation Analysis – Hydrometer and Pipette Methods. Consistency of Soil</p> <p>– Atterberg Limits, Different Indices, Discussion on Limits and Indices.</p> <p>Classification of Soil</p> <p>Classification by Structure, Particle Size Classification, Textural System, PRA System (AASHTO Classification), Unified Classification System, As per IS Code Recommendation, Field Identification of Soil, Classification by Casagrande’s Plasticity Chart.</p>	
Module 2	<p><b>Soil Hydraulics</b></p> <p>Modes of Occurrence of Water in Soil – Free Water, Held Water, Structural Water, Capillary Water, Gravitational Water, Adsorbed Water, Pore Water, Pore Water Pressure, Effective Pressure, Total Pressure, Effective Pressure under Different Conditions and in Different Cases of Flow through Soils, Critical Hydraulic Gradient, Quick Sand Condition.</p>	3L + 1T
Module 3:	<p><b>Permeability</b></p> <p>Introduction, Darcy’s Law, Coefficient of Permeability, Discharge Velocity, Seepage Velocity, Factors Affecting Permeability.</p>	3L + 1T



	Determination of Coefficient of Permeability – Constant Head and Falling Head Methods, Permeability of Stratified Soil Deposits, Field Determination of Permeability – Unconfined and Confined Aquifers.	
Module 4:	<b>Seepage Analysis</b> Introduction, Seepage, Seepage Pressure, Two Dimensional Flow, Laplace’s Equations, Continuity equation, Flow Nets, Flow through Earthen Dam, Estimation of Seepage, Construction, Properties and Use of Flow Nets, Piping and Heaving, Uplift due to Seepage, Design of Fillers.	3L + 1T
Module 5:	<b>STRESS DISTRIBUTION IN SOILS</b> Introduction, Geostatic Stress, Boussinesq’s Equation, Determination of Stress due to Point Load, Vertical Stress Distribution on a Horizontal Plane, Isobar and Pressure Bulb, Vertical Stress Distribution on a Vertical Plane, Vertical Stress under Uniformly Loaded Circular Area, Vertical Stress Beneath a Corner of a Rectangular Area, Equivalent Point Load Method, 2:1 Method, Newmark’s Influence Chart, Vertical Stress Beneath Line and Strip Loads. Westergaard Analysis, Comparison of Boussinesq and Westergaard Theories, Contact Pressure.	4L + 2T
Module 6	<b>SHEARING STRENGTH OF SOILS</b> Shear Strength of Soil Introduction, Basic Concept of Shear Resistance and Shear Strength of Soil, Mohr Circle of Stress, Sign Conventions, Mohr - Coulomb Theory, Relationship between Principal Stresses and Cohesion. Determination of Shear Parameters of Soil Stress Controlled and Strain Controlled Tests, Laboratory Determination of Soil Shear Parameters- Direct Shear Test, Triaxial Test, Classification of Shear Tests Based on Drainage Conditions, Unconfined Compression Test, Vane Shear Test as per Relevant IS Codes. Stress- Strain Relationship of Clays and Sands, Concept of Critical Void Ratio. Skempton’s Pore Pressure Parameters. Sensitivity and Thixotropy of clay. Concept of Stress path.	5L + 3T

## Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	Textbook of Soil Mechanics and Foundation Engineering (Geotechnical Engineering Series)	V.N.S. Murthy	CBS Publishers
	2	Soil Mechanics and Foundations	Punmia, B.C. and Jain A. K	Laxmi Publications (P) Ltd



	3	Basic and Applied Soil Mechanics	Gopal Ranjan & A.S.R. Rao	New Age International Pvt. Ltd, Publishers
	4	Principles of Geotechnical Engineering	B.M. Das	Thomson Brooks / Cole

## CO-PO Mapping

### CO-PO Mapping

#### Soil Mechanics-I

(Course Code – CE(PC)401)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	2	1	-	2	-	1	1	-	-	1	-	3	2	1	2
<b>CO2</b>	3	3	2	3	1	2	3	1	1	-	1	3	3	3	1
<b>CO3</b>	1	2	-	-	2	-	1	-	1	1	-	3	1	1	1
<b>CO4</b>	3	2	3	2	3	1	3	2	2	2	2	3	3	2	3
<b>CO5</b>	2	1	2	1	3	1	3	3	3	3	3	3	3	2	3
<b>Avg.</b>	<b>2.2</b>	<b>1.8</b>	<b>2.33</b>	<b>2</b>	<b>2.25</b>	<b>1.25</b>	<b>2.2</b>	<b>2</b>	<b>1.75</b>	<b>1.75</b>	<b>2</b>	<b>3</b>	<b>2.4</b>	<b>1.8</b>	<b>2</b>



## CE(PC)402: Environmental Engineering-I

Course Code – CE(PC)402	Environmental Engineering-I	2L+1T+0P	3 Credits
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>1. The students will be able to define the basic concepts and terminologies of water supply engineering and solid waste management</li> <li>2. The students will be able to describe different surface and groundwater sources; and composition and characteristics of municipal solid waste</li> <li>3. The students will be able to apply the methods of quantifying water requirement and MSW generation</li> <li>4. The students will be able to solve different mathematical problems regarding different components of water supply systems, distribution networks and MSW management systems.</li> <li>5. The students will be able to compare between different water samples based on their physical, chemical and biological characteristics</li> </ol>
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### Syllabus

Sl No.	Course Content	Total Hours
<b>Module 1</b>	<b>Water Requirement Estimation</b> Water Demand: Different types of water demand; Per capita demand; Variations in demand; Factors affecting water demand Future Demand Forecasting: Design period; Population forecasting methods	2L + 2T
<b>Module 2</b>	<b>Sources of Water</b> Surface Water Sources; Ground Water Sources	4L + 2T
<b>Module 3:</b>	<b>Water Quality</b> Water Quality Characteristics: Physical, Chemical, and Biological parameters Drinking Water Standards: BIS; WHO; USEPA Water Quality Indices: Basic concept and examples	4L + 2T
<b>Module 4:</b>	<b>Water Treatment</b> Typical flow chart for surface and groundwater treatments Unit Operation and Processes: Aeration, Plain Sedimentation, Sedimentation with Coagulation and Flocculation, Water Softening, Filtration, Disinfection	9L + 3T
<b>Module 5:</b>	<b>Water Conveyance and Distribution</b> Hydraulic design of pressure pipes; Analysis of distribution network; Storage and distribution reservoirs; Capacity of reservoirs.	4L + 2T
<b>Module 6</b>	<b>Characteristics of Municipal Solid Waste (MSW)</b> Composition and characteristics of MSW	1L + 1T



<b>Module 7</b>	<b>Handling of MSW</b> Generation, collection and transportation of MSW	1L + 1T
<b>Module 8</b>	<b>Engineered Systems for MSW Management</b> Methods of reuse/ recycle, energy recovery, treatment and disposal of MSW	3L + 1T

## Books

<b>Books</b>	Sl.	Book Name	Author	Publishing House
	1	Environmental Engineering	S.C. Sharma	Khanna Publishing House
	2	Environmental Engineering. Volume-1 and Volume-2	Garg, S.K.	Khanna Publishers
	3	Environmental Engineering	Peavy, H.S, Rowe, D.R, Tchobanoglous, G	Tata McGraw Hill Indian Edition
	4	Introduction to Environmental Engineering and Science	Masters, G.M., Ela, W.P.	Prentice Hall Pearson

## CO-PO Mapping

### CO-PO Mapping

#### Environmental Engineering

(Course Code – CE(PC)402)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	2	2	3	3	-	-	2	-	-	-	1	3	1	2	1
<b>CO2</b>	3	2	3	2	3	1	2	-	-	1	1	2	3	2	3
<b>CO3</b>	3	1	2	2	3	-	-	1	1	1	-	1	2	2	3
<b>CO4</b>	3	-	2	-	3	2	2	-	1	-	-	2	3	3	3
<b>CO5</b>	1	2	-	2	2	2	3	-	1	1	-	2	3	2	3
<b>Avg.</b>	<b>2.4</b>	<b>1.75</b>	<b>2.5</b>	<b>2.25</b>	<b>2.75</b>	<b>1.67</b>	<b>2.25</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>2.4</b>	<b>2.2</b>	<b>2.6</b>



## CE(PC)404: Concrete Technology

Course Code – CE(PC)404	Concrete Technology	2L + 1T	3 Credits
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## Course Outcome (CO)

Course Outcome (CO)	<ol style="list-style-type: none"> <li>1. Students will be able to identify various materials for concrete and classify them accordingly.</li> <li>2. Students will be able to apply fundamental knowledge in assessing various properties of concrete in fresh and hardened state</li> <li>3. Students will be able to ensure quality control of concrete by performing tests of properties of concrete materials as per IS code</li> <li>4. Students will be able to gather knowledge about various additive materials that are used in concrete and their proper usage to make the concrete better</li> <li>5. Students will be able to design concrete mix as per latest IS Codes parameters</li> </ol>
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## Syllabus

Sl No.	Course Content	Total Hours
Module 1	Cement: Manufacturing of cement, Oxides composition of cement and the calculation of compounds, Heat of hydration, Types of cement- OPC, RPC. Low heat cement, PPC, PSC, Sulphate resisting cement, High Alumina cement, Expansive cement, White cement; Test on cement- fineness, consistency, initial setting time & final setting time, soundness test, strength test, specific gravity of cement, storage of cement.	5L + 3T
Module 2	Aggregates: Classification, Grading, alkali-aggregate reaction, deleterious substances in aggregates, physical properties, testing of aggregates- fineness modulus, bulking, specific gravity, sieve analysis, flakiness & elongation index. Quality of Water for mixing and curing - use of sea water for mixing concrete.	3L + 1T
Module 3:	Properties of fresh concrete: Workability, factors affecting workability, segregation and bleeding, tests on workability- slump test, compacting factor test, vee-bee test, flow table test.	3L + 1T
Module 4:	Properties of Hardened concrete: Tensile & compressive strength, flexural strength, stress-strain characteristics, modulus of elasticity, poisson's ratio, Creep, shrinkage, permeability of concrete, micro cracking of concrete.	3L + 1T
Module 5:	Strength of concrete: curing methods, water-cement ratio. gel-space ratio, maturity of concrete,	3L + 1T
Module 6	Admixtures: types, uses, superplasticizers, plasticizers, Bonding	2L + 1T



	admixtures.	
Module 7	Mix Design – Objective, factors influencing mix proportion - Mix design by I.S. 10262-2019. (with & without admixture)	3L + 1T
Module 8	Non-destructive test: Rebound hammer and Ultra-sonic pulse velocity testing methods.  Quality control - Sampling and testing, Acceptance criteria.	3L + 1T
Module 9	Special Concrete – Ferrocement - Fibre reinforced concrete - Polymer concrete  - Sulphur Concrete - Self compacting concrete. Ready mix concrete, Batching plant.	4L + 1T

## Books

Books	Sl.	Book Name	Author	Publishing House
	1	Concrete Technology (Theory & Practice)	Shetty, M.S.	S. Chand and Co.
	2	Concrete Technology	Gambhir, M.L.	Tata McGraw Hill
	3	Concrete Technology	A. M. Neville and J.J. Brooks	Pearson Education India Ltd.
	4	Properties of Concrete	A.M.Neville	Pearson India
IS Codes	I.S. 10262-2019			Bureau of Indian Standards

## CO-PO Mapping

### CO-PO Mapping

#### Concrete Technology

(Course Code – CE(PC)404)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	3	2	3	3	-	-	2	-	-	-	1	3	1	2	1
<b>CO2</b>	3	3	3	2	3	1	2	-	-	1	1	2	3	2	3
<b>CO3</b>	3	1	2	1	3	-	-	1	-	1	-	1	2	2	3
<b>CO4</b>	3	-	2	-	3	2	2	-	-	-	-	2	3	3	3
<b>CO5</b>	3	3	-	2	2	2	3	-	1	1	-	2	3	2	3
	<b>3</b>	<b>2.25</b>	<b>2.5</b>	<b>2</b>	<b>2.75</b>	<b>1.67</b>	<b>2.25</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>2.4</b>	<b>2.2</b>	<b>2.6</b>



## CE(HS)401: Civil Engineering – Societal and Global Impact

Course Code – CE(HS)401	Civil Engineering – Societal and Global Impact	2L+0T+0P	2 Credits
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### Course Outcome (CO)

Course Outcome (CO)	<ol style="list-style-type: none"> <li>Students will be able to understand The impact which Civil Engineering projects have on the Society at large and on the global area and using resources efficiently and effectively.</li> <li>Students will be able to understand The extent of Infrastructure, its requirements for energy and how they are met: past, present and future</li> <li>Students will be able to understand The potentials of Civil Engineering for Employment creation and its Contribution to the GDP</li> <li>Students will be able to understand The Built Environment and factors impacting the Quality of Life</li> </ol>
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### Syllabus

Sl No.	Course Content	Total Hours
Module1	Introduction to Course and Overview; Understanding the past to look into the future: Preindustrial revolution days, Agricultural revolution, first and second industrial revolutions, IT revolution; Recent major Civil Engineering break through and innovations; Present day world and future projections, Ecosystems in Society and in Nature; the steady erosion in Sustainability; Global warming, its impact and possible causes; Evaluating future requirements for various resources; GIS and applications for monitoring systems; Human Development Index and Ecological Footprint of India Vs other countries and analysis;	3L
Module2	Understanding the importance of Civil Engineering in shaping and impacting the world; The ancient and modern Marvels and Wonders in the field of Civil Engineering; Future Vision for Civil Engineering	3L
Module3 :	Infrastructure-Habitats, Megacities, Smart Cities, futuristic visions; Transportation (Roads, Railways & Metros, Airports, Seaports, River ways, Sea canals, Tunnels (belowground, underwater); Futuristic systems(ex,HyperLoop)); Energy generation (Hydro, Solar (Photovoltaic, Solar Chimney), Wind,Wave, Tidal, Geothermal, Thermalenergy); Water provisioning; Telecommunication needs (towers, above-ground and underground cabling); Awareness of various Codes & Standards governing Infrastructure development; Innovations and methodologies for ensuring Sustainability;	8L
Module4 :	Environment-Traditional & futuristic methods ;Solid waste management, Water purification, Waste water treatment & Recycling, Hazardous waste treatment; Flood control (Dams,Canals,Riverinterlinking), Multi-purpose water projects, Atmospheric pollution ;Global warming phenomena and Pollution Mitigation measures, Stationarity and non-stationarity; Environmental Metrics& Monitoring; Other Sustainability measures; Innovations and methodologies for ensuring Sustainability.	7L



Module5 :	Built environment–Facilities management, Climate control; Energy efficient built environments and LEED ratings, Recycling, Temperature/Sound control in built environment, Security systems; Intelligent/Smart Buildings; Aesthetics of built environment, Role of Urban Arts Commissions; Conservation, Repairs & Rehabilitation of Structures & Heritage structures; Innovations and methodologies for ensuring Sustainability	5L
Module6	Civil Engineering Projects–Environmental Impact Analysis procedures; Waste (materials, manpower, equipment)avoidance/Efficiency increase; Advanced construction techniques for better sustainability; Techniques for reduction of Green House Gas emissions in various aspects of Civil Engineering Projects; New Project Management paradigms & Systems(Ex. Lean Construction), contribution of Civil Engineering to GDP, Contribution to employment (projects, facilities management),Quality of products ,Health & safety aspects for stakeholders; Innovations and methodologies for ensuring Sustainability during Project development	4L

## Books

Books	Sl.	Book Name	Author	Publishing House
	1	Global Challenges and the Role of Civil Engineering.	Ziga Turk (2014)	Springer
	2	Engineering impacting Social, Economic and Working Environment	Brito, Ciampi, Vasconcelos, Amarol, Barros (2013)	120th ASEE Annual Conference and Exposition

## CO-PO Mapping

### CO-PO Mapping

#### Civil Engineering – Societal and Global Impact

(Course Code –CE(HS)401)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	2	1	2	2	2	1	3	2	3	1	2	3	1	1	2
<b>CO2</b>	2	1	1	3	2	2	3	1	1	1	1	3	3	3	1
<b>CO3</b>	1	1	3	1	2	3	1	1	1	1	1	3	2	1	2
<b>CO4</b>	3	2	3	2	3	1	3	2	2	2	2	3	3	2	3
<b>Avg.</b>	2	1.25	2.25	2	2.25	1.75	2.5	1.5	1.5	1.25	1.5	3	2.25	1.75	2



## CE(MC)401: Management I (Organizational Behaviour)

<b>Course Code – CE(MC)401</b>	<b>Management I (Organizational Behaviour)</b>	<b>2L+0T+0P</b>	<b>0 Credits</b>
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>1. Students will have Ability to understand some of the main theories of organizational Behavior</li> <li>2. Students will be able to analyze how these theories and empirical evidence can help to understand contemporary organizational issues.</li> <li>3. Students will be able to develop concept of social sciences (psychology) subject in which they will study the behavior of people/employees at workplace</li> <li>4. Students will be able to manage effective teams and it helps to understand and predict human behavior in an organization. It studies on how organizations can be structures more accurately, and how several events in their outside situations effect organizations</li> </ol>
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### Syllabus

SI No.	Course Content	Total Hours
Module 1	<p>Introduction to Organizational Behaviour-Concept, Importance, Challenges and Opportunities</p> <p>Personality-Meaning of Personality, Personality Determinants and Traits, Psychoanalytic Theory, Argyris Immaturity to Maturity Continuum Impact on organization.</p> <p>Attitude-Concept, Components, Cognitive Dissonance Theory, Attitude Surveys.</p>	5L
Module 2	<p>Perception- Concept, Nature and Importance, Process of Perception, Factors influencing perception, Perceptual Selectivity, Shortcuts to Judge Others: Halo Effect, Stereotyping, Projection and Contrast Effects, Impact on Organization. Motivation-Definition, Theories of Motivation-Maslow's Hierarchy of Needs Theory, McGregor's Theory X&amp;Y, Herzberg's Motivation-Hygiene Theory, Alderfer's ERG Theory, McClelland's Theory of Needs, Vroom's Expectancy Theory.</p>	6L
Module 3:	<p>Leadership-Concept, Leadership Styles, Theories-Behavioural Theory: Ohio Studies, Michigan Studies, Blake &amp; Mouton Managerial Grid; Contingency Theory: Fielder Theory.</p> <p>Group Behaviour: Definition, Characteristics of Group, Types of Groups: Formal &amp; Informal; Stages of Group Development, Group Decision making,</p>	8L



	Group Decision Making Vs Individual Decision Making.	
Module 4:	Organizational Design-Various organizational structures and their pros and cons. Concepts of organizational climate and culture, Organizational Politics- Concept, Factors influencing degree of Politics  Conflict management- Concept, Sources of conflict, Stages of conflict process, Conflict resolution techniques, Tools-Johari Window to analyse and reduce interpersonal conflict, Impact on organization.	5L

## Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	Organization Behaviour	Stephen Robbins	
	2	Organization Behaviour	Luthans	
	3	Organization Behaviour	L.M. Prasad	
	4	Organization Behaviour : Text, Cases & Games	K. Aswathappa	

## CO-PO Mapping

### CO-PO Mapping

#### Management I (Organizational Behaviour)

(Course Code – CE(MC)401)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	-	-	1	-	-	-	-	-	-	--	-	-	1	1	2
<b>CO2</b>	-	2	-	-	-	-	-	-	-	-	-	-	2	-	2
<b>CO3</b>	-	1	-	-	-	-	-	-	-	-	-	-	-	2	2
<b>CO4</b>	-	-	-	-	-	-	-	1	2	-	3	-	2	2	1
<b>Avg.</b>	-	<b>1.5</b>	<b>1</b>	-	-	-	-	<b>1</b>	<b>2</b>	-	<b>3</b>	-	<b>1.67</b>	<b>1.67</b>	<b>1.75</b>

## CE(ES)491: Fluid Mechanics Laboratory

Course Code – CE(ES)491	Fluid Mechanics Laboratory	0L+0T+2P	1 Credit
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>1. Students will be able to Calibrate the notch and orifice meter.</li> <li>2. Students will be able to Evaluate the performance of pump and turbine.</li> <li>3. Students will be able to Determine the various hydraulic coefficients.</li> <li>4. Students will be able to Determine the minor losses through pipes.</li> <li>5. Students will be able to Measure the water surface profile due to formation of hydraulic jump.</li> <li>6. Students will be able to Measure the water surface profile for flow over Broad crested weir.</li> </ol>
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### Syllabus

Sl No.	Course Content	Total Hours
Experiment 1	Calibration of Notches	2
Experiment 2	Calibration of Orifice meter.	2
Experiment 3	Determination of Hydraulic Coefficient of an Orifice	2
Experiment 4	Performance Test on Centrifugal Pump	2
Experiment 5	Performance Test on Reciprocating Pump	2
Experiment 6	Determination of Minor Losses in Pipes due to Sudden Enlargement and Sudden Contraction.	2
Experiment 7	Performance Test on Pelton Wheel Turbine	2
Experiment 8	Measurement of water surface profile for flow over Broad crested weir Quality control - Sampling and testing, Acceptance criteria.	2
Experiment 9	Measurement of water surface profile for a hydraulic jump.	2

### Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	A Textbook of Fluid Mechanics	R. K. Bansal	Laxmi Publications (P) Ltd., New Delhi
	2	Fluid Mechanics	Sadhu Singh.	Khanna Publishing House



	3	Introduction to Fluid Mechanics and Fluid Machines	S. K. Som, G. Biswas and S. Chakraborty	Tata McGraw Hill Education Private Limited, New Delhi, 2012.
	4	Fluid Mechanics and Hydraulic Machines	K. Subramanya	McGraw Hill Education (India)

## CO-PO Mapping

### CO-PO Mapping

#### Fluid Mechanics Laboratory

(Course Code – CE(ES)491)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	3	2	3	3	-	-	2	-	-	-	1	3	1	2	1
<b>CO2</b>	3	3	3	2	3	1	2	-	-	1	1	2	3	2	3
<b>CO3</b>	3	1	2	1	3	-	-	1	-	1	-	1	2	2	3
<b>CO4</b>	3	-	2	-	3	2	2	-	-	-	-	2	3	3	3
<b>CO5</b>	3	3	-	2	2	2	3	-	1	1	-	2	3	2	3
<b>CO6</b>	3	3	3	2	2	3		2	-	-	1	2	2	2	3
<b>Avg.</b>	<b>3</b>	<b>2.40</b>	<b>2.6</b>	<b>2</b>	<b>2.60</b>	<b>1.60</b>	<b>2.25</b>	<b>1.5</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>2.0</b>	<b>2.16</b>	<b>2.6</b>





## CE(ES)492: Solid Mechanics Laboratory

Course Code – CE(ES)492	Solid Mechanics Laboratory	0L+0T+2P	1 Credits
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### Course Outcomes

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>The students will be able to demonstrate the method and findings of tension and compression tests on ductile and brittle materials.</li> <li>The students will be able to explain the method of bending tests on mild steel beam and concrete beam.</li> <li>The students will be able to demonstrate the method and findings of Torsion test on mild steel circular bar and concrete beam.</li> <li>The students will be able to illustrate the concept of hardness and explain the procedure and findings of Brinnel and Rockwell tests.</li> <li>The students will be able to demonstrate the concept and procedure of calculation of spring constant and elaborate its use in Civil Engineering</li> </ol>
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### Syllabus

Sl No.	Course Content	Total Hours
<b>Experiment 1</b>	Tension test on Structural Materials: Mild Steel and Tor steel (HYSD bars)	2P
<b>Experiment 2</b>	Compression Test on Structural Materials: Timber, bricks and concrete cubes	2P
<b>Experiment 3</b>	Bending Test on Mild Steel	2P
<b>Experiment 4</b>	Torsion Test on Mild Steel Circular Bar	2P
<b>Experiment 5</b>	Hardness Tests on Ferrous and Non-Ferrous Metals: Brinnel and Rockwell Tests	2P
<b>Experiment 6</b>	Test on closely coiled helical spring	2P
<b>Experiment 7</b>	Impact Test: Izod and Charpy	2P
<b>Experiment 8</b>	Demonstration of Fatigue Test	2P



## CO-PO Mapping

### CO-PO Mapping

#### Solid Mechanics Laboratory

( Course Code – CE(ES)492)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	3	2	2	2	2	-	-	-	1	-	1	1	2	2	3
<b>CO2</b>	3	2	2	2	2	1	1	1	1	-	-	1	2	1	3
<b>CO3</b>	3	2	3	2	2	1	-	-	1	-	-	1	2	2	3
<b>CO4</b>	2	3	-	1	1	-	1	1	3	2	2	1	3	1	2
<b>CO5</b>	2	2	-	2	2	1	-	1	-	1	-	1	3	2	2
<b>Avg.</b>	<b>2.6</b>	<b>2.2</b>	<b>2.33</b>	<b>1.8</b>	<b>1.8</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1.2</b>	<b>1.5</b>	<b>1</b>	<b>1</b>	<b>2.4</b>	<b>1.6</b>	<b>2.6</b>

## CE(ES)493: Engineering Geology Laboratory

Course Code – CE(ES)493	Engineering Geology Laboratory	0L+0T+2P	1 Credits
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### Course Outcome (CO)

Course Outcome (CO)	<ol style="list-style-type: none"> <li>1. Students will able to Define and state the role of engineering geology in civil engineering.</li> <li>2. Students will able to Understand origin of rocks and geologic structures.</li> <li>3. Students will able to Apply different tools to identify rocks and minerals in hand specimen and under microscope.</li> <li>4. Students will able to Analyze the geological structures through drawing the cross sections from the geological Maps.</li> </ol>
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### Syllabus

Sl No.	Course Content
Experiment1	Identification of minerals in hand specimen
Experiment2	Identification of igneous rocks in hand specimen
Experiment3	Identification of sedimentary rocks in hand specimen
Experiment4	Identification of metamorphic rocks in hand specimen
Experiment5	Study of crystals with the help of crystal models
Experiment6	Study of geologic structures with the help of models
Experiment7	Interpretationofgeologicalmaps:horizontal,vertical,uniclinal,foldedandfaultedstructures
Experiment8	Microscopic study of rocks and minerals

### Books

	Sl.	Book Name	Author	Publishing House
Books	1	Engineering and General Geology	Parvin Singh	Katson publishing house Delhi
	2	Engineering Geology for Civil Engineers	D. Venkat Reddy	Oxford, IBH
	3	Structural Geology	Marland P. Billings	Wiley eastern Prentice-Hall,



## CO-PO Mapping

### CO-PO Mapping

#### Engineering Geology Laboratory

(Course Code - CE(ES)493)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	2	1	3	2	2	1	1	2	1	1	2	3	1	1	2
<b>CO2</b>	2	1	1	3	2	2	3	1	1	1	1	3	2	3	1
<b>CO3</b>	1	1	1	2	2	3	1	2	1	1	1	3	2	3	1
<b>CO4</b>	3	2	3	2	3	1	3	2	2	2	2	3	3	2	3
<b>Avg.</b>	<b>2</b>	<b>1.25</b>	<b>2</b>	<b>2.25</b>	<b>2.25</b>	<b>1.75</b>	<b>2</b>	<b>1.75</b>	<b>1.25</b>	<b>1.25</b>	<b>1.5</b>	<b>3</b>	<b>2</b>	<b>2.25</b>	<b>1.75</b>



## CE(PC)493: Surveying & Geomatics

Course Code – CE(PC)493	Surveying & Geomatics	0T+0L+2P	1 Credits
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>1. Students will be able to State the interdependency and advancement of different surveying methods</li> <li>2. Students will be able to Comprehend the working principles of different surveying and geomatics instruments and experiments</li> <li>3. Students will be able to Execute the different methods of surveying and geomatics to measure the features of interest</li> <li>4. Students will be able to Examine the results obtained from the surveying and geomatics experiments</li> <li>5. Students will be able to Critically appraise the different techniques of surveying and geomatics in measuring and assessing the features of interest</li> <li>6. Students will be able to Design and construct solutions for real world problems related to surveying and geomatics.</li> </ol>
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### Syllabus

SI No.	Course Content	Total Hours
Experiment 1	Traverse survey by Prismatic Compass: Procedure; Computation and checks on closed traverse; Preparation of field book; Plotting the traverse; Sources of errors.	2
Experiment 2	Theodolite Survey: Closed traverse by transit theodolite, Preparation of field book	2
Experiment 3	Differential Levelling using Dumpy level: Collimation and Rise and Fall methods, Field book preparation	2
Experiment 4	Total Station Survey: Traversing and Levelling	2
Experiment 5	Visual Image Interpretation	2
Experiment 6	Satellite Image Pre-processing	2
Experiment 7	Digital Image Classification and Accuracy Assessment	2
Experiment 8	Stereoscopic fusion of aerial photographs using mirror stereoscope	2



## Books

<b>Books</b>	Sl.	Book Name	Author	Publishing House
	1	Surveying & Levelling	N. N. Basak	McGraw Hill Education (India) Private Limited
	2	Surveying – Vol. I, II & III	B. C. Punmia Ashok Kumar Jain Arun Kumar Jain	Laxmi Publications (P) Ltd.
	3	Surveying – Vol. I & II	S. K. Duggal	McGraw Hill Education (India) Private Limited
	4	Surveying & Levelling – Part I & II	T. P. Kanetkar, S. V. Kulkarni	Pune Vidyarthi Griha Prakashan
	5	Remote Sensing and GIS	Basudeb Bhatta	Oxford University Press
	6	Principles of Geoinformatics	P.K. Garg	Khanna Publishing House

## CO-PO Mapping

### CO-PO Mapping

#### Surveying & Geomatics

(Course Code – CE(PC)493)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	3	2	3	-	-	2	1	1	3	3	2	-	3	2	1
<b>CO2</b>	3	3	3	-	-	2	1	1	2	2	3	1	2	3	3
<b>CO3</b>	3	2	3	-	-	2	1	1	3	2	3	1	3	2	2
<b>CO4</b>	3	3	3	1	-	2	1	3	3	3	2	3	3	2	3
<b>CO5</b>	2	3	2	-	1	1	3	1	1	3	3	2	1	2	2
<b>CO6</b>	3	2	3	1	-	1	2	1	2	3	2	2	3	2	2
<b>Avg.</b>	<b>2.83</b>	<b>2.5</b>	<b>2.83</b>	<b>1</b>	<b>1</b>	<b>1.67</b>	<b>1.5</b>	<b>1.33</b>	<b>2.33</b>	<b>2.67</b>	<b>2.5</b>	<b>1.8</b>	<b>2.5</b>	<b>2.17</b>	<b>2.17</b>

## CE(PC)494: Concrete Technology Laboratory

Course Code – CE(PC)494	Concrete Technology Laboratory	0T+0L+2P	1 Credits
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### Course Outcome (CO)

Course Outcome (CO)	<ul style="list-style-type: none"> <li>Students will be able to Demonstrate the method and findings of tension and compression tests on cement &amp; concrete ingredients.</li> <li>Students will be able to Understand the concepts of different tests on hardened concrete &amp; setting time.</li> <li>Students will be able to Calculate the specific gravity of cement &amp; concrete ingredients.</li> <li>Students will be able to Find out the mix proportion of high grade of concrete.</li> <li>Students will be able to Measure the workability of the concrete mix.</li> </ul>
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### Syllabus

SI No.	Course Content	Total Hours
Module – 1	Test on Fine Aggregates <ul style="list-style-type: none"> <li>Bulking,</li> <li>Specific gravity,</li> <li>Bulk Density,</li> <li>Percentage voids,</li> <li>Fineness Modulus.</li> <li>Grading curve.</li> </ul>	5P
Module – 2	Test on Coarse Aggregates <ul style="list-style-type: none"> <li>Specific gravity,</li> <li>Bulk Density,</li> <li>Percentage voids,</li> <li>Fineness Modulus.</li> <li>Grading curve.</li> </ul>	5P
Module – 3	Test on Cement <ul style="list-style-type: none"> <li>Normal consistency,</li> <li>fineness,</li> <li>Initial setting and final setting time of cement.</li> <li>Specific gravity,</li> <li>soundness and</li> <li>Compressive strength of Cement.</li> </ul>	10P
Module – 4	Test on Fresh Concrete <ul style="list-style-type: none"> <li>Concrete mix design,</li> <li>Various workability tests –               <ol style="list-style-type: none"> <li>slump,</li> <li>compacting factor,</li> <li>Vee-bee test.</li> </ol> </li> </ul>	10P
Module – 5	Test on Hardened Concrete <ul style="list-style-type: none"> <li>Spilt-tensile strength test,</li> </ul>	10P



	<ul style="list-style-type: none"> <li>Flexure test,</li> <li>NDT Tests (Rebound hammer and Ultra-sonic pulse velocity),</li> <li>Poission ratio.</li> </ul>	
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## Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	Concrete Technology (Theory & Practice)	Shetty, M.S.	S. Chand and Co.
	2	Concrete Technology	Gambhir, M.L.	Tata McGraw Hill
	3	Concrete Technology	A. M. Neville and J.J. Brooks	Pearson Education India Ltd.
	4	Properties of Concrete	A.M.Neville	Pearson India
<b>IS Codes</b>	I.S. 10262-2019			Bureau of Indian Standards

## CO-PO Mapping

### CO-PO Mapping

#### Concrete Technology Laboratory

( Course Code – CE(PC)494)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	3	2	2	2	2	-	-	-	1	-	1	1	2	2	3
<b>CO2</b>	3	2	2	2	2	1	1	1	1	-	-	1	2	1	3
<b>CO3</b>	3	2	2	2	2	1	-	-	1	-	-	1	2	2	3
<b>CO4</b>	1	1	1	1	1	-	1	1	3	2	2	1	3	1	2
<b>CO5</b>	1	1	1	2	2	1	-	1	-	1	-	1	3	2	2
	<b>2.2</b>	<b>1.6</b>	<b>1.6</b>	<b>1.8</b>	<b>1.8</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1.2</b>	<b>1.5</b>	<b>1</b>	<b>1</b>	<b>2.4</b>	<b>1.6</b>	<b>2.6</b>



## 5<sup>th</sup> Semester

### CE(PC)501: Design of RC Structure

Course Code – CE(PC)501	Design of Reinforced Concrete Structure	2L+1T+0P	3 Credits
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>1. Students will be able to Understand material properties and design methodologies for reinforced concrete structures.</li> <li>2. Students will be able to Assess different type of loads and prepare layout for reinforced concrete structures</li> <li>3. Students will be able to Identify and apply the applicable industrial design codes relevant to the design of reinforced concrete members</li> <li>4. Students will be able to Analyze and design various structural elements of reinforced concrete building like beam, slab, column, footing, and staircase</li> <li>5. Students will be able to Prepare structural drawings and detailing and produce design calculations and drawing in appropriate professional format</li> </ol>
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### Syllabus

Sl No.	Course Content	Total Hours
Module 1:	Introduction: Principles of design of reinforced concrete members - Working stress and Limit State method of design	1L
Module 2:	Working stress method of design: Basic concepts and IS code provisions (IS: 456 2000) for design against bending moment and shear forces - Balanced, under reinforced and over reinforced beam/ slab sections; design of singly and doubly reinforced sections	2L+2T
Module 3:	Limit state method of design: Basic concepts and IS code provisions (IS: 456 2000) for design against bending moment and shear forces; concepts of bond stress and development length; Use of 'design aids for reinforced concrete' (SP:16).	5L+2T
Module 4:	Beam Design by LSM: Analysis, design and detailing of singly reinforced rectangular, 'T', 'L' and doubly reinforced beam sections by limit state method.	3L+2T
Module 5:	Slab Design by LSM : Design and detailing of one-way and two-way slab panels as per IS code provisions	2L+1T
Module 6:	Continuous slab and beam design by LSM: Design and detailing of continuous beams and slabs as per IS code provisions	2L+1T
Module 7:	Design of Staircases by LSM: Types; Design and detailing of reinforced concrete doglegged staircase	3L+1T



Module 8	Design of Columns by LSM: Design and detailing of reinforced concrete short columns of rectangular and circular cross-sections under axial load. Design of short columns subjected to axial load with moments (uniaxial and biaxial bending) – using SP 16.	4L+1T
Module 9	Design of Foundation by LSM: Design and detailing of reinforced concrete isolated square and rectangular isolated and combined footing for columns as per IS code provisions by limit state method Design and detailing of Pile foundation as per IS code provisions.	6L+2T

## Books

Books	Sl.	Book Name	Author	Publishing House
	1	Reinforced Concrete Design	Pillai and Menon	TMH
	2	Reinforced Concrete Design	Krishna Raju &	New Age
	3	R.C.C. Design	B.C. Punmia	Laxmi Publication
	4	Reinforced concrete structures	N. Subramanian	OXFORD University Press
<b>IS Codes</b>	IS: 456 – 2000 IS 875 – I (1987), IS 875 - II (1987), IS 875 - III (2015), SP: 16 Design Aid to IS 456			Bureau of Indian Standards

## CO-PO Mapping

### CO-PO Mapping

#### Design of Reinforced Concrete Structure – 1

(Course Code - CE501)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	2	1	-	2	-	1	1	-	-	1	-	3	2	1	2
<b>CO2</b>	3	3	1	3	-	2	3	1	1	-	1	3	3	3	1
<b>CO3</b>	1	1	-	-	2	-	1	-	1	1	-	3	1	1	1
<b>CO4</b>	3	2	3	2	3	1	3	2	2	2	2	3	3	2	3
<b>CO5</b>	2	1	2	1	3	1	3	3	3	3	3	3	3	2	3
	<b>2.2</b>	<b>1.6</b>	<b>2</b>	<b>2</b>	<b>2.67</b>	<b>1.25</b>	<b>2.2</b>	<b>2</b>	<b>1.75</b>	<b>1.75</b>	<b>2</b>	<b>3</b>	<b>2.4</b>	<b>1.8</b>	<b>2</b>

## CE(PC)502: Engineering Hydrology

Course Code – CE(PC)502	Engineering Hydrology	2L+1T+0P	1 Credits
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>1. Students will be able to study the source, occurrence, movement and distribution of water which is a prime resource for development of a nation.</li> <li>2. Students will be able to learn about the functioning of reservoirs and estimation of storage capacities.</li> <li>3. Students will be able to learn about flood hazards, estimation of design floods for various structures and methods of estimating effects of passage of floods through rivers and reservoirs.</li> <li>4. Students will be able to know the basic principles of measurement of flow in rivers..</li> </ol>
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### Syllabus

SI No.	Course Content	Total Hours
Module 1	Hydrology: Hydrologic Cycle, Global Water Budget, India's Water Budget	1L
Module 2	Catchment: Definition & Descriptions, Various Types of Catchment, Factors Characterizing a Catchment, Delineation of Catchment Boundary.	2L
Module 3	Measurement of Precipitation: Precipitation, Description and Functioning of Various Types of Rain gauges, Rain gauge Network-Codal Provisions, Optimum Number of Raingauge Stations.	3L
Module 4	Processing of Rainfall Data: Normal Rainfall, Estimation of Missing Rainfall Data, Test for Consistency of Record; Mass Curve of Rainfall, Hyetograph, Point Rainfall; Mean Precipitation over an Area– Arithmetic Mean, Thiessen Polygon and Isohyetal Method.	4L
Module 5	Losses from Precipitation: Evaporation – Evaporation Process, Factors affecting Evaporation, Measurement of Evaporation– Description and Functioning of Pan Evaporimeter, Pan Coefficient, Evapotranspiration: AET, PET, Measurement of ET, Estimation of ET–Blaney Criddle Formulae; Infiltration– Process, Factors Affecting Infiltration, Infiltration Rate and Infiltration Capacity, Measurement of Infiltration, Infiltration Equations, Infiltration Indices.	6L
Module 6	Streamflow Measurement: Importance, Direct and Indirect Methods, Measurement of Stage– Various Gauges and Recorders, Measurement of Velocity–Current Meters, their Functioning and Calibration; Velocity Distribution, Floats; Streamflow Computation– Area-	12L



	Velocity Method, Moving Boat Method, Dilution Technique, Electromagnetic Method, Ultrasonic Method; Indirect Methods– Flow Measuring Structures, Slope Area Method; Stage Discharge Relation, Permanent Control, Stage for Zero Discharge, Shifting Control– Backwater Effect, Unsteady Flow Effect, Extension of the Rating Curve.	
Module 7	Runoff: Description of the Process, Components of Runoff, Factors Affecting Runoff, Characteristics of Streams, Rainfall Runoff Relationships. Hydrographs: Types, Base Flow Separation, Effective Rainfall.	2L
Module 8	Unit Hydrograph– Definition, Assumptions, Applications– Derivation of Unit Hydrograph, Distribution Graph, Unit Hydrograph of Different Durations– Method of Superposition and S-Curve.	4L
Module 9	Floods: Concept of flood as a natural hazard; Estimation of flood discharge in a river – rational method, empirical formulae, unit hydrograph method; flood frequency studies – return period.	2L
Module 10	Flood Routing: Concept of flood routing in channels and through a reservoir, basic routing equations; reservoir routing – Modified Pul’s method; channel routing – Muskingum method.	5L

## Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	Engineering Hydrology (4th Ed.	K. Subramanya	McGraw Hill Education (India) Private Limited
	2	Engineering Hydrology	R. Srivastava and A. Jain	Laxmi Publications (P) Ltd.
	3	Hydrology	M. M. Das, M. Das Saikia	PHI Learning Private Limited, New Delhi,
	4	Applied Hydrology	V. T. Chow, D. Maidment, L. Mays	Tata McGraw Hill Edition, New Delhi,
	5	Remote Sensing and GIS	Basudeb Bhatta	Oxford University Press
	6	Principles of Geoinformatics	P.K. Garg	Khanna Publishing House



## CO-PO Mapping

### CO-PO Mapping

#### Engineering Hydrology

(Course Code – CE(PC)502)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	3	2	3	-	1	2	1	1	3	3	2	-	3	2	1
<b>CO2</b>	3	3	3	-	-	2	1	1	2	2	3	1	2	3	3
<b>CO3</b>	3	2	3	-	-	2	1	1	3	2	3	1	3	2	2
<b>CO4</b>	3	3	3	1	-	2	1	3	3	3	2	3	3	2	3
<b>Avg.</b>	<b>3</b>	<b>2.5</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>1.5</b>	<b>2.75</b>	<b>2.50</b>	<b>2.5</b>	<b>1.67</b>	<b>2.75</b>	<b>2.25</b>	<b>2.25</b>

## CE(PC)503: Structural Analysis – I

Course Code – CE(PC)503	Structural Analysis – I	2L+1T+0P	3 Credits
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## Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>1. Students will be able to Distinguish between stable and unstable and statically determinate and indeterminate structures.</li> <li>2. Students will be able to Apply equations of equilibrium to structures and compute the reactions.</li> <li>3. Students will be able to Calculate the internal forces in cable and arch type structures.</li> <li>4. Students will be able to Evaluate and draw the influence lines for reactions, shears and bending moments in beams due to moving loads.</li> <li>5. Students will be able to Calculate the deflections of truss structures and beams.</li> </ol>
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## Syllabus

Sl No.	Course Content	Total Hours
Module 1	<p>Basics of Structural Analysis: Concept of static and kinematic indeterminacy, Determination of degree of indeterminacy for different types of structures.</p> <p>Theorem of minimum potential energy, law of conservation energy, principle of virtual work, the first and second theorems of Castiglano, Betti's law, Clark Maxwell's theorem of reciprocal deflection</p>	3L+1T
Module 2	Analysis of Determinate Structures: Portal Frames, Three hinged arches, Cables	3L+2T
Module 3	Deflection of Determinate Structures: Energy methods. Unit Load method for beams, Deflection of trusses and Simple Portal Frames.	3L+2T
Module 4	Influence Line Diagram: Statically determinate beams and trusses under series of concentrated and uniformly distributed rolling loads, criteria for maximum and absolute maximum moments and shear.	6L+3T
Module 5	Analysis of Statically Indeterminate Beams: Theorem of three moments, Energy methods, Force method (Method of consistent deformation) [For analysis of propped cantilever, fixed beams and continuous beams (maximum two degree of indeterminacy) for simple loading case], Analysis of two hinged arch.	8L+4T
Module 6	Influence Line Diagram for Indeterminate Structures: Muller – Breslau principle.	3L+2T



## Books

<b>Books</b>	Sl.	Book Name	Author	Publishing House
	1	Structural Analysis	R. Agor	Khanna Publishing House
	2	Structural Analysis (Vol I & Vol II)	S S Bhavikatti	Vikas Publishing House Pvt. Ltd
	3	Theory of Structures	S. Ramamrutham	Khanna Publishers
	4	Strength of Materials and Theory of Structures (Vol I & Vol II)	Punmia, Jain, Jain	Laxmi Publication
	5	Structural Analysis	R.C. Hibbeler	Prentice Hall
	6	Theory of Structures	Timoshenko and Young	McGrawHill

## CO-PO Mapping

### CO-PO Mapping

#### Structural Analysis – I

(Course Code - CE(PC)503)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	3	1	-	-	-	1	1	-	2	-	1	2	1	1	3
<b>CO2</b>	3	2	2	-	-	1	1	-	2	1	-	2	1	1	3
<b>CO3</b>	3	2	1	1	-	1	1	2	2	-	-	2	1	1	3
<b>CO4</b>	3	2	1	-	1	1	1	-	2	-	1	2	1	1	3
<b>CO5</b>	3	2	-	-	-	1	1	-	2	1	1	2	1	1	3
	<b>3</b>	<b>1.8</b>	<b>1.33</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>3</b>

## CE(PC)504: Soil Mechanics-II

Course Code – CE(PC)504	Soil Mechanics-II	2L+1T+0P	3 Credits
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## Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>1. The students will be able to assess the compaction and consolidation characteristics of soil for solving geotechnical problems.</li> <li>2. The students will be able to calculate earth pressure on rigid retaining walls on the basis of classical earth pressure theories.</li> <li>3. The students will be able to analyze and design rigid retaining walls (cantilever types) from geotechnical engineering consideration.</li> <li>4. The students will be able to evaluate the bearing capacity of shallow foundation by applying established theory.</li> <li>5. The students will be able to estimate settlement in soils by different methods.</li> </ol>
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## Syllabus

Sl No.	Course Content	Total Hours
Module 1	<b>Consolidation of Soil</b> Terzaghi's theory of one dimensional consolidation, Compressibility characteristics of soils, Compression index, Coefficient of compressibility and volume change, Coefficient of consolidation, Degree and rate of consolidation, Time factor, Settlement computation, Consolidometer and laboratory one dimensional consolidation test as per latest IS Code, Determination of consolidation parameters.	5L+3T
Module 2	<b>Compaction of Soil</b> Principles of compaction, Standard and modified proctor compaction test, Field compaction methods, Field compaction control, Factors affecting compaction, Effect of compaction on soil properties.	3L+1T
Module 3	<b>Earth Pressure Theories</b> Plastic equilibrium of soil, Earth pressure at rest, Active and passive earth pressures, Rankine's and Coulomb's earth pressure theories, Different types of backfill, Wedge method of analysis. Analytical and graphical methods for determination of earth pressure against various earth retaining structures. Stability of retaining walls: Cantilever retaining wall.	7L+3T





Module 4	<b>Bearing capacity of shallow foundations</b> Bearing capacity, Definition, Factors affecting bearing capacity, Modes of failures, Methods of determining bearing capacity of soils. Terzaghi's bearing capacity theory, Effect of depth of embedment, Eccentricity of load, Foundation shape on bearing capacity, Effect of 11 water table and eccentric loads. Isolated footings with combined action of loads and moments, Bearing capacity as per IS: 6403.	7L+4T
Module 5	<b>Settlement</b> Allowable bearing pressure and settlement analysis (as per IS: 8009), Immediate and consolidation settlements, Rigidity and depth factor corrections, Settlement values as per IS: 1904 recommendations.	2L+1T
Module 6	<b>Stability of slopes</b> Types of failure, Analysis of finite and infinite slopes, Swedish and friction circle method, Ordinary method of slices, Factor of safety, Taylor's stability number, Bishop's simplified method of stability analysis.	3L+2T

## Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	Textbook of Soil Mechanics and Foundation Engineering (Geotechnical Engineering Series)	V.N.S. Murthy	CBS Publishers
	2	Soil Mechanics and Foundations	Punmia B.C. and Jain A. K	Laxmi Publications (P) Ltd
	3	Basic and Applied Soil Mechanics	Gopal Ranjan & A.S.R. Rao	New Age International Pvt. Ltd, Publishers
	4	Principles of Geotechnical Engineering	B.M. Das	Thomson Brooks / Cole



## CO-PO Mapping

### CO-PO Mapping

#### Soil Mechanics-II

(Course Code – CE(PC)504)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	2	1	-	2	-	1	1	-	-	1	-	3	2	1	2
<b>CO2</b>	3	3	2	3	-	2	3	1	1	-	1	3	3	3	2
<b>CO3</b>	2	2	-	-	2	-	1	-	1	1	-	3	1	1	2
<b>CO4</b>	3	2	3	2	3	1	3	2	2	2	2	3	3	2	3
<b>CO5</b>	2	3	2	2	3	1	3	3	3	3	3	3	3	2	3
<b>Avg.</b>	<b>2.4</b>	<b>2.2</b>	<b>2.33</b>	<b>2.25</b>	<b>2.67</b>	<b>1.25</b>	<b>2.2</b>	<b>2</b>	<b>1.75</b>	<b>1.75</b>	<b>2</b>	<b>3</b>	<b>2.4</b>	<b>1.8</b>	<b>2.4</b>

## CE(PC)505: Environmental Engineering-II

Course Code – CE(PC)505	Environmental Engineering-II	1L+0T+2P	2 Credits
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>1. The students will be able to define the basic concepts and terminologies of waste water engineering and hazardous waste management.</li> <li>2. The students will be able to describe different home plumbing systems for water supply and wastewater disposal</li> <li>3. The students will be able to apply the methods of quantifying sanitary sewage and storm sewage.</li> <li>4. The students will be able to solve different mathematical problems regarding different components of sewerage system</li> <li>5. The students will be able to compare between different wastewater samples based on their physical, chemical and biological characteristics.</li> </ol>
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### Syllabus

Sl No.	Course Content	Total Hours
Module 1	<b>Sewage and Drainage</b> Definition of Common Terms: Sewage or Sanitary Sewage, Drainage or Storm Sewage, Sullage, Black Water, Grey Water Sewerage Systems: Separate system, Combined System, Partially Separate System; applicability, advantages and disadvantages	1L+1T
Module 2	<b>Sewage and Drainage Quantity</b> Quantity estimation for sanitary sewage; Quantity estimation for storm sewage	3L+1T
Module 3	<b>Conveyance of Sewage</b> Sewers: Shapes; Design parameters; Operation and maintenance of sewers; Sewer appurtenances Hydraulic Design of Sewers: Partial flow diagrams and Nomograms	4L+2T
Module 4	<b>Wastewater Characteristics</b> Physical, chemical and biological characteristics of municipal and domestic sewage; Effluent discharge standards	4L+2T
Module 5	<b>Wastewater Treatment</b> Primary, secondary and tertiary treatment of wastewater; aerobic and anaerobic treatment options Primary and Secondary Treatment of Domestic Wastewater: Typical Flow Chart of STP; Screen and Bar Racks; Grit Chamber; Primary and Secondary Sedimentation Tank; Activated Sludge Process; Trickling Filter	8L+4T



Module 6	<b>Sludge Handling and Disposal</b> Sludge Thickening; Sludge Digestion; Sludge Drying Bed	3L+1T
Module 7	<b>Building Plumbing</b> Introduction to various types of home plumbing systems for water supply and waste water disposal; high rise building plumbing; Pressure reducing valves; Break pressure tanks; Storage tanks; Building drainage for high rise buildings; various kinds of fixtures and fittings used	3L+1T
Module 8	<b>Hazardous waste</b> Types and nature of hazardous waste as per the HW Schedules of regulating authorities	3L+1T

## Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	Environmental Engineering	S.C. Sharma	Khanna Publishing House
	2	Environmental Engineering. Volume-1 and Volume-2	Garg, S.K.	Khanna Publishers
	3	Environmental Engineering	Peavy, H.S, Rowe, D.R, Tchobanoglous, G	Tata McGraw Hill Indian Edition
	4	Introduction to Environmental Engineering and Science	Masters, G.M., Ela, W.P.	Prentice Hall / Pearson



## CO-PO Mapping

### CO-PO Mapping

#### Environmental Engineering-II

(Course Code – CE(PC)505)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	2	2	3	3	-	-	2	-	-	-	2	3	1	2	1
<b>CO2</b>	3	3	3	2	3	-	2	-	-	2	2	2	3	2	3
<b>CO3</b>	3	2	2	1	3	-	-	1	1	1	1	1	2	2	3
<b>CO4</b>	3	-	2	-	3	2	2	2	-	-	-	2	3	3	3
<b>CO5</b>	3	3	-	2	2	2	3	1	1	1	-	2	3	2	3
<b>Avg.</b>	<b>2.8</b>	<b>2.5</b>	<b>2.5</b>	<b>2</b>	<b>2.75</b>	<b>2</b>	<b>2.25</b>	<b>1.33</b>	<b>1</b>	<b>1.33</b>	<b>1.67</b>	<b>2</b>	<b>2.4</b>	<b>2.2</b>	<b>2.6</b>

## CE(PC)506: Transportation Engineering

Course Code – CE(PC)506	Transportation Engineering	2L+1T+0P	3 Credits
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>1. Students will able to Understand the knowledge of planning, design and the fundamental properties of highway materials in highway engineering.</li> <li>2. Students will able to Apply the knowledge of geometric design and draw appropriate conclusion.</li> <li>3. Students will able to Interpret the concept of different methods in design, construction of the pavement.</li> <li>4. Students will able to Interpret traffic parameters by applying the knowledge in traffic planning and intersection design.</li> </ol>
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### Syllabus

Sl No.	Course Content	Total Hours
<b>Module1</b>	<b>Introduction to Highway Engineering</b> Scope of Highway Engineering; Jayakar Committee Report: Recommendations – CRF,IRC,CRRI; Scope of Motor Vehicle Act; Recommendations ofNagpurRoadconference;RoadClassificationasperthird20yearsroaddevelopmentplan(1981-2001);Basic types of Road Patterns and its scope of application	2L+1T
<b>Module2</b>	<b>Highway alignment</b> Factors controlling Highway Alignment; Engineering Surveys for Highway Alignment.	1L+1T
<b>Module3</b>	<b>Geometric Design</b> Cross-sectional elements of highway; Design Parameters (as per IRC) – Vehicle dimensions, Carriageway width, Design speed, Frictional coefficients (Lateral and Longitudinal) etc.; Design Principles of Horizontal Alignment: Camber, Sight Distance (PIEV theory, SSD, OSD, ISD); Horizontal Curves– [Radius, Super elevation, Extra widening, Set back distance, Transition curve]; Design Principles of Vertical Alignment: Gradients; Grade Compensation; Vertical Curves–Summit Curve, Valley curve.	8L+4T
<b>Module4</b>	<b>Traffic Engineering</b> Traffic studies: Fundamental parameters of Traffic Flow (speed, flow, density, capacity) and their basic relations; Basics of Spot Speed Studies- Speed and Delay Study-O&D study; Intersections and Channelization: At Grade and Grade Separated intersections; Conflict points; Salient features of Rotary; Traffic Signs; Signal Design – Basic concepts of IRC design method, 2phasesignaldesign by Webster method.	7L+3T



<b>Module 5</b>	<b>Pavement Design</b> Pavement materials: Bitumen, Aggregate, Subgrade soil; Types of Pavement: Flexible and Rigid pavements and their typical cross-sections; Design parameters: Wheel Load, ESWL, Tyre Pressure, CBR, Resilient Modulus & Poisson's Ratio of various layers, Subgrade Modulus etc. Design of Flexible Pavement using IRC 37:2018 Design of Rigid Pavement: Wheel Stresses, Frictional Stresses and Warping Stresses; Expansion, Contraction and Construction Joints; Design of Rigid Pavement thickness, Dowel Bar and Tie Bar. Distresses in Pavements	8L+5T
<b>Module 6</b>	<b>Sustainability</b> Scope of adoption of sustainable construction techniques by using recyclable hazardous materials- fly ash, plastics, recyclable construction materials.	1L+1T

## Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	Traffic Engineering and Transport Planning	Kadiyali L.R	Khanna Publishers
	2	Highway Engineering	Khanna, S.K. and C.E.G. Justo	Nem Chand and Bros
	3	Transportation Engineering–An Introduction	Jotin Khisty C.and B.Kent Lall	Prentice Hall of India Pvt. Ltd

## CO-PO Mapping

### CO-PO Mapping

#### Transportation Engineering

(Course Code – CE(PC)506)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	3	2	1	2	1	2	2	1	2	1	2	3	2	1	3
<b>CO2</b>	3	3	2	2	1	1	1	2	2	2	1	3	3	3	2
<b>CO3</b>	2	2	1	2	1	1	3	3	1	1	1	3	2	2	2
<b>CO4</b>	2	1	3	1	3	2	1	1	3	2	2	3	1	2	1
<b>Avg.</b>	2	2.25	1.75	1.75	1.5	1.5	1.75	1.75	2	1.5	1.5	3	2	2	2



## CE(MC)501: Constitution of India/ Essence of Indian Knowledge Tradition

Course Code – CE(MC)501	Constitution of India/ Essence of Indian Knowledge Tradition	0L+0T+0P	0 Credits
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>1. Students will be able to Understand the emergence and evolution of Indian Constitution.</li> <li>2. Students will be able to evaluate the structure and composition of Indian Constitution</li> <li>3. Students will be able to analyse federalism in the Indian context.</li> <li>4. Students will be able to analyse the three organs of the state in the contemporary scenario</li> </ol>
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### Syllabus

Sl No.	Course Content	Total Hours
Module 1:	<b>Indian Constitution</b> Sources and constitutional history, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy	
Module 2:	<b>Union Government and its administration</b> Structure of the Indian Union- Union Federalism, Centre-State relationship President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha. State government and its administration: Governor: Role and Position, CM and Council of ministers, State Secretariat: Organization, Structure and Functions	
Module 3:	<b>Supreme Courts</b> Organization of supreme court, procedure of the court, independence of the court, jurisdiction and power of supreme court. High court: Organization of high court, procedure of the court, independence of the court, jurisdiction and power of supreme court. Subordinate courts: constitutional provision, structure and jurisdiction. National legal services authority, Lok adalats, family courts, gram nyayalays. Public interest litigation (PIL): meaning of PIL, features of PIL, scope of PIL, principle of PIL, guidelines for PIL	





Module 4:	<b>Local Administration</b> District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation, Pachayati raj: Introduction, PRI: Zila Pachayat, Elected officials and their roles, CEO Zila Pachayat: Position and role, Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy	
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## Books

Books	Sl.	Book Name	Author	Publishing House
	1	Indian polity	M, Laxmikanth	MC Graw Hill education
	2	Introduction to the constitution of	DD Basu	Lexis Nexis Books

## CO-PO Mapping

### CO-PO Mapping

#### Constitution of India/ Essence of Indian Knowledge Tradition

(Course Code - CE(MC)501)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	-	-	1	2	-	2	2	-	1	1	1	3	2	1	3
<b>CO2</b>	-	-	1	2	-	2	1	-	2	1	-	3	1	2	2
<b>CO3</b>	-	-	2	2	-	2	1	-	3	1	-	3	2	3	1
<b>CO4</b>	-	-	2	2	-	1	1	-	3	2	-	3	2	1	2
<b>Avg.</b>	-	-	<b>1.5</b>	<b>2</b>	-	<b>1.75</b>	<b>1.25</b>	-	<b>2.25</b>	<b>1.25</b>	<b>1</b>	<b>3</b>	<b>1.75</b>	<b>1.75</b>	<b>2</b>



## CE(PC)591: RC Design Sessional

Course Code – CE(PC)591	RC Design Sessional	0L+0T+2P	1 Credits
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>1. Students will be able to understand material properties and design methodologies for reinforced concrete structures.</li> <li>2. Students will be able to assess different type of loads and prepare layout for reinforced concrete structures.</li> <li>3. Students will be able to Identify and apply the applicable industrial design codes relevant to the design of reinforced concrete members.</li> <li>4. Students will be able to analyse and design various structural elements of reinforced concrete building like beam, slab, column, footing, and staircase.</li> <li>5. Students will be able to assessment of serviceability criteria for reinforced concrete beam and slab.</li> <li>6. Students will be able to prepare structural drawings and detailing and produce design calculations and drawing in appropriate professional format.</li> </ol>
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### Syllabus

Sl No.	Course Content	Total Hours
<b>Module 1:</b>	Design of a small RCC framed building using Limit State method of design including preparation of necessary working drawing and report in accordance with CE(PC)501	

### Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	Reinforced Concrete Design	Pillai and Menon	TMH
	2	Reinforced Concrete Design	Krishna Raju & Pranesh	New Age
	3	R.C.C. Design	B.C. Punmia	Laxmi Publication
	4	Reinforced concrete structures	N. Subramanian	OXFORD University Press
<b>IS Codes</b>	IS: 456 – 2000 IS 875 – I (1987), IS 875 - II (1987), IS 875 - III (2015), SP: 16 Design Aid to IS 456			Bureau of Indian Standards



## CO-PO Mapping

### CO-PO Mapping

#### RC Design Sessional

(Course Code - CE(PC)591)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	2	1	-	2	-	2	1	-	-	1	-	3	1	1	3
<b>CO2</b>	3	3	2	1	2	-	2	-	1	-	1	3	2	3	2
<b>CO3</b>	2	1	-	-	1	-	1	2	-	1	-	3	1	1	2
<b>CO4</b>	2	3	3	2	3	1	2	1	2	1	2	3	3	1	3
<b>CO5</b>	2	1	-	-	1	-	1	2	-	1	-	3	1	1	3
<b>CO6</b>	2	3	3	2	3	1	2	1	2	1	2	3	3	1	3
<b>Avg.</b>	<b>2.17</b>	<b>2</b>	<b>2.67</b>	<b>1.75</b>	<b>2</b>	<b>1.33</b>	<b>1.5</b>	<b>1.5</b>	<b>1.67</b>	<b>1</b>	<b>1.67</b>	<b>3</b>	<b>1.83</b>	<b>1.33</b>	<b>2.67</b>



## Course Code – CE(PC)594: Soil Mechanics Laboratory

Course Code – CE(PC)594	Soil Mechanics Laboratory	0L + 0T + 2P	1 Credits
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>Students will be able to identify different types of soil &amp; can determine the moisture content.</li> <li>Students will be able to determine the specific gravity of cohesionless &amp; cohesive soil.</li> <li>Students will be able to determine the in-situ density of soil.</li> <li>Students will be able to perform the grain size distribution of cohesionless &amp; fine-grained soil.</li> <li>Students will be able to determine Atterberg's limits &amp; coefficient of permeability of soil.</li> <li>Students will be able to determine the compaction characteristics of soil.</li> </ol>
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### Syllabus

Sl No.	Course Content	Total Hours
<b>Experiment 1</b>	Field identification of different types of soil as per Indian Standards [collection of field samples and identifications without laboratory testing].	<b>2</b>
<b>Experiment 2</b>	Determination of natural moisture content.	<b>2</b>
<b>Experiment 3</b>	Determination of specific gravity of cohesionless and cohesive soils.	<b>2</b>
<b>Experiment 4</b>	Determination of in-situ density by core cutter method and sand replacement method.	<b>2</b>
<b>Experiment 5</b>	Determination of grain size distribution by sieve and hydrometer analysis.	<b>2</b>
<b>Experiment 6</b>	Determination of Atterberg limits (liquid limit, plastic limit and shrinkage limit).	<b>2</b>
<b>Experiment 7</b>	Determination of co-efficient of permeability by constant and variable head permeability tests.	<b>2</b>
<b>Experiment 8</b>	Determination of compaction characteristics of soil by standard proctor compaction test.	<b>2</b>
<b>Experiment 9</b>	Determination of unconfined compressive strength of soil by unconfined compression test.	<b>2</b>



<b>Experiment 10</b>	Determination of shear strength parameters of soil by direct shear test.	<b>2</b>
<b>Experiment 11</b>	Determination of undrained shear strength of soil by vane shear test.	<b>2</b>
<b>Experiment 12</b>	Determination of shear strength parameters of soil by unconsolidated undrained triaxial test.	<b>2</b>
<b>Experiment 13</b>	Determination of California Bearing Ratio (CBR) of soil.	<b>2</b>
<b>Experiment 14</b>	Determination of relative density of soil.	<b>2</b>
<b>Experiment 15</b>	Standard Penetration Test.	<b>2</b>

## Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	Soil Mechanics Laboratory Manual	Braja Mohan Das	Oxford university press
	2	Soil Testing: Laboratory Manual & Question Bank	K.V.S. Apparao	Laxmi Publications
<b>IS Codes</b>	<b>SP: 36 (Part - I and Part - II)</b>		<b>Bureau of Indian Standards</b>	

## CO-PO Mapping

### CO-PO Mapping

#### Soil Mechanics Laboratory

(Course Code - CE(PC)594)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	2	1	1	2	-	1	1	1	-	1	1	3	2	1	2
<b>CO2</b>	3	3	1	-	-	2	3	1	1	-	1	3	3	3	1
<b>CO3</b>	1	1	-	1	2	1	1	3	1	1	3	3	1	1	1
<b>CO4</b>	3	2	3	2	3	1	3	2	-	2	2	-	2	2	3
<b>CO5</b>	1	2	2	-	-	1	-	2	-	1	3	3	3	2	1
<b>CO6</b>	2	1	2	1	3	1	-	-	3	-	3	3	3	2	2
<b>Avg.</b>	<b>2</b>	<b>1.67</b>	<b>1.8</b>	<b>1.5</b>	<b>2.67</b>	<b>1.67</b>	<b>2</b>	<b>1.8</b>	<b>1.67</b>	<b>1.25</b>	<b>2.167</b>	<b>3</b>	<b>2.34</b>	<b>1.84</b>	<b>1.7</b>

## CE(PC)595: Environmental Engineering Laboratory

Course Code – CE(PC)595	Environmental Engineering Laboratory	1L+0T+2P	2 Credits
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>1. The students will be able to determine various physical characteristics for a given sample of water and wastewater.</li> <li>2. The students will be able to determine various chemical characteristics for a given sample of water and wastewater.</li> <li>3. The students will be able to examine the bacteriological characteristics for a given sample of water and wastewater.</li> <li>4. The students will be able to examine the suitability of a few treatment options for a given sample of water and wastewater</li> <li>5. The students will be able to compare the determined quality parameters with standards to decide on the suitability of use for the tested water and disposal of tested wastewater.</li> </ol>
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### Syllabus

Sl No.	Course Content	Total hours
Experiment 1	Determination of turbidity for a given sample of water	2P
Experiment 2	Determination of electrical conductivity for a given sample of water	2P
Experiment 3	Determination of Total Solids, Suspended Solids, Dissolved Solids and Volatile Solids in a given sample of water	2P
Experiment 4	Determination of pH for a given sample of water	2P
Experiment 5	Determination of carbonate, bi-carbonate and hydroxide alkalinity for a given sample of water	2P
Experiment 6	Determination of acidity for a given sample of water	2P
Experiment 7	Determination of hardness for a given sample of water	2P
Experiment 8	Determination of concentration of Iron in a given sample of water	2P
Experiment 9	Determination of concentration of Chlorides in a given sample of water	2P
Experiment 10	Determination of the Optimum Alum Dose for a given sample of water through Jar Test	2P
Experiment 11	Determination of the Chlorine Demand and	2P



	Break-Point Chlorination for a given sample of water	
Experiment 12	Determination of amount of Dissolved Oxygen (DO) in a given sample of water	2P
Experiment 13	Determination of the Biochemical Oxygen Demand (BOD) for a given sample of wastewater	2P
Experiment 14	Determination of the Chemical Oxygen Demand (COD) for a given sample of wastewater	2P
Experiment 15	Determination of Colliform Bacteria: presumptive test, Confirmative test and Determination of MPN	2P

## Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	Environmental Engineering	S.C. Sharma	Khanna Publishing House
	2	Environmental Engineering. Volume-1 and Volume-2	Garg, S.K.	Khanna Publishers
	3	Environmental Engineering	Peavy, H.S, Rowe, D.R, Tchobanoglous, G	Tata McGraw Hill Indian Edition
	4	Introduction to Environmental Engineering and Science	Masters, G.M., Ela, W.P.	Prentice Hall / Pearson

## CO-PO Mapping

### CO-PO Mapping

#### Environmental Engineering Laboratory

( Course Code – CE(PC)595)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	2	2	2	2	2	-	-	-	1	-	1	1	2	2	3
<b>CO2</b>	3	2	2	2	2	1	1	3	1	-	-	1	2	1	3
<b>CO3</b>	3	2	2	2	2	1	-	2	1	-	-	1	2	2	3
<b>CO4</b>	2	1	1	1	1	-	2	1	3	2	2	-	3	1	2
<b>CO5</b>	1	1	1	2	2	1	1	1	-	1	2	-	3	2	2
<b>Avg.</b>	<b>2.2</b>	<b>1.6</b>	<b>1.6</b>	<b>1.8</b>	<b>1.8</b>	<b>1</b>	<b>1.33</b>	<b>1.75</b>	<b>1.2</b>	<b>1.5</b>	<b>1.67</b>	<b>1</b>	<b>2.4</b>	<b>1.6</b>	<b>2.6</b>



## CE(PC)596: Transportation Engineering Laboratory

Course Code – CE(PC)596	Transportation Engineering Laboratory	0L+0T+2P	1 Credits
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### Course Outcome (CO)

Course Outcome (CO)	<ol style="list-style-type: none"> <li>1. Students will able to Identify engineering properties of aggregate.</li> <li>2. Students will able to Identify the grade &amp; properties of bitumen.</li> <li>3. Students will able to Perform quality control tests on pavements and pavement materials.</li> <li>4. Students will able to Understand the importance of soil quality for the design of pavement.</li> </ol>
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### Syllabus

Sl No.	Course Content	Total Hours
<b>Introduction</b>	Introduction on pavement construction materials	2
<b>Experiment1</b>	Shape test of aggregate	2
<b>Experiment2</b>	Crushing Strength Test of aggregate	2
<b>Experiment3</b>	Impact test of aggregate	2
<b>Experiment4</b>	Los Angeles Abrasion test of aggregate	2
<b>Experiment5</b>	Specific Gravity and Water Absorption test of aggregate	2
<b>Experiment6</b>	Specific Gravity test	2
<b>Experiment7</b>	Penetration test	2
<b>Experiment8</b>	Static or Kinematic viscosity	2
<b>Experiment 9</b>	Softening point test	2
<b>Experiment 10</b>	Flash and Fire Point test	2
<b>Experiment 11</b>	Ductility test	2
<b>Experiment 12</b>	CBR value of sub-grade (Soaked and unsoaked)	4
<b>Experiment 13</b>	Marshall Stability test	4
<b>Demonstration</b>	Demonstration on Stripping value and Loss on heating tests of bitumen, Benkelman Beam and Bump Integrator test.	

### Books

Books	Sl.	Book Name	Author	Publishing House
	1	Highway Engineering	Khanna,S.K.and C.E.G.Justo	Nem Chandand Bros
	2	Traffic Engineering and Transport Planning	KadiyaliL.R	Khanna Publishers

### CO-PO Mapping





## CO-PO Mapping

### Transportation Engineering Laboratory

(Course Code –CE(PC)596)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	2	1	2	2	2	1	1	2	3	1	3	3	2	1	3
<b>CO2</b>	3	3	1	3	2	2	3	1	1	3	1	3	2	2	2
<b>CO3</b>	1	1	1	1	2	1	1	2	1	1	3	3	1	3	1
<b>CO4</b>	3	2	3	2	3	1	3	2	2	2	2	3	3	2	2
<b>Avg.</b>	2.25	1.75	1.75	2	2.25	1.25	2	1.75	1.75	1.75	2.25	3	2	2	2



## CE(PC)597: Computer Application in CE

Course Code – CE(PC)597	Computer Application in CE	0L+0T+2P	1 Credits
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>1. Students will be able to Identify and formulate Civil Engineering problems solvable by computers.</li> <li>2. Students will be able to Perform linear algebra and matrix operations and their application to solve Civil Engineering problems.</li> <li>3. Students will be able to Solve sets of linear equations and determine roots and nonlinear equations</li> <li>4. Students will be able to Construct, interpret and solve simple optimization problems</li> <li>5. Students will be able to Develop programs for Civil Engineering analysis and design problems.</li> <li>6. Students will be able to Use various software used in industries for analysis and design.</li> </ol>
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### Syllabus

Sl No.	Course Content	Total Hours
Module 1:	Introduction: Concept of problem-solving using computer, use of programming language and software for problem solving; Identification of various design and analysis problems in different fields of Civil Engineering to be solved using computers; Procedure, formulae and data related to the analysis and design of such problems.	8
Module 2:	Use of spreadsheets: Learning spreadsheets like MS Excel, matrix analysis, use of Goal Seek and Solver, Optimization Tools; Plotting. Applications to problems involving tabular data, CE estimation, surveying, and design problems.	6
Module 3:	Programming Languages: Learning at least one language: Fortran 2003/2008/2018, C++11/C++14, Python 3, VBA 7.0; Computing platforms like Matlab/Scilab/MathCAD; Solving analysis and design problems in areas like surveying, hydraulics, structural analysis, RCC design, soil mechanics and foundation, transportation, water resources, etc.	12
Module 4:	Use of Software: Familiarity with widely used Civil Engineering software like STAAD Pro, HECRAS, HEC-HMS, SWMM, Mx Roads, etc.; Solving at least two such analysis/design problems	4



## Books

Books	Sl.	Book Name	Author	Publishing House
	1	Computer Application in Civil Engineering	Dr. Ritu Agarwal & Khushbu Naruka Dr. Hari Singh Parihar	Neelkanth Publishers

## CO-PO Mapping

### CO-PO Mapping

#### Computer Application in CE

(Course Code - CE(PC)597)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	3	2	3	3	2	-	2	-	-	-	1	3	1	2	2
<b>CO2</b>	1	3	3	1	3	-	2	1	2	2	-	3	2	3	2
<b>CO3</b>	2	1	2	1	2	1	3	3	3	3	3	3	3	3	2
<b>CO4</b>	3	2	3	2	3	1	1	2	2	2	2	3	3	2	3
<b>CO5</b>	2	3	2	1	1	1	1	-	1	1	-	3	3	2	3
<b>CO6</b>	2	1	2	1	3	1	-	-	2	3	-	3	3	3	2
<b>Avg.</b>	<b>2.16</b>	<b>2</b>	<b>2.5</b>	<b>1.5</b>	<b>2.33</b>	<b>1</b>	<b>1.8</b>	<b>2</b>	<b>2</b>	<b>2.2</b>	<b>2</b>	<b>3</b>	<b>2.5</b>	<b>2.5</b>	<b>2.33</b>

## 6<sup>th</sup> Semester

### CE(PC)601: Construction Engineering & Management

Course Code – CE(PC)601	Construction Engineering & Management	2L+0T+0P	2 Credits
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<p>CO1. Students will be able to assess an idea of how structures are built and projects are developed on the field and of modern construction practices</p> <p>CO 2. Students will be able to develop a good idea of basic construction dynamics-various stakeholders, project objectives, processes, resources required, and project economics</p> <p>CO 3. Students will develop the ability to plan, control, and monitor construction projects with respect to time and cost and also optimize construction projects based on costs</p> <p>CO 4. Students will be able to analyze how construction projects are administered with respect to contract structures and issues.</p> <p>CO 5. Students will be able to develop ideas to put forward ideas and understandings to others with effective communication processes</p>
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### Syllabus

Sl No.	Course Content	Total Hours
<b>Module – 1</b>	Planning: General consideration, Definition of aspect, prospect, roominess, grouping,	<b>2L</b>
<b>Module – 2</b>	Regulation and Bye laws Bye Laws in respect of side space, Back and front space, Covered areas, height of building etc., Lavatory blocks, ventilation, Requirements for stairs, lifts in public assembly building, offices.	<b>4L</b>
<b>Module – 3</b>	Fire Protection Firefighting arrangements in public assembly buildings, planning, offices, auditorium.	<b>2L</b>
<b>Module – 4</b>	Planning & Scheduling of constructions Projects Planning by CPM Preparation of network, Determination of slacks or floats. Critical activities.	<b>6L</b>



	<p>Critical path. Project duration.</p> <p>Planning by PERT</p> <p>Expected mean time, probability of completion of project, Estimation of critical path, problems.</p>	
<b>Module – 5</b>	<p>Construction Methods basics</p> <p>Types of foundations and construction methods; Basics of Formwork and Staging; Common building construction methods (conventional walls and slabs; conventional framed structure with blockwork walls; Modular construction methods for repetitive works; Precast concrete construction methods; Basics of Slip forming for tall structures; Basic construction methods for steel structures; Basics of construction methods for Bridges.</p>	<b>4L</b>
<b>Module – 6</b>	<p>Construction plants &amp; Equipment</p> <p>Plants &amp; equipment for earth moving, road constructions, excavators, dozers, scrapers, spreaders, rollers, their uses.</p> <p>Plants &amp; Equipment for concrete construction</p> <p>Batching plants, Ready Mix Concrete, concrete mixers, Vibrators etc., quality control.</p>	<b>3L</b>
<b>Module – 7</b>	<p>Contracts Management basics</p> <p>Importance of contracts; Types of Contracts, parties to a contract; Common contract clauses (Notice to proceed, rights and duties of various parties, notices to be given, Contract Duration and Price. Performance parameters; Delays, penalties and liquidated damages; Force Majeure, Suspension and Termination. Changes &amp; variations, Dispute Resolution methods.</p>	<b>4L</b>
<b>Module – 8</b>	<p>Management</p> <p>Professional practice, Definition, Rights and responsibilities of owner, engineer, Contractors, types of contracts.</p>	<b>3L</b>
<b>Module – 9</b>	<p>Departmental Procedures</p> <p>Administration, Technical and financial sanction, operation of PWD, Tenders and its notification, EMD and SD, Acceptance of tenders, Arbitration.</p>	<b>2L</b>

## Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	Construction Engineering & Management	S.V. Deodhar & S.C.Sharma	Khanna Publishing House
	2	Building Construction	Varghese, P.C	Prentice Hall India
	3	Construction Technology	Chudley, R	ELBS Publishers
<b>IS Codes</b>		<b>National Building Code</b>		<b>Bureau of Indian Standards</b>



## CO-PO Mapping

### CO-PO Mapping

#### Construction Engineering & Management

(Course Code - CE(PC)601)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	1	2	1	-	-	2	1	2	3	1	-	-	2	2	2
<b>CO2</b>	2	2	1	1	2	1	3	-	1	-	1	2	3	3	1
<b>CO3</b>	1	1	2	-	2	-	1	3	-	-	3	2	1	2	3
<b>CO4</b>	3	2	-	2	2	-	3	-	2	2	2	-	3	2	3
<b>CO5</b>	2	2	1	-	-	3	3	3	3	-	-	3	2	2	2
	1.8	1.8	1.25	1.5	2	2	2.2	2.67	2.25	1.5	2	2.34	2.2	2.2	2.2

## CE(PC)602: Engineering Economics, Estimation & Costing

Course Code – CE(PC)602	Engineering Economics, Estimation & Costing	2L+0T+0P	2 Credits
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>1. Students will be able to have an idea of Economics in general, Economics of India particularly for public sector agencies and private sector businesses</li> <li>2. Students will be able to perform and evaluate present worth, future worth and annual worth analyses on one of more economic alternatives.</li> <li>3. Students will be able to carry out and evaluate benefit/cost, life cycle and breakeven analyses on one or more economic alternatives.</li> <li>4. Students will be able to understand the technical specifications for various works to be performed for a project and how they impact the cost of a structure.</li> <li>5. Students will be able to quantify the worth of a structure by evaluating quantities of constituents, derive their cost rates and build up the overall cost of the structure.</li> <li>6. Students will be able to understand how competitive bidding works and how to submit a competitive bid proposal.</li> </ol>
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### Syllabus

Sl No.	Course Content	Total Hours
Module 1:	Basic Principles and Methodology of Economics. Demand/Supply – elasticity – Government Policies and Application. Theory of the Firm and Market Structure. Basic Macroeconomic Concepts (including GDP/GNP/NI/Disposable Income) and Identities for both closed and open economies. Aggregate demand and Supply (IS/LM). Price Indices (WPI/CPI), Interest rates, Direct and Indirect Taxes	3L
Module 2:	Basic Principles and Methodology of Economics. Demand/Supply – elasticity – Government Policies and Application. Theory of the Firm and Market Structure. Basic Macroeconomic Concepts (including GDP/GNP/NI/Disposable Income) and Identities for both closed and open economies. Aggregate demand and Supply (IS/LM). Price Indices (WPI/CPI), Interest rates, Direct and Indirect Taxes	3L
Module 3:	Estimation / Measurements for various items Introduction to the process of Estimation; Use of relevant Indian Standard Specifications for the same, taking out quantities from the given requirements of the work, comparison of different alternatives, Bar bending schedules, Mass haul Diagrams, Estimating Earthwork and Foundations, Estimating Concrete and Masonry, Finishes, Interiors, MEP works; BIM and quantity take-offs; adding equipment costs; labour costs; rate analysis; Material survey-Thumb rules for computation of materials requirement for different materials for buildings, percentage breakup of the cost, cost sensitive index, market survey of basic materials. Use of Computers in quantity surveying	9L



Module 4:	Specifications Types, requirements and importance, detailed specifications for buildings, roads, minor bridges and industrial structures.	3L
Module 5:	Rate analysis Purpose, importance and necessity of the same, factors affecting, task work, daily output from different equipment/ productivity.	3L
Module 6:	TenderPreparation of tender documents, importance of inviting tenders, contract types, relative merits, prequalification. general and special conditions, termination of contracts, extra work and Changes, penalty and liquidated charges, Settlement of disputes, R.A. Bill & Final Bill, Payment of advance, insurance, claims, price variation, etc. Preparing Bids- Bid Price buildup: Material, Labour, Equipment costs, Risks, Direct & Indirect Overheads, Profits; Bid conditions, alternative specifications; Alternative Bids. Bid process management	3L
Module 7:	Valuation Values and cost, gross income, outgoing, net income, scrap value, salvage value, market value, Book Value, sinking fund, capitalised value, Y. P., depreciation, obsolescence, deferred income, freehold and leasehold property, mortgage, rent fixation, valuation table	3L
Module 8	Introduction to Acts pertaining to-Minimum wages, Workman's compensation, Contracts, Arbitration, Easement rights.	2L

## Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	Estimating, Costing Specifications & Valuation	M Chakravarty	
	2	Typical PWD Rate Analysis		
	3	Estimating and Costing in Civil Engineering (Theory & Practice)	Dutta, B.N.	UBS Publishers
	4	Sociology & Economics for Engineers	Premvir Kapoor	Khanna Publishing House
	5	Distributors, Estimating and Costing in Civil Engineering: Theory and		UBS PublisherS





## CO-PO Mapping

### CO-PO Mapping

#### Engineering Economics, Estimation & Costing

(Course Code - CE(PC)602)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	1	3	3	1	3	-	2	1	2	2	-	3	2	3	3
<b>CO2</b>	1	3	3	1	3	-	2	1	2	2	-	3	2	3	3
<b>CO3</b>	1	3	3	1	3	-	2	1	2	1	2	3	2	3	3
<b>CO4</b>	3	1	2	3	-	2	2	1	1	1	3	3	3	2	2
<b>CO5</b>	1	1	1	-	1	2	2	1	2	2	3	3	3	2	3
<b>CO6</b>	1	-	1	-	1	2	2	1	2	2	3	3	2	1	3
<b>Avg</b>	<b>1.33</b>	<b>2.2</b>	<b>2.16</b>	<b>1.5</b>	<b>2.2</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>1.83</b>	<b>1.67</b>	<b>2.75</b>	<b>3</b>	<b>2.33</b>	<b>2.33</b>	<b>2.83</b>

## CE(PC)603: Water Resources Engineering

Course Code – CE(PC)603	Water Resources Engineering	2L	2 Credits
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>1. Students will be able to Understand the fundamentals of flow in open channels.</li> <li>2. Students will be able to Understand the concepts of irrigation.</li> <li>3. Students will be able to Estimate the quantity of water required by different crops in different seasons, and accordingly the irrigation water requirement.</li> <li>4. Students will be able to Design channels and other irrigation structures required for irrigation, drainage, soil conservation, flood control and other water-management projects.</li> <li>5. Students will be able to Learn about groundwater resources, aquifers and wells..</li> </ol>
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### Syllabus

Sl No.	Course Content	Total Hours
Module – 1	<b>OPEN CHANNEL FLOW:</b> Channel Characteristics and parameters, Energy-depth relationships, Specific Energy concept, Critical Flow, Hydraulic Jump, Uniform flow, Efficient sections, Slope profiles, Gradually Varied Flow, Water surface profiles.	8L
Module – 2	<b>IRRIGATION:</b> Definition, Necessity, Scope, Benefits of Irrigation; Types, techniques and sources of irrigation; Development of irrigation in India.	3L
Module – 3	<b>SOIL-WATER-PLANT RELATIONSHIP:</b> Types of crops, cropping seasons, water requirement of crops, base period, kor period, Duty, Delta, Commanded area, Net Irrigation Requirement, Field Irrigation Requirement, Gross Irrigation Requirement, Intensity of irrigation, Consumptive use of water, estimation of evapotranspiration, Blaney-Criddle method, Modified Penman's method, Irrigation efficiencies, Frequency of irrigation.	6L
Module – 4	<b>CANAL IRRIGATION:</b> Classification of irrigation canals, canals in alluvium; Design of unlined canals: Kennedy's method, Lacey's method; Lined canals: advantages, materials used, typical sections, design of lined canals, economics of canal lining; Canal sections – filling, cutting, partial cutting and partial filling.	6L
Module – 5	<b>LAND DRAINAGE:</b> Water logging issues in irrigation, provision of drains, design and maintenance of open drains, closed drains, discharge and spacing of closed drains.	4L
Module -6	<b>GROUNDWATER:</b> Occurrence of groundwater– Aquifers, Various Types of Aquifers, Aquifer Parameters: Specific Yield, Specific Retention, Storage Coefficient, Transmissivity.	4L



## Books

Books	Sl.	Book Name	Author	Publishing House
	1	Irrigation and Water Power Engineering	B. C. Punmia, A. K. Jain and P. B. Lal	Laxmi Publications (P) Ltd., New Delhi, 2019.
	2	Irrigation, Water Resources and Water Power Engineering	P. N. Modi.	Standard Book House, New Delhi, 2019
	3	Irrigation Engineering and Hydraulic Structures	S. K. Sharma	S Chand Publishing, New Delhi, 2017.2012..
	4	Irrigation Engineering	N. N. Basak	Tata McGraw Hill Education India Private

## CO-PO Mapping

### CO-PO Mapping

#### Water Resources Engineering

( Course Code – CE(PC)603)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	3	2	2	2	2	-	-	-	1	-	1	1	2	2	3
<b>CO2</b>	3	2	2	2	2	1	1	1	1	-	-	1	2	1	3
<b>CO3</b>	3	2	2	2	2	1	-	-	1	-	-	1	2	2	3
<b>CO4</b>	1	1	1	1	1	-	1	1	3	2	2	1	3	1	2
<b>CO5</b>	1	1	1	2	2	1	-	1	-	1	-	1	3	2	2
<b>Avg.</b>	<b>2.2</b>	<b>1.6</b>	<b>1.6</b>	<b>1.8</b>	<b>1.8</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1.2</b>	<b>1.5</b>	<b>1</b>	<b>1</b>	<b>2.4</b>	<b>1.6</b>	<b>2.6</b>

## CE(PC)604: Design of Steel Structures

Course Code – CE(PC)604	Design of Steel Structures	2L+0T+0P	2 Credits
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>1. Students will be able to Use of all loadings and limit state design method for steel structure</li> <li>2. Students will be able to Analyze and design the Tension and compression member, resources required and project economics</li> <li>3. Students will be able to Explain the behavior of various connections and able to solve the problems various fasters (Bolted, welded &amp; eccentric) used in steel construction.</li> <li>4. Students will be able to Use of knowledge of analysis in structural planning and design of various components of buildings.</li> <li>5. Students will be able to Analyze and design of steel composite problems such as various girders.</li> </ol>
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### Syllabus

Sl No.	Course Content	Total Hours
Module 1	Materials and Specification: Rolled steel sections, mechanical properties of steel and their specifications for structural use. Codes of practices. Design of Steel structures using tubular, rectangular and square section	1L
Module 2	Structural connections: Riveted, welded and bolted including High strength friction grip bolted joints. – types of riveted & bolted joints, assumptions, failure of joints, efficiency of joints, design of bolted, riveted & welded joints for axial load.  Eccentric connection:- Riveted & bolted joints subjected to torsion & shear, tension & shear, design of riveted, bolted & welded connection.	6L
Module 3	Design of Tension members: Design of tension members, I.S code provisions. Permissible stresses, Design rules, Examples.	3L
Module 4	Design of Compression members: Effective lengths about major & minor principal axes, I.S code provisions. Permissible stresses, Design rules, Design of one component, two components and built up compression members under axial load. Examples. Built up columns under eccentric loading:  Design of lacing and batten plates, Different types of Column Bases- Slab Base , Gusseted Base, Connection details	6L
Module 5	Design of Beams: Permissible stresses in bending, compression and tension. Design of rolled steel sections, plated beams. simple Beam end connections, beam -Column connections. I.S code provisions	4L
Module 6	Design of Plate girders: Design of webs & flanges, Concepts of curtailment of	4L



	flanges – Riveted & welded web stiffeners, web flange splices - Riveted, welded & bolted.	
Module 7	Design of Gantry Girder: Design gantry girder considering lateral buckling – I.S code provisions.	4L

## Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	Steel structures	N. Subramanian	OXFORD University
	2	Design Of Steel Structures	S.K.Duggal	TMH
	3	Design Of Steel Structures	Bhavikatti	I.K. Publishing House
<b>IS Codes</b>	IS: 456 – 2000 IS 875 – I (1987), IS 875 - II (1987), IS 875 - III (2015), S.P.: 6(1) – 1964 Structural Steel Sections			Bureau of Indian Standards

## CO-PO Mapping

### CO-PO Mapping

#### Design of Steel Structures

(Course Code – CE(PC)604)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	3	-	1	-	1	2	2	1	-	-	2	3	1	1	3
<b>CO2</b>	3	3	2	2	1	-	1	2	-	-	1	3	3	3	2
<b>CO3</b>	2	2	-	2	-	-	3	3	-	-	-	3	3	2	2
<b>CO5</b>	2	1	3	-	3	2	-	-	3	2	2	3	1	2	1
<b>CO6</b>	3	-	2	2	3	-	3	-	2	-	1	3	3	2	2
	<b>2.6</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2.25</b>	<b>2</b>	<b>2.5</b>	<b>2</b>	<b>1.5</b>	<b>3</b>	<b>2.2</b>	<b>2</b>	<b>2</b>



## CE(PE)601A: Stability of Slopes

Course Code – CE(PE)601A	Stability of Slopes	2L	2 Credits
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>1. Students will be able to Understand the fundamental theories and knowledge in the stability analysis of soil slopes.</li> <li>2. Students will be able to Measure the finite and infinite slope stability.</li> <li>3. Students will be able to Develop the analytical and numerical skills in treating a complicated practical slope problem.</li> <li>4. Students will be able to Evaluate the safety and design proper slope protection measures.</li> <li>5. Students will be able to Analyze the strength parameters in slope stability..</li> </ol>
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### Syllabus

Sl No.	Course Content	Total Hours
Module 1	Introduction: slope failure- causes, short- and long-term failure.	2L
Module 2	Landslides: types, multiple and complex slides, rate of land movement, factor of safety, examples	4L
Module 3	Slope stability analysis: basic concepts, finite and infinite slopes, analysis of infinite slopes-dry or moist cohesive slope, non-cohesive slope, cohesive slope with seepage;	8L
Module 4	Analysis of finite slopes: planar failure surface, circular failure surface, friction circle method, Taylors stability chart, locaton of critical circle, total stress analysis,	8L
Module 5	Method of Slices: Fellenius method, Bishop's simplified method, effective stress stability chart.	4L
Module 6	Non-circular failure surfaces, selection of strength parameter in slope stability, various slope protection measures..	2L



## Books

Books	Sl.	Book Name	Author	Publishing House
	1	Soil Mechanics and Foundation Engineering	P. Purushothama Raj	Pearson publication
	2	Principles of Foundation Engineering	Braja M. Das	Thomson Asia Pvt. Ltd., Singapore, 2005.
	3	Soil strength and slope stability	J.M. Duncan, S.G. Wright	John Wiley & Sons (Imprint: Hoboken, N.J.), 2005
	4	The Stability of Slopes.	E.N. Bromhead	Blackie Academic & Professional
	5	Slope Analysis.	R. Chowdhury	Elsevier Scientific Publishing
	6	Theory of Structures	Timoshenko and Young	McGrawHill

## CO-PO Mapping

### CO-PO Mapping

#### Stability of Slopes

(Course Code - CE(PE)601A)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	3	1	-	-	-	1	1	-	2	-	1	2	1	1	3
<b>CO2</b>	3	2	2	-	-	1	1	-	2	1	-	2	1	1	3
<b>CO3</b>	3	2	1	1	-	1	1	2	2	-	-	2	1	1	3
<b>CO4</b>	3	2	1	-	1	1	1	-	2	-	1	2	1	1	3
<b>CO5</b>	3	2	-	-	-	1	1	-	2	1	1	2	1	1	3
<b>Avg.</b>	<b>3</b>	<b>1.8</b>	<b>1.33</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>3</b>

## CE(PE)601B: Foundation Engineering

<b>Course Code – CE(PE)601B</b>	<b>Foundation Engineering</b>	<b>1L+0T+2P</b>	<b>2 Credits</b>
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>1. The students will be able to determine the load carrying capacity of pile foundation.</li> <li>2. The students will be able to compute the efficiency and settlement of pile group.</li> <li>3. The students will be able to understand different subsoil exploration methods and interpret field and laboratory test data to obtain design parameters for geotechnical analysis.</li> <li>4. The students will be able to correlate bearing capacity of shallow foundation from field test data.</li> <li>5. The students will be able to analyze and design sheet pile structure on the basis of earth pressure theories.</li> </ol>
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### Syllabus

SI No.	Course Content	Total Hours
Module 1	<b>Introduction</b> Classification, selection- shallow and deep foundations.	2L
Module 2	<b>Deep foundations</b> Pile foundation: Types of piles, material, Suitability and uses, Method of installation of piles - classification of piles based on material, Installation Techniques – Selection and uses, Determination of types and lengths of piles, Load transfer mechanism, Determination of load carrying capacities of piles by static and dynamic formulae as per IS codes, Pile spacing and group action, Group efficiency, Negative skin friction, Pile load test, Settlement of pile group, Lateral load capacity of pile by IS: 2911 and Reese & Matlock methods, Uplift capacity of pile - introduction.	9L
Module 3:	<b>Site Investigation &amp; Soil Exploration</b> Planning of sub-surface exploration, Methods of boring, sampling, Different types of samples, Spacing, Depth and number of exploratory borings, Bore log, Preparation of sub-soil investigation report. In-situ tests Standard penetration test, Static cone penetration test, Dynamic cone penetration test, Field vane shear test, Plate load test. Indirect methods of soil exploration Geophysical method: seismic refraction and electrical resistivity methods.	6L
Module 4:	<b>Shallow Foundations</b> Bearing Capacity from SPT, SCPT and Plate load Test data.	3L





Module 5:	Sheet pile structures Type of sheet piling, Design of sheet pile, Cantilever sheet piling, Anchored sheet piling, Free earth and fixed earth support methods, Analysis with anchored bulk heads.	4L
Module 6	<b>Introduction to Ground Improvement Techniques</b> Introduction, Economic considerations, Consolidation by preloading and sand	6L

## Books

	Sl.	Book Name	Author	Publishing House
Books	1	Textbook of Soil Mechanics and Foundation Engineering (Geotechnical Engineering Series)	V.N.S. Murthy	CBS Publishers
	2	Soil Mechanics and Foundations	Punmia, B.C. and Jain A. K	Laxmi Publications (P) Ltd
	3	Basic and Applied Soil Mechanics	Gopal Ranjan & A.S.R. Rao	New Age International Pvt. Ltd, Publishers
	4	Principles of Geotechnical Engineering	B.M. Das	Thomson Brooks / Cole



## CO-PO Mapping

### CO-PO Mapping

#### Foundation Engineering

(Course Code – CE(PE)601B)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	2	3	2	1	1	2	2	2	-	2	2	3	2	2	2
<b>CO2</b>	3	3	2	1	-	2	-	2	1	1	-	3	2	2	3
<b>CO3</b>	3	3	3	-	2	2	-	2	-	-	1	3	3	2	3
<b>CO4</b>	3	-	2	-	1	2	1	2	1	1	1	3	2	3	3
<b>CO5</b>	2	2	2	2	1	2	1	2	1	-	-	3	2	2	3
<b>Avg.</b>	<b>2.6</b>	<b>2.75</b>	<b>2.2</b>	<b>1.33</b>	<b>1.25</b>	<b>2</b>	<b>1.33</b>	<b>2</b>	<b>1</b>	<b>1.33</b>	<b>1</b>	<b>3</b>	<b>2.2</b>	<b>2.2</b>	<b>2.8</b>



## CE(PE)601C: Ground Improvement Technique

Course Code – CE(PE)601C	Ground Improvement Technique	2L+0T+0P	2 Credits
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>Students will be able to gain competence in properly devising alternative solutions to difficult and earth construction.</li> <li>Students will be able to evaluate their effectiveness before, during and after construction.</li> <li>Students will be able to understand different approaches to the ground modification.</li> <li>Students will be able to Understand the soil stabilization for reinforced earth construction.</li> </ol>
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### Syllabus

Sl No.	Course Content	Total Hours
<b>Module – 1</b>	Introduction: ground modification by vibro-replacement, stone columns, preloading and prefabricated drains, Reinforced earth structures.	<b>4L</b>
<b>Module – 2</b>	In-situ densification: Introduction, Compaction: methods and controls Densification of granular soil: Vibration at ground surface, Impact at ground surface, Vibration at depth (Vibroflotation), Impact at depth.	<b>6L</b>
<b>Module – 3</b>	Geo-textiles: Introduction to geotextiles and geomembranes, applications of geotextiles, design methods using geotextiles, geogrids, geonets, geomembranes, geotubes.	<b>6L</b>
<b>Module – 4</b>	Grouting: Over view: Suspension and Solution grout, Grouting equipment and methods, Grout design and layout, Grout monitoring schemes.	<b>6L</b>
<b>Module – 5</b>	Soil stability: Reinforced earth fundamentals, Soil nailing, Soil and Rock Anchors, Underpinning.	<b>4L</b>



<b>Module – 6</b>	Densification of Cohesive Soils: Preloading and dewatering, Design of Sand drains and Stone columns, Electrical and thermal methods.	<b>4L</b>
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## Books

Books	Sl.	Book Name	Author	Publishing House
	1	Construction and Geotechnical methods in foundation engineering	R.M. Koener	McGraw Hill Publication
	2	Reinforced Earth	T S Ingold	T Thoam Telford Publication
	3	Ground Improvement Techniques	P. Purushothama Raj	Laxmi Publications Pvt Limited, 2nd edition

## CO-PO Mapping

### CO-PO Mapping

#### Ground Improvement Technique

(Course Code - CE(PE)601C)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	2	1	3	2	1	2	2	-	2	-	3	-	1	1	2
<b>CO2</b>	2	2	-	-	-	2	-	1	1	2	1	2	3	3	1
<b>CO3</b>	2	2	1	3	2	-	1	-	-	1	-	3	1	1	3
<b>CO4</b>	1	2	3	3	3	1	-	1	2	-	2	3	3	1	3
<b>Avg.</b>	<b>1.75</b>	<b>1.75</b>	<b>2.34</b>	<b>2.67</b>	<b>2</b>	<b>1.67</b>	<b>1.5</b>	<b>1</b>	<b>1.67</b>	<b>1.5</b>	<b>2</b>	<b>2.67</b>	<b>2</b>	<b>1.5</b>	<b>2.25</b>

## CE(PE)602A: Building Construction Practice

Course Code – CE(PE)602A	Building Construction Practice	2T+0L+0P	2 Credits
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<p>CO1. Students will be able to understand the different technical terms related to construction &amp; earthwork, site clearance procedure.</p> <p>CO2. Students will be able to Understand the concept of various methods of construction of sub structure.</p> <p>CO3. Students will be able to understand different Techniques of construction of super structure like Box jacking &amp; Tunnelling techniques.</p> <p>CO4. Students will be able to Understand the Support structure for heavy Equipment and conveyors.</p>
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### Syllabus

Sl No.	Course Content	Total Hours
<b>Module – 1</b>	<p><b>Introduction</b></p> <p>Specifications, details and sequence of activities and construction co-ordination – Site Clearance – Marking – Earthwork - masonry – stone masonry – Bond in masonry - concrete hollow block masonry – flooring – damp proof courses – construction joints – movement and expansion joints –pre cast pavements – Building foundations – basements temporary shed –centering and shuttering – slip forms – scaffoldings – de-shuttering forms –Fabrication and erection of steel trusses – frames – braced domes – laying brick — weather and water proof – roof finishes – acoustic and fire protection.</p>	<b>12L</b>
<b>Module – 2</b>	<p><b>Sub Structure Construction</b></p> <p>Techniques of Box jacking – Pipe Jacking -under water construction of diaphragm walls and basement-Tunnelling techniques – Piling techniques -well and caisson - sinking cofferdam - cable anchoring and grouting-driving diaphragm walls, sheet piles - shoring for deep cutting - well points –Dewatering and stand by Plant equipment for underground open excavation.</p>	<b>10L</b>
<b>Module – 3</b>	<p><b>Super Structure Construction</b></p>	<b>8L</b>



	Launching girders, bridge decks, off shore platforms – special forms for shells - techniques for heavy decks – in-situ pre-stressing in high rise structures, Material handling - erecting light weight components on tall structures - Support structure for heavy Equipment and conveyors - Erection of articulated structures, braced domes and space decks.	
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## Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	Building Materials	S. K. Duggal	New Age International Publishers
	2	Building Materials and construction	Sushil Kumar	Standard Publishers
	3	Building Construction	Dr.B. C. Punmia	Laxmi Publications (P) ltd

## CO-PO Mapping

### CO-PO Mapping

#### Building Construction Practice

(Course Code - CE(PE)602A)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	1	1	2	3	3	2	2	1	-	1	2	-	1	2	2
<b>CO2</b>	1	2	1	1	-	2	-	1	1	2	1	2	2	2	1
<b>CO3</b>	2	1	1	3	2	-	2	-	2	1	-	2	1	1	2
<b>CO4</b>	1	1	2	-	2	-	2	1	2	1	2	3	1	1	2
	1.25	1.25	1.5	2.34	2.34	2	2	1	1.67	1.25	1.67	2.34	1.25	1.5	1.75

## CE(PE)602B: Structural Analysis-II

Course Code – CE(PE)602B	Structural Analysis-II	2L+0T+0P	2 Credits
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## Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>1. The Students will be able to Apply the Slope Deflection and Moment Distribution Method to analyze indeterminate structures as well as suspension bridge and stiffness girders.</li> <li>2. The Students will be able to Apply and analyze the concepts of curved beam analysis in hooks, rings and Bow girders.</li> <li>3. The Students will be able to Develop the concept bending in unsymmetrical beams.</li> <li>4. The Students will be able to Develop the fundamental concepts of plastic analysis using kinematic method and apply them in frames and continuous beam analysis.</li> <li>5. The Students will be able to analyze the indeterminate structures (continuous beams and frames) using flexibility and stiffness matrix method.</li> </ol>
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## Syllabus

Sl No.	Course Content	Total Hours
Module 1	<p>Analysis of statically Indeterminate Structures: Moment distribution method- solution of continuous beam, effect of settlement and rotation of support, frames with or without side sway.</p> <p>Slope deflection method: method and application in continuous beams and frames.</p> <p>Suspension Bridge and stiffening girders.</p>	8L
Module 2	Curved Beam analysis: Hooks, rings and Bow girders. Unsymmetrical bending.	8L
Module 3	Plastic analysis of structures: beams and portal frames.	5L
Module 4	Approximate method of analysis of structures: Portal and Cantilever methods.	4L
Module 5	Matrix methods of structural analysis – Stiffness and flexibility approaches for analysis of beam.	5L



## Books

<b>Books</b>	Sl.	Book Name	Author	Publishing House
	1	Structural Analysis (Vol I & Vol II)	S S Bhavikatti	Vikas
	2	Theory of Structures	S. Ramamrutham	Khanna Publishers
	3	Strength of Materials and Theory of Structures (Vol I & Vol II)	Punmia, Jain, Jain	Laxmi Publication
	4	Structural Analysis	R.C. Hibbeler	Prentice Hall
	5	Theory of Structures	Timoshenko	and Young
	6	Structural Analysis	Pandit and Gupta	TMH

## CO-PO Mapping

### CO-PO Mapping

#### Structural Analysis-II

(Course Code – CE(PE)602B)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	2	-	1	1	-	2	-	2	3	1	2	3
CO2	3	2	-	-	2	1	1	1	2	-	-	2	3	2	3
CO3	3	2	1	1	-	1	1	-	2	1	2	2	1	2	2
CO4	3	2	-	-	-	1	1	-	2	-	-	2	2	1	3
CO5	3	2	1	-	-	1	1	-	2	1	-	3	1	2	2
Avg.	<b>3</b>	<b>1</b>	<b>1</b>	<b>1.5</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>2.4</b>	<b>1.6</b>	<b>1.8</b>	<b>2.6</b>





## CE(PE)602C: Industrial Structures

Course Code – CE(PE)602C	Industrial Structures	2L+0T+0P	2 Credits
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### Course Outcome (CO)

Course Outcome (CO)	<ol style="list-style-type: none"> <li>1. Students will be able to understand how perform the analysis and design of reinforced concrete members and their connections.</li> <li>2. Students will be able to understand how to identify and apply the industrial design codes relevant to the design of Reinforced concrete members.</li> <li>3. Students will be able to understand how to familiar with the professional and contemporary design issues and fabrication of Reinforced concrete members.</li> </ol>
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### Syllabus

Sl No.	Course Content	Total Hours
Module – 1	<p><b>Overall Review of RC Design:</b></p> <p>Review of Limit State Design of Beams, Slabs &amp; Columns according to IS 456-2000. Yield line theory, Biaxial Bending &amp; Slender Column.</p> <p>Analysis and Design of beams curved in plan:</p> <p>Design principle, structural design of beams curved in plan of circular and rectangular types.</p> <p>Flat slabs:</p> <p>Introduction, components – IS code provisions Design method –</p> <p>Design for flexure and shear and Detailing.</p>	8L
Module – 2	<p><b>Deep beams:</b></p> <p>Introduction, Flexural and shear stresses in deep beam and Design and Detailing.</p> <p>Water tank:</p> <p>Introduction, Types, Analysis and Design of water tanks e.g., Underground &amp; Elevated water tank (Circular, Rectangle and Intz).</p>	7L



<b>Module – 3</b>	<p><b>Raft Foundation:</b></p> <p>Introduction, Types and Design of raft foundation. Design of folded plate</p> <p>Design of shear wall as per IS 13920</p>	<b>7L</b>
<b>Module – 4</b>	<p><b>Design of bunkers and silos:</b></p> <p>Introduction, Difference between Bunkers and Silo (rectangular, square and circular bunker and silo design for storage of cement).</p> <p>Analysis and design of chimneys:</p> <p>Introduction and different type of linings, wind load calculation on chimney (Static and dynamic) Analysis and design of chimney linings, foundation types.</p>	<b>8L</b>

## Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	R.C.C. Design	B.C. Punmia	Laxmi Publication
	2	Reinforced concrete structures	N. Subramanian	OXFORD University Press
<b>IS Codes</b>		<ol style="list-style-type: none"> <li>1. IS: 456 – 2000 (latest revision)</li> <li>2. IS 875 – I (1987), II (1987), -III (2015), -IV (1987), V (1987)</li> <li>3. SP: 16 Design Aid to IS 456</li> <li>4. IS 1893-Part-I: 2016, IS 1893-Part-II: 2014</li> <li>5. <b>IS 3370 –I (1967), II (2009), III (1967), IV (1967)</b></li> </ol>		



## CO-PO Mapping

### CO-PO Mapping

#### Industrial Structures

(Course Code - CE(PE)602C)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	2	3	2	3	-	2	1	2	-	1	3	-	1	1	2
<b>CO2</b>	1	1	2	1	-	2	-	1	3	2	1	1	3	2	3
<b>CO3</b>	2	1	1	3	2	-	2	-	2	1	3	2	1	1	1
<b>Avg.</b>	1.67	1.67	1.67	2.34	2	2	1.5	1.5	2.5	1.34	2.34	1.5	1.67	1.34	2

## CE(OE)601A: Soft Skills and Interpersonal Communication – I

Course Code – CE(OE)601A	Soft Skills and Interpersonal Communication – I	2T+0L+0P	2 Credits
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### Course Outcome (CO)

Course Outcome (CO)	<ol style="list-style-type: none"> <li>Students will be able to Communicate in an official and formal environment and Analyze the dynamics of business communication</li> <li>Students will be able to Write business letters, MOM, agenda, CV, Reports, and Proposals with incorporation of principles of communication.</li> <li>Students will be able to Appreciate the use of language to create beautiful expressions and Analyze and appreciate literature.</li> <li>Students will be able to Learn application of grammar and Learn to articulate opinions with clarity.</li> </ol>
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### Syllabus

SI No.	Course Content	Total Hours
Module 1	Communication Skill Definition, nature & attributes of Communication Process of Communication Models or Theories of Communication Types of Communication Levels or Channels of Communication Barriers to Communication	3L
Module 2	Business Communication- Scope & Importance Writing Formal Business Letters Writing Reports Organizational Communication: Agenda & minutes of a meeting, notice, memo, circular Project Proposal Technical Report Writing Organizing e-mail messages E-mail etiquette Tips for e-mail Effectiveness communication, Usability, Human factors, Managing technical communication projects, time estimation, Single sourcing, Localization.	8L
Module 3	Language through Literature Modes of literary & non-literary expression Introduction to Fiction, (An Astrologer's Day by R.K. Narayan and Monkey's Paw by W.W. Jacobs), Drama (The Two Executioners by Fernando Arrabal) or (Lithuania by Rupert Brooke) & Poetry (Night of	8L



	the Scorpion by Nissim Ezekiel and Palanquin Bearers by Sarojini Naidu)	
Module 5	Grammar in usage (nouns, verbs, adjectives, adverbs, tense, prepositions, voice change) - to be dealt with the help of the given texts..	10L

## Books

<b>Books</b>	Sl.	Book Name	Author	Publishing House
	1	Theories of Communication: A Short	Armand Matterlart and	Michele Matterlart
	2	Professional Writing Skills	Chan, Janis Fisher, and Diane Lutovich	San Anselmo, CA: Advanced Communication Designs,
	3	Effective Business Communications	Kulbhushan Kumar	Khanna Publishing House
	4	Writing and Speaking at Work: A Practical Guide for Business Communication	Edward P.Bailey	Prentice-Hall
	5	Intercultural Business Communication	Lillian Chaney and Jeanette Martin	Prentice-Hall

## CO-PO Mapping

### CO-PO Mapping

#### Soft Skills and Interpersonal Communication – I

(Course Code – CE(OE)601A)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	-	2	-	1	1	1	-	1	3	3	2	2	2	2	1
<b>CO2</b>	-	2	-	-	-	1	-	1	3	3	1	2	3	1	2
<b>CO3</b>	-	2	-	1	1	-	-	-	1	3	-	2	2	2	3
<b>CO4</b>	-	1	-	-	1	1	-	-	3	3	-	2	2	1	2
<b>Avg.</b>	-	<b>1.75</b>	-	<b>1</b>	<b>1</b>	<b>1</b>	-	<b>1</b>	<b>2.5</b>	<b>3</b>	<b>1.5</b>	<b>2</b>	<b>2.25</b>	<b>1.5</b>	<b>2</b>

## CE(OE)601B: Introduction to Philosophical Thoughts

Course Code – CE(OE)601B	Introduction to Philosophical Thoughts	2T+0L+0P	2 Credits
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### Course Outcome (CO)

Course Outcome (CO)	<ol style="list-style-type: none"> <li>1. Students will be able to Learn about the culture of our country.</li> <li>2. Students will be able to Develop an insight into the philosophical roots of our country.</li> <li>3. Students will be able to Learn about the impact of philosophical knowledge for developing a healthy mind.</li> <li>4. Students will be able to Understand the traditional practices of our country</li> </ol>
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### Syllabus

Sl No.	Course Content	Total Hours
Module 1	Introduction to Indian Philosophy: Brief discussion on Veda and Upanishads; Origin of Indian Philosophy	1L
Module 2	Charvaka Philosophy: Epistemology; Metaphysics	2L
Module 3	Samkhya Philosophy: Metaphysics; Theory of Causation. --Prakṛti, Purusa, Evolution; Epistemology	3L
Module 4	Yoga Philosophy: Organization of the YogaSutras; Psychology of Yoga -- Stages of Citta, Forms of Citta, Modifications of Citta, Kinds of Klesas; The Eight-Fold Yoga; God and Liberation	3L
Module 5	Nyaya Philosophy : Epistemology -- Perception (Pratyaksa), Inference (Anumāna), Comparison (Upamāna), Testimony (Sabda); Theory of Causation (Asatkāryavāda); Self and Liberation; The Concept of God	5L
Module 6	Mimamsa Philosophy: Epistemology -- Validity of Knowledge; Sources of Valid Knowledge (Pramāna) – Perception, Inference, Comparison, Verbal Testimony, Postulation (Arthapati), Non Apprehension (Anupalabdhi); Theories of Error (Khyativāda) – Akhyativāda, AnirvacaniyaKhyativāda, Viparitakhyativāda; Metaphysics -- Theory of Causation; Nature of Self; God and Liberation	4L
Module 7	Vaisesika Philosophy: Metaphysics and the Categories -- Substance (Dravya), Quality (Guṇa), Action (Karma), Generality (Sāmānya), Particularity (Vaiśeṣa), Inherence (Samavāya), Nonexistence (Abhāva); Epistemology; The Concept of God; Bondage and	3L



	Liberation	
Module 8	Buddhist Philosophy: Epistemology -- Dependent Origination; Four Noble Truths; Eight Fold Paths; Ethics; Karma and Rebirth; Liberation	4L
Module 9	Jaina Philosophy: Syādvāda; Anekāntavāda; Ethics; Karma and Liberation	3L

## Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	Living Philosophy: A Historical Introduction to Philosophical Ideas	Lewis Vaughn	
	2	Thinking Things Through: An Introduction to Philosophical Issues and Achievements	Clark Glymour	
	3	An Historical Introduction to Philosophical Thinking	Chaïm Perelman	

## CO-PO Mapping

### CO-PO Mapping

#### Introduction to Philosophical Thoughts

(Course Code – CE(OE)601B)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	-	-	3	1	-	2	2	3	1	2	-	3	2	2	2
<b>CO2</b>	-	-	3	2	-	1	2	3	2	1	-	3	2	1	2
<b>CO3</b>	-	-	2	1	-	2	2	3	1	2	-	3	1	2	2
<b>CO4</b>	-	-	2	-	-	2	2	3	1	2	-	3	2	2	2
<b>Avg.</b>	-	-	<b>2.5</b>	<b>1.33</b>	-	<b>1.75</b>	<b>2</b>	<b>3</b>	<b>1.25</b>	<b>1.75</b>	-	<b>3</b>	<b>1.75</b>	<b>1.75</b>	<b>2</b>

## CE(PC)693: Water Resource Engineering Laboratory

Course Code – CE(PC)693	Water Resource Engineering Laboratory	0L+0T+2P	1 Credits
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>1. Students will be able to Delineate the watershed of any reservoir using DEM.</li> <li>2. Students will be able to Determine the average rainfall over a catchment.</li> <li>3. Students will be able to Use the rain gauge properly for a specified purpose.</li> <li>4. Students will be able to Measure the rate of infiltration of water through the soil.</li> <li>5. Students will be able to Measure the sunshine hours in a particular day.</li> </ol>
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### Syllabus

Sl No.	Course Content	Total Hours
Experiment 1	Catchment area delineation (Manually and using DEM)	2
Experiment 2	Calculation of average rainfall over a catchment area with arithmetic mean method, Thiessen polygon method and Isohyetal Method.	2
Experiment 3	Use of different type of Rain gauges. Permissible stresses, Design rules, Examples.	2
Experiment 4	Measurement of infiltration rate using double ring infiltrometer	2
Experiment 5	Measurement of evaporation using evaporimeter	2
Experiment 6	Measurement of bright sunshine hours using sunshine recorder.	2

### Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	Irrigation and Water Power Engineering	B. C. Punmia, A. K. Jain and P. B. Lal	Laxmi Publications (P) Ltd., New Delhi, 2019.
	2	Irrigation, Water Resources and Water Power Engineering	P. N. Modi.	Standard Book House, New Delhi, 2019
	3	Irrigation Engineering and Hydraulic Structures	S. K. Sharma	S Chand Publishing, New Delhi, 2017.2012..
	4	Irrigation Engineering	N. N. Basak	Tata McGraw Hill Education India Private





## CO-PO Mapping

### CO-PO Mapping

#### Water Resource Engineering Laboratory

(Course Code - CE(PC)693)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	3	3	-	-	-	1	1	-	2	-	1	2	1	1	3
<b>CO2</b>	3	3	2	-	-	1	1	-	2	1	-	2	1	1	3
<b>CO3</b>	3	3	1	1	-	1	1	2	2	-	-	2	1	1	3
<b>CO4</b>	3	3	1	-	1	1	1	-	2	-	1	2	1	1	3
<b>CO5</b>	3	3	-	-	-	1	1	-	2	1	1	2	1	1	3
<b>Avg.</b>	<b>3</b>	<b>3</b>	<b>1.33</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>3</b>



## CE(PC)694: Steel Structure Design Sessional

Course Code – CE(PC)694	Steel Structure Design Sessional	0T+0L+2P	1 Credits
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>1. The students will identify different bolted and welded connections, analyses and design them for axial and eccentric loads.</li> <li>2. The students will be able to Design different steel sections subjected to axial compression and tension following Indian codes of practices.</li> <li>3. The students will be able analyze structural components subjected to axial compression, bending and tension.</li> <li>4. The students will be able analyze behavior of structures subjected to lateral loading system as well as gravity loading system</li> <li>5. The students will be able to Design different components of an industrial building.</li> </ol>
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### Syllabus

Sl No.	Course Content	Total Hours
Module – 1	Design of a factory shed including preparation of necessary working drawings and report in accordance with CE(PC)604	-

### Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	Steel structures	N. Subramanian	OXFORD University Press
	2	Design Of Steel Structures	S.K.Duggal	TMH
<b>IS Codes</b>		IS: 456 – 2000 IS 875 – I (1987), IS 875 - II (1987), IS 875 - III (2015), S.P.: 6(1) – 1964 Structural Steel Sections		Bureau of Indian Standards



## CO-PO Mapping

### CO-PO Mapping

#### Steel Structure Design Sessional

( Course Code – CE(PC)694)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	3	2	3	3	-	-	2	-	-	-	1	3	1	2	1
<b>CO2</b>	3	3	3	2	3	1	2	-	-	1	1	2	3	2	3
<b>CO3</b>	3	1	2	1	3	-	-	2	-	1	-	1	2	2	3
<b>CO4</b>	3	-	2	-	3	2	2	-	-	-	-	2	3	3	3
<b>CO5</b>	3	3	-	2	2	2	3	-	2	1	-	2	3	2	3
	<b>3</b>	<b>2.25</b>	<b>2.5</b>	<b>2</b>	<b>2.75</b>	<b>1.67</b>	<b>2.25</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>2.4</b>	<b>2.2</b>	<b>2.6</b>

## CE(PC)695: Quantity Survey Estimation and Valuation Sessional

Course Code – CE(PC)695	Quantity Survey Estimation and Valuation Sessional	0L+1T+2P	2 Credits
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>Students will be able to understand introduction to quantity surveying</li> <li>Students will be able to know analysis and schedule of rates</li> <li>Students will be able to know specification of materials</li> <li>Students will be able to understand about specification of works</li> <li>Students will be able to understand the introduction to valuation</li> </ol>
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### Syllabus

SI No.	Course Content	Total Hours
Module 1:	Quantity Surveying: Types of estimates, approximate estimates, items of work, unit of measurement, unit rate of payment	2
Module 2:	Quantity estimate of a single storied building	2
Module 3:	Bar bending schedule.	2
Module 4:	Details of measurement and calculation of quantities with cost, bill of quantities, abstract of quantities.	2
Module 5:	Estimate of quantities of road, Underground reservoir, Surface drain, Septic tank.	2
Module 6:	Analysis and schedule of rates: Earthwork, brick flat soling, DPC, PCC and RCC, brick work, plastering, flooring and finishing	2
Module 7:	Specification of materials: Brick, cement, fine and coarse aggregates	2
Module 8	Specification of works: Plain cement concrete, reinforced cement concrete, first class brickwork, cement plastering, pointing, white washing, colour washing, distempering, lime punning, painting and varnishing	2
Module 9	Valuation: Values and cost, gross income, outgoing, net income, scrap value, salvage value, market value, Book Value, sinking fund, capitalised value, Y. P., depreciation, obsolescence, deferred income, freehold and leasehold property, mortgage, rent fixation, valuation table	2



## Books

<b>Books</b>	Sl.	Book Name	Author	Publishing House
	1	Estimating, Costing Specifications & Valuation	M Chakravarty	
	2	Typical PWD Rate Analysis		
	3	Estimating and Costing in Civil Engineering (Theory & Practice)	Dutta, B.N.	UBS Publishers
	4	Sociology & Economics for Engineers	Premvir Kapoor	Khanna Publishing House
	5	Distributors, Estimating and Costing in Civil Engineering: Theory and		UBS PublisherS

## CO-PO Mapping

### CO-PO Mapping

#### Quantity Survey Estimation and Valuation Sessional

(Course Code - CE(PC)695)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	2	-	-	1	-	2	1	-	-	1	-	3	2	1	2
<b>CO2</b>	1	3	3	1	3	-	2	1	2	2	-	3	2	3	3
<b>CO3</b>	3	2	2	1	-	2	2	1	-	-	1	3	2	1	3
<b>CO4</b>	3	1	2	1	-	2	2	1	-	-	1	3	2	1	3
<b>CO5</b>	2	1	1	1	-	1	3	1	3	3	2	3	3	2	3
<b>Avg</b>	<b>2.2</b>	<b>1.75</b>	<b>2</b>	<b>1</b>	<b>3</b>	<b>1.75</b>	<b>2</b>	<b>1</b>	<b>2.5</b>	<b>2</b>	<b>1.33</b>	<b>3</b>	<b>2.2</b>	<b>1.6</b>	<b>2.8</b>



7<sup>th</sup> Semester

## CE(OE)701A: Metro Systems & Engineering

Course Code – CE(OE)701A	Metro Systems & Engineering	2L+0T+0P	2 Credits
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>The Students will be able to understand the basics of metro system and concepts of routing and financial criteria</li> <li>The Students will be able to determine the need of various fields of engineering that are associated to metro system.</li> <li>The Students will be able to analyze the various technical components that are needed to develop a proper metro system</li> <li>The Students will be able to gain ideas of environmental aspect of proper metro system and its design</li> </ol>
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### Syllabus

SI No.	Course Content	Total Hours
Module 1	Overview of Metro Systems; Need for Metros; Routing studies; Basic Planning and Financial.	4L
Module 2	<b>CIVIL ENGINEERING</b> Overview and construction methods for: Elevated and underground Stations; Viaduct spans and bridges; Underground tunnels; Depots; Commercial and Service buildings. Initial Surveys & Investigations; Basics of Construction Planning & Management, Construction Quality & Safety Systems. Traffic integration, multimodal transfers and pedestrian facilities; Environmental and social safeguards; Track systems-permanent way. Facilities Management	12L
Module 3:	<b>ELECTRONICS AND COMMUNICATION ENGINEERING</b> Signaling systems; Automatic fare collection; Operation Control Centre (OCC and BCC); SCADA and other control systems; Platform Screen Doors.	5L
Module 4:	<b>MECHANICAL &amp; TV + AC</b> Rolling stock, vehicle dynamics and structure; Tunnel Ventilation systems; Air conditioning for stations and buildings; Fire control systems; Lifts and Escalators	5L



Module 5:	<b>ELECTRICAL:</b> OHE, Traction Power; Substations- TSS and ASS; Power SCADA; Standby and Back-up systems; Green buildings, Carbon credits and clear air mechanics	5L
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## Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	Metro Rail in India for Urban Mobility	M. M. Agarwal, M. M. Agarwal, K. K. Miglani .	Prabha & Co.
	2	World Metro Systems	Paul E. Garbutt	Capital Transport Publishing

## CO-PO Mapping

### CO-PO Mapping

#### Metro Systems & Engineering

(Course Code – CE(OE)701A)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	1	1	2	1	3	-	2	1	-	2	-	3	2	2	3
<b>CO2</b>	1	2	2	1	-	3	1	2	2	2	-	3	1	1	3
<b>CO3</b>	3	1	2	1	-	2	2	1	-	-	2	3	2	2	1
<b>CO4</b>	3	1	1	1	-	-	3	3	3	3	2	3	1	2	3
<b>Avg.</b>	2	1.25	1.75	1	3	2.5	2	1.75	2.5	2.34	2	3	1.5	1.75	2.5

## CE(OE)701B: ICT for Development

Course Code – CE(OE)701B	ICT for Development	2T+0L+0P	2 Credits
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>1. Students will be able to about the types of ICT in relation to e-learning and web commerce</li> <li>2. Students will be able to about the system of networking and digital communication</li> <li>3. Students will know about the different existing theories giving rise to the concept of digital communication</li> <li>4. Students will develop knowledge about the application of computer mediated information and use of multimedia in digital communication</li> </ol>
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### Syllabus

Sl No.	Course Content	Total Hours
Module 1	Introduction to ICT: New media and ICT, Different types of ICT. Use of ICT for development; e-learning; Web commerce; Mobile telephony and Development: telecom industry in India. ICT Projects implemented in India and Northeast – Problems and Prospects	7L
Module 2	Digital Revolution and Digital Communication: Basics of New media theories – Information Society; Surveillance society; Digital Divide, Knowledge society; Network society. Works of Machlup, Bell, Negroponte and Castells	6L
Module 3:	Technology and Development: ICT for Development its societal implications; Evolution of ICT in Development Endeavour; ICT and Millennium Development Goals. Democratic and decentralized processes in development. Technology and culture: community and identity; participatory culture and ICT, community informatics	8L
Module 4:	Computer Mediated Communication and development: Different types of CMC; Important theoretical framework of CMC, cyber platform and communities, Social Networking Site; Convergent media, Multimedia platforms, Scope of convergent journalism for Development; Characteristics of convergent journalism; Different types of convergent journalism: precision journalism; annotative and open-source journalism; wiki journalism; open source journalism; citizen journalism; back- pack journalism, Convergent technologies and applications; Multimedia convergence and Interactivity	10L





## Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	Information and Communication Technology for Development (ICT4D)	Richard Heeks	
	2	The Development Dimension ICTs for Development: Improving Policy Coherence	OECD, Organisation for Economic Co-operation and Development	OECD Publishing

## CO-PO Mapping

### CO-PO Mapping

#### ICT for Development

(Course Code – CE(OE)701B)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	1	1	2		1	1	1	3	1	1	1	3	2	1	2
<b>CO2</b>	1	2	2	2	2	1	2	3	2	1	1	3	2	2	1
<b>CO3</b>	1	2	3	3	1	2	2	3	1	-	1	3	1	3	1
<b>CO4</b>	1	3	3	2	2	2	1	3	2	2	1	3	2	2	1
<b>Avg.</b>	<b>1</b>	<b>2</b>	<b>2.5</b>	<b>2.33</b>	<b>1.5</b>	<b>1.5</b>	<b>1.5</b>	<b>3</b>	<b>1.5</b>	<b>1</b>	<b>1</b>	<b>3</b>	<b>1.75</b>	<b>2</b>	<b>1.25</b>

## CE(OE)701C: Cyber Law & Ethics

Course Code – CE(OE)701C	Cyber Law & Ethics	2T+0L+0P	2 Credits
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>Students will Have general knowledge on cyber legal literacy.</li> <li>Students will be able to Understand computer ethics, policies, and fundamental duties.</li> <li>Students will be able to Understand the concepts of Intellectual property to protect the traditional knowledge</li> <li>Students will be able to Get aware of Indian IT Acts and Standards.</li> </ol>
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### Syllabus

Sl No.	Course Content	Total Hours
Module 1	Introduction: Basics of Law, Understanding Cyber Space, Defining Cyber Laws, Scope and Jurisprudence, Concept of Jurisdiction, Cyber Jurisdiction, Overview of Indian Legal System, Introduction to IT Act 2000, Amendments in IT Act, Cyber Laws of EU – USA – Australia - Britain, other specific Cyber laws	6L
Module 2	Computer Ethics, Privacy and Legislation: Computer ethics, moral and legal issues, descriptive and normative claims, Professional Ethics, code of ethics and professional conduct. Privacy, Computers and privacy issue, Digital Evidence Controls, Evidence Handling Procedures, Basics of Indian Evidence ACT, Legal Policies, legislative background	7L
Module 3:	Intellectual Property Rights Issues: Copyrights, Jurisdiction Issues and Copyright Infringement, Multimedia and Copyright issues, WIPO, Intellectual Property Rights, Understanding Patents, Understanding Trademarks, Trademarks in Internet, Domain name registration, Software Piracy, Legal Issues in Cyber Contracts, Authorship, Document Forgery	7L
Module 4:	Indian IT Act and Standards: Indian IT ACT, Adjudication under Indian IT ACT, IT Service Management Concept, IT Audit standards, ISO/IEC 27000 Series, COBIT, HIPPA, SOX, System audit, Information security audit, ISMS, SoA (Statement of Applicability), BCP (Business Continuity Plan), DR (Disaster	6L
Module 5:	International Laws governing Cyber Space: Introduction to International Cyber Law, UNCITRAL, Cyber Laws: Legal Issues and	4L



	Challenges in India, Net neutrality, Role of INTERPOL.	
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## Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	Computer Ethics	Deborah G. Johnson	Pearsons Education
	2	Information Security and Cyber Laws	Gupta & Gupta	Khanna Publishing House
	3	Cyber Law Simplified	Vivek Sood	McGraw Hill Education
	4	Cyber frauds, cybercrimes & law in India	Pavan Duggal,	Saakshar Law Publications
	5	The Internet Law of India: Indian Law Series	Shubham Sinha	CreateSpace

## CO-PO Mapping

### CO-PO Mapping

#### Cyber Law & Ethics

(Course Code – CE(OE)701C)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	-	-	-	-	1	2	-	3	1	1	1	2	2	2	2
<b>CO2</b>	-	-	-	-	1	2	-	3	1	-	1	2	1	1	1
<b>CO3</b>	-	-	-	-	1	2	-	3	1	1	1	2	1	1	1
<b>CO4</b>	-	-	-	-	-	2	-	3	-	-	-	2	2	1	1
<b>Avg.</b>	-	-	-	-	<b>1</b>	<b>2</b>	-	<b>3</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>1.5</b>	<b>1.25</b>	<b>1.25</b>

## CE(PE)701A: Computational Hydraulics

<b>Course Code –CE(PE)701A</b>	<b>Computational Hydraulics</b>	<b>2L+1T+0P</b>	<b>3 Credits</b>
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## Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>1. Students will be able to Identify the complexities involved in fluid flow problems.</li> <li>2. Students will be able to Model the specific flow problem in terms of defining the governing equations, initial and boundary conditions and appropriate solution schemes to use.</li> <li>3. Students will be able to Develop finite difference formulation of ordinary and partial differential equations of flow problems.</li> <li>4. Students will be able to Develop finite volume formulation of ordinary and partial differential equations of flow problems.</li> </ol>
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## Syllabus

SI No.	Course Content	Total Hours
Module 1:	Introduction: Modelling Theory - Physical modelling, analytical modelling, numerical modelling; classification of models based on i) Scale (space and time), ii) Solution (analytical and numerical); Concept of computational hydraulics; Processes involved in model development and application.	4L
Module 2:	Modelling Fluid Flow Problems: Governing equations- Conservation of mass, conservation of momentum, conservation of energy; Mathematical classification of flow equations, solution of ordinary differential equations and partial differential equations, boundary conditions; Solution of Saint-Venant Equations - Kinematic wave solution, Diffusive wave solution and full dynamic solution; Characteristic form of Saint-Venant Equations.	8L
Module 3:	Numerical Solution Schemes: Discrete solution of governing equations, Space discretization - Structured grids and unstructured grids, grid generation, time discretization.	2L
	Finite Difference Method: General concept, approximation of derivatives; Finite difference formulation for ordinary differential equations - Explicit schemes, Implicit schemes, Mixed schemes and weighted average schemes; Finite difference formulation for partial differential equations - initial conditions, boundary conditions, explicit and implicit schemes; The Preissmann Scheme, The Abbott-Ionescu scheme.	8 L
	Example Applications: Ordinary differential equation - Solution of linear reservoir problem; Partial differential equation - Solution of	6L



	simple wave propagation, Solution of diffusion equation.	
Module 4:	Finite Volume Method: General concept, Steps in application of Finite Volume Method- Surface and volume integrals, Discretization of convective fluxes, Discretization of diffusive fluxes, evaluation of time derivative, boundary conditions.	8L
	Example Application: Solution of Advection-Diffusion Equation in 1-D.	4L

## Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	Computational Hydraulics	M. B. Abbott and A. W. Minns	Routledge, London, 2016
	2	Computational Hydraulics – An Introduction	C. B. Vreugdenhil,	Springer – Verlag, New York, 1989
	3	Computational Hydraulics	C. A. Brebbia and A. J. Ferrante,	Butterworth-Heinemann, 2013.
	4	Computational Methods for Fluid Dynamics,	J. H. Ferziger and M. Peric	Springer, London, 2002.

## CO-PO Mapping

### CO-PO Mapping

#### Computational Hydraulics

(Course Code - CE(PE)701A)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	1	1	-	3	-	1	2	-	-	1	-	3	1	2	3
<b>CO2</b>	2	2	3	3	2	1	2	1	1	-	1	3	2	3	3
<b>CO3</b>	1	2	3	1	2	-	1	-	-	1	-	3	2	3	3
<b>CO4</b>	1	2	3	1	2	-	1	-	-	1	-	3	2	3	3
<b>Avg.</b>	<b>1.25</b>	<b>1.75</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>1.5</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>3</b>	<b>1.75</b>	<b>2.75</b>	<b>3</b>



## CE(PE)701B: Disaster Preparedness and Planning

Course Code – CE(PE)701B	Disaster Preparedness and Planning	2L+1T+0P	3 Credits
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>Students will be able to understand the basic concepts and terminologies disaster management.</li> <li>Students will be able to understand and describe the categories of disaster.</li> <li>Students will realize the roles and responsibilities of a civil engineer towards society in time of a disaster.</li> <li>Students will be able to analyze relationship between development and disasters.</li> <li>Students will apply different concepts of disaster management.</li> </ol>
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### Syllabus

Sl. No.	Course Content	Total Hours
<b>Module – 1</b>	<b>Introduction, Basic Concepts and Definitions</b> Disaster, Hazard, Vulnerability, Risks, Severity, Frequency and details, Capacity, Impact, Prevention, Mitigation.	<b>3L+1T</b>
<b>Module – 2</b>	<b>Disasters and their Classification</b> Natural Disasters: Floods, Draught, Cyclones, Volcanoes, Earthquakes, Tsunami, Landslides, Coastal Erosion, Soil Erosion, Forest Fires Manmade Disasters: Industrial Pollution, Artificial Flooding in Urban Areas, Nuclear Radiation, Chemical Spills, Transportation Accidents, Terrorist Strikes Hazard and vulnerability profile of India, Mountain and coastal areas, Ecological fragility.	<b>5L+3T</b>
<b>Module – 3</b>	<b>Disaster Impacts</b> Disaster Impacts: Environmental, Physical, Social, Ecological, Economic, Political	<b>7L+3T</b>



	Health, Psycho-social issues; Demographic aspects (gender, age, special needs); Hazard locations; Global and national disaster trends; Climate change and urban disasters.	
<b>Module – 4</b>	<b>Disaster Risk Reduction (DRR)</b> Phases of disaster management cycle; 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 programs in India and the activities of National Disaster Management Authority.	<b>7L+3T</b>
<b>Module – 5</b>	<b>Disasters, Environment and Development</b> Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, land use changes, urbanization etc.), Sustainable and environmental friendly recovery; Reconstruction and development methods.	<b>6L+4T</b>

## Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	Disaster Management	S.C. Sharma	Khanna Publishing House
	2	Disaster Risk Reduction in South Asia	Pradeep Sahni	Prentice Hall
<b>References</b>	1. Disaster Medical Systems Guidelines, Emergency Medical Services Authority, State of California, EMSA no.214, June 2003. 2. IASC Guidelines on Mental Health and Psychosocial Support in Emergency Settings, Inter Agency Standing Committee (IASC) (Feb. 2007).			



## CO-PO Mapping

### CO-PO Mapping

#### Disaster Preparedness and Planning

(Course Code - CE(PE)701B)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	1	2	1	2	1	-	2	3	1	1	3	3	1	3	2
<b>CO2</b>	2	2	-	1	-	2	-	1	-	2	1	1	3	2	3
<b>CO3</b>	1	1	1	-	2	1	3	-	2	3	-	-	3	1	2
<b>CO4</b>	2	2	1	-	2	-	2	-	3	1	3	2	1	2	1
<b>CO5</b>	1	2	1	2	-	2	1	2	-	1	3	-	2	1	2
	1.4	1.8	1	1.67	1.67	1.67	2	2	2	1.6	2.5	2	2	1.8	2





## CE(PE)701C: Hydraulic Structure

Course Code – CE(PE)701C	Hydraulic Structure	2L+1T+0P	3 Credits
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>Students will be able to Identify the characteristics of various types of dams and their selection procedure.</li> <li>Students will be able to Perform the reconnaissance survey and, geophysical investigations necessary for selection of suitable dam site</li> <li>Students will be able to Estimate forces acting on a gravity dams and perform stability analysis.</li> <li>Students will be able to. Estimate the seepage loss through embankment dams and suggest necessary remedial measures.</li> <li>Students will be able to Calculate the discharge through the overflow section and design the appropriate energy dissipation structures.</li> </ol>
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### Syllabus

Sl No.	Course Content	Total Hours
Module 1	Storage Structures: Dams, Types of Dams – Embankment dams, gravity dams, various components and their functions	1L + 1T
Module 2	Selection of Dam Site: Site investigations, initial study, reconnaissance survey, geophysical investigations, preliminary selection, evaluation of selected site - various types of foundation testing, field testing and borrow pit investigations, detailed investigations; assessment of foundation characteristics and suitability; selection of type of dam.	4L + 2T
Module 3	Gravity Dam: Definition, Features of some important gravity dams, Forces acting on a gravity dam, estimation of forces due to: self-weight, water pressure on upstream and downstream face, Uplift pressure, wave pressure, silt pressure, wind pressure, earthquake forces, hydrodynamic forces; Stability analysis - load combinations, codal provisions, modes of failures - overturning, sliding, tension and compression failures, factors of safeties, principal stresses; Elementary profile of a gravity dam - forces acting, minimum base width - no tension, no sliding basis, principal stresses..	8L + 4T
Module 4	Embankment Dams: Definitions, Features of some important embankment dams; Types of embankment dams and their sectional features; Design criteria; Freeboard - necessity, estimation procedure; Seepage analysis - Laplace's flow equations, drainage blanket and rock	6L + 2T



	toe, phreatic line, graphical procedure of drawing phreatic line, estimation of seepage loss; Stability analysis of embankment dams – slip circle method; Seepage Control - cut-offs, slurry trench, sheet piling, grouting, slope protection	
Module 5	Diversion headworks: Necessity and uses, different types, layout and different components; weirs on permeable foundation, Creep theories, Khosla's method; Different types of modules, Canal escapes, Silt control devices.	5L + 3T
Module 6	Spillways and Energy Dissipation Structures: Necessity, types, selection, spillway gates; High overflow ogee spillway - profile, discharge computation, flow equations, factors affecting coefficient of discharge, codal provisions. stilling basins (USBR and BIS) types	4L + 2T

## Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	Hydraulic Structures)	Novak, A. I. B. Moffat, C. Nalluri and R. Narayan P	E & FN Spon, UK, 2010
	2	Hydraulic Structures	S. H. Chen	Springer Nature, USA, 2015.
	3	Irrigation Engineering and Hydraulic Structures	S. K. Sharma	S. Chand Publishing, New Delhi, 2017.
	4	Dams and Appurtenant Hydraulic Structures	A. Tanchev	CRC Press, USA, 2014
	5	Fluid Mechanics & Hydraulic Machines	S.S. Rattna	Khanna Publishing House
	6	Fluid Mechanics and Hydraulic Machines	K. Subramanya	McGraw Hill Education (India) Private Limited,



## CO-PO Mapping

### CO-PO Mapping

#### Hydraulic Structure

(Course Code – CE(PE)701C)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	2	-	1	1	-	2	-	2	3	1	2	3
CO2	3	2	-	-	2	1	1	1	2	-	-	2	3	2	3
CO3	3	2	1	1	-	1	1	-	2	1	2	2	1	2	2
CO4	3	2	-	-	-	1	1	-	2	-	-	2	2	1	3
CO5	3	2	1	-	-	1	1	-	2	1	-	3	1	2	2
Avg.	<b>3</b>	<b>1</b>	<b>1</b>	<b>1.5</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>2.4</b>	<b>1.6</b>	<b>1.8</b>	<b>2.6</b>

## CE(PE)702A: Pre-stressed Concrete

Course Code –CE(PE)702A	Pre-stressed Concrete	2L+1T+0P	3 Credits
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>1. Students will be able to learn the introduction of pre-stressed concrete member and its deflection properties</li> <li>2. Students will be able to Develop the design criteria of pre-stressed concrete section for flexure and shear properties</li> <li>3. Students will be able to Analyze the anchorage zone stress for post-tensioned members</li> <li>4. Students will be able to Impart knowledge regarding the methods of Analysis of Statically Indeterminate Structures.</li> <li>5. Students will be able to Impart knowledge regarding the composite construction of Pre-stress and In-situ concrete.</li> <li>6. Students will be able to Impart knowledge regarding Design of Pre-stressed concrete poles and sleepers and introduction of partial pre-stressing.</li> </ol>
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### Syllabus

Sl No.	Course Content	Total Hours
Module 1:	Introduction of Pre-stressed concrete: Materials, Pre-stressing system, analysis of Pre-stress and bending stress, losses Shear and torsional resistance: design of shear reinforcement, design of reinforcement for torsion shear and bending. Deflections of Pre-stressed concrete members: Importance, factors, short term and long term deflection	8L+4T
Module 2:	Shear and Torsional Resistance: Design of Shear Reinforcement, Design of Reinforcement for Torsion, Shear and Bending. Limit State Design Criteria: Inadequacy of Elastic and Ultimate Load Method, Criteria for Limit States, Strength and Serviceability. Design of Pre-stressed Concrete Section: for Flexure & methods by Lin and Magnel	8L+4T
Module 3:	Anchorage Zone stresses in post tensioned members: Stress distribution in end block, anchorage zone reinforcement	3L+1T
Module 4:	Statically Indeterminate Structures: Advantages of Continuous Member, Effect of Pre-stressing, Methods of Achieving Continuity and Method of Analysis of Secondary Moments	4L+2T
Module 5:	Composite Construction of Pre-stressed and In-situ Concrete: Types,	3L+1T



	Analysis of Stresses	
Module 6:	Pre-stressed Concrete Poles and Sleepers: Design of Sections for Compression and Bending. Introduction to Partial Pre-stressing.	2L+2T

## Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	Pre-stressed Concrete	N. KrishnaRaju	TMH
	2	Pre-stressed Concrete	Ramamuthram	Dhanpat Rai Publishing
	3	Pre-stressed Concrete	Srikant Vanakudre	Khanna Publishing House
	4	Fundamentals of Pre-stressed Concrete	N.C.Sinha and S.K.Roy	S. Chand
	5	Pre-stressed Concrete	Karuna Moy Ghosh	PHI
	6	Design of Pre-stressed Structures	T.Y.Lin and N.H.Burns	
<b>IS Codes</b>	IS: 1343 : 2012			Bureau of Indian Standards

## CO-PO Mapping

### CO-PO Mapping

#### Pre-stressed Concrete

(Course Code - CE(PE)702A)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	2	-	-	1	-	2	1	-	-	1	-	3	2	1	2
<b>CO2</b>	1	3	3	-	2	-	2	-	1	1	-	3	1	3	3
<b>CO3</b>	1	3	3	1	3	-	2	1	2	2	-	3	2	3	3
<b>CO4</b>	3	2	3	2	3	1	3	2	2	2	2	3	3	2	3
<b>CO5</b>	3	-	1	1	2	1	2	1	2	1	-	3	2	1	2
<b>CO6</b>	3	-	3	1	2	1	2	1	2	1	-	3	2	1	3
	<b>2.16</b>	<b>2.67</b>	<b>2.6</b>	<b>1.2</b>	<b>2.4</b>	<b>1.25</b>	<b>2</b>	<b>1.25</b>	<b>1.8</b>	<b>1.33</b>	<b>2</b>	<b>3</b>	<b>2</b>	<b>1.83</b>	<b>2.67</b>



## CE(PE)702B: Repairs & Rehabilitation of Structures

Course Code – CE(PE)702B	Repairs & Rehabilitation of Structures	2L+1T+0P	3 Credits
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>1. Students will be able to understand the various distress and damages to concrete and masonry structures.</li> <li>2. Students will understand the importance of maintenance of structures, types and properties of repair materials etc.</li> <li>3. Students will realize the assessing damage to structures and various repair techniques.</li> </ol>
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### Syllabus

Sl No.	Course Content	Total Hours
<b>Module – 1</b>	Introduction:  Overview of distress, deterioration in concrete structures,  Scenario of distressed structures world over, need for repairs and upgrading of structures, General introduction to process (Road-map) to a durable concrete repair.	<b>3L+1T</b>
<b>Module – 2</b>	Deterioration of concrete structures:  Types of deterioration – Signs, causes & symptoms, Mechanism of deterioration, contributing factors like permeability, inadequate durability & micro-structure of concrete. Physical deterioration due to moisture, temperature, shrinkage, freeze-thaw, abrasion, erosion, cavitation, crystallization of salts, Efflorescence, exposure to severe environment like marine exposure. Chemical deterioration due to corrosion of reinforcement (chloride induced, carbonation induced), Alkali-silica reaction, sulphate attack, Acid attack Deterioration due to water leakage, fire – detection & mitigation of the same. Deterioration due to ageing, inadequate maintenance, Design & construction deficiencies, overloading etc. Types of cracks, causes & characteristics of cracking in various structural components like beam, column, slab, masonry walls. Measurement of cracks, interpretation of the cause of particular type of crack.	<b>6L+3T</b>
<b>Module – 3</b>	Conditional/damage assessment & Evaluation of structures:  Structural assessment: Conditional evaluation / Structural Appraisal of the structure – Importance, objective & stages, Conditional/damage	<b>6L+3T</b>



	<p>assessment procedure, Preliminary &amp; Detailed investigation – Scope, Objectives, Methodology &amp; Rapid visual inspection of structures</p> <p>Damage Assessment allied Tests (Destructive, Semi-destructive, Nondestructive): Field &amp; laboratory testing procedures for evaluating the structure for strength, corrosion activity, performance &amp; integrity, durability Interpretation of the findings of the tests.</p>	
<b>Module – 4</b>	<p>Repairs, rehabilitation &amp; Retrofitting of concrete structures:</p> <p>Repair materials - Criteria for durable concrete repair, Methodology, performance requirements, repair options, selection of repair materials, Preparatory stage of repairs, Different types of repair materials &amp; their application, types of repair techniques.</p> <p>Retrofitting/Strengthening:</p> <p>Need for retrofitting, Design philosophy of strengthening structures, Techniques available for strengthening including conventional and advanced techniques. Seismic retrofit of concrete structures: Deficiencies in structure requiring seismic retrofit, Design philosophy, Techniques to enhance the seismic resistance of structures, advanced techniques for making seismic resistant structures.</p>	<b>9L+3T</b>
<b>Module – 5</b>	<p>Protection &amp; maintenance of structures –</p> <p>Importance of protection &amp; maintenance, Categories of maintenance, Building maintenance. Corrosion mitigation techniques to protect the structure from corrosion.</p> <p>Long term health monitoring / Structural health monitoring (SHM)–</p> <p>Definition and motivation for SHM, Basic components of SHM and its working mechanism, SHM as a tool for proactive maintenance of structures.</p>	<b>4L+2T</b>

## Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	Failures and repair of concrete structures	S. Champion	John Wiley and Sons
	2	Diagnosis and treatment of structures in distress	R.N. Raikar	R & D Centre of Structural Designers and Consultants Pvt. Ltd.
	3	Maintenance, Repair & Rehabilitation and Minor works in Building	P.C. Varghese	PHI
<b>IS Codes</b>	Handbook on repair and rehabilitation of RCC buildings by CPWD, Government of India			



## CO-PO Mapping

### CO-PO Mapping

#### Repairs & Rehabilitation of Structures

(Course Code - CE(PE)702B)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	1	1	1	2	1	1	2	-	1	1	3	3	1	2	1
<b>CO2</b>	2	2	3	2	-	2	-	1	-	-	2	2	1	3	2
<b>CO3</b>	1	1	1	-	-	1	2	-	3	3	3	3	1	1	1
<b>Avg.</b>	1.34	1.34	1.67	2	1	1.34	2	1	2	2	2.67	2.67	1	2	1.34



## CE(PE)702C: Finite Element Method

Course Code – CE(PE)702C	Finite Element Method	2L+1T+0P	3 Credits
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>The Students will be able to Obtain an understanding of the fundamental theory of the FEA method.</li> <li>The Students will be able to Develop the ability to generate the governing FE equations for systems governed by partial differential equations.</li> <li>The Students will be able to Understand the use of the basic finite elements for structural applications using truss, beam, frame, and plane elements.</li> </ol>
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### Syllabus

Sl No.	Course Content	Total Hours
Module 1	Introduction to Finite Element Analysis: Basic Concepts of Finite Element Analysis and its necessity	2L
Module 2	Numerical tools for Finite Element Formulation: Vibrational Principle: Ritz method, Weighted residual method: Galerkin approach, Petrov-Galerkin approach.	5L+2T
Module 3	Finite element Formulation: Formulation of Euler-Bernoulli beam element and Timoshenko beam element, Imposition of boundary conditions.	7L+3T
Module 4	Elements and their properties: One dimensional and Two dimensional elements (Bar element, Beam element, Plate element), Interpolation functions, Numerical integration.	7L+3T
Module 5	Finite element solutions: Formulation of stiffness matrix and solution of beam, plate and truss problems, Problems on Plates with cutout. Introduction to the software SAP2000.	7L+4T

### Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	An Introduction to the Finite Element Method	Reddy J.N	McGraw
	2	Matrix and Finite Element Analyses of Structures	Mukhopadhyay	Oxford
	3	Concepts and Applications of Finite Elements Analysis	Cook R.D, Malkus, Plesha and Witt	Wiley
	4	Finite Element Analysis: Theory and Programming	Krishnamoorthy C. S.	McGraw Publication



5	Introduction to Finite Elements in Engineering	Chandrupatla elegundu	and
6	Finite Element Method with Applications in Engineering	Desai	Pearson

## CO-PO Mapping

### CO-PO Mapping

#### Finite Element Method

(Course Code – CE(PE)702C)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	3	1	3	1	-	1	1	1	2	-	-	2	3	1	3
<b>CO2</b>	3	1	3	3	3	-	2	1	1	1	2	2	2	2	2
<b>CO3</b>	3	1	3	2	2	1	1	1	-	2	1	3	2	2	2
<b>Avg.</b>	<b>3</b>	<b>1</b>	<b>3</b>	<b>2</b>	<b>2.5</b>	<b>1</b>	<b>1.33</b>	<b>1</b>	<b>1.5</b>	<b>1.5</b>	<b>1.5</b>	<b>2.33</b>	<b>2.33</b>	<b>1.67</b>	<b>2.33</b>



## CE(PE)703A: Air and Noise Pollution and Control

Course Code – CE(PE)703A	Air and Noise Pollution and Control	2L+1T+0P	2 Credits
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>1. The students will be able to define the basic concepts and terminologies regarding air pollution and noise pollution.</li> <li>2. The students will be able to describe the physics of air pollution and noise pollution.</li> <li>3. The students will be able to apply the methods of air pollution and noise pollution measurements.</li> <li>4. The students will be able to analyze different concepts of air and noise pollution solving mathematical problems.</li> <li>5. The students will be able to compare air and noise quality with allowable standards and limits.</li> </ol>
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### Syllabus

Sl. No.	Course Content	Total Hours
Module 1	<b>Air Pollutants</b> Sources; Classification; Effects on Human, Vegetation, Material, Effects of Air pollution on Atmosphere: Photochemical Smog, Ozone Layer Depletion, Acid Rain, Greenhouse Effect and Global Warming	4L+2T
Module 2	<b>Air Pollution Meteorology</b> Lapse Rate; Atmospheric Stability; Inversion; Plume Pattern	3L+1T
Module 3	Dispersion of Air Pollutants Point Source Gaussian Plume Model, Stability Classes, Stability Charts, Design of Stack Height	3L+1T
Module 4	<b>Air Quality</b> Methods of Measurement: Gaseous pollutants, Particulate pollutants, Air Quality Standards and Indices: Ambient Air Quality Standard, NAAQS, Emission Standard, Air Quality Indices	4L+2T
Module 5	<b>Air Pollution Control</b> Control of Gaseous Pollutants: Adsorption, Absorption, Condensation, Control of Particulate Pollutants: Settling chambers, Cyclone separators, Wet collectors, Fabric filters, Electrostatic precipitators Control of Pollution from Automobiles	5L+3T
Module 6	<b>Physics of Noise</b> Basics of Acoustics; Sound Pressure, Power and Intensity and their Interrelations	1L+1T



Module 7	<b>Measurement of Noise</b> Noise Level; Interrelation between Noise, Pressure, Power and Intensity Levels; Noise Meter; Noise Networks; Frequency Band Analysis; Decibel Addition Measurement of Community Noise: LN, Leq, Ldn., LNP	4L+2T
Module 8	<b>Source and Effect of Noise</b> Psychoacoustics and noise criteria; effects of noise on health; annoyance rating schemes	1L+1T
Module 9	<b>Noise Pollution Control</b> Noise Standards and Limits; Methods of Noise Pollution Control	3L+1T

## Books

Books	Sl.	Book Name	Author	Publishing House
	1	Air Pollution and Control	Keshav Kant, Rajni Kant	Khanna Publishing House
	2	Environmental Engineering	S.C. Sharma	Khanna Publishing House
	3	Introduction to Environmental Engineering and Science	Masters, G.M., Ela, W.P.	Prentice Hall / Pearson
	4	Environmental Engineering. Volume-1 and Volume-2.	Garg, S.K.	Khanna Publishers

## CO-PO Mapping

### CO-PO Mapping

#### Air and Noise Pollution and Control

(Course Code – CE(PE)703A)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	2	2	3	3	-	-	2	-	-	-	1	3	1	2	1
<b>CO2</b>	3	3	3	2	3	1	2	-	-	1	2	2	3	2	3
<b>CO3</b>	3	2	2	1	3	-	-	1	1	1	2	1	2	2	3
<b>CO4</b>	2	-	1	-	3	2	2	-	-	-	-	2	3	3	3
<b>CO5</b>	2	3	-	1	2	2	3	2	1	2	-	2	3	2	3
<b>Avg.</b>	2.4	2.5	2.25	1.75	2.75	1.67	2.25	1.5	1	1.33	1.67	2	2.4	2.2	2.6



## CE(PE)703B: Physico-Chemical Processes for Water and Wastewater Treatment

<b>Course Code – CE(PE)703B</b>	<b>Physico-Chemical Processes for Water and Wastewater Treatment</b>	<b>2T+1L+0P</b>	<b>3Credits</b>
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>1. Students will be able to Define the basic concepts and terminologies regarding physico-chemical treatment of water and wastewater</li> <li>2. Students will be able to Describe the physics, chemistry and hydraulics of different unit operations and processes for water and wastewater treatment</li> <li>3. Students will be able to Analyze different physico-chemical water and wastewater treatment options solving mathematical problems</li> <li>4. Students will be able to Design different physico-chemical treatment processes to treat water and wastewater</li> </ol>
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### Syllabus

Sl No.	Course Content	Total Hours
<b>Module – 1</b>	Introduction and Basic Concepts  Water purification in natural systems, physical processes, chemical processes and biological processes; Primary, secondary and tertiary treatment; Unit operations, unit processes	2L+2T -
<b>Module – 2</b>	Aeration Aeration and Gas Transfer	2L
<b>Module – 3</b>	Sedimentation  Sedimentation, different types of settling; sedimentation tank design	3L+1T
<b>Module – 4</b>	Clariflocculation Coagulation and flocculation; Coagulation processes, Stability of colloids; Destabilization of colloids; Destabilization in water and wastewater treatment; Transport of colloidal particles; Design aspects	4L+2T
<b>Module – 5</b>	Filtration Filtration processes; Hydraulics of flow through porous media; Rate control patterns and methods; Filter effluent quality parameters; Mathematical model for deep granular filters; Slow sand filtration, Rapid sand filtration, Precoat filtration; design aspects	4L+2T
<b>Module – 6</b>	Disinfection Types of disinfectants; Kinetics of disinfection; Chlorination and its theory; Design of Chlorinators	3L+1T



<b>Module – 7</b>	Precipitation Hardness removal; Iron, Manganese, and Heavy metal removal	3L+1T
<b>Module – 8</b>	Adsorption Adsorption equilibria and adsorption isotherm; Rates of adsorption; Sorption kinetics in batch reactors; Continuous reactors; Factors affecting adsorption	3L+1T
<b>Module – 9</b>	Ion Exchange Processes Materials and reactions; Methods of operation; Application; Design aspects	3L+1T
<b>Module – 10</b>	Membrane Processes Reverse osmosis, Ultrafiltration, Electrodialysis	3L+1T

## Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	Elements of Water Pollution Control Engineering	O.P. Gupta	Khanna Publishing House
	2	Environmental Engineering. Volume-1 and Volume-2.	Garg, S.K.	Khanna Publishers
	3	Environmental Engineering	Peavy, H.S, Rowe, D.R, Tchobanoglous, G	Tata McGraw Hill Indian Edition
	4	Manual on Water Supply and Treatment	CPHEEO	Govt. of India

## CO-PO Mapping

### CO-PO Mapping

#### Physico-Chemical Processes for Water and Wastewater Treatment

( Course Code – CE(PE)703B)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	3	2	3	3	-	-	2	-	-	-	1	3	1	2	1
<b>CO2</b>	3	3	3	2	3	1	2	-	-	1	1	2	3	2	3
<b>CO3</b>	3	1	2	1	3	-	-	2	-	1	-	1	2	2	3
<b>CO4</b>	3	-	2	-	3	2	2	-	-	-	-	2	3	3	3
<b>Avg.</b>	<b>3</b>	<b>2.33</b>	<b>2.5</b>	<b>2</b>	<b>3</b>	<b>1.5</b>	<b>2</b>	<b>2</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>2.25</b>	<b>2.25</b>	<b>2.5</b>



## CE(PE)703C: Water and Air Quality Modelling

Course Code – CE(PE)703C	Water and Air Quality Modelling	2L + 1T+0P	3 Credits
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>Students will be able to Define the basic concepts and terminologies regarding water and air quality modelling</li> <li>Students will be able to Describe the background mechanisms in modeling water and air quality</li> <li>Students will be able to Analyze different water and air quality models solving mathematical problems</li> <li>Students will be able to Apply the concepts of air and water quality modeling in air and water pollution control and management</li> </ol>
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### Syllabus

SI No.	Course Content	Total Hours
Module 1	Introduction to Water Quality Models Introduction to mathematical models; Water quality model development; Calibration and verification; Cost benefit analysis using models; Model requirements and limitations	4L+2T
Module 2	Dissolved Oxygen Model for Streams Sources and sinks of dissolved oxygen; Estimation of system parameters; Streeter Phelps model, oxygen 'sag' curve, Determination of deoxygenation and re-aeration coefficients; Benthic oxygen demand; Mass transport mechanisms	6L+2T
Module 3:	Models for Estuary and Lakes Physical chemical and biological processes in estuaries and lakes	4L+2T
Module 4:	Introduction to Air Quality Models	4L+2T



	Micrometeorological processes, Wind rose, Dispersion, coefficients and Stability classes	
Module 5:	Dispersion Models Point Source Gaussian Dispersion Model, Stack height computation; Line Source Models; Box Models	7L+3T
Module 6:	Air Quality Models Regional air quality models, Source inventories and significance	4L+2T

## Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	Air Pollution and Control	Keshav Kant, Rajni Kant.	Khanna Publishing House
	2	Elements of Water Pollution Control Engineering	O.P. Gupta	Khanna Publishing House
	3	Environmental Engineering	S.C. Sharma	Khanna Publishing House
	4	Environmental Engineering. Volume-1 and Volume-2.	Garg, S.K.	Khanna Publishers





## CO-PO Mapping

### CO-PO Mapping

#### Water and Air Quality Modelling

(Course Code – CE(PE)703C)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	3	3	2	2	3	-	-	1	3	1	1	3	3	3	3
<b>CO2</b>	3	3	3	1	3	-	-	-	2	1	1	3	1	3	3
<b>CO3</b>	3	3	3	3	3	1	-	-	3	1	1	3	2	3	3
<b>CO4</b>	3	3	2	2	3	-	1	1	3	3	1	3	2	3	2
<b>Avg.</b>	<b>3</b>	<b>3</b>	<b>2.5</b>	<b>2</b>	<b>3</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>2.75</b>	<b>1.5</b>	<b>1</b>	<b>3</b>	<b>2</b>	<b>3</b>	<b>2.75</b>



## CE(PE)704A: Structural Dynamics

Course Code – CE(PE)704A	<b>Structural Dynamics</b>	<b>2L+1T+0P</b>	<b>3 Credits</b>
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## Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>1. The Students will be able to understand Fundamental theory of dynamic equation of motion</li> <li>2. The Students will be able to analysis methods for dynamic systems</li> <li>3. The Students will be able to generate ideas about Dynamic properties and behavior of civil structures</li> <li>4. The Students will be able to develop Modelling approach of dynamic response in civil engineering applications</li> </ol>
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## Syllabus

SI No.	Course Content	Total Hours
<b>Module – 1</b>	Basics of Structural Dynamics: Introduction of Structural Dynamics, Differential Equations in Civil Engineering, Types of Analysis/Static and Dynamic load, Degrees of Freedom (Ex: Generation of Stiffness matrix), Dynamic Equilibrium Equation.	3L+2T
<b>Module – 2</b>	Free Vibration of SDOF: Undamped free Vibration, Natural Period/Frequency, Energy in Free Vibration, Damped Free Vibration, Types of damping, Logarithmic decrement equation Forced Vibration of SDOF: Undamped Forced vibration, Amplitude & Phase Angle, Dynamic amplification factor for deflection (Rd), Damped Forced vibration, Relationship between Rd, Rv and Ra	8L+4T
<b>Module – 3</b>	Force Transmission, Vibration Measurement: Resonant frequency and Half power band width, Force Transmission and Isolation, Design of Vibration Measuring Instruments	3L+1T
<b>Module – 4</b>	Response to Arbitrary Motions: Response to Unit Impulse, : Response to Arbitrary Force (Duhamel's Integral), Response to Step and Ramp Forces, Response to Rectangular Pulse, Half Sinusoidal wave	2L
<b>Module – 5</b>	Numerical Methods of Solution: Time Stepping Methods, Central Difference Method, Newmark's Method	2L
<b>Module – 6</b>	Response Spectrum: Concept of Response Spectrum, Uses of Response Spectrum, Special Cases in Spectrum, Development of Tripartite Plot, :Example: Base Shear and Base Moment, Response of Structure in Frequency Domain	3L+2T
<b>Module – 7</b>	Multi-Degree of Freedom Systems: Equation of Motion for MDOF System, Solution of Equation, Natural Frequencies and mode Shapes (60), Modal Orthogonality, Approximate Method for finding Natural frequency.	2L+1T
<b>Module – 8</b>	Earthquake Response of MDOF Systems: Time History Analysis, Response Spectrum Analysis, 3D Dynamic Analysis	2L



<b>Module 9</b>	Dynamic Response of Continuous Systems: Vibration of Continuous systems, Shear behaviour and bending behaviour, Generalized SDOF	2L
<b>Module 10</b>	Dynamics of Rigid Blocks: Dynamics of Rigid Blocks, Non Structural Elements, : Floor Response Spectrum	2L
<b>Module 11</b>	Vibration Control: : Introduction to Vibration Control, Active Control, Passive Control, Design of Tuned Mass Damper	2L+1T

## Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	Structural Dynamics (Theory and Computation)	Mario Paz.	CBS Publishers
	2	Dynamics of Structure (Theory and Application to Earthquake Engineering)	A.K.Chopra	Pearson Education
	3	Dynamics of Structures	Ashok K. Jain	Pearson Education

## CO-PO Mapping

### CO-PO Mapping

#### Structural Dynamics

(Course Code – CE(PE)704A)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	3	1	2	2	2	-	2	2	-	2	2	3	2	3	1
<b>CO2</b>	2	2	2	1	1	1	-	2	2	2	-	2	3	2	2
<b>CO3</b>	2	1	2	2	3	2	2	1	2		2	2	2	3	2
<b>CO4</b>	2	2	2	1	-	-	-	2	-	1	-	3	2	2	3
	<b>2.25</b>	<b>1.5</b>	<b>2</b>	<b>1.5</b>	<b>2.33</b>	<b>1.5</b>	<b>2</b>	<b>1.75</b>	<b>2</b>	<b>1.67</b>	<b>2</b>	<b>2.5</b>	<b>2.25</b>	<b>2.5</b>	<b>2</b>

## CE(PE)704B: Advanced Structural Analysis

Course Code –CE(PE)704B	Advanced Structural Analysis	2L+1T+0P	3 Credits
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### Course Outcome (CO)

Course Outcome (CO)	<ol style="list-style-type: none"> <li>Students will be able to know increase their basic Knowledge.</li> <li>Student will be able to apply stiffness and flexibility method using system approach.</li> <li>Student will understand the yield conditions from their knowledge of stress-strain relations.</li> <li>Student will be able to solve simple plate and shell problems</li> </ol>
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### Syllabus

SI No.	Course Content	Total Hours
Module 1:	Matrix methods of structural analysis: Application of matrix methods to plane truss, beams, continuous frames	9L+5T
Module 2:	Finite difference and relaxation technique-application to simple problems.	6L+3T
Module 3:	Theory of plate bending: Navier's Solutions. Levy's solution. Plate buckling problem. Membrane theory of domes and cylindrical shells.	7L+3T
Module 4:	Theory of Elasticity: Three dimensional stress and strain analysis, stress strain transformation, stress invariants, equilibrium and compatibility equations. Two dimensional problems in Cartesian and polar coordinates. Plane stress, plane strain problems, St. Venant's principle	6L+1T

### Books

	Sl.	Book Name	Author	Publishing House
Books	1	Matrix, finite element, computer and	Mukhopadhyay	ANE Books
	2	Intermediate Structural analysis	Wang	McGrawHill
	3	Theory of Plates and Shells	Timoshenko & Krieger	McGrawHill
	4	Structural Analysis	R Agor	Khanna Publishing House
	5	Theory of Elasticity	Timoshenko & Goodier	McGrawHill
	6	Analysis of Structures	T.S. Thandavamoorthy	Oxford University Press



## CO-PO Mapping

### CO-PO Mapping

#### Advanced Structural Analysis

(Course Code - CE(PE)704B)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	1	3	3	1	3	-	2	1	2	2	-	3	2	3	3
<b>CO2</b>	2	1	2	1	3	1	3	3	3	3	3	3	3	3	2
<b>CO3</b>	1	2	3	1	2	-	1	-	-	1	-	3	2	3	3
<b>CO4</b>	1	2	3	1	2	-	1	-	-	1	-	3	2	3	3
<b>Avg</b>	<b>1.25</b>	<b>2</b>	<b>2.75</b>	<b>1</b>	<b>2.5</b>	<b>1</b>	<b>1.75</b>	<b>2</b>	<b>2.5</b>	<b>1.75</b>	<b>3</b>	<b>3</b>	<b>2.25</b>	<b>3</b>	<b>2.75</b>



## CE(PE)704C: Coastal Hydraulics and Sediment Transport

Course Code – CE(PE)704C	Coastal Hydraulics and Sediment Transport	2L+1T+0P	3 Credits
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>Students will be able to Explain and quantify coastal wave processes including wave generation, propagation, refraction, shoaling, diffraction, and breaking.</li> <li>Students will be able to Explain and quantify coastal wave properties important to coastal engineering, including wave heights, speeds, induced water velocities, pressures, making appropriate approximations for deep and shallow waters.</li> <li>Students will be able to Characterize and quantify basic coastal sediment transport processes and rates</li> <li>Students will be able to Analyze coastal sites to determine design waves by utilizing historical and bathymetric data. Estimate hydrodynamic forces on coastal structures</li> </ol>
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### Syllabus

SI No.	Course Content	Total Hours
Module 1	Introduction: Basic understanding of wave mechanics including wave generation, propagation, form and assessment in the coastal zone. Statistical and spectral analysis of recorded wave data and prediction in coastal zone.	6L
Module 2	Tides and currents: The equilibrium tide, Dynamic modifications of the equilibrium tide, Modification of tidal pattern, Tidal streams, Tidal bores	6L
Module 3	Waves: The linear theory of waves, Waves of finite height, Wind waves, Waves in shoaling water, Refraction of waves, Reflection of waves, Diffraction of waves, Oscillations in a harbour, Ship waves.	8L
Module 4	Sediment Transport: Basic concepts, Transport modes, Material in suspension, Bed-Load, Turbidity and density currents, Banks and channels in river estuaries, Regime of the sea-bed; Vertical distribution of suspended sediment in waves and current over a plane bed..	8L
Module 5	Littoral drift: Definition of limit for littoral drift, The effect of grain size, The beach profile, Longshore transport of material, Coastal features.	8L
Module-6	Coastal Structures: Types and use; Effect of construction of coastal structures on stability of shoreline/ beaches, shoreline configuration.	6L



## Books

Books	Sl.	Book Name	Author	Publishing House
	1	Coastal hydrodynamics	J. S. Mani	Prentice-Hall of India Ltd, 2012
	2	Advances in Coastal Hydraulics	V. Panchang, J. Kaihatu	World Scientific Publishing Company,
	3	Basic Coastal Engineering	R. M. Sorensen	Springer, 2010
	4	Computational Modelling in Hydraulic and Costal Engineering	C. Kouttias and P. D. Scarlatos	CRC Press, 2016.

## CO-PO Mapping

### CO-PO Mapping

#### Coastal Hydraulics and Sediment Transport

(Course Code – CE(PE)704C)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	3	1	3	1	-	1	1	1	2	-	-	2	3	1	3
<b>CO2</b>	3	1	3	3	3	-	2	1	1	1	2	2	2	2	2
<b>CO3</b>	3	1	3	2	2	1	1	1	-	2	1	3	2	2	2
<b>CO4</b>	3	1	3	2	1	1	-	1	3	-	3	1	1	3	1
	<b>3</b>	<b>1</b>	<b>3</b>	<b>2</b>	<b>2.0</b>	<b>1</b>	<b>1.33</b>	<b>1</b>	<b>2.0</b>	<b>1.5</b>	<b>2.0</b>	<b>2.33</b>	<b>2.0</b>	<b>2.0</b>	<b>2.0</b>

## CE(PE)705A: Railway and Airport Engineering

Course Code – CE(PE)705A	Railway and Airport Engineering	2T+0L+0P	2 Credits
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>1. Students will able to Explain the basics in planning functional components of Railway and Airport.</li> <li>2. Students will able to Illustrate the engineering concepts of construction, operation and maintenance of Railway and Airport components.</li> <li>3. Students will able to Interpret the geometric design parameters of Railway</li> <li>4. Students will able to Decide the runway orientation of proposed runway on the basis of previous wind data analysis.</li> <li>5. Students will able to Assess the basic runway length parameters.</li> </ol>
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### Syllabus

Sl No.	Course Content	Total Hours
<b>Module1</b>	<p><b>Railway Engineering</b> Introduction to Railway Engineering: Socio-economic impact of Indian Railways; Zonal classification of Indian Railways; Railway track gauge; Classification of Indian Railways based on Speed Criteria. Permanent Way (P-way): Components – Rails, Rail joints, Sleepers, Ballast, Fastenings, Sub-grade.</p> <p>Track Alignment and Engineering Survey: Basic requirement of good alignment; Factors in selection of good alignment; Engineering Survey. Track Stresses;</p> <p>Geometric Design: Gradient, Speed, Degree of Curve, Super-elevation, Transition curve, Widening of gauge on curves, Shift. Points and Crossings; Station and Yards; Signaling and Control Systems.</p>	20L
<b>Module2</b>	<p><b>Airport Engineering</b> Airport Site Selection; Airport layout; Functions and planning of the Airfield components – runway, taxiway and Aprons, hanger, terminal building and control tower; Design of Runway and Taxiway; Runway orientation: Wind rose diagrams.</p>	10L





## Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	A Textbook of Railway Engineering	Saxena S.P.& Arora S.P	Dhanpat Rai & Sons
	2	Airport Planning & Design	Khanna S.K , Arora M.G & JainS.S	Nemchand Brothers

## CO-PO Mapping

### CO-PO Mapping

#### Railway and Airport Engineering

(Course Code –CE(PE)705A)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	2	1	2	2	2	1	1	1	3	1	2	3	3	2	3
<b>CO2</b>	3	3	1	3	2	2	3	1	1	3	1	3	2	3	1
<b>CO3</b>	1	1	1	1	2	1	1	1	1	1	2	3	1	1	1
<b>CO4</b>	3	2	3	2	3	1	3	2	2	2	2	3	2	1	3
<b>CO5</b>	2	1	2	1	3	1	3	3	3	3	3	3	3	2	2
<b>Avg.</b>	<b>2.2</b>	<b>1.6</b>	<b>1.8</b>	<b>1.8</b>	<b>2.4</b>	<b>1.2</b>	<b>2.2</b>	<b>1.6</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>3</b>	<b>2.2</b>	<b>1.8</b>	<b>2</b>

## CE(PE)705B: Pavement Design

Course Code – CE(PE)705B	Pavement Design	2L+0T+0P	2 Credits
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## Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>1. Students will able to develop a fundamental understanding of the Pavement Materials used for road construction.</li> <li>2. Students will able to visualize the relationship between key materials and their properties along with the behavior of pavement component systems.</li> <li>3. Students will able to instill an appreciation of an analytical approach to greater understanding of the factors that affects the material characteristics during the thickness design.</li> <li>4. Students will able to know about the Equipment Used in the Construction of Roads and their Operational approach.</li> <li>5. Students will able to learn about the various construction procedures of both Flexible and Rigid pavements</li> </ol>
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## Syllabus

Sl No.	Course Content	Total Hours
Module 1	<b>Introduction</b> Basic road construction materials: Types of basic materials, Suitability of different materials depends on their availability and characteristics, Economic, Environmental, and Social issues of material usage, Life cycle analysis and its use in design	3L
Module 2	<b>Soil</b> Classification; Index & Engineering properties of soil, Properties of sub-grade; Suitability of different type of soil for the construction of highway embankments and pavement layers; Field compaction and control. Introduction to Soil Stabilization: Physical and Chemical modification: Stabilization with admixtures like cement, lime, calcium chloride, fly ash and bitumen. A critical look at the different laboratory and in-situ procedures for evaluating the mechanical properties of soils viz. CBR, Plate Load test, Resilient modulus, DCPT	7L
Module 3:	<b>Aggregate</b> Characterization: Origin, classification, properties. Tests and specifications on road aggregates for flexible and rigid pavements. Importance of aggregate gradation problems on Rothfutch's and Critical sieve methods and Shape Factor in mix-design	6L
Module 4:	<b>Bitumen Binders</b> Different types, properties and uses, Tests on bitumen, Rheological and pavement performance related properties, Criteria for selection of different	6L



	binders. Marshall Method of mix-design, Additives & Modifiers in Bituminous mixes, problems on mix design	
Module 5:	<b>Cement</b> Requirements, design of mix for CC pavement, use of additives, IRC specifications & Tests, joint filler and sealer materials.	<b>3L</b>
Module 6:	Modern trend of using Modified, Sustainable and Environment friendly materials  Geo-Synthetics: Geo-synthetic clay liner – Construction details – Geo Synthetic Materials – Functions – Property characterization  Modified bitumen: Crumb Rubber Modified bitumen, Natural rubber modified bitumen, polymer modified bitumen; Long term and short term ageing and its effect on bitumen performance  Plastic waste: Types of polymer, applicability of polymer based waste product in different layers of pavement.	<b>4L</b>

## Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	Highway Engineering	Khanna, S.K .and C.E.G .Justo	Nem Chandand Bros
	2	Traffic Engineering and Transport Planning	Kadiyali L.R	Khanna Publishers
IS code	IS73, revised 2006, IS2720, IS2386, IS 1201 to 1220, IS8887-1995, IS217-1986			
	IRC:51-1992, 63-1976, 74-1979, 88-1984,			
	IRCSP:53 – 2002, IRCSP:58 – 2000,			
	“Guidelines for use of Geo-textiles in Road Pavements and Associated works”-2002; IRC			
	State of art, special report 3 – “compaction of earth work and subgrade”-IRC, HRB, 1999			
	MoRTH ‘Specifications for Roads and Bridges Works’ -Indian Roads Congress			



## CO-PO Mapping

### CO-PO Mapping

#### Pavement Materials

(Course Code –CE(PE)801D)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	3	1	2	2	2	1	2	2	2	2	2	3	2	3	1
<b>CO2</b>	2	2	2	1	1	1	1	2	2	2	2	2	3	2	2
<b>CO3</b>	2	1	2	2	3	2	2	1	2	3	2	2	2	3	2
<b>CO4</b>	2	2	2	1	1	1	2	2	3	1	3	3	2	2	3
<b>CO5</b>	3	2	2	1	2	2	2	1	1	3	3	2	2	3	1
<b>Avg.</b>	<b>2.4</b>	<b>1.6</b>	<b>2</b>	<b>1.4</b>	<b>1.8</b>	<b>1.4</b>	<b>1.8</b>	<b>1.6</b>	<b>2</b>	<b>2.2</b>	<b>2.4</b>	<b>2.4</b>	<b>2.2</b>	<b>2.6</b>	<b>1.8</b>

## CE(PE)705C: Transport System Planning

Course Code –CE(PE)705C	Transport System Planning	2L+0T+0P	2 Credits
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>1. Students will be able to understand the knowledge of planning, design and the fundamental properties of highway materials in highway engineering.</li> <li>2. Students will be able to apply the knowledge of geometric design and draw appropriate conclusion.</li> <li>3. Students will be able to interpret the concept of different methods in design, construction of the pavement.</li> <li>4. Students will be able to interpret traffic parameters by applying the knowledge in traffic planning and intersection design.</li> </ol>
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### Syllabus

Sl No.	Course Content	Total Hours
<b>Module – 1</b>	<p>Introduction</p> <p>Importance of transportation, transportation planning methodology, hierarchical levels of planning and its relation to rural, urban areas. Long range planning, Passenger and goods transportation, General concept and process of transport planning, Land-use transport interactions, Socio-economic characteristics of Land use.</p>	<b>5L</b>
<b>Module – 2</b>	<p>Transportation System</p> <p>Multi modal transportation system; Characteristics of Mass Transit systems including technical, demand operational and economic problems, fixed Track Facility, Mass Rapid Transit System Elevated, Surface and Underground construction, integrated Operating Characteristics of Terminal and Transfer facilities.</p>	<b>10L</b>
<b>Module – 3</b>	<p>Transport planning</p> <p>Studies: Urban Travel Characteristics, Private and Public Behavior analysis, Transportation demand Surveys, Delineation of the urban area, zoning, Origin-Destination Studies, Home Interviews, trip Classification.</p> <p>Methodology: Study of existing network-trip generation techniques,</p>	<b>15L</b>



	Category analysis, multiple regression techniques, Modal split analysis, Trip distribution techniques, Growth Factor model, Gravity models, Opportunity models and multiple regression models.	
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## Books

	Sl.	Book Name	Author	Publishing House
Books	1	Highway Engineering	L.R. Kadiyali	Khanna Book Publishing
	2	A Text Book for Transportation Engineering	A.K.Upadhayaya	Lakshmi Prakashani
	3	Transportation Engineering	L.R. Kadiyali	Khanna Book Publishing

## CO-PO Mapping

### CO-PO Mapping

#### Transport System Planning

(Course Code - CE(PE)705C)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	2	1	2	3	-	2	1	2	-	1	3	-	1	1	2
<b>CO2</b>	1	1	2	1	2	3	2	-	3	-	1	1	2	1	3
<b>CO3</b>	1	1	2	-	-	1	-	3	2	1	-	2	1	2	1
<b>CO4</b>	1	1	1	2	2	1	2	-	2	-	-	2	3	2	2
<b>Avg.</b>	<b>1.25</b>	<b>1</b>	<b>1.75</b>	<b>2</b>	<b>2</b>	<b>1.75</b>	<b>1.67</b>	<b>2.5</b>	<b>2.34</b>	<b>1</b>	<b>2</b>	<b>1.67</b>	<b>1.75</b>	<b>1.5</b>	<b>2</b>



## CE(IN)791: Industrial Internship (after sixth semester)

Course Code – CE(IN)791	Industrial Internship (after sixth semester)	0L+0T+0P	1 Credits
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>Students will be able to Explore the preferred field of specialization and develop analytical/ hardware/ software/ experimental/ observation skills.</li> <li>Students will be able to Manage technical content and work</li> <li>Students will be able to Prepare and present technical report.</li> </ol>
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### CO-PO Mapping

#### CO-PO Mapping

#### Industrial Internship

(after sixth semester)

(Course Code - CE(IN)791)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	2	3	2	1	-	1	1	-	1	1	-	3	3	2	3
<b>CO2</b>	1	1	2	3	1	1	2	1	2	-	2	3	3	2	3
<b>CO3</b>	1	1	-	-	3	-	1	-	1	1	-	3	3	2	2
<b>Avg</b>	<b>1.33</b>	<b>1.67</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>1</b>	<b>1.33</b>	<b>1</b>	<b>1.33</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>2.67</b>



## CE(IN)791: Project-1 (Project work)

Course Code – CE(IN)791	Project-1 (Project work)	0L+0T+10P	5 Credits
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## Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>Students will be able to Practice acquired knowledge within the chosen area of technology for project development policy.</li> <li>Students will be able to Identify, discuss and justify the technical aspects of the chosen project with a comprehensive and systematic approach</li> <li>Students will be able to Reproduce, improve and refine technical aspects for engineering projects</li> <li>Students will be able to Work as an individual or in a team in development of technical projects</li> <li>Students will be able to Communicate and report effectively project related activities and findings.</li> </ol>
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## CO-PO Mapping

CO-PO Mapping																
Project-1 (Project work)																
(Course Code - CE(IN)791)																
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	
<b>CO1</b>	3	-	1	1	-	1	2	1	2	1	-	3	2	1	2	
<b>CO2</b>	3	1	2	3	-	2	2	1	1	1	-	3	3	2	2	
<b>CO3</b>	1	1	-	-	2	-	1	-	1	1	-	3	3	1	2	
<b>CO4</b>	1	2	2	3	1	1	2	-	3	2	2	3	3	1	2	
<b>CO5</b>	2	1	3	1	3	1	2	3	2	3	1	3	2	2	3	
<b>Avg.</b>	<b>2</b>	<b>1.25</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>1.25</b>	<b>1.8</b>	<b>1.67</b>	<b>1.8</b>	<b>1.6</b>	<b>1.5</b>	<b>3</b>	<b>2.6</b>	<b>1.4</b>	<b>2.2</b>	



## 8<sup>th</sup> Semester

### CE(HS)801: Professional Practice, law & Ethics

Course Code – CE(HS)801	Professional Practice, law & Ethics	2T+0L+0P	2 Credits
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>Students will be able to Have general knowledge and legal literacy and thereby to take up competitive examinations.</li> <li>Students will be able to Understand state and central policies, fundamental duties. Understand Electoral Process, special provisions</li> <li>Students will be able to Understand Engineering ethics and responsibilities of Engineers. Understand Engineering Integrity &amp; Reliability</li> <li>Students will be able to Understand the concepts of Intellectual property to protect the traditional knowledge</li> </ol>
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### Syllabus

Sl No.	Course Content	Total Hours
Module 1	<p><b>Professional Practice</b> – Respective roles of various stakeholders: Government(constituting regulatory bodies and standardization organizations, prescribing norms to ensure safety of the citizens); Standardization Bodies (ex. BIS, IRC)(formulating standards of practice);professional bodies (ex. Institution of Engineers(India), Indian Roads Congress, IIA/COA, ECI, Local Bodies/ Planning Authorities) (certifying professionals and offering platforms for interaction);Clients/ owners (role governed by contracts); Developers (role governed by regulations such as RERA); Consultants (role governed by bodies such as CEAI); Contractors (role governed by contracts and regulatory Acts and Standards); Manufacturers/ Vendors/ Service agencies (role governed by contracts and regulatory Acts and Standards)</p> <p><b>Professional Ethics</b> – Definition of Ethics, Professional Ethics, Business Ethics, Corporate Ethics, Engineering Ethics, Personal Ethics; Code of Ethics as defined in the website of Institution of Engineers (India); Profession, Professionalism, Professional Responsibility, Professional Ethics; Conflict of Interest, Gift Vs Bribery, Environmental breaches, Negligence, Deficiencies in state-of-the-art; Vigil Mechanism, Whistleblowing, protected disclosures.</p>	4L



Module 2	<p><b>General Principles of Contracts Management</b></p> <p>: Indian Contract Act, 1972 and amendments covering General principles of contracting; Contract Formation &amp; Law; Privacy of contract; Various types of contract and their features; Valid &amp; Voidable Contracts; Prime and subcontracts; Joint Ventures &amp; Consortium; Complex contract terminology; Tenders, Request For Proposals, Bids &amp; Proposals; Bid Evaluation; Contract Conditions &amp; Specifications; Critical /“Red Flag” conditions; Contract award &amp; Notice To Proceed; Variations &amp; Changes in Contracts; Differing site conditions; Cost escalation; Delays, Suspensions &amp; Terminations; Time extensions &amp; Force Majeure; Delay Analysis; Liquidated damages &amp; Penalties; Insurance &amp; Taxation; Performance and Excusable Non- performance; Contract documentation; Contract Notices; Wrong practices in contracting (Bid shopping, Bid fixing, Cartels); Reverse auction; Case Studies; Build-Own-Operate &amp; variations; Public- Private Partnerships; International Commercial Terms;</p>	18L
Module 3:	<p><b>Arbitration, Conciliation and ADR (Alternative Dispute Resolution) system:</b></p> <p>Arbitration – meaning, scope and types – distinction between laws of 1940 and 1996; UNCITRAL model law – Arbitration and expert determination; Extent of judicial intervention; International commercial arbitration; Arbitration agreements – essential and kinds, validity, reference and interim measures by court; Arbitration tribunal – appointment, challenge, jurisdiction of arbitral tribunal, powers, grounds of challenge, procedure and court assistance; Award including Form and content, Grounds for setting aside an award, Enforcement, Appeal and Revision; Enforcement of foreign awards – New York and Geneva Convention Awards; Distinction between conciliation, negotiation, mediation and arbitration, confidentiality, resort to judicial proceedings, costs; Dispute Resolution Boards; Lok Adalats.</p>	5L
Module 4:	<p><b>Engagement of Labour and Labour &amp; other construction-related Laws:</b></p> <p>Role of Labour in Civil Engineering; Methods of engaging labour- on rolls, labour sub- contract, piece rate work; Industrial Disputes Act, 1947; Collective bargaining; Industrial Employment ( Standing Orders) Act, 1946; Workmen’s Compensation Act, 1923; Building &amp; Other Construction Workers (regulation of employment and conditions of service) Act (1996) and Rules (1998); RERA Act 2017, NBC 2017</p>	2L
Module 5:	<p><b>Law relating to Intellectual property:</b></p> <p>Introduction – meaning of intellectual property, main forms of IP, Copyright, Trademarks, Patents and Designs, Secrets; Law relating to Copyright in India including Historical evolution of Copy Rights Act, 1957, Meaning of copyright – computer programs, Ownership of copyrights and assignment, Criteria of infringement, Piracy in Internet</p>	



	<p>– Remedies and procedures in India; Law relating to Patents under Patents Act, 1970 including Concept and historical perspective of patents law in India, Patentable inventions with special reference to biotechnology products, Patent protection for computer programs, Process of obtaining patent – application, examination, opposition and sealing of patents, Patent cooperation treaty and grounds for opposition, Rights and obligations of patentee, Duration of patents</p> <p>– law and policy considerations, Infringement and related remedies;</p>	1L
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## Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	Professional Ethics & Human Values	Premvir Kapoor	Khanna Publishing House
	2	Legal Aspects of Building and Engineering Contracts	B.S. Patil	
	3	The National Building Code	BIS	
	4	Indian Contract Act	Dutta	Eastern Law House
	5	The Arbitration & Conciliation of Law in India with case law on UNCITRAL Model Law on Arbitration	Kwatra G.K.	Indian Council of Arbitration

## CO-PO Mapping

### CO-PO Mapping

#### Professional Practice, law & Ethics

(Course Code – CE(HS)801)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	-	-	-	-	-	-	-	-	-	-	-	-	1	2	1
<b>CO2</b>	-	-	-	-	-	-	-	-	-	-	-	-	2	1	2
<b>CO3</b>	-	-	-	-	-	-	-	3	-	-	-	-	1	1	2
<b>CO4</b>	-	-	-	-	-	-	-	1	-	-	-	-	1	2	1
<b>Avg.</b>	-	-	-	-	-	<b>0.75</b>	<b>0.50</b>	<b>1</b>	-	-	-	-	<b>1.25</b>	<b>1.5</b>	<b>1.5</b>

## CE(PE)801A: GIS & Remote Sensing

Course Code –CE(PE)801A	GIS & Remote Sensing	2L+0T+0P	2 Credits
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>1. Students will be able to Define and state the scope GIS &amp; remote sensing in civil engineering</li> <li>2. Students will be able to Understand the basic principles of remote sensing and GIS</li> <li>3. Students will be able to Apply the various methods of remote sensing and GIS to different geospatial datasets</li> <li>4. Students will be able to Analyze the different results obtained from different remote sensing data sources</li> <li>5. Students will be able to Evaluate the different results in solving real world problems.</li> <li>6. Students will be able to Design and construct optimum solutions for real world problems that can be resolved by GIS &amp; remote sensing</li> </ol>
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### Syllabus

Sl No.	Course Content	Total Hours
Module 1:	Fundamentals of Remote Sensing: Energy sources and radiation principles; Electromagnetic Spectrum; Energy interactions in the atmosphere and with earth surface features; Atmospheric windows; Spectral response patterns and spectral signatures	3L
Module 2:	Digital Image Processing: Image rectification and restoration; Image enhancement; Image classification; Accuracy assessment; Digital change detection; Spatial, spectral, radiometric and temporal resolution characteristics of IRS, Landsat and Sentinel data.	6L
Module 3:	Advanced Remote Sensing: Microwave remote sensing: Frequency and wavelengths, polarization, range and azimuth resolution, relief displacement, foreshortening, layover, shadows and speckles; Synthetic Aperture Radar (SAR); Indian microwave sensors; Working principles of LiDAR remote sensing	3L
Module 4:	Advanced Digital Image Processing: Principal Component Analysis (PCA); Colour Space Transformation; Fourier Transformation; Image fusion; Hybrid classification system	3L
Module 5:	GIS: Definition, components and applications of GIS; Spatial and attribute data; Raster vs. Vector GIS; Concept of topology; Non-topological data	3L



	structures	
Module 6:	Database and Coordinate System: Concepts of Relational Data Base Management System (RDBMS) and geodatabase; Spatial and attribute query; Datum and projection; Universal Transverse Mercator (UTM) grid system; On-the-fly projection	3L
Module 7:	Spatial Data Analysis: Concepts of local, focal, zonal and global analysis; Proximity analysis; Distance measurement; Raster and vector overlay; Spatial interpolation; DEM and TIN, Cost surface analysis	6L
Module 8	Applications of GIS & Remote Sensing: Watershed analysis; Runoff and erosion modelling, Location and allocation analysis; Atmospheric pollution monitoring; Urban growth modelling; Carbon sequestration and climate change	5L

## Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	Principles of Geoinformatics	P.K. Garg	Khanna Publishing House
	2	Remote Sensing and Image	Thomas M. Lillesand	
	3	Introduction to Geographic Information Systems	Kang-tsung Chang	Tata McGraw-Hill Publishing Company
	4	Remote Sensing and GIS	Basudeb Bhatta	Oxford University Press
	5	Remote Sensing of Environment: An Earth Resource Perspective	J. R. Jensen	Pearson
	6	Applications of Geomatics in Civil Engineering	J. K. Ghosh I. de Silva (Eds.)	Springer
	7	Introductory Digital Image Processing: A Remote Sensing	J. R. Jensen	Pearson
	8	Principles of Geoinformatics	P.K. Garg	Khanna Publishing House



## CO-PO Mapping

### CO-PO Mapping

#### GIS & Remote Sensing

(Course Code - CE(PE)801A)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	2	-	-	1	-	2	1	-	-	1	-	3	2	1	2
<b>CO2</b>	3	2	2	1	-	2	2	1	-	-	1	3	2	1	3
<b>CO3</b>	1	3	3	-	2	-	2	-	1	1	-	3	1	3	3
<b>CO4</b>	1	3	3	1	3	-	2	1	2	2	-	3	2	3	3
<b>CO5</b>	2	1	2	1	3	1	3	3	3	3	3	3	3	3	2
<b>CO6</b>	2	1	3	1	3	1	3	3	3	3	3	3	3	3	3
<b>Avg.</b>	<b>1.83</b>	<b>2</b>	<b>2.6</b>	<b>1</b>	<b>2.75</b>	<b>1.5</b>	<b>2.16</b>	<b>2</b>	<b>2.25</b>	<b>2</b>	<b>2.33</b>	<b>3</b>	<b>2.16</b>	<b>2.33</b>	<b>2.67</b>



## CE(PE)801B: Rock Mechanics

Course Code – CE(PE)801B	Rock Mechanics	2L+0T+0P	2 Credits
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>1. The students will be able to define the characteristics and the mechanical properties (strength and failure criteria) of rock mass, rock matrix and discontinuities.</li> <li>2. The students will be able to explain methods for in situ investigation and laboratory testing of rock matrix and discontinuities.</li> <li>3. The students will be able to use rock mass classification systems (RMR, Q, and GSI).</li> <li>4. The students will be able to conduct rock slope stability analyses.</li> <li>5. The students will be able to analyse the stress distribution (isotropic, anisotropic) in situ and around an opening in rock (competent rock, jointed rock mass, blocky rock)</li> </ol>
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### Syllabus

Sl No.	Course Content	Total Hours
Module 1	Composition of rocks, Engineering classification and Limitation of Geologic classification of rocks	4L
Module 2	Rock coming, various methods of obtaining rock cores, Engineering Properties of rock, stress -strain relations, elastic theory application to design in rock.	6L
Module 3:	Strength and failure of rocks, Uniaxial and triaxial strength of rocks, failure theories of rocks and propagation of cracks, Griffith Chack theory -Water in rock, Structural feature of mass rocks and their effects on engineering properties.	8L
Module 4:	Measurement of stresses -rock mass, various types of measuring devices, evaluation of properties of rocks in the field.	6L
Module 5:	Strain and displacement of the rock mass, rock reinforcement and support, subsidence.	6L



## Books

Books	Sl.	Book Name	Author	Publishing House
	1	Rock Mechanics in Engineering Practice	K.G.Stagg and O.C.Zienkiewicz,	John Wiley and Sons
	2	Engineering Behavior of Rocks	W. Farmer,	Chapman and Hall Ltd

## CO-PO Mapping

### CO-PO Mapping

#### Rock Mechanics

(Course Code – CE(PE)601B)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	2	2	3	3	-	-	2	-	-	-	1	3	1	2	1
<b>CO2</b>	3	3	3	2	3	1	2	-	-	1	1	2	3	2	3
<b>CO3</b>	2	1	2	1	3	-	-	1	-	1	-	1	2	2	3
<b>CO4</b>	3	-	2	-	3	2	2	-	-	-	-	2	3	3	3
<b>CO5</b>	3	3	2	2	2	2	3	-	1	1	-	2	3	2	3
<b>Avg.</b>	<b>2.6</b>	<b>2.25</b>	<b>2.4</b>	<b>2</b>	<b>2.75</b>	<b>1.67</b>	<b>2.25</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>2.4</b>	<b>2.2</b>	<b>2.6</b>



## CE(PE)801C: Environmental laws and Policy

Course Code –CE(PE)801C	Environmental laws and Policy	2L+0T+0P	2 Credits
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>1. Students will be able to apply the relevant measures to mitigate pollution from different sources.</li> <li>2. Students will be able to understand the effects of the various pollutants on the environment as a whole according to the formulated guidelines.</li> <li>3. Students will be able to give recommendations for alternatives to reduce pollution.</li> <li>4. Students will be able to formulate standards of the various parameters corresponding to their impact on the environment with changing time.</li> </ol>
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### Syllabus

Sl No.	Course Content	Total Hours
<b>Module 1</b>	<b>Introduction:</b> Environment, Nature, Ecosystem, Origin of Environmental laws, Concept of laws and policies, Environment and Governance.	<b>3L</b>
<b>Module 2</b>	Sustainable Development and Environment: Understanding of Climate change Concept of Carbon Footprint, Carbon Credit, Carbon Offsetting Use of Hybrid Energy (Conventional +Non-Conventional) Use of Clean Development Mechanism.	<b>6L</b>
<b>Module 3:</b>	<b>Environmental Laws (Indian Perspective):</b> Indian Environmental Laws and Policies.	<b>8L</b>
<b>Module 4:</b>	<b>Environmental Laws (International Perspective):</b> Fundamental Principles and Application of International Environmental Law, Introduction to Trade and Environment Right to Environment as Human Right International Humanitarian Law and Environment and Conflict Management Focus on International Protocols- UNFCCC & Kyoto Protocol, Treaty on Antarctic & Polar Regions, UN Conventions of Law of the Sea and Regional Sea Convention, Law on International Water Courses.	<b>11L</b>



## Books

Books	Sl.	Book Name	Author	Publishing House
	1	Environmental Law and Policy	Aruna Venkat	PHI Publication.
	2	Environmental Law and Policy	James Salzman & Burton H. Thompson (Jr.)	Foundation Press.
	3	Climate Change, Law, Policy and Governance	Usha Tandon	Eastern Book Company.

## CO-PO Mapping

### CO-PO Mapping

#### Environmental laws and Policy

(Course Code – CE(PE)801C)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	3	2	3	3	-	-	2	3	-	-	1	3	1	2	1
<b>CO2</b>	3	3	3	2	3	1	2	-	-	1	1	2	1	2	3
<b>CO3</b>	1	1	2	1	3	1	-	1	-	1	-	1	2	2	1
<b>CO4</b>	2	1	2	-	3	2	2	3	-	3	-	2	3	1	3
<b>Avg.</b>	<b>2.25</b>	<b>1.75</b>	<b>2.5</b>	<b>2</b>	<b>3</b>	<b>1.34</b>	<b>2</b>	<b>2.34</b>	<b>-</b>	<b>1.67</b>	<b>1</b>	<b>2</b>	<b>1.75</b>	<b>1.75</b>	<b>2</b>



## CE(PE)801D: Pavement Materials

Course Code – CE(PE)801D	Pavement Materials	2L+0T+0P	2 Credits
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>1. Students will able to develop a fundamental understanding of the Pavement Materials used for road construction.</li> <li>2. Students will able to visualize the relationship between key materials and their properties along with the behavior of pavement component systems.</li> <li>3. Students will able to instill an appreciation of an analytical approach to greater understanding of the factors that affects the material characteristics during the thickness design.</li> <li>4. Students will able to know about the Equipment Used in the Construction of Roads and their Operational approach.</li> <li>5. Students will able to learn about the various construction procedures of both Flexible and Rigid pavements</li> </ol>
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### Syllabus

Sl No.	Course Content	Total Hours
<b>Module1</b>	<b>Introduction</b> Basic road construction materials: Types of basic materials, Suitability of different material depends on their availability and characteristics, Economic, Environmental, and Social issues of material usage, Life cycle analysis and its use in design	3L
<b>Module2</b>	<b>Soil</b> Classification; Index & Engineering properties of soil, Properties of sub-grade; Suitability of different type of soil for the construction of high way embankments and pavement layers; Field compaction and control. Introduction to Soil Stabilization: Physical and Chemical modification: Stabilization with admixtures like cement, lime, calcium chloride, fly ash and bitumen. A critical look at the different laboratory and in-situ procedures for evaluating the mechanical properties of soils viz. CBR, Plate Load test, Resilient modulus, DCPT	7L
<b>Module3</b>	<b>Aggregate</b> Characterization: Origin, classification, properties. Tests and specifications on road aggregates for flexible and rigid pavements. Importance of aggregate gradation problems on Rothfutch's and Critical sieve methods and Shape Factor in mix design	6L
<b>Module4</b>	<b>Bitumen Binders</b> Different types, properties and uses, Tests on bitumen, Rheological and pavement performance related properties, Criteria for selection of different binders. Marshall	6L



	Method of mix design, Additives & Modifiers in Bituminous mixes, problems on mix design	
<b>Module 5</b>	<b>Cement</b> Requirements, design of mix for CC pavement, use of additives, IRC specifications & Tests, joint filler and sealer materials.	<b>3L</b>
<b>Module 6</b>	Modern trend of using Modified, Sustainable and Environment friendly materials Geo-Synthetics: Geo-synthetic clay liner – Construction details – Geo Synthetic Materials – Functions – Property characterization Modified bitumen: Crumb Rubber Modified bitumen, Natural rubber modified bitumen, polymer modified bitumen; Long term and short term ageing and its effect on bitumen performance Plastic waste: Types of polymer, applicability of polymer based waste production different layers of pavement.	<b>4L</b>

## Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	Highway Engineering	Khanna,S.K.and C.E.G.Justo	Nem Chand and Bros
	2	Traffic Engineering and Transport Planning	Kadiyali L. R	Khanna Publishers

IS code	IS73, revised 2006, IS2720, IS2386, IS 1201 to 1220, IS8887-1995, IS217-1986
	IRC:51-1992, 63-1976, 74-1979, 88-1984,
	IRCSP:53 – 2002, IRCSP:58 – 2000,
	“Guidelines for use of Geotextiles in Road Pavements and Associated works”-2002; IRC
	State of art, special report 3 – “compaction of earth work and subgrade”-IRC, HRB, 1999
	MoRTH ‘Specifications for Roads and Bridges Works’-Indian Roads Congress



## CO-PO Mapping

### CO-PO Mapping

#### Pavement Materials

(Course Code –CE(PE)801D)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	3	1	2	2	2	1	2	2	2	2	2	3	2	3	1
<b>CO2</b>	2	2	2	1	1	1	1	2	2	2	2	2	3	2	2
<b>CO3</b>	2	1	2	2	3	2	2	1	2	3	2	2	2	3	2
<b>CO4</b>	2	2	2	1	1	1	2	2	3	1	3	3	2	2	3
<b>CO5</b>	3	2	2	1	2	2	2	1	1	3	3	2	2	3	1
<b>Avg.</b>	2.4	1.6	2	1.4	1.8	1.4	1.8	1.6	2	2.2	2.4	2.4	2.2	2.6	1.8



## CE(OE)801B: Bridge Engineering

Course Code – CE(OE)801B	Bridge Engineering	2L+0T+0P	2 Credits
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>1. The Students will be able to Discuss basic definitions, types, and components of bridges.</li> <li>2. The Students will be able to Discuss sub-surface investigations required for bridge construction.</li> <li>3. The Students will be able to Understand standard specification and loads for bride design.</li> <li>4. The Students will be able to Perform design of different types bearings and joints for bridges.</li> <li>5. The Students will be able to Perform design of various reinforced concrete and steel bridges.</li> </ol>
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### Syllabus

SI No.	Course Content	Total Hours
<b>Module – 1</b>	Introduction: Definition and basic forms, components of a typical bridge, classification of bridges, site investigation, bridge hydrology and hydraulics. Loads: I.R.C loads, impact factors, wind loads, longitudinal forces, lateral forces and centrifugal forces. Bearings: Types of bearings, details of bearing, joints, design examples	3L
<b>Module – 2</b>	Design of reinforced concrete solid slab bridge: Introduction, general design features, economic span, effective width method, simply supported and cantilever slab bridges, analysis and design.	7L
<b>Module – 3</b>	Design of box culvert bridge: Introduction, design method and design example.	4L
<b>Module – 4</b>	Design of a T beam bridge: Introduction, components, design of interior panel of slab, longitudinal and cross girders, Pigeaud's method, design example.	6L
<b>Module – 5</b>	Design of composite bridge: General aspects, method of construction, analysis of composite section, shear connectors, design of composite beam.	4L
<b>Module – 6</b>	Design of steel bridges: General features, types of stress, design of railway truss bridge and plate girder bridge	6L
<b>Module – 7</b>	Design of cable stayed bridge: General features, Philosophy of design.	2L

### Books



<b>Books</b>	<b>Sl.</b>	<b>Book Name</b>	<b>Author</b>	<b>Publishing House</b>
	1	Pre-stressed Concrete	Shrikant Vanakudre	Khanna Book Publishing Co
	2	Pre-stressed Concrete Bridges	N. Krishnaraju	CBS Publisher
	3	Essential Bridge Engineering	Jhonson Victor D.	Oxford, IBH Publishing Co
	4	Design of Bridge Structures	Jagadish and Jayaram	PHI

## CO-PO Mapping

### CO-PO Mapping

#### Bridge Engineering

(Course Code – CE(OE)801B)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	3	2	2	1	1	2	2	2	-	2	2	3	2	2	3
<b>CO2</b>	3	3	2	1	-	2	-	2	1	1	-	3	2	1	3
<b>CO3</b>	3	3	2	-	2	2	-	2	-	-	1	3	3	2	3
<b>CO4</b>	3	3	2	-	1	2	1	2	1	1	1	3	2	1	3
<b>CO5</b>	3	2	2	1	1	2	1	2	1	-	-	3	2	2	3
<b>Avg.</b>	<b>3</b>	<b>2.6</b>	<b>2</b>	<b>1</b>	<b>1.25</b>	<b>2</b>	<b>1.33</b>	<b>2</b>	<b>1</b>	<b>1.33</b>	<b>1.33</b>	<b>3</b>	<b>2.2</b>	<b>1.6</b>	<b>3</b>



## CE(OE)801C: Deep Foundations

<b>Course Code – CE(OE)801C</b>	<b>Deep Foundations</b>	<b>2L+0T+0P</b>	<b>2 Credits</b>
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>1. The students will be able to explain the concept of bearing capacity for deep foundation.</li> <li>2. The students will be able to estimate the safe bearing capacity including settlement consideration for deep foundations.</li> <li>3. The students will be able to select a suitable deep foundation system for various site conditions and also analysis of that.</li> <li>4. The students will be able to explain in what circumstances pile is needed and how to estimate pile and pile group capacity under various soil conditions</li> </ol>
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### Syllabus

SI No.	Course Content	Total Hours
Module 1	Piles: types - load carrying capacity of pile - static and dynamic formula - pile load test - penetration test - pile groups - Efficiency - Feld's rule –Converse Labarre formula, Settlement of piles and pile groups - Negative skin friction – under-reamed piles, pile cap	10L
Module 2	Drilled Pier: Introduction, uses, types, bearing capacity, settlement, construction procedures.	6L
Module 3:	Cassion foundations: Types & selections, forces & moments, depth determination.	4L
Module 4:	Well foundations: The Types, components, design of well foundations – grip, size, steining, curb, cutting edge, top & bottom plug, well cap; stability analysis of well foundation, construction, shift & tilts.	8L

### Books

Books	Sl.	Book Name	Author	Publishing House
	1	Principles of Foundation Engineering	Braja M. Das	Thomson Asia Pvt. Ltd., Singapore, 2005.





2	Geotechnical Engineering, Principles and Practices,	Donald P. Coduto, Man- Chu Ronald Yeung and	PHI Learning Private limited, 2011.
3	Soil Mechanics and Foundation Engineering	P. Purushothama Raj	Pearson publication

## CO-PO Mapping

### CO-PO Mapping

#### Deep Foundations

(Course Code – CE(OE)801B)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	2	2	2	2	3	-	-	1	3	1	1	3	3	1	3
<b>CO2</b>	3	2	3	1	3	-	2	-	2	1	1	3	1	2	3
<b>CO3</b>	3	3	3	3	2	1	2	-	3	1	1	3	2	3	3
<b>CO4</b>	3	3	2	2	1	2	1	2	3	3	1	2	2	3	2
<b>Avg.</b>	<b>2.75</b>	<b>2.5</b>	<b>2.5</b>	<b>2</b>	<b>2.25</b>	<b>1.5</b>	<b>1.67</b>	<b>1.5</b>	<b>2.75</b>	<b>1.5</b>	<b>1</b>	<b>2.75</b>	<b>2</b>	<b>2.25</b>	<b>2.75</b>



## CE(OE)801D: Groundwater Contamination

<b>Course Code – CE(OE)801D</b>	<b>Groundwater Contamination</b>	<b>2L+0T+0P</b>	<b>2 Credits</b>
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>1. Students will be able to understand the principles and theories regarding groundwater contamination with</li> <li>2. Students will be able to formulate the various remedial measures for groundwater contamination</li> </ol>
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### Syllabus

SI No.	Course Content	Total Hours
<b>Module – 1</b>	Introduction: Definition of groundwater, hydrological properties of various water bearing strata, vertical distribution of subsurface water, groundwater in hydrologic cycle	2L
<b>Module – 2</b>	Groundwater Hydraulics: Darcy's Law, Dupuit's assumption, Application of Darcy's Law for simple flow systems, governing differential equations for confined and unconfined aquifers, steady and unsteady flow solutions for fully penetrating wells, partially penetrating wells, Interference of wells, Test pumping analysis with steady and unsteady flows, Delayed yield, method of images	7L
<b>Module – 3</b>	Groundwater quality: Indian & International standards	3L
<b>Module – 4</b>	Groundwater pollution: Sources, Remedial and preventive measures	3L
<b>Module – 5</b>	Groundwater conservation: Groundwater budget, seepage from surface water, artificial recharge with reclamation	3L
<b>Module – 6</b>	Models for Groundwater flow: Sampling & Monitoring methods, transport mechanisms, modeling (advective and dispersive transport), (adsorption and chemical reaction), biodegradation kinetics, numerical flow and transport modeling, waste site characterization/investigation, groundwater remediation, legal issues in groundwater contamination: Example: Base Shear and Base Moment, Response of Structure in Frequency Domain	10L

### Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	Elements of Hydrology and Groundwater	R.N. Saxena & D.C. Gupta.	PHI



2	Groundwater Contamination, Performance, Limitations and Impacts	Anna L Powell	Nova Science Publishers
3	Groundwater Contamination and Remediation	Edited by Timothy D. Scheibe & David C. Mays	MDPI

## CO-PO Mapping

### CO-PO Mapping

#### Groundwater Contamination

(Course Code – CE(OE)801D)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	3	1	2	2	2	-	2	2	-	2	2	3	2	3	1
<b>CO2</b>	2	2	2	1	1	1	-	2	2	2	-	2	3	2	2
	<b>2.5</b>	<b>1.5</b>	<b>2</b>	<b>1.5</b>	<b>1.5</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2.5</b>	<b>2.5</b>	<b>2.5</b>	<b>1.5</b>

## CE(OE)802A: Soft Skills and Personality Development

Course Code – CE(OE)802A	Soft Skills and Personality Development	2T+0L+0P	2 Credits
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>1. Students be able to understand and apply their knowledge to find problem solutions.</li> <li>2. Students would be able to apply their best managerial attributes in decision making.</li> <li>3. Students will be able to the Ability to gain skills with use of communications. For managers tasked with leading projects or overseeing teams of people, communication becomes even more important, with effective communication skills considered a must-have.</li> <li>4. Students will be aware of the most crucial aspects of managing a team and provide them a growing path towards learning effective leadership skills.</li> </ol>
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### Syllabus

Sl No.	Course Content	Total Hours
Module 1	<b>Self-Growth</b> i) Self Growth- Maslow's Hierarchy of Needs Theory ii) Anger, Stress & Time Management- Theories and application iii) SWOT Analysis	6L
Module 2	<b>Stepping Up</b> i) Growth & Environment ii) Competitive Spirit iii) Responsibility Factor	7L
Module 3:	<b>Professional Communication</b> i) Impression Management- theory on social psychology ii) Employability Quotient iii) Cross-cultural communication	6L
Module 4:	<b>Leadership &amp; Team Playing</b> i) Leadership & Team Playing: Theories, Styles, Stages ii) Motivation, Negotiation Skills, Conflict Management iii) Planning & Envisioning: Initiative and Innovation in the Work Environment- De Bono's Six Thinking Hats	6L



## Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	Personality Development and Soft Skills	Barun K. Mitra	Oxford University
	2	Soft Skills: An Integrated Approach to Maximise Personality	Gajendra Singh Chauhan and Sangeeta Sharma	Wiley
	3	The Ace of Soft Skills: Attitude, Communication and Etiquette for Success	Gopaldaswamy Ramesh and Mahadevan Ramesh	Pearson

## CO-PO Mapping

### CO-PO Mapping

#### Soft Skills and Personality Development

(Course Code - CE(OE)802A)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	1	-	-	-	-	-	-	-	-	-	-	-	1	2	1
<b>CO2</b>	-	-	-	-	-	-	-	-	2	-	-	-	1	2	2
<b>CO3</b>	-	-	-	-	-	-	-	-	-	3	-	-	2	1	2
<b>CO4</b>	-	-	-	-	-	-	-	-	3	-	-	-	2	2	1
<b>Avg.</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>2.5</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>1.5</b>	<b>1.75</b>	<b>1.5</b>



## CE(OE)802B: Earthquake Engineering

Course Code – CE(OE)802B	Earthquake Engineering	2T+0L+2P	2 Credits
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>Students will be able to provide a coherent development to the students for the courses in sector of earthquake engineering.</li> <li>Students will be able to present the foundations of many basic engineering concepts related earthquake Engineering.</li> <li>Students will be able to learn an experience in the implementation of engineering concepts which are applied in field of earthquake engineering.</li> <li>Students will involve the application of scientific and technological principles of planning, analysis, design of buildings according to earthquake design philosophy.</li> </ol>
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### Syllabus

Sl No.	Course Content	Total Hours
<b>Module 1</b>	<b>Seismology:</b> Earth's Interior and Plate Tectonics; Causes of Earthquakes and Seismic Waves; Measurement of Earthquakes and Measurement parameters; Modification of Earthquake due to the Nature of Soil; Seismic Hazard Analysis.	<b>4L</b>
<b>Module 2</b>	<b>Earthquake Inputs:</b> Time History Records and Frequency Contents of Ground Motion; Power Spectral Density Function of Ground Motion; Concept of Response Spectrums of Earthquake; Combined D-V-A Spectrum and Construction of Design Spectrum; Site Specific, Probabilistic and Uniform Hazard Spectrums; Predictive Relationships for earthquake parameters.	<b>4L</b>
<b>Module 3</b>	<b>Dynamics for Earthquake Analysis:</b> Equations of Motion for SDOF and MDOF Systems; Undamped Free Vibration of SDOF and MDOF Systems; Mode Shapes and Frequencies of MDOF System; Rayleigh Damping Matrix; Direct Time Domain Analysis of MDOF System; Direct Frequency Domain Analysis of MDOF System; Modal Analysis in Time and Frequency Domain.	<b>4L</b>
<b>Module 4</b>	<b>Response Analysis for Specific Ground Motion:</b> Equations of Motion for Single and Multi- Support Excitations and Solutions; Equations of Motion in State Space and Solutions; Computational Steps for the Solutions using MATLAB; Time History Analysis of 3D Tall Buildings.	<b>4L</b>



<b>Module 5</b>	<b>Response Spectrum Method of Analysis:</b> Concept of Equivalent Lateral Force for Earthquake; Modal Combination Rules; Response Spectrum Method of Analysis of Structures and Codal Provisions; Response Spectrum Method of Analysis for Torsionally Coupled Systems; Response Spectrum Method of Analysis for Non-Classically Damped Systems.	<b>4L</b>
<b>Module 6</b>	<b>Seismic Soil - Structure Interaction: Fundamentals of Seismic</b> Soil-Structure Interaction; Direct Method of Analysis of Soil-Structure Interaction using FEM and Use of ABAQUS, Sub structuring Method of Analysis of Soil- Structure Interaction Problem.	<b>4L</b>
<b>Module 7</b>	Inelastic Response of Structures for Earthquake Forces: Fundamental Concepts of Inelastic Response Analysis for Earthquake Forces; Solutions of Incremental Equations of Motions for SDOF Systems; Solutions of Incremental Equations of Motions for MDOF Systems; Push over Analysis; Concepts of Ductility and Inelastic Spectrum.	<b>5L</b>
<b>Module 8</b>	<b>Base isolation for earthquake resistant design of structures:</b> Base isolation concept, isolation systems and their modelling; linear theory of base isolation; stability of elastomeric bearings; codal provisions for seismic isolation, practical applications.	<b>5L</b>

## Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	Earthquake resistant design of Structures	Agarwal and Shrikhande	PHI
	2	Earthquake-resistant design of structures	S.K. Duggal	Oxford University Press
	3	Elements of Earthquake Engineering	Jai Krishna, A. R.Chandrashekhara and Brijesh Chandra	South Asian Publishers
<b>IS Codes</b>	4	IS1893: Part I (2016)	Bureau of Indian Standards	
	5	IS 13920: 2016		
	6	IS 4326		



## CO-PO Mapping

### CO-PO Mapping

#### Earthquake Engineering

(Course Code – CE(OE)802B)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	3	2	3	-	-	2	1	1	3	3	2	-	3	2	1
<b>CO2</b>	2	3	3	-	-	2	1	1	2	2	3	1	2	3	3
<b>CO3</b>	3	2	2	-	-	2	1	1	3	2	3	1	3	2	2
<b>CO4</b>	3	3	3	1	-	2	1	3	3	3	2	3	3	2	3
<b>Avg.</b>	<b>2.75</b>	<b>2.5</b>	<b>2.75</b>	<b>1</b>	<b>-</b>	<b>2</b>	<b>1</b>	<b>1.5</b>	<b>2.75</b>	<b>2.5</b>	<b>2.5</b>	<b>1.67</b>	<b>2.75</b>	<b>2.25</b>	<b>2.25</b>





## CE(OE)802C: Urban Transport Planning

Course Code – CE(OE)802C	Urban Transport Planning	2T+0L+2P	2 Credits
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### Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>1. Students will be able to understand the how to apply up-to-date information for planning and operation of urban transport.</li> <li>2. Students will be able to understand the to execute various transportation related surveys.</li> <li>3. Students will be able to understand the how evaluate relative importance of various modes and their capacities.</li> <li>4. Students will be able to understand to solve travel demand forecasting problems.</li> </ol>
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### Syllabus

Sl No.	Course Content	Total Hours
<b>Module 1</b>	<p><b>Introduction</b></p> <p>Urban morphology - Urbanization and travel demand – Urban activity systems and travel patterns – Systems approach – Trip based and Activity based approach</p>	<b>4L</b>
<b>Module 2</b>	<p><b>Urban Transportation Planning</b></p> <p>Goals, Objectives and Constraints - Inventory, Model building, Forecasting and Evaluation - Study area delineation – Zoning - UTP survey.</p> <p>Trip generation models – Trip classification - productions and attractions –</p> <p>Trip rate analysis - Multiple regression models - Category analysis.</p> <p>Trip distribution models – Growth factor models, Gravity model and</p> <p><b>Opportunity modes.</b></p> <p>Modal split models – Mode choice behavior – Trip end and trip interchange models - Probabilistic models – Utility functions - Logit models - Two stage</p>	<b>21L</b>



	<p>model.</p> <p>Traffic assignment – Transportation networks – Minimum Path Algorithms -</p> <p>Assignment methods – All or Nothing assignment, Capacity restrained assignment and Multi path assignment - Route-choice behavior.</p>	
<b>Module 3</b>	<p><b>Scope of UTP in present scenario</b></p> <p>Financing of Project – urban development planning policy - Case studies.</p>	<b>5L</b>

## Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	Transportation Engineering	L.R. Kadiyali	Khanna Publication
	2	Traffic Engineering and Transport Planning	L.R. Kadiyali	Khanna Publication
	3	Urban Transportation: Planning, Operation and Management	S Ponnuswamy and Johnson Victor	Tata McGraw-Hill Publication
	4	Transportation Planning: Principles, Practices and Policies	Pradeep Kumar Sarkar and Vinay Maitri	

## CO-PO Mapping

### CO-PO Mapping

#### Urban Transport Planning

(Course Code – CE(OE)802C)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	2	2	2	3	2	-	-	-	1	-	1	1	2	2	3
<b>CO2</b>	3	2	3	-	2	3	1	1	3	-	-	1	3	1	3
<b>CO3</b>	2	3	3	2	2	1	-	-	1	-	-	1	2	2	3
<b>CO4</b>	1	1	1	1	1	-	1	1	3	2	2	1	3	1	2
<b>Avg.</b>	<b>2</b>	<b>2</b>	<b>2.25</b>	<b>2</b>	<b>1.75</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>1.5</b>	<b>1</b>	<b>2.5</b>	<b>1.5</b>	<b>2.75</b>

## CE(OE)802D: Environmental Impact Assessment and Life Cycle Analysis

Course Code – CE(OE)802D	Environmental Impact Assessment and Life cycle Analysis	2T+0L+2P	2 Credits
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### Course Outcome (CO)

Course Outcome (CO)	<ol style="list-style-type: none"> <li>1. Students will be able to understand and evaluate the impact of any activity (large or small scale) on the surrounding environment.</li> <li>2. Students will be able to formulate mitigation strategies to protect the environment leading to sustainability.</li> <li>3. Students will be able to understand the intricacies of Life Cycle Analysis and apply basic knowledge for coherent existence.</li> </ol>
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### Syllabus

Sl No.	Course Content	Total Hours
<b>Module 1</b>	Introduction Definition, Objective with legal aspect of Environmental Impact Assessment (EIA).	<b>2L</b>
<b>Module 2</b>	Methodology for EIA with Base Line Studies, Screening, Scoping and Public Consultation.	<b>4L</b>
<b>Module 3</b>	EIA Analysis Data Collection & Environmental Impact Analysis, preparation of EIA report.	<b>5L</b>
<b>Module 4</b>	EIA Mitigation and Audit- Mitigation and Impact Management with various case studies, Environmental Audit.	<b>5L</b>
<b>Module 5</b>	Introduction to Life Cycle Analysis (LCA): History, Definition, Standards and structure of LCA Goal and Scope of LCA: System of a product with boundary, unit process and functional unit.	<b>2L</b>
<b>Module 6</b>	Life Cycle Interpretation and Inventory: Limitation of LCA, Identification of significant issues, Evaluation, Reporting,	<b>3L</b>



	Critical Review. Inventory: Data Collection, Data Bases, Allocation, Validation.	
<b>Module 7</b>	LCA Impact Assessment and Practice: Categories, Classification, Normalization, LCA Management, Life Cycle thinking, Sustainability.	<b>4L</b>
<b>Module 8</b>	Introduction: Definition, Objective with legal aspect of Environmental Impact Assessment (EIA).	<b>2L</b>

## Books

	Sl.	Book Name	Author	Publishing House
<b>Books</b>	1	Environmental Impact Assessment	R. R. Barthwal	New Age International Publication
	2	Environmental Impact Assessment: Theory and Practice	M. Anji Reddy	B. S. Publication
	3	Life Cycle Assessment (LCA): A Guide to Best Practice	Walter Klöpffer, Birgit Grahl	Wiley Publishers

## CO-PO Mapping

### CO-PO Mapping

#### Environmental Impact Assessment and Life Cycle Analysis

(Course Code - CE(OE)802D)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	3	1	-	-	-	1	1	-	2	-	1	2	1	2	3
<b>CO2</b>	3	2	2	-	-	1	2	-	3	1	-	2	2	1	2
<b>CO3</b>	2	2	1	2	-	1	1	2	2	-	-	2	1	1	3
<b>Avg.</b>	<b>2.67</b>	<b>1.67</b>	<b>1.5</b>	<b>2</b>	<b>-</b>	<b>1</b>	<b>1.34</b>	<b>2</b>	<b>2.34</b>	<b>1</b>	<b>1</b>	<b>2</b>	<b>1.34</b>	<b>1.34</b>	<b>2.67</b>



## CE(CV)891: Comprehensive Viva Voce

Course Code – CE(CV)891	Comprehensive Viva Voce	0L+0T+10P	1 Credits
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## Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>Students will be able to demonstrate knowledge in the program domain.</li> <li>Students will be able to present his views cogently and precisely.</li> <li>Students will be able to Exhibit professional etiquette suitable for career progression.</li> </ol>
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## CO-PO Mapping

### CO-PO Mapping

#### Comprehensive Viva Voce

(Course Code - CE(CV)891)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	3	2	3	2	3	1	3	2	2	2	2	3	3	2	3
<b>CO2</b>	3	1	1	2	1	2	3	2	1	2	-	3	3	2	3
<b>CO3</b>	3	1	1	2	-	1	2	2	2	3	1	3	3	2	3
<b>Avg</b>	<b>3</b>	<b>1.33</b>	<b>1.67</b>	<b>2</b>	<b>2</b>	<b>1.33</b>	<b>2.67</b>	<b>2</b>	<b>1.67</b>	<b>2.33</b>	<b>1.5</b>	<b>3</b>	<b>3</b>	<b>2</b>	<b>3</b>

## CE(PROJ)881: Project Part II

Course Code – CE(PROJ)881	Project Part II	0L+0T+10P	5 Credits
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## Course Outcome (CO)

<b>Course Outcome (CO)</b>	<ol style="list-style-type: none"> <li>1. Students will able to Practice acquired knowledge within the chosen area of technology for project Development.</li> <li>2. Students will able to Identify, discuss and justify the technical aspects of the chosen project with a comprehensive and systematic approach.</li> <li>3. Students will able to Reproduce, improve and refine technical aspects for engineering projects.</li> <li>4. Students will able to Work as an individual or in a team in development of technical projects.</li> <li>5. Students will able to Report project related activities effectively to peers and mentors.</li> </ol>
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## CO-PO Mapping

### CO-PO Mapping

#### Project Part II

(Course Code – CE(PROJ)881)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
<b>CO1</b>	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
<b>CO2</b>	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
<b>CO3</b>	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
<b>CO4</b>	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
<b>CO5</b>	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
<b>Avg.</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>