Department: Civil Engineering
Curriculum Structure & Syllabus
for BTech in Civil Engineering
(Effective from 2021-22 admission batch)

First Year First Semester

Sl. No.	Category	Course Code	Course Title	Hours per week				Credits
	A. THEORY			L	T	P	Total	
1	Basic Science course	CH101	Chemistry-I	3	0	0	3	3
2	Basic Science course	M101	Mathematics –I	4	0	0	4	4
3	Engineering Science Courses	EE101	Basic Electrical Engineering	3	0	0	**3**	3
4	Humanities and Social Sciences including Management courses	HSMC 101	Professional Communication	2	0	0	**2**	2
	B. PRACTICAL							
5	Basic Science course	CH191	Chemistry-I Lab	0	0	3	3	1.5
6	Engineering Science Courses	EE 191	Basic Electrical Engineering Lab	0	0	3	3	1.5
7	Engineering Science Courses	ME 192	Engineering Graphics & Design Lab	0	0	3	3	1.5
8	PROJECT	PR191	Theme based Project I	0	0	1	1	0.5
9	PROJECT	PR192	Skill Development I: Soft Skill	0	0	1	1	0.5
	C. MANDATORY ACTIVITIES / COURSES							
10	Mandatory Course	MC181	Induction Program	0	0	0	0	2Units
	TOTAL CREDIT							17.5

First Year 2nd Semester

Sl. No.	Category	Course Code	Course Title	Hours per week				Credits
	A. THEORY			L	T	P	Total	
1	Basic Science courses	PH 201	Physics-I	3	0	0	3	3
2	Basic Science courses	M 201	Mathematics –II	4	0	0	4	4
3	Engineering Science Courses	CS 201	Programming for Problem Solving	3	0	0	3	3
	B. PRACTICAL							
4	Basic Science course	PH 291/ CH 291	Physics-I Lab	0	0	3	3	1.5
5	Humanities and Social Sciences including Management courses	HSMC 291	Professional Communication LAB	0	0	3	3	1
6	Engineering Science Courses	ME 291	Workshop & Manufacturing Practices Lab	0	0	3	3	1.5
7	Engineering Science Courses	CS 291	Programming for Problem Solving Lab	0	0	3	3	1.5
8	PROJECT	PR291	Theme based Project II	0	0	1	1	0.5
9	PROJECT	PR292	Skill Development II: Life Skill	1	0	0	1	0.5
	C. MANDATORY ACTIVITIES / COURSES							
10	Mandatory Course	MC281	NSS/ Physical Activities / Meditation & Yoga / Photography/ Nature Club	0	0	3	3	3 Units
	TOTAL CREDIT							16.5

2nd Year 1st Semester

Sl. No.	Category	Course Code	Course Title	Hours per week				Credits
				L	**T**	**P**	**Total**	
A. THEORY								
1	Basic Science course	PH(CE)301	Physics-II	3	0	0	3	3
2	Engineering Science Courses	M(CS)301	Numerical Methods	3	0	0	3	3
3	Engineering Science Courses	M(CS)302	Engineering Geology	3	0	0	3	3
4	Program Core Course	CE301	Surveying	3	0	0	3	3
5	Program Core Course	CE302	Strength of Materials	3	0	0	3	3
6	Humanities and Social Sciences including Management courses	HSMC 302	Gender Culture and Development	2	0	0	2	2
B. PRACTICAL								
7	Basic Science course	PH(CE)391	Physics-II Lab	0	0	2	2	1.0
8	Engineering Science Courses	M(CS)391	Numerical Methods Lab	0	0	3	3	1.5
9	Engineering Science Courses	M(CS)392	Engineering Geology Lab	0	0	3	3	1.5
10	Program Core Course	CE391	Surveying Practice	0	0	3	3	1.5
11	PROJECT	PR391	Theme based Project III	0	0	1	1	0.5
12	PROJECT	PR392	Skill Development III: Technical Seminar Presentation	1	0	0	1	0.5
C. MANDATORY ACTIVITIES / COURSES								
13	MC	MC381	Learning an Art Form [vocal or instrumental, dance, painting, clay modeling, etc.] OR Environmental Protection Initiatives		0	0	3	0
	TOTAL CREDIT WITHOUT MOOCS COURSES							23.5
D.MOOCS COURSES**								
14	MOOCS COURSES	HM301	MOOCS COURSE-I		3	1	4	4
TOTAL CREDIT WITH MOOCS COURSES								**27.5**

**** MOOCS COURSES for HONOURS/MINOR Degree are Program specific and to be taken from MOOCS BASKET**

2nd Year 2nd Semester

Sl. No.	Category	Course Code	Course Title	Hours per week				Credits
				L	T	P	Total	
A. THEORY								
1	Basic Science course	M401	MathematicsIII	3	0	0	3	3
2	PC	CE401	Structural Analysis	3	0	0	3	3
3	PC	CE402	Concrete Technology	3	0	0	3	3
4	PC	CE403	Soil Mechanics	3	0	0	3	3
5	PC	CE404	Building Materials and Construction	3	0	0	3	3
6	Humanities and Social Sciences including Management courses	HSMC 403	Universal Human Values II: Understanding Harmony	3	0	0	3	3
B. PRACTICAL								
7	Engineering Science course	M (CS)491	Object oriented Programmig Using Java Lab	0	0	3	3	1.5
8	PC	CE491	Building Planning and Drawing	0	0	3	3	1.5
9	PC	CE492	Civil Engineering Lab-I	0	0	3	3	1.5
10	PC	CE493	Soil Mechanics Lab-I	0	0	3	3	1.5
11	PC	CE494	Quantity Surveying, Specifications and Valuation	0	0	3	3	1.5
12	PROJECT	PR 491	Theme based Project IV	0	0	1	1	0.5
13	PROJECT	PR492	Skill Development IV: Soft Skill & Aptitude-I	1	0	0	1	0.5
C. MANDATORY ACTIVITIES / COURSES								
14	MC	MC 401	Environmental Science	0	0	3	3	0
	TOTAL CREDIT WITHOUT MOOCS COURSES							26.5
D.MOOCS COURSES								
15	MOOCS COURSES	HM401	MOOCS COURSE-II	3	1	0	4	4
TOTAL CREDIT WITH MOOCS COURSES								**30.5**

**** MOOCS COURSES for HONOURS/MINOR Degree are Program specific and to be taken from MOOCS BASKET**

3rd Year 1st Semester

Sl. No.	Category	Course Code	Course Title	Hours per week				Credits
				L	**T**	**P**	**Total**	
A. THEORY								
1	Humanities and Social Sciences including Management courses	HSMC 504	Economics for Engineers	2	0	0	2	2
2	PC	CE501	Structural Design-I	3	0	0	3	3
3	PC	CE502	Foundation Engineering	3	0	0	3	3
4	PC	CE503	Transportation Engineering-I	3	0	0	3	3
5	PE	CE504	A. Hydraulics B. Water Supply and Plumbing C. Waste Water and Treatment	3	0	0	3	3
B. PRACTICAL								
7	PC	CE 591	Soil Mechanics Lab-II	0	0	3	3	1.5
8	PC	CE 592	Civil Engineering Lab-II	0	0	3	3	1.5
9	PC	CE 593	Transportation and Highway Engineering Lab	0	0	3	3	1.5
10	PE	CE594	A. Hyrdaulics Lab B. Water Supply and Plumbing Lab C. Waste Water Treatment Lab	0	0	3	3	1.5
11	PROJECT	PR 591	Minor Project I	0	0	3	3	1
12	PROJECT	PR 592	Skill Development V: Soft Skill & Aptitude-II	1	0	0	1	0.5
C. MANDATORY ACTIVITIES / COURSES								
14	MC	MC501	Intellectual Property Rights	0	0	3	3	0
	TOTAL CREDIT WITHOUT MOOCS COURSES							21.5
D. MOOCS COURSES**								
15	MOOCS COURSES	HM501	MOOCS COURSE-III	3	1	0	4	4
TOTAL CREDIT WITH MOOCS COURSES								**25.5**

**** MOOCS COURSES for HONOURS/MINOR Degree are Program specific and to be taken from MOOCS BASKET**

3rd Year 2nd Semester

Sl. No.	Category	Course Code	Course Title	Hours per week				Credits
				L	**T**	**P**	**Total**	
A. THEORY								
1	Humanities and Social Sciences including Management courses	HU 605	Principles of Management	2	0	0	2	2
2	PC	CE601	Structural Design – II	3	0	0	3	3
3	PC	CE602	Construction Planning and Management	3	0	0	3	3
4	PE	CE603	A.Bridge Engineering B.Pre stressed Concrete C.Structural Dynamics and Earthquake Engineering	3	0	0	3	3
5	PE	CE604	A. Infrastructure Planning & Design B. Public Transport System C. Transportation Engineering-II	3	0	0	3	3
6	OE	CE605	A.Operations Research B.Human Resource Management C.Studies on Six Sigma	3	0	0	3	3
B. PRACTICAL								
7	PC	CE691	Structural Design and Detailing	0	0	3	3	1.5
9	PC	CE692	Computer Aided Design	0	0	3	3	1.5
10	PE	CE693	Structural Lab	0	0	3	3	1.5
11	PROJECT	PR 691	Minor Project II	0	0	3	2	1
12	PROJECT	PR 692	Skill Development VI: Soft Skill & Aptitude-III	1	0	0	1	0.5
C. MANDATORY ACTIVITIES / COURSES								
13	MC	MC 601	Constitution of India	3	0	0	3	0
	TOTAL CREDIT WITHOUT MOOCS COURSES							23.0
D.MOOCS COURSES**								
14	MOOCS COURSES	HM601	MOOCS COURSE-IV	3	1	0	4	4
TOTAL CREDIT WITH MOOCS COURSES								**27.0**

**** MOOCS COURSES for HONOURS/MINOR Degree are Program specific and to be taken from MOOCS BASKET**

4th Year 1st Semester

Sl No	Course Code	Paper Code	Theory	Contact Hours /Week				Credit Points
				L	T	P	Total	
A. THEORY								
1	PE	CE701	A. Water Resource Engineering B. Hydrology and Irrigation Engineering C.Hydraulic Structure	3	0	0	3	3
2	PE	CE702	A. Water and Wastewater Engineering B. Environmental Engineering C.Water Pollution and its Control	3	0	0	3	3
3	OE	CE703	A.Engineering Materials B.Electrical And Electronics Measurement C.Material Handling	3	0	0	3	3
4	OE	CE704	A.Urban Planning B.APPLICATION OF IOT IN CIVIL ENGINEERING	3	0	0	3	3
B. PRACTICAL								
5	PE	CE791	Environmental Engineering Lab	0	0	0	3	1.5
6	OE	CE792	Advanced Programming for Problem solving	0	0	3	3	1.5
7	PROJECT	PR 791	Major Project-I	0	0	0	4	2
8	PROJECT	PR 792*	Industrial Training / Internship	0	0	0	0	1
9	PROJECT	PR 793	Skill Development VII: Seminar & Group Discussion	1	0	0	1	0.5
C. MANDATORY ACTIVITIES / COURSES								
10	MC	MC 781	Entrepreneurship & Innovation Skill	0	0	3	3	0
TOTAL CREDIT WITHOUT MOOCS COURSES								18.5
D.MOOCS COURSES**								
11	MOOCS COURSES	HM701	MOOCS COURSE-V	3	1	0	4	4
TOTAL CREDIT WITH MOOCS COURSES								**22.5**

***Collective Data from 3rd to 6th Semester (Summer/Winter Training during Semester Break & Internship should be done after 5th Semester or 6th Semester). All related certificates to be collected by the training/internship coordinator(s).**

**** MOOCS COURSES for HONOURS/MINOR Degree are Program specific and to be taken from MOOCS BASKET**

4th Year 2nd Semester

Sl No	Course Code	Paper Code	Theory	Contact Hours /Week				Credit Points
				L	T	P	Total	
A. THEORY								
1	PE	CE801	A.Soil Dynamics and Machine Foundation B.Finite Element Analysis C.Advanced Structural Analysis	3	0	0	3	3
2	OE	CE802	A.Advanced Foundation Engineering B.Advanced Transportation Engineering C.Pavement Design	3	0	0	3	3
3	OE	CE803	A.Metro System and Engineering B.Air & Noise Pollution and Control C.Advanced Surveying	3	0	0	3	3
B. PRACTICAL								
4	PROJECT	PR 891	Major Project-II	0	0	0	12	6
5	PROJECT	PR 892	Grand Viva	0	0	0	0	1
C. MANDATORY ACTIVITIES / COURSES								
8	MC	MC 881	Essence of Indian Knowledge Tradition	0	0	3	3	0
TOTAL CREDIT								16

Total: CE Department

Semester	Without MOOCS	With MOOCS
1st	17.5	NA
2nd	16.5	27.5
3rd	23.5	30.5
4th	26.5	25.5
5th	21.5	27.0
6th	23.0	22.5
7th	18.5	22.5
8th	16.0	18.0
Total	163.0	183.0 (for Honors/minor)

Credit Distribution

Subject Category	Subjects	Credit Distribution as per AICTE (%)	Suggested Breakup of Credits (Total 160) as per AICTE	
Humanities and Social Sciences including Management courses (HSMC)	**Humanities & Social Science:** (i)English (ii)Language / English Lab **Management courses** (i)Principle of Management, (ii)Economics for Engineers (iii)Principles of Management (iv)Values & Ethics in Profession	5 to 10%	**12**	**9+3** **5.63%**
Basic Sciences (BS)	**Physics** (i)Introduction to Electromagnetic Theory (ii)Introduction to Mechanics (iii)Quantum Mechanics for Engineers (iv)Oscillation, Waves and Optics (v)Semiconductor Optoelectronics (vi)Semiconductor Physics	**15 to 20%**	**25**	**24 [IT, BME, ME, CE]** **15.00%**
	Chemistry & Biology (i)Chemistry – I (Concepts in chemistry for engineering) (ii)Chemistry Laboratory **Elective Courses** (i)Chemistry-II (Chemical Applications) (ii)Polymer Chemistry (iii)Experiments in Polymer Chemistry **Biology**			
	Mathematics **(i)Mathematics (Option**			

	1) Mathematics 1 Mathematics 2 Mathematics 3 **(ii)Mathematics (Option 2)** (for CSE students)			
Engineering Sciences and Skills (ES)	(i)Workshop / Manufacturing Practice (ii)Drawing / Engineering Graphics & Design, (iii)Basics of Electrical (iv)Computer / Programming for Problem Solving (v)Numerical Methods (vi)Circuit theory	15 to 20%	**24**	**22.5** **14.06%**
Professional core courses (PC)	Courses relevant to chosen branch	30 to 40%	**48**	**48.0** **30.37%**
Professional Elective	Elective courses relevant to chosen specialization/branch	10 to 15%	**18**	**22.5** **13.80%**
Open Elective	Elective Courses from other technical programs and /or **emerging subjects**: 1.Artificial Intelligence (AI) 2. Internet of Things (IoT) 3. Block Chain 4. Robotics 5. Quantum Computing 6. Data Sciences 7. Cyber Security 8. 3D Printing and Design 9. Virtual Reality (VR)	5 to 10%	**18**	**16.5** **10.31%**
Project work, seminar and internship in industry or elsewhere	(i)PROJECT (PR….91): Project work (ii)PROJECT (PR….92): (iii) PROJECT (PR …93): (iv)Grand Viva - 1	10 to 15%	**15**	**17.5** **10.94%**
Mandatory Courses [Environmental Sciences, Induction training, Indian	**MC Courses:** (i)Environmental Science, (ii)Foreign language, (iii)Constitution of India (iv)Behavioral & Interpersonal skills (v)Essence of Indian Knowledge Tradition **& others as mentioned in**	**No Credit Course**	Minimum 2 units per semester min. Max: 28 Units/Program	

Constitution, Essence of Indian Knowledge Tradition]	**AICTE guidelines** **MC Activities:** (i)Induction Programming (ii)NSS/NCC/Yoga (iii)Technical Lecture Presentation **& others as mentioned in AICTE guidelines**			

Summary

Sub	Credit	%	AICTE %
HSMC	9	5.63	5to10
BSHU	24	15.00	15to20
ES	22.5	14.06	15to20
PC	48	30.00	30to40
PE	22.5	14.06	10to15
OE	16.5	10.31	5to10
Project	17.5	10.94	10to15
	160	100.00	

Professional Electives (It is expected Options in a vertical column would lead to expertise in a specific/allied domain)				
	Option 1	**Option 2**	**Option 3**	**Option 4**
Professional Elective I	**a**			
Professional Elective II	**b**			
Professional Elective III	**c**			
Professional Elective IV	**d**			
Professional Elective V	**e**			
Professional Elective VI	**e**			

Open Electives (It is expected Options in a vertical column would lead to expertise in a specific/allied domain)				
	Option 1	**Option 2**	**Option 3**	**Option 4**
Open Elective I				
Open Elective II				
Open Elective III				
Open Elective IV				

MOOCs (It is expected Options in a vertical column would lead to expertise in a specific/allied domain)						
	Sem	Credit	Option 1	Option 2	Option 3	Option 4
MOOCS COURSE-I	III	4	Related to Minor/Honors	Related to Minor/Honors	Related to Minor/Honors	Related to Minor/Honors
MOOCS COURSE-II	IV	4	Related to Minor/Honors	Related to Minor/Honors	Related to Minor/Honors	Related to Minor/Honors
MOOCS COURSE-III	V	4	Related to Minor/Honors	Related to Minor/Honors	Related to Minor/Honors	Related to Minor/Honors
MOOCS COURSE-IV	VI	4	Related to Minor/Honors	Related to Minor/Honors	Related to Minor/Honors	Related to Minor/Honors
MOOCS COURSE-V	VII	4	Related to Minor/Honors	Related to Minor/Honors	Related to Minor/Honors	Related to Minor/Honors

**Please define your Honors/Minor programme credit point of 20 to be earned by the student. Related BoS would endorse the selection of these courses followed by the necessary intimation at the Academic Council of the Institute.

First Year First Semester

Sl. N	Category	Course Code	Course Title	Hours per week				Credits
	D. THEORY			L	T	P	Total	
1	Basic Science course	CH101	Chemistry-I	3	0	0	3	3
2	Basic Science course	M101	Mathematics –I	4	0	0	4	4
3	Engineering Science Courses	EE101	Basic Electrical Engineering	3	0	0	**3**	3
4	Humanities and Social Sciences including Management courses	HSMC 101	Professional Communication	2	0	0	**2**	2
	E. PRACTICAL							
5	Basic Science course	CH191	Chemistry-I Lab	0	0	3	3	1.5
6	Engineering Science Courses	EE 191	Basic Electrical Engineering Lab	0	0	3	3	1.5
7	Engineering Science Courses	ME 192	Engineering Graphics & Design Lab	0	0	3	3	1.5
8	PROJECT	PR191	Theme based Project I	0	0	1	1	0.5
9	PROJECT	PR192	Skill Development I: Soft Skill	0	0	1	1	0.5
	F. MANDATORY ACTIVITIES / COURSES							
10	Mandatory Course	MC181	Induction Program	0	0	0	0	2Units
	TOTAL CREDIT							17.5

COURSE NAME: CHEMISTRY
COURSE CODE: CH 101
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDITS: 3

Prerequisites: A basic knowledge in 10+2 science with chemistry

Course Objective:

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications.

Course Outcomes (COs):

After completion of this course students will be able to

CO1: Describe the fundamental properties of atoms & molecules, atomic structure and the periodicity of elements in the periodic table

CO2: Apply fundamental concepts of thermodynamics in different engineering applications.

CO3: Apply the knowledge of water quality parameters, corrosion control & polymers to different industries.

CO4: Determine the structure of organic molecules using different spectroscopic techniques.

CO5: Evaluate theoretical and practical aspects relating to the transfer of the production of chemical products from laboratories to the industrial scale, in accordance with environmental considerations.

Course Content

Module- I: Inorganic Chemistry **9L**

(i) Atomic structure **5L**

Bohr's theory to hydrogen-like atoms and ions; spectrum of hydrogen atom. Quantum numbers, Introduction to the concept of atomic orbitals, diagrams of s, p and d orbitals, Pauli's exclusion principle, Hund's rule, exchange energy, Aufbau principle and its limitation, introduction to Schrodinger equation.

(ii) Periodic properties **4L**

Modern Periodic table, group trends and periodic trends in physical properties: electron affinity, electronegativity, polarizability, oxidation states, effective nuclear charges, penetration of orbitals, variations of s, p and d orbital energies of atoms.

Module II: Physical Chemistry **8L**

(i) Use of free energy in chemical equilibria **6L**

Thermodynamic functions: internal energy, enthalpy, entropy and free energy. 2nd Law of Thermodynamics, Estimations of entropy and free energies, Free energy and emf, Cell potentials, the Nernst equation and applications.

(ii) Real Gases **2L**

Reason for deviation of real gases from ideal behavior, Equations of state of real gases,Vander Waals' equation, pressure & volume correction, validity, critical state of gas.

Module III: Organic Chemistry **8L**

(i) Stereochemistry **4L**

Representations of 3 dimensional structures, Chirality, optical activity, isomerism, structural isomerism, stereoisomers, enantiomers, diastereomers, configurations (D,L & cis trans), racemisation.

(ii) Organic reactions **4L**

Concepts of inductive effect, resonance, hyperconjugation, introduction to reactions involving substitution, addition, elimination, oxidation (Baeyer villiger oxidation), reduction (Clemmensen reduction, Wolff-Kishner reduction).

Module IV: Industrial Chemistry **8L**

(i) Water **2L**

Hardness, alkalinity, numerical

(ii) Corrosion. **2L**

Types of corrosion: wet & dry, preventive measures

(iii) Polymers **3L**

Classification of polymers, conducting polymers, biodegradable polymers

(iv) Synthesis of a commonly used drug molecule. **1L**

Paracetamol, Aspirin

Module V: Spectroscopic techniques in Chemistry **3L**

Electromagnetic radiation, Principles of spectroscopy, spectrophotometer, infrared spectroscopy, fingerprint region, functional group region, UV-VIS spectroscopy, ^{1}H Nuclear magnetic resonance spectroscopy, chemical shift.

Textbooks

1. A Text Book of Organic Chemistry, Arun Bahl & Arun Bahl
2. General & Inorganic Chemistry, P.K. Dutt
3. General & Inorganic Chemistry, Vol I, R.P. Sarkar
4. Physical Chemistry, P.C. Rakshit

Reference Books

1. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
2. Fundamentals of Molecular Spectroscopy, by C. N.Banwell
3. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S.Krishnan
4. Physical Chemistry, by P. W.Atkins
5. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Editionhttp://bcs.whfreeman.com/vollhardtschore5e/default.asp

Project Domain

1. Application of Thermodynamics
2. Application of polymers in daily life
3. Nanomaterials and its applications
4. Determination of water quality parameters
5. Electronic storage devices

6. Managing E –wastes
7. Application of chemistry in core engineering
8. Application of spectroscopy in medical field
9. Applications of green chemistry
10. Merits of commercial organic products
11. Bioplastics
12. Any other related topics

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	-	-	-	-	2	2	2	2
CO2	3	3	3	3	-	-	-	-	2	2	2	3
CO3	3	3	2	2	-	2	2	-	2	-	3	3
CO4	3	2	3	2	-	-	2	-	2	2	3	3
CO5	3	3	3	3	2	2	2	-	2	-	2	3

COURSE NAME: MATHEMATICS-I
COURSE CODE: M 101
CONTACT: 4:0:0
TOTAL CONTACT HOURS: 48
CREDITS: 4

Prerequisite: The students to whom this course will be offered must have the concept of (10+2) standard matrix algebra, calculus, and vector algebra.

Course Objectives:

The objective of this course is to disseminate the prospective engineers with techniques in matrix algebra and calculus. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

Course Outcomes (COs):

On successful completion of the learning sessions of the course, the learner will be able to

CO1: Recall the properties and formula related to matrix algebra, differential calculus, multivariable calculus, vector calculus and infinite series.

CO2: Determine the solutions of the problems related to matrix algebra, differential calculus, multivariable calculus, vector calculus and infinite series.

CO3: Apply the appropriate mathematical tools of matrix algebra, differential calculus, multivariable calculus, vector calculus and infinite series for the solutions of the problems.

CO4: Analyze different engineering problems linked with matrix algebra, differential calculus, multivariable calculus, vector calculus.

Course Content:

Module I: Matrix Algebra **11L**

Echelon form and Normal (Canonical) form of a matrix; Inverse and rank of a matrix; Consistency and inconsistency of system of linear equations, Solution of system of linear equations; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton theorem.

Module II: Differential Calculus and Infinite Series **10L**

Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; Concept of sequence and series, Tests for convergence of infinite series: Comparison test, D'Alembert's ratio test, Raabe's test, Cauchy's root test, Leibnitz's Test, Power series; Taylor's series, Series for exponential, trigonometric and logarithm functions.

Module III: Multivariable Calculus (Differentiation) **13L**

Function of several variables, Concept of limit, continuity and differentiability; Partial derivatives, Total derivative and its application; Chain rules, Derivatives of implicit functions Euler's theorem on homogeneous function, Jacobian. Maxima and minima of functions of two variables, Method of Lagrange multipliers.

Module IV: Multivariable Calculus (Integration) **6L**

Line Integral, Double Integral, Triple Integral,Change of order in multiple integrals, Change of variables in multiple integrals.

Module V: Vector Calculus **8L**

Gradient, Directional derivatives, Divergence, Curl, vector line integrals, vector surface integrals, vector volume integrals, Green's theorem, Gauss divergence theorem and Stokes' theorem.

Project Domain:

1. Study on eigenvalues and eigenvectors.
2. Study on convergence of infinite series.
3. Application of partial derivatives.
4. Application of vector calculus
5. Application of integral calculus.

Text Books:

1. Kreyszig, E., Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. Ramana, B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
3. Veerarajan, T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. Grewal, B.S., Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
5. Bali, N.P. and Goyal, M., A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
6. Samanta Guruprasad, A text book of Engineering Mathematics-I, New age International Publishers

Reference Books:

1. Thomas, G.B. and Finney, R.L., Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Apostol, M., Calculus, Volumes 1 and 2 (2nd Edition), Wiley Eastern, 1980.
3. Kumaresan, S., Linear Algebra - A Geometric approach, Prentice Hall of India, 2000.
4. Poole, D., Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
5. Bronson, R., Schaum's Outline of Matrix Operations. 1988.
6. Piskunov, N., Differential and Integral Calculus, Vol. I & Vol. II, Mir Publishers, 1969

CO-PO Mapping:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	2
CO2	3	2	-	-	-	-	-	-	-	-	-	2
CO3	3	2	2	-	-	-	-	-	-	-	-	2
CO4	2	3	2	2	-	-	-	-	-	-	-	2

COURSE NAME: BASIC ELECTRICAL ENGINEERING
COURSE CODE: EE101
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDITS: 3

Pre-requisite: Basic 12th standard Physics and Mathematics, Concept of components of electric circuit.

Course Outcomes (COs):

After attending the course students' would be able to

CO1: understand and analyze basic electric circuits

CO2: study the working principles of electrical machines.

CO3: introduce the components of low voltage electrical installations

CO4: study the fundamentals of electrical Power systems and Control Systems

Course Content

Module- I: DC Circuits **8L**

Definition of electric circuit, linear circuit, non-linear circuit, bilateral circuit, unilateral circuit, Dependent source, node, branch, active and passive elements, Kirchhoff's laws, Source equivalence and conversion, Network Theorems - Superposition Theorem, Thevenin's Theorem, Norton Theorem, Maximum Power Transfer Theorem, Star-Delta Conversions.

Module- II: AC Fundamentals **8L**

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.

Module- III: Electrical Machines **10L**

Transformer: Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

Rotating Machines - DC Machines: Brief idea on constructional features, classifications, working principle of both motor and generator. Simple problems on Voltage equation. Three-Phase Induction Motor: Basic concept of three phase circuit and production of rotating magnetic field. Working principle of three-phase induction motor and torque-speed characteristics (concept only).

Module- IV: Electrical Installations **3L**

Earthing of Electrical Equipment, ideas of basic components- MCB, MCCB, ELCB, SFU, Megger. Types of Wires and Cables, Earthing.

Module- V: Fundamentals of Power Systems **5L**

Generation of power: Block schematic representation of Thermal and nuclear power plants. Renewable energy sources: solar, wind, tidal and geothermal (Block diagram and working only- No Problems). Power

transmission: Typical electrical power transmission scheme-need for high voltage transmission-(Derivation is not needed, No Problems). Power Distribution: substation equipments, primary and secondary transmission and distribution systems- feeder, service mains.

Module- VI: Introduction to Control Systems **2L**

Concept control systems, Objectives of control system, Types of control systems, Real examples of control systems.

Text books:

A. P. Kothari & I. J. Nagrath, Basic Electrical Engineering, TMH.
1. V. Mittle& Arvind Mittal, Basic Electrical Engineering, TMH.
2. Ashfaq Hussain, Basic Electrical Engineering, S. Chand Publication.
3. Chakrabarti, Nath& Chanda, Basic Electrical Engineering, TMH.
4. C.L. Wadhwa, Basic Electrical Engineering, Pearson Education.

Reference books:

1. E. Hughes, ―Electrical and Electronics Technology‖, Pearson, 2010.
2. V. D. Toro, ―Electrical Engineering Fundamentals‖, Prentice Hall India, 1989.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2	-	-	-	-	-	-	-	-	1
CO2	1	2	2	-	-	-	-	-	-	-	-	1
CO3	-	2	2	-	-	-	-	-	-	-	-	2
CO4	-	2	-	-	-	-	-	-	-	-	-	1

COURSE NAME: PROFESSIONAL COMMUNICATION
COURSE CODE: HSMC 101
CONTACT: 2:0:0
TOTAL CONTACT HOURS: 24
CREDITS: 2

Pre-requisites: Basic (10+2) level of knowledge of English grammar, vocabulary reading and writing skills.

Course Objectives:

The course aims to impart domain and industry-specific communication skills in a globalized context and deepening understanding of business communication practices and cross-cultural dynamics.

Course Outcomes (COs):

After attending the course students' should be able to

CO1: apply the modalities and nuances of communication in a workplace context.

CO2: analyze communication across cultures and societies.

CO3: apply the basic formats, templates of business and official communication.

CO4: employ formal communication modes in meetings and reports.

CO5: justify importance of culturally neutral language in interpersonal and business communication.

Course Content:

Module- 1: Verbal and Non-verbal communication **4L**

1.1: Definition, Relevance and Effective Usage
1.2: Components of Verbal Communication: Written and Oral Communication
1.3: Components of Non-verbal Communication: Kinesics, Proxemics, Chronemics, Haptics Paralanguage
1.4: Barriers to Effective Communication

Module- 2: Social Communication Essentials and Cross-Cultural Communication **6L**

2.1: Communication in Society and the Workplace
2.2: Greetings, Courtesies and Socially Useful Language
2.3: Cultural Contexts: High Context and Low Context Cultures
2.4: Understanding Cultural Nuances and Stereotyping
2.5: Achieving Culturally Neutral Communication in Speech and Writing

Module- 3: Meetings **4L**

3.1: Meetings: Nature and Types
3.2: Conducting Meetings: Organization and Procedures
3.3: Meeting Coordination: Roles of Chairpersons and Members
3.4: Notice and Agenda for a Meeting
3.5: Preparing the Minutes of a Meeting (MOM)

Module- 4: Report Writing **4L**

4.1: Nature and Function of Reports
4.2: Types of Reports
4.3: Researching for a Business Report
4.4: Format, Language and Style
4.5: Report Documentation

Module 5: Employment Communication **6L**

5.1: Writing Business Letters- (Enquiry, Order, Sales, Complaint, Adjustment, Job Application, Offer)

5.2: Preparing a CV or Rẽsumẽ
5.3: Creating a Digital/Online Profile – LinkedIn (Résumé/Video Profile)
5.4: Writing E-mails: types, convention, and etiquette
5.5: Memo, Notices and Circulars
5.6: Writing Technicalities—Paragraphing, Sentence Structure and Punctuation

Text Books &Reference Books:

1. Meenakshi Raman and Sangeetha Sharma. *Technical Communication*. 3rd edition. New Delhi: Oxford University Press, 2015.
2. Mark Ibbotson. *Cambridge English for Engineering*. Cambridge: Cambridge University Press, 2008.
3. Mark Ibbotson. *Professional English in Use: Engineering*. Cambridge: Cambridge UP, 2009.
4. Lesikar et al. *Business Communication: Connecting in a Digital World*. New Delhi: Tata McGraw-Hill, 2014.
5. John Seeley. *Writing Reports*. Oxford: Oxford University Press, 2002.
6. Judith Leigh. *CVs and JobApplications*. Oxford: Oxford University Press, 2002.
7. Judith Leigh. *Organizing and Participating in Meetings*. Oxford: Oxford University Press, 2002.
8. Michael Swan. *Practical English Usage*. Oxford: OUP, 1980.
9. Pickett, Laster and Staples. *Technical English: Writing, Reading & Speaking.* 8th ed. London: Longman, 2001.
10. Diana Booher. *E-writing: 21st Century Tools for Effective Communication*.

Links:

1. Purdue University's Online Writing Lab (OWL)-https://owl.purdue.edu/
2. Business English Pod-https://www.businessenglishpod.com/

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	-	-	2	-	-	3	-	2
CO2	2	3	2	-	-	2	2	2	-	3	-	3
CO3	2	3	-	-	-	3	3	3	-	3	-	3
CO4	-	-	-	-	-	3	3	3	-	3	-	3
CO5	-	-	-	-	-	-	3	3	-	3	-	3

COURSE NAME: CHEMISTRY LAB
COURSE CODE: CH 191
CONTACT: 0:0:3
CREDITs: 1.5

Pre-requisite: A basic knowledge in 10+2 science with chemistry.

Course Objective:

1. Study the basic principles of pH meter and conductivity meter for different applications.
2. Analysis of water for its various parameters & its significance in industries.
3. Learn to synthesis Polymeric materials and drugs.
4. Study the various reactions in homogeneous and heterogeneous medium.

Course Outcomes (COs):

After attending this course, students would be

CO1: able to operate different types of instruments for estimation of small quantities chemicals used in industries and scientific and technical fields.

CO2: able to analyze and determine the composition of liquid and solid samples working as an individual and also as a team member.

CO3: able to analyze different parameters of water considering environmental issues.

CO4: able to synthesize drug and polymer materials.

CO5: Capable to design innovative experiments applying the fundamentals of chemistry.

Course Content:

Choice of 10-12 experiments from the following:

1. Determination of surface tension and viscosity
2. Thin layer chromatography
3. Determination of hardness of water
4. Determination of chloride content of water
5. Determination of the rate constant of a reaction
6. Determination of cell constant and conductometric tritration
7. pH metric titrations
8. Synthesis of a polymer/drug
9. Saponification/acid value of an oil
10. Chemical analysis of a salt
    Chemical oscillations- Iodine clock reaction
11. Determination of the partition coefficient of a substance between two immiscible liquids
12. Adsorption of acetic acid by charcoal
13. Estimation of iron in Mohr's salt solution by permanganometry (Redox Titration)
14. Innovative experiments (any one)
    - Synthesis of silver nano-particles
    - Green synthesis

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	2	-	2	3	-	-	-	-	2
CO2	2	2	2	2	-	2	-	-	-	2	-	2
CO3	-	-	-	-	-	-	-	-	3	3	2	2
CO4	2	2	2	2	-	-	2	-	-	-	-	2
CO5	3	3	3	3	2	2	2	2	-	-	2	2

COURSE NAME: BASIC ELECTRICAL ENGINEERING LABORATORY
COURSE CODE: EE191
CONTACT: 0:0:3
CREDITS: 1.5

Prerequisite: Basic Physics and applied physics, Basic Mathematics, Basic concept of Electric Circuit.

Course Outcomes (COs):

After completion of this course students will be able to

CO1: Identify and use common electrical components.

CO2: To develop electrical networks by physical connection of various components and analyze the circuit behavior.

CO3: Apply and analyze the basic characteristics of transformers and electrical machines.

List of Experiments

1. Basic safety precautions – earthing, introduction to measuring instruments – Voltmeter, Ammeter, Multimeter, Wattmeter, Real life Resistor, Capacitor, Inductor.
2. Verification of Thevenin's and Norton's Theorem.
3. Verification of Superposition and Maximum Power Transfer Theorem.
4. Characteristics of Fluorescent, Tungsten and Carbon filament lamps.
5. Study of R-L-C series circuit.
6. Three-phase Power measurement with two wattmeter methods.
7. Demonstration of cut-out sections of machines: DC Machine (commutator-brush arrangement), Induction Machine (squirrel cage rotor).
8. Measurement of primary and secondary voltage and current of single-phase transformer – Open Circuit and Short Circuit Test.
9. Starting, Reversing and speed control of DC shunt motor.
10. Torque-Speed characteristics of DC Machine.
11. Torque-Speed characteristics of Three-phase Induction Motor.
12. Test on single-phase Energy Meter.
13. Innovative experiments

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	2	-	-	-	-	-	-	1	-	-	1
CO2	-	2	2	2	-	-	-	-	2	-	-	1
CO3	-	2	-	2	-	-	-	-	2	-	-	1

COURSE NAME: ENGINEERING GRAPHICS & DESIGN
COURSE CODE: ME192
CONTACT: 0:0:3
CREDITS: 1.5

Prerequisites: Basic knowledge of geometry

Course Objectives:

To learn detailed drawing and modeling of a system, component, or process which meets desired needs within realistic constraints. It will help students to use the techniques, skills, and modern engineering tools and communicate effectively.

Course Outcomes (COs):

After attending the course students would

CO1: get introduced with Engineering Graphics and visual aspects of design.

CO2: know and use common drafting tools with the knowledge of drafting standards.

CO3: be able to apply computer aided drafting techniques to represent line, surface or solid models in different Engineering viewpoints.

CO4: be able to produce part models; carry out assembly operation and show working procedure of a designed project work using animation.

List of Drawing:

Traditional Engineering Graphics:

Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Perspective; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle; intersection, Shortest Distance.

Module 1: Introduction to Engineering Drawing

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

Module 2: Orthographic & Isometric Projections

Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes on inclined Planes - Auxiliary Planes; Projection of Solids inclined to both the Planes- Auxiliary Views; Isometric Scale, Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa.

Module 3: Sections and Sectional Views of Right Angular Solids

Drawing sectional views of solids for Prism, Cylinder, Pyramid, Cone and project the true shape of the sectioned surface, Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw sectional orthographic views of objects from industry and dwellings (foundation to slab only).

Computer Graphics:

Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Co-ordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modeling; Solid Modeling.

Module 4: Overview of Computer Graphics

Demonstration of CAD software [The Menu System, Toolbars (Standard, Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), Zooming methods, Select and erase objects].

Module 5: CAD Drawing, Customization, Annotations, layering

Set up of drawing page including scale settings, ISO and ANSI standards for dimensioning and tolerancing; Using various methods to draw straight lines, circles, applying dimensions and annotations to drawings; Setting up and use of Layers, changing line lengths (extend/lengthen); Drawing sectional views of solids; Drawing annotation,
CAD modeling of parts and assemblies with animation, Parametric and nonparametric solid, surface and wireframe modeling, Part editing and printing documents.

Module 6: Demonstration of a simple team design project

Illustrating 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, use of solid-modeling software for creating associative models at the component and assembly levels.

Text Books:

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

2. K. Venugopal, Engineering Drawing + AutoCAD, New Age International publishers

Reference Books:

1. Pradeep Jain, Ankita Maheswari, A.P. Gautam, Engineering Graphics & Design, Khanna Publishing House

2. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication.
3. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education

4. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	2	2	2	2	-	2	2	2	2
CO2	2	2	3	2	2	2	2	2	2	2	2	2
CO3	2	2	3	2	3	2	2	-	2	2	2	3
CO4	2	2	3	3	3	3	2	2	3	3	2	2

First Year 2nd Semester

Sl. No.	Category	Course Code	Course Title	Hours per week				Credits
	A. THEORY			L	T	P	Total	
1	Basic Science courses	PH 201	Physics-I	3	0	0	3	3
2	Basic Science courses	M 201	Mathematics –II	4	0	0	4	4
3	Engineering Science Courses	CS 201	Programming for Problem Solving	3	0	0	3	3
	B. PRACTICAL							
4	Basic Science course	PH 291	Physics-I Lab	0	0	3	3	1.5
5	Humanities and Social Sciences including Management courses	HSMC 291	Professional Communication LAB	0	0	3	3	1
6	Engineering Science Courses	ME 291	Workshop & Manufacturing Practices Lab	0	0	3	3	1.5
7	Engineering Science Courses	CS 291	Programming for Problem Solving Lab	0	0	3	3	1.5
8	PROJECT	PR291	Theme based Project II	0	0	1	1	0.5
9	PROJECT	PR292	Skill Development II: Life Skill	1	0	0	1	0.5
	C. MANDATORY ACTIVITIES / COURSES							
10	Mandatory Course	MC281	NSS/ Physical Activities / Meditation & Yoga / Photography/ Nature Club	0	0	3	3	3 Units
	TOTAL CREDIT							16.5

PAPER NAME: PHYSICS –I
PAPER CODE: PH 201
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDIT: 3

Prerequisites: Knowledge of Physics up to 12^{th} standard.

Course Objective:

The aim of courses in Physic-I is to provide adequate exposure and develop insight about the basic principles of physical sciences and its practical aspects which would help engineers to learn underlying principles of various tools and techniques they use in core engineering and related industrial applications. The course would also inculcate innovative mindsets of the students and can create awareness of the vital role played by science and engineering in the development of new technologies.

Course Outcomes (COs):

After attending the course students' should be able to

CO1: describe various types of mechanical resonance and its electrical equivalence

CO2: explain basic principles of Laser, Optical fibers and Polarization of light

CO3: apply superposition principle to explain interference and diffraction

CO4: analyze different crystallographic structures according to their co-ordination number and packing factors

CO5: justify the need of a quantum mechanics as remedy to overcome limitations imposed by classical physics

Course Content:

Module 1 (5L):-
Waves & Oscillations:-
Simple Harmonic Motion (Recap), superposition of waves, damped harmonic motion-over damped, critically damped and under damped motion, energy decay, logarithmic decrement, force vibration and resonance (amplitude, velocity resonance), sharpness of resonance, quality factor, related numerical problems. 5L

Module 2 (12L):-
Classical Optics:
2.01- Interference of light: Huygens's principle, conditions of sustained interference, classification of interference, Newton's ring (qualitative descriptions of working principles and procedures-no deduction required). Engineering applications, related numerical problems. 4L

2.02- Diffraction of light: Fresnel and Fraunhofer class, Fraunhoffer diffraction of a single slit, double slit, multiple slits, intensity distributions, missing order, Rayleigh criterion (no deduction) and resolving power of grating and microscope (no deduction), related numerical problems.
4L

2.03- Polarization: Definition, Plane of polarization, Plane of vibration, Malus Law, Fundamental concepts of plane, circular & elliptical polarizations (only qualitative idea) with examples, Brewster's law, Double refraction: Ordinary & Extra ordinary rays, positive and negative crystal, Nicol's prism, Numerical problems 4L

Module 3 (8L):-
Quantum Mechanics-I
3.01 Quantum Theory: Inadequacy of classical physics-concept of quantization of energy, particle concept of electromagnetic wave (example: photoelectric and Compton Effect; no derivation required, origin of modified

and unmodified lines), wave particle duality; phase velocity and group velocity; de Broglie hypothesis; Davisson and Germer experiment. 4L

3.02 Quantum Mechanics 1: Concept of wave function, physical significance of wave function, probability interpretation; normalization of wave functions; uncertainty principle, relevant numerical problems. Introduction of Schrödinger wave equation (only statement). 4L

Module 4 (3L):-
Solid State Physics-I:
4.01 Crystal Structure: Structure of solids, amorphous and crystalline solids (definition and examples), lattice, basis, unit cell, Fundamental types of lattices –Bravais lattice, simple cubic, fcc and bcc lattices, Miller indices and miller planes, co-ordination number and atomic packing factor, Bragg's equation, applications, numerical problems. 3L

Module 5 (8L):
Modern Optics-I:
5.01- Laser: Concepts of various emission and absorption processes, Einstein A and B coefficients and equations, working principle of laser, metastable state, population inversion, condition necessary for active laser action, optical resonator, illustrations of Ruby laser, He-Ne laser, Semiconductor laser, applications of laser, related numerical problems. 5L

5.02-Fibre optics-Principle and propagation of light in optical fibers (Step index, Graded index, single and multiple modes) - Numerical aperture and Acceptance angle, Basic concept of losses in optical fiber, related numerical problems. 3L

Recommended Text Books for Physics I (PH 101):

Waves & Oscillations:

1. Sound-N. K. Bajaj (TMH)
2. Advanced Acoustics-D. P. Roy Chowdhury (Chayan Publisher)
3. Principles of Acoustics-B.Ghosh (Sridhar Publisher)
4. A text book of sound-M. Ghosh (S. Chand publishers)
5. A text book of Light- K.G. Mazumder & B.Ghoshs, (Book & Allied Publisher)
6. Physics of Oscillations and Waves- R.P. Singh
7. College Physics Vol. II - A.B. Gupta
8. Vibration, Waves and Acoustics- Chattopadhyay and Rakshit

Classical & Modern Optics:

1. A text book of Light- K.G. Mazumder & B.Ghoshs (Book & Allied Publisher)
2. A text book of Light-Brijlal & Subhramanium, (S. Chand publishers)
3. Modern Optics-A. B. Gupta (Book & Allied Publisher)
4. Optics-Ajay Ghatak (TMH)
5. Optics-Hecht
6. Optics-R. Kar, Books Applied Publishers
7. Physical Optics Möler
8. Optics -F.A. Jenkins and H.E White

Quantum Mechanics-I

1. Introduction to Quantum Mechanics-S. N. Ghoshal (Calcutta Book House)
2. Quantum Mechanics-Bagde and Singh (S. Chand Publishers)
3. Perspective of Quantum Mechanics-S. P. Kuilla (New Central Book Agency)
4. Quantum Mechanics-Binayak Datta Roy (S. Chand Publishers)
5. Quantum Mechanics-Bransden (Pearson Education Ltd.)
6. Perspective of Modern Physics-A. Beiser (TMH)
7. Quantum mechanics -A.K. Ghatak and S Lokenathan
8. Modern Physics -E.E. Anderson
9. Physics Volume 2 -Haliday, Resnick & Krane, Published by Wiley India

Solid State Physics-I:

1. Solid state physics-Puri & Babbar (S. Chand publishers)
2. Materials Science & Engineering-Kakani Kakani
3. Solid state physics- S. O. Pillai
4. Introduction to solid state physics-Kittel (TMH)
5. Solid State Physics and Electronics-A. B. Gupta and Nurul Islam (Book & Allied Publisher)
6. Problem in Solid state physics -S.O. Pillai (a. b.)

Text Books:

1. Refresher courses in physics (Vol. 1, Vol. 2 & Vol. 3)-C. L. Arora (S. Chand Publishers)
2. Basic Engineering Physics-Amal Chakraborty (Chaya Prakashani Pvt. Ltd.)
3. Perspective & Concept of Modern Physics -Arthur Baiser
4. Principles of engineering physics – Md. N Khan and S Panigrahi.
5. Basic Engineering Physics-Sujoy Bhattacharya, Saumen Pal (MG)
6. Engineering Physics (Vol. 1, Vol. 2)-S.P. Kuila (S. Chand Publishers)
7. Engineering Physics-A. S. Vasudeva

**Total marks of the questions set from each module should be in proportion to the number of lectures allotted.

Project Domains

1. Study of Superposition of waves: Lissajous figures.

2. Electrical analogue of mechanical vibrations: application to electrical circuit (LC and LCR circuits), Electrical and mechanical impedance, quality factor, complex representation and phasor diagram.

3. Study of N-slit diffractions

4. Optical Fiber & its applications: Study of losses, estimation of numerical aperture in practical problems.

5. Photonic nature of electromagnetic waves

6. Optical Rotation

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	2
CO2	3	-	-	-	-	-	-	-	-	-	-	2
CO3	3	2	-	-	-	-	-	-	-	-	-	2
CO4	2	3	-	-	-	-	-	-	-	-	-	2
CO5	2	3	-	-	-	-	-	-	-	-	-	2

COURSE NAME: MATHEMATICS-II
COURSE CODE: M 201
CONTACT: 4:0:0
TOTAL CONTACT HOURS: 48
CREDIT: 4

Prerequisite: The students to whom this course will be offered must have the concept of (10+2) calculus.

Course Objectives:

The objective of this course is to disseminate the prospective engineers with techniques in ordinary differential equations, Improper integrals, Laplace transform and numerical methods. It aims to equip the students with concepts and tools at an intermediate to advanced level of mathematics and applications that they would find useful in their disciplines.

Course Outcomes (COs):

On successful completion of the learning sessions of the course, the learner will be able to

CO1: Recall the properties and formula related to ordinary differential equations, improper integral, Laplace transform and numerical techniques.

CO2: Determine the solutions of the problems related to ordinary differential equations, improper integral, Laplace transform and numerical techniques.

CO3: Apply appropriate mathematical tools of ordinary differential equations, improper integral, Laplace transform and numerical techniques for the solutions of the problems.

CO4: Analyze engineering problems by using differential equation, Laplace Transform and Numerical Methods.

Course Content:

Module I: First Order Ordinary Differential Equations (ODE): 10L

Solution of first order and first degree ODE: Exact ODE, Rules for finding Integrating factors, Linear ODE, Bernoulli's equation, Solution of first order and higher degree ODE: solvable for p, solvable for y solvable for x and Clairaut's equation.

Module II: Second Order Ordinary Differential Equations (ODE): 10L

Solution of second order ODE with constant coefficients: C.F. & P.I., Method of variation of parameters, Cauchy-Euler equations, Solution of simultaneous linear ODEs.

Module III: Laplace Transform (LT): 14L

Improper integrals; Beta and Gamma functions and their properties.
Definition and existence of LT, LT of elementary functions, First and second shifting properties, Change of scale property, LT of $t\,f\,(t)$, LT of $\frac{f\,(t)}{t}$, LT of derivatives of $f\,(t)$, LT of integral of $f(t)$, Evaluation of improper integrals using LT, LT of periodic and step functions, Inverse LT: Definition and its properties, Convolution theorem (statement only) and its application to the evaluation of inverse LT, Solution of linear ODE with constant coefficients (initial value problem) using LT.

Module IV: Numerical Methods 14L

Introduction to error analysis, Calculus of finite difference. **Interpolation:** Newton forward and backward interpolation, Lagrange's interpolation, Newton's divided difference interpolation formula. Numerical

integration: Trapezoidal rule, Simpson's 1/3 rule, Weddle's rule. Numerical solution of ordinary differential equation: Euler method, Modified Euler method, Fourth order Runge-Kutta method.

Project Domains:

1. Mathematical modeling using ODE.
2. Application of ODE.
3. Application of Laplace Transform in different engineering branches.
4. Application of Numerical Methods in different engineering branches.

Text Books:

1. Kreyszig, E., Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. Ramana, B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
3. Veerarajan, T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. Grewal, B.S., Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
5. Bali, N.P. and Goyal, M., A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
6. Samanta Guruprasad, A text book of Engineering Mathematics-II, New age International Publishers
7. Mollah, S. A, Numerical Analysis and Computational Procedures, Books and Allied (P) Ltd.

Reference Books:

1. Thomas, G.B. and Finney, R.L., Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Boyce, W. E. and DiPrima, R. C., Elementary Differential Equations and Boundary Value Problems, 9th Edn., Wiley India, 2009.
3. Ross, S. L., Differential Equations, 3rd Ed., Wiley India, 1984.
4. Piskunov, N., Differential and Integral Calculus, Vol. I & Vol. II, Mir Publishers, 1969.
5. Coddington, E. A., An Introduction to Ordinary Differential Equations, Prentice Hall, India, 1995.
6. Dey, Sukhendu, Gupta Sisir, Numerical Methods, MsGraw Hill Education(India) Private Limited.
7. Jain, M. K., Iyengar, S. R. K., Jain, R. K., Numerical Methods, New age International Publishers

CO-PO Mapping:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	3	2	-	-	-	-	-	-	-	-	-	2
CO2	3	2	-	-	-	-	-	-	-	-	-	2
CO3	3	2	2	-	-	-	-	-	-	-	-	2
CO4	2	3	2	2	-	-	-	-	-	-	-	2

COURSE NAME: PROGRAMMING FOR PROBLEM SOLVING
COURSE CODE: CS 201
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDITS: 3

Prerequisites: Number system, Boolean Algebra

Course Objectives:

The objective of the course is to make the students able to –

1. Understand the fundamental concept of Computer and mathematical knowledge for problem solving.
2. Understand the basic the principles of designing structured programs like C programming and use of data types/operators/input/output function for developing and implementing program.
3. Use conditional branching, iteration, recursion and formulate algorithms and programs.
4. Understand the concept of arrays, pointers, file and dynamic memory allocation and also able to create new data types using structure, union and enum.
5. Understand how to decompose a problem into functions and assemble into a complete program by means of modular programming.

Course Outcomes (COs): After completion of the course students will be able to

CO1: Understand the fundamental concept of Computer and mathematical knowledge and apply them in designing solution to engineering problem.

CO2: Understand the basic concept of C programming and use of data types/operators/input/output function for developing and implementing complete program leading to solution of mathematical and engineering problem.

CO3: Use conditional branching, iteration, recursion and formulate algorithms and programs in solving mathematical/ scientific/ engineering problem leading to lifelong learning.

CO4: Understand the concept of arrays, pointers, file and dynamic memory allocation and apply it for problem solving and also create new data types using structure, union and enum.

CO5: Understand how to decompose a problem into functions and assemble into a complete program by means of modular programming possibly as a team.

Course Content:

Module-1: Fundamentals of Computer **9L**

History of Computer, Generation of Computer, Classification of Computers, Basic structure of Computer System, Primary & Secondary Memory, Processing Unit, Input & Output devices.

Number System: basic of Binary, Octal, Decimal and Hexadecimal number systems; Representation and interchanging of number in different number systems. Introduction to complements system, Representation of signed and unsigned numbers in singed magnitude singed 1's complement system and signed 2's complement system.

Arithmetic– Addition and Subtraction (using1'scomplementand2'scomplement).

Representation of Characters-ASCII Code

Basics of Compiler, Interpreter and Assembler

Problem solving – Basic concept of Algorithm. Representation of algorithm using flow chart and pseudo code. Some basic examples.

Module-2: Introduction to C Programming **5L**

Overview of Procedural vs Structural language; History of C Programming Language.

Variable and Data Types: The C characterse identifiers

And keywords, data type & sizes, variable names, declaration, statements.
Operators & Expressions: Arithmetic operators,relational operators, logical operators, increment anddecrementoperators,bitwiseoperators,assignmentoperators,conditionaloperators,specialoperators-typeconversion, C expressions, precedence and associativity.
Input and Output: Standard input and output, formatted output–print f,formatted input scan f.

Module-3: Branch and Loop **5L**

Branching: Concept of Statement and Blocks in C, Simple if, if -else, nested if-else and if-else ladder.
Switch Case: break andcontinue; switch-case, concept of goto and labels
Loops - while, for, do while

Module-4: Program Structures **4L**

Function: Basics of Functions, function types, function prototypes, formal and actual parameter, function calling, functions returning values, functions not returning values. Recursion and Recursive Function.
Storage Class in C: Storage Class-auto, external, static and register storage class, scope rules and life time of variables
C pre-processor: Pre-processing directive and macro, parameterized macro.

Module-5: Array and Pointer **7L**

Arrays: One dimensional arrays, Two-dimensional arrays, Passing an array to a function
Pointers: Pointers, Pointer andArray, Pointer and functions.
Strings: Character array and string, array of strings, Passing a string to a function, String related functions, Pointer and String.
Dynamic memory allocation: Malloc, calloc, realloc and free with example.

Module-6: Structures, Unions and Enum **3L**

Basic of structures, arrays of structures, structures and pointers, bit fields. Basics of union and enum, difference between structure and union.

Module-7: File in C **3L**

Files handling- opening and closing a file in different mode, formatted and unformatted files, Command line arguments, f open, f close, f get c, f put c, f print f, f scan f function.

Textbook:

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. KanetkarY.-LetusC,BPBPublication,15thEdition

ReferenceBooks:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India
2. K R Venugopal & S R Prasad – MASTERING C, TMH, 2nd Edition

CO–PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	-	-	-	-	-	-	-
CO2	2	2	3	2	-	-	-	-	-	-	-	-
CO3	2	3	2	2	-	-	-	-	-	-	-	3
CO4	3	2	2	2	3	-	-	-	-	-	-	-
CO5	2	2	2	2	-	-	-	-	3	2	-	-

PAPER NAME: PHYSICS I LAB
PAPER CODE: PH 291
CONTACT HOURS: 0:0:3
CREDIT: 1.5

Prerequisites: Knowledge of Physics up to 12th standard.

Course Objective:

The aim of courses in Physic-I lab is to provide an adequate exposure and develop insight about the basic principles of physical sciences and its practical aspects which would help engineers to learn underlying principles of various tools and techniques they use in core engineering and related industrial applications. They course would also inculcate innovative mindsets of the students and can create awareness of the vital role played by science and engineering in the development of new technologies.

Course Outcomes (COs):

After attending the course students' will be able to

CO1 : demonstrate experiments allied to their theoretical concepts

CO2 : conduct experiments using LASER, Optical fiber, Torsional pendulum, Spectrometer

CO3 : participate as an individual, and as a member or leader in groups in laboratory sessions actively

CO4 : analyze experimental data from graphical representations , and to communicate effectively them in Laboratory reports including innovative experiments

General idea about Measurements and Errors (One Mandatory):

i) Error estimation using Slide calipers/ Screw-gauge/travelling microscope for one experiment.
ii) Proportional error calculation using Carrey Foster Bridge.

Any 6 to be performed from the following experiments

Experiments on Waves & Oscillations:
1. Study of Torsional oscillation of Torsional pendulum & determination of time using various load of the oscillator.
2. Determination of elastic moduli of different materials (Young's modulus /Rigidity modulus)
3. Determination of Q factor using LCR Circuit.
4. Calibration of an oscillator using Lissajous Figure.

Experiments on Classical Optics:
5. Determination of wavelength of light by Newton's ring method.
6. Determination of wavelength of light by Laser diffraction method.
7. To determine the angle of optical rotation of a polar solution using polarimeter

Experiments on Quantum Physics-I:
8. Determination of Planck's constant using photoelectric cell.
9. Verification of Bohr's atomic orbital theory through Frank-Hertz experiment.
10. Determination of Stefan's Constant

In addition it is **recommended that each student should carry out at least one experiment beyond the syllabus/one experiment as Innovative experiment

Probable experiments beyond the syllabus:
1. Determination of wavelength of light by Fresnel's bi-prism method (beyond the syllabus).
3. Study of dispersive power of material of a prism.
4. Study of viscosity using Poiseuille's capillary flow method/using Stoke's law.
5. Measurement of nodal and antipodal points along transmission wire and measurement of wavelength.
6. Any other experiment related to the theory**.**

Recommended Text Books for Physics I Lab (PH 291):

Waves & Oscillations:
1. Vibration, Waves and Acoustics- Chattopadhyay and Rakshit

Classical & Modern Optics:
1. A text book of Light- K.G. Mazumder & B.Ghoshs (Book & Allied Publisher)

Quantum Mechanics-I
1. Introduction to Quantum Mechanics-S. N. Ghoshal (Calcutta Book House)

Solid State Physics-I:
1. Solid State Physics and Electronics-A. B. Gupta and Nurul Islam (Book & Allied Publisher)

Text Books:
1. Practical Physics by Chatterjee & Rakshit (Book & Allied Publisher)
2. Practical Physics by K.G. Mazumder (New Central Publishing)
3. Practical Physics by R. K. Kar (Book & Allied Publisher)

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	2
CO2	2	2	-	3	-	-	-	-	-	-	-	2
CO3	2	2	-	-	-	-	-	-	3	-	-	2
CO4	2	2	-	-	-	-	-	-	-	3	-	2

COURSE NAME: PROFESSIONAL COMMUNICATION LAB
COURSE CODE: HSMC291
CONTACT: 0:0:3
CREDIT: 1

Pre requisites: Basic knowledge of LSRW skills.

Course Objectives: To train the students in acquiring interpersonal communication skills by focusing on language skill acquisition techniques and error feedback.

Course Outcomes (COs):

After attending the course students' would be able to

CO1: explain advanced skills of Technical Communication in English through Language Laboratory.

CO2: apply listening, speaking, reading and writing skills in societal and professional life.

CO3: demonstrate the skills necessary to be a competent Interpersonal communicator.

CO4: analyze communication behaviours.

CO5: adapt to multifarious socio-economical and professional arenas with the help of effective communication and interpersonal skills.

Course Content:

Module- 1: Introduction to the Language Lab

a. The Need for a Language Laboratory
b. Tasks in the Lab
c. Writing a Laboratory Note Book

Module- 2: Active Listening

a. What is Active Listening?
b. Listening Sub-Skills—Predicting, Clarifying, Inferencing, Evaluating, Note-taking
c. Academic Listening vs Business Listening
d. Listening in Business Telephony
e. Study of Contextualized Examples based on Lab Recordings

Module- 3: Speaking

a. Speaking—Accuracy and Fluency Parameters
b. Pronunciation Guide—Basics of Sound Scripting, Stress and Intonation
c. Fluency-focussed activities—JAM, Conversational Role Plays, Speaking using Picture/Audio Visual inputs
d. Accuracy-focussed activities—Identifying Minimal Pairs, Sound Mazes, Open and Closed Pair Drilling, Student Recordings (using software)
e. Group Discussion: Principles and Practice
f. Business Meetings and Sales Talks

Module- 4: Lab Project Work

a. Making a brief Advertisement video (1-2 minutes)
b. Making a brief Business Documentary film (5-7 minutes)
c. Client interaction video (5-7 minutes)

d. Making a short video CV (1-2 minutes)

References:

1. IIT Mumbai, Preparatory Course in English syllabus
2. IIT Mumbai, Introduction to Linguistics syllabus
3. Sasikumar et al. A Course in Listening and Speaking. New Delhi: Foundation Books, 2005.
4. Tony Lynch, Study Listening. Cambridge: Cambridge UP, 2004.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	-	-	2	-	-	3	-	2
CO2	2	3	2	-	-	2	2	2	-	3	-	3
CO3	2	3	-	-	-	3	3	3	-	3	-	3
CO4	-	-	-	-	-	3	3	3	-	3	-	3
CO5	-	-	-	-	-	-	3	3	-	3	-	3

COURSE NAME: WORKSHOP/MANUFACTURING PRACTICES
COURSE CODE: ME291
CONTACT: 0:0:3
CREDITS: 1.5

Prerequisite: Higher Secondary with Mathematics, Physics and Chemistry.

Course Objectives:

1. To understand the basic knowledge of Workshop Practice and Safety
2. To identify and use of different hand tools and other instruments like Hack Saw, Jack Plane, Chisels etc. and operations like Marking,
3. Cutting etc. To expose students to different types of manufacturing/fabrication processes

Course Outcomes (COs):

After completion of this course students will be able to

CO1: Identify and operate various hand tools related to variety of manufacturing operations

CO2: Safely fabricate simple components with their own hands.

CO3: Get practical knowledge of the dimensional accuracies and tolerances applicable for different manufacturing processes.

CO4: Produce small devices of their interest in project or research purpose.

Course Content:

(i) Theoretical discussion & videos: 3P

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods
2. Fitting operations & power tools
3. Carpentry
4. Welding (arc welding & gas welding), brazing
5. Electrical & Electronics
6. Metal casting
7. CNC machining, Additive manufacturing
8. Plastic moulding& Glass Cutting

(ii) Workshop Practice:

Module 1 - Machine shop 6P

Typical jobs that may be made in this practice module:

i. To make a pin from a mild steel rod in a lathe.

ii. To make rectangular and vee slot in a block of cast iron or mild steel in a shaping and / or milling machine.

Module 2 - Fitting shop 6P

Typical jobs that may be made in this practice module:

i. To make a Gauge from MS plate.

Module 3 - Carpentry 6P

Typical jobs that may be made in this practice module:

i. To make wooden joints and/or a pattern or like.

Module 4 - Welding shop (Arc welding 3P + gas welding 3P) 3P

Typical jobs that may be made in this practice module:

i. ARC WELDING (3P): To join two thick (approx 5mm) MS plates by manual metal arc welding.

ii. GAS WELDING (3P): To join two thin mild steel plates or sheets by gas welding.

Module 5 - Electrical & Electronics **3P**
House wiring, soft Soldering

Module 6 – Smithy **3P**

Typical jobs that may be made in this practice module:

i. A simple job of making a square rod from a round bar or similar.

For further study (Optional)

Module 7 - Casting **3P**
Typical jobs that may be made in this practice module:
i. One/ two green sand moulds to prepare, and a casting be demonstrated.

Module 8 - Plastic moulding & Glass Cutting **3P**
Typical jobs that may be made in this practice module:
i. For plastic moulding, making at least one simple plastic component should be made.
ii. At least one sample shape on glass should be made using laser cutting machine.

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

Text Books:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGrawHill House, 2017.

Reference Books:

1. Gowri P., Hariharan and A. Suresh Babu, Manufacturing Technology – I, Pearson Education, 2008.
2. Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.
3. Kalpakjian S. and Steven S. Schmid, Manufacturing Engineering and Technology, 4th edition, Pearson Education India Edition, 2002.
4. Manufacturing Science by A. Ghosh and A.K. Mallick, Wiley Eastern.
5. Principles of Metal Cutting/Principles of Machine Tools by G.C. Sen and A. Bhattacharya, New Central Book Agency, Kolkata.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	-	2	3	2	-	2	2	2	3
CO2	2	2	3	2	2	2	2	-	3	2	2	3
CO3	3	2	2	2	2	2	2	2	2	2	2	3
CO4	2	2	3	2	3	3	2	-	3	3	3	3

COURSENAME: PROGRAMMING FOR PROBLEM SOLVING LAB
COURSE CODE: CS 291
CONTACT: 0:0:3
CREDITS: 1.5

Prerequisites: Number system, Boolean Algebra.

Course Objectives:

The objective of the course is to make the students able to

1. Understand and propose appropriate command or function in running system or developing program.
2. Identify and propose appropriate data type, arithmetic operators, input/output functions and also conditional statements in designing effective programs.
3. Design and develop effective programs using iterative statements as well as recursive functions using modular programming approach.
4. Explain and organize data in arrays, strings and structures and manipulate them through programs and also define pointers of different types and use them in defining self-referential structures and also to construct and use files for reading and writing.
5. Prepare laboratory reports on interpretation of experimental results and analyze it for validating the same.

Course Outcomes (COs):

After completion of the course students will be able to

CO1: Understand and propose appropriate command or function in running system or developing program for engineering and mathematical problems depending on the platform used even in changed environment leading to their lifelong learning.

CO2: Identify and propose appropriate data type, arithmetic operators, input/output functions and also conditional statements in designing effective programs to solve complex engineering problem using modern tools.

CO3: Design and develop effective programs for engineering and mathematical problems using iterative statements as well as recursive functions using modular programming approach possibly as a team maintaining proper ethics of collaboration.

CO4: Explain and organize data in arrays, strings and structures and manipulate them through programs and also define pointers of different types and use them in defining self-referential structures and also to construct and use files for reading and writing to and from leading to solution of engineering and mathematical problem.

CO5: Prepare laboratory reports on interpretation of experimental results and analyze it for validating the same maintaining proper ethics of collaboration.

Course Content:

Module-1: Familiarization with some basic commands of DOS and Linux. File handling and Directory structures, file permissions, creating and editing simple C program in different editor and IDE, compilation and execution of C program. Introduction to Code block.

Module-2: Problem based on

a) Basic data types

b) Different arithmetic operators.

c) Print f( ) and scan f( ) functions.

Module-3: Problem based on conditional statements using

a) if-else statements

b) different relational operators

c) different logical operators

Module-4: Problem based on

a) **for** loop

b) **while** loop

c) **do-while** loop

Module-5: Problem based on

a) How to write a menu driven program using **switch-case** statement
b) How to write a function and passing values to a function
c) How to write a **recursive function.**

Module-6: Problem based on

a) How to use **array (both I-Dand2-D).**
b) How to pass an **array** to a **function.**

Module-7: Problem based on manipulation of strings in different way.

Module-8: Problem based on

a) How to handle compound variables in C

b) How to handle file in C

c) How to use command line argument in C

Textbook:

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill

2. KanetkarY.-LetusC,BPBPublication,15th Edition

ReferenceBooks:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

2. K R Venugopal & S R Prasad – MASTERING C, TMH, 2nd Edition.

CO-PO Mapping:

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	3	2	-	-	-	-	-	-	-	3
CO2	3	3	3	3	3	-	-	-	-	-	-	-
CO3	3	3	3	3	-	-	-	3	3	-	-	-
CO4	3	3	3	3	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	3	-	3	-	-

2nd Year 1st Semester

Sl. No.	Category	Course Code	Course Title	Hours per week				Credits
				L	T	P	Total	
A. THEORY								
1	Basic Science course	PH (CE) 301	Physics-II	3	0	0	3	3
2	Engineering Science Courses	M(CS)301	Numerical Methods	3	0	0	3	3
3	Engineering Science Courses	M(CS)302	Engineering Geology	3	0	0	3	3
4	Program Core Course	CE301	Surveying	3	0	0	3	3
5	Program Core Course	CE302	Strength of Material	3	0	0	3	3
6	Humanities and Social Sciences including Management courses	HSMC 302	Gender Culture and Development	2	0	0	2	2
B. PRACTICAL								
7	Basic Science course	PH (CE) 391	Physics-II lab	0	0	2	2	1.0
8	Engineering Science Courses	M(CS)391	Numerical Methods Lab	0	0	3	3	1.5
9	Engineering Science Courses	M(CS)392	Engineering Geology Lab	0	0	3	3	1.5
10	Program Core Course	CE391	Surveying Practice	0	0	3	3	1.5
11	PROJECT	PR391	Theme based Project III	0	0	1	1	0.5
12	PROJECT	PR392	Skill Development III: Technical Seminar Presentation	1	0	0	1	0.5
C. MANDATORY ACTIVITIES / COURSES								
13	MC	MC 381	Learning an Art Form [vocal or instrumental, dance, painting, clay modeling, etc.] OR Environmental Protection Initiatives	0	0	3	3	3Units
	TOTAL CREDIT WITHOUT MOOCS COURSES							23.5
D.MOOCS COURSES**								
14	MOOCS COURSES	HM301	MOOCS COURSE-I	3	1	4	4	4
TOTAL CREDIT WITH MOOCS COURSES								**27.5**

**** MOOCS COURSES for HONOURS/MINOR Degree are Program specific and to be taken from MOOCS BASKET**

COURSE NAME: PHYSICS -II
COURSE CODE: PH(CE) 301
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS : 3

Pre-Requisites: 1st year Basic Physics knowledge

Course Outcome (COs):
On successful completion of the learning sessions of the course, the learner will be able to:

COS	DESCRIPTIONS
CO1	explain electromagnetic wave propagation using fundamentals of electrostatics, magnetostatics and electromagnetic theory.
CO2	apply Schrödinger equation in variety of atomic scale problems including nanomaterials.
CO3	analyze the importance of superposition principle of quantum mechanics in conceptualization of Quantum bits.
CO4	justify the importance of Fermi energy level in turning electronic properties of various semiconductors

COURSE CONTENTS:

Module 1: Electric and Magnetic properties of materials (8L)

Module 1.01: Insulating materials:

Dielectric Material: Concept of Polarization, the relation between **D, E** and **P**, Polarizability, Electronic (derivation of polarizability), Ionic, Orientation & Space charge polarization (no derivation), internal field, ferroelctric and piezoelectrics (Qualitative study).

3L

Module 1.02: Magnetic materials and storage devices:

Magnetic Field & Magnetization M, relation between **B, H, M**. Bohr magneton, susceptibility, Diamagnetism- & Paramagnetism - Curie law (qualitative discussion), Ferromagnetism– Curie Temperature, Weiss molecular field theory (qualitative) & Curie-Weiss law, concept of θ_p , Hysteresis, Hard ferromagnets, Comparison and applications of permanent magnets (storage devices) and Soft ferromagnets (Permalloys, Ferrites etc.) **5L**

Module 2: Building Acoustics, Ultrasound and infrasound (6L)

2.01: Building Acoustics: Introduction, bel, decibel-their physical significance, Reverberation, reverberation time, Sabine's formula (statement only), remedies over reverberation; Absorption of sound, absorbent materials; Conditions for good acoustics of a building; Noise, its effects and remedies. **2L**

2.02: Ultrasound-Introduction, definition and properties –Production of ultrasonics by Piezo-electric crystal and magnetostriction method; Detection of ultrasonics; Engineering applications of Ultrasonics (Non-destructive testing, cavitations, measurement of gauge). **Infrasound** – Introduction and definition, production, application: Seismography (concept only).

4L

Module 3: Quantum Mechanics-II (8L)

Formulation of quantum mechanics and Basic postulates- superposition principle, orthogonality of wave function, expectation value; operator correspondence, Commutator. Measurements in Quantum Mechanics-Eigen value, Eigen function, Schrödinger's equation as energy eigen value equation. **4L**

Application of Schrödinger equation – Particle in an infinite square well potential (1-D and 3-D potential well; Discussion on degenerate levels), 1D finite barrier problem and concept of quantum tunnelling (solve only $E<V_0$). **4L**

Module 4: Statistical Mechanics (4L)

Concept of energy levels and energy states. Microstates, Macrostates and thermodynamic probability, MB, BE, FD, statistics (Qualitative discussions)- physical significance, conception of bosons, fermions, classical limits of quantum statistics, Fermi distribution at zero & non-zero temperature, Concept of Fermi level. **4L**

Module 5: Solid state physics (6L)

5.01: Defects: Point defects; line defects; Dislocations, Types of dislocations, Planar defects, stacking faults, twins, grain boundaries, defect propagation (qualitative). **3L**

5.02: Vibration in solids: Lattice vibrations – Mono and diatomic lattice, concept of phonon, specific heat of solids-Dulong-Pettit law, Einstein, Debye theory (qualitative discussion).

3L

Module 6: Physics of Nanomaterials (4L)

Reduction of dimensionality, properties of nanomaterials, Quantum wells (two dimensional), Quantum wires (one dimensional), Quantum dots (zero dimensional); Quantum size effect and Quantum confinement. Carbon allotropes. Application of nanomaterials (CNT, graphene, electronic, environment, medical). **4L**

List of recommended Books:

Module1:

1. Electromagnetics-B.B. Laud (TMH)
2. Electricity Magnetism-B.Ghosh (Book & Allied Publisher)
3. Electricity Magnetism-Chattopadhyay & Rakshit (New Central Book Agency)
4. Electricity Magnetism-Fewkes and Yardwood (Oxford University Press)
5. Solid State Physics- Ali Omar (Pearson Eduction)
6. Solid state physics- S. O. Pillai
7. Solid State Physics-A. J. Dekker (Prentice-Hall India)

Module 2:

1. Acoustics by D. P. Chattopadhyay

Module 3:

1. Advanced Quantum Mechanics-J. J. Sakurai (TMH)
2. Quantum Mechanics-Schiff (Addison-Wesley)

3. Quantum Computation and Quantum Information(10th Anniversary Edition)-Nielsen & Chuang (Cambridge University Press)
4. The physics of quantum information-Dirk Bouwmeester, Artur K. Ekert, Anton Zeilinger (Springer)
5. Quantum Mechanics-Cohen Tanuje.
6. Advanced Quantum Mechanics-P.A.M. Dirac

Module 4.

Statistical Mechanics by B.B. Laud
Statistical Mechanics by Singh and Singh
Statistical Mechanics by Satyaprakash

Module 5

1 Introduction to solid state physics-Kittel (TMH)
2. Solid State Physics- Ali Omar (Pearson Eduction)
3. Solid state physics- S. O. Pillai
4. Solid State Physics-A. J. Dekker (Prentice-Hall India)
5. Materials Science-Raghavan

Module 6

6. Nanotechnology-Rakesh Rathi (S. Chand Publishers)
7. Integrated Electronics-Millman Halkias (TMH)
8. Nanotechnology-Rakesh Rathi (S. Chand Publishers)
9. Nanoscience-H. E. Schaefer (Springer)

Genarl Book:

1. Engineering Physics by **Khan** and Panigrahi Publisher: Oxford.

**Total marks of the questions set from each module should be in proportion to the number of lectures allotted.

CO-PO Mapping:

CO	PO1	PO 2	PO3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	1	-	-	-	-	-	-	-	-	-	1	2	2	-
CO2	3	2	-	-	-	-	-	-	-	-	-	2	2	2	-
CO3	2	3	-	-	-	-	-	-	-	-	-	1	2	2	-
CO4	1	2	2	3	-	-	-	-	-	-	-	1	2	2	-

Course Name: Numerical Methods
Course Code: M(CS) 301
Total Contact Hours: 36
Credit: 3

Prerequisite:

The students to whom this course will be offered must have the concept of (10+2) standard number system, algebra and calculus and basic knowledge of numerical analysis.

Course Objectives:

The purpose of this course is to provide better understanding of the derivation and the use of the numerical methods along with the knowledge of finite precision arithmetic.

Course Outcomes (COs):
On successful completion of the learning sessions of the course, the learner will be able to:

CO	DESCRIPTIONS
CO1	Recall the distinctive principles of numerical analysis and the associated error measures.
CO2	Understand the theoretical workings of numerical techniques.
CO3	Apply numerical methods used to obtain approximate solutions to intractable mathematical problems such as interpolation, the solution of linear and nonlinear equations, and the solution of ordinary and partial differential equations.
CO4	Select appropriate numerical methods to apply to various types of problems in engineering and science in consideration of the mathematical operations involved, accuracy requirements, and available computational resources.

Course Content

MODULE I: ***Error Analysis and Interpolation (10 Lectures)***

Approximation in Numerical Computation: Truncation and rounding errors, Propagation of errors, Fixed and floating-point arithmetic.
Interpolation: Central Difference Operator: Stirling's interpolation formula, Bessel's interpolation formula, Cubic Spline interpolation.

MODULE II: Matrix and ***Numerical Solution of Linear and Non-linear Equations (16 Lectures)***

Matrix: Eigen values and eigen vectors of matrix: Power method.

Numerical Solution of a System of Linear Equations: Gauss elimination method, Tridiagonal matrix algorithm, LU Factorization method, Gauss-Jacobi iterative method, Gauss-Seidel iterative method, Successive over Relaxation (SOR) method.
Solution of Polynomial and Transcendental Equations: Bisection method, Regula-Falsi, Secant Method, Newton-Raphson method, fixed point iteration.

MODULE III: ***Numerical Solution of Differential Equation*** ***(10 Lectures)***

Numerical Solution of Ordinary Differential Equation: Taylor series method, Adams- Bashforth-Moulton method and Milne's Predictor-Corrector methods, finite difference method.
Numerical solution of partial differential equation: Finite Difference method, Crank–Nicolson method.

Project Domains:

6. Application of PDE and ODE in Engineering Field.
7. Application of numerical methods for the relevant field.
8. Mathematical modelling.

Text Books:

1. Shishir Gupta &S.Dey, Numerical Methods, Mc. Grawhill Education Pvt. Ltd.
2. C.Xavier: C Language and Numerical Methods, New age International Publisher.
3. Dutta& Jana: Introductory Numerical Analysis. PHI Learning
4. J.B.Scarborough: Numerical Mathematical Analysis.Oxford and IBH Publishing
5. Jain, M. K., Iyengar, S. R. K. and Jain, R. K. *Numerical Methods (Problems and Solution)*. New age International Publisher.
6. Prasun Nayek: Numerical Analysis, Asian Books

Reference Books:

1. Balagurusamy, E. *Numerical Methods*, Scitech. TMH.
2. Dutta, N. *Computer Programming & Numerical Analysis*, Universities Press.
3. Guha, S. and Srivastava, R. *Numerical Methods*, Oxford Universities Press.
4. Shastri, S. S. *Numerical Analysis*, PHI.
5. Mollah, S. A. *Numerical Analysis*, New Central Book Agency.
6. Numerical Methods for Mathematics ,Science&Engg., Mathews, PHI.
7. Rao, G. S. *Numerical Analysis*, New Age International.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	P12	PS O1	PS O2	PS O3
CO1	3	1	1	-	-	-	-	-	-	-	-	1	2	2	-
CO2	3	2	1	-	-	-	-	-	-	-	-	1	2	2	-
CO3	3	2	2	-	-	-	-	-	-	-	-	1	2	2	-
CO4	3	3	2	3	-	-	-	-	-	-	-	1	2	2	-

COURSE NAME: ENGINEERING GEOLOGY
COURSE CODE: M(CS)302
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS : 3

Pre requisites: Basic knowledge of Geography & Earth Science

Course Objective:
To make the students knowledgeable to understand, apply and explore Geological parameters, Rock and other materials and activity related to earth science.

Course Outcome:

CO1	Students will have knowledge about Engineering properties of Rocks and their Minerals.
CO2	Student will be appraised about Dam, reservoir, tunnel
CO3	Student will understand about Earthquake phenomena.
CO4	Student will able to carry out Physical exploration
CO5	Student will able to estimate various geological parameters by use of modern tools & techniques

COURSE CONTENTS:

Module-1: [2L+1T]

Geology and its importance in Civil Engineering

Module-2: [2L+1T]

Mineralogy: Definition, internal and external structure of minerals, Classification and physical properties of minerals.

Module-3: [2L+1T]

Classification of rocks:

a) Igneous rocks: Origin, mode of occurrence, forms & texture, classification and engineering importance.

b) Sedimentary rocks: Process of sedimentation, classification and engineering importance.
c) Metamorphic rocks: Agents and types of metamorphism, classification and engineering importance.

Module-4: [2L+1T]

Weathering of rocks: Agents and kinds of weathering, soil formation & classification based on origin.

Module-5: [2L+1T]

Geological work of rivers: Origin and stages in the system, erosion, transportation and deposition.

Module-6: [2L+1T]

Structural geology: Introduction to structural elements of rocks, dip & strike, definition, description, classification of folds, faults and joints, importance of geological structures in Civil Engineering.

Module-7: [2L+1T]

Earthquakes and seismic hazards: Causes and effects, seismic waves and seismographs, Mercelli's intensity scale and Richter's scale of magnitude

Module-8: [2L+1T]

Engineering properties of rocks: Porosity, permeability, compressive strength, tensile strength and abrasive resistance

Module-9: [2L+1T]

Rocks as construction materials: Qualities required for building and ornamental stones, foundations, concrete aggregate, railway ballast, road metal, pavement, flooring and roofing

Module-10: [2L+1T]

Geophysical exploration: Methods of Geophysical Exploration, electrical resistivity method field procedure –sounding and profiling, electrode configuration, interpretation of resistivity data. Geophysical surveys in ground water and other Civil Engg. Projects.

Module-11: [2L+1T]

Applied Geology: Surface and subsurface geological and geophysical investigations in major Civil Engg. Projects. Geological studies of Dams and reservoir sites, Geological studies for selection of tunnels and underground excavations.

Module-12: [2L+1T]
Landslides: Types of landslides, causes, effects and prevention of landslides

Text / Reference Books:

Sl no	Name	Author	Publisher
1	Engineering and General Geology	Parvin Singh	Katson house Delhi 1987

2	Engineering Geology for Civil Engineers	D. Venkat Reddy	Oxford, IBH, 1995.
3	Principles of petrology	Tyrell	Asia, Bombay
4	Structural Geology	Marland P. Billings	Wileyeastern Prentice-Hall, U.S.A.
5	Ground Water hydrology	Todd D.K.	John Wiley & Sons, Second edition, 1980.

CO-PO mapping

COS	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	2	1	2	1	-	1	1	1	1	1	2	2	2	-
CO2	3	2	1	2	1	-	1	1	1	1	1	2	2	2	-
CO3	3	2	2	2	2	1	1	1	1	1	1	-	2	2	-
CO4	3	3	3	3	3	-	-	1	-	2	1	1	2	2	-
CO5	3	2	1	3	3	2	1	1	2	2	1	2	2	2	-

COURSE NAME: SURVEYING
COURSE CODE: CE301
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS : 3

Pre requisites: Student should have knowledge about measurement and mathematical knowledge

Course Objective: The objective of this course is appreciate of the need for lifelong learning through the discussion of recent changes in survey procedures and equipment and also have the ability to apply knowledge of mathematics, science, and engineering to understand the measurement techniques and equipment used in surveying.

Course Outcome:

CO1	Students will summarize surveying techniques that will remain correct for long period of time.
CO2	Students will experiment about different methods using instrument such as Chain, Compass, Leveling, minor instruments like planimeter, etc.
CO3	Students will learn about Area & Volume calculation.
CO4	Students will evaluate about Trigonometrically leveling.
CO5	Students will analyze about simple & complex problems of different instrument methods of Survey.

COURSE CONTENTS:

Module-1: [1L]

Introduction: Definition, classification of surveying, objectives, principles of surveying.

Module-2: [9L]

Chain surveying: Chain and its types, Optical square, Cross staff, Reconnaissance and site Location, Locating ground features by offsets – Field book. Chaining for obtaining the outline of structures, Methods for overcoming obstacles, Conventional symbols, Plotting chain survey and Computation of areas, Errors in chain surveying and their elimination: Problems.

Compass Surveying: Details of prismatic compass, Use and adjustments, Bearings, Local attraction and its adjustments. Chain and compass surveying of an area, Booking and plotting, Adjustments of traverse, Errors in compass surveying and precautions: Problems.

Module-3: [3L]

Plane Table Surveying: Equipment, Orientation, Methods of Plane Tabling, Three Point Problems.

Module-4: [9L]

Leveling: Introduction, Basic definitions, Detail of dumpy Level, Temporary adjustment of Levels, Sensitiveness of bubble tube; Methods of leveling – Differential, Profile & fly Leveling, Effect of curvature and refraction, Automatic levels, Plotting longitudinal sections and Cross sections; Measurement of area and volume.

Contouring: Topographic Map, Characteristics of Contour, Contour Interval. Methods of Locating Contours, Interpolation of Contours.

Module-5: [9L]

Theodolite Surveying: Components of a Transit Theodolite, Measurement of horizontal and vertical Angles, Co-ordinates and traverse Table.

Tacheometry: Definition, Details of stadia System, Determination of horizontal and vertical distance with Tacheometer- Staff held vertically and normal to the line of sight.

Module-6: [3L]

Simple & Transition Curves: Definition, Degree of Curve, Elements of Simple Curve, Setting out by Linear method and Rankine's tangential method, Transition Curves.

Module-7: [3L]

Introduction to Total Station with Field applications.

Text / Reference Books:

Sl No	Title	Author
1	Surveying:- Vol - I & II	B.C. Punmia
2	Surveying & Leveling	R. Subramanian (OXFORD)
3	Surveying& Leveling Vol - I [Part I & II]	T.P.Kanetkar & Kulkarni
4	Surveying:- Vol - I & II	S.K. Duggal
5	Fundamental of Engineering Survey	J.K. Ghosh (Studium Press, Roorkee)
6	Higher Surveying	Dr. A. M. Chandra
7	Surveying	R.B. Gupta & B.K. Gupta
9	Plane and Geodetic Surveying (Vol - I & II)	David Clark
10	Fundamental of Surveying	S. K. Roy
11	Surveying	Saikia & Das (PHI)

CO-PO mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	3	1	1	1	3	3	3	3	3	3	3
CO2	3	3	3	2	2	2	1	2	3	2	3	2	2	3	2
CO3	1	1	1	-	-	-	-	-	1	1	1	1	1	1	1
CO4	3	3	3	3	2	2	2	1	3	2	2	2	2	2	2
CO5	3	3	3	3	2	1	1	1	3	2	1	2	2	2	2

COURSE NAME: STRNGTH OF MATERIALS
COURSE CODE: CE 302
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS : 3

Pre requisites: Student should have the knowledge about Elements of Civil Engineering & Mechanics.

Course Objective: The objective of this course is elaborate on the knowledge of engineering mechanics (statics) and to teach the students the purpose of studying strength of materials with respect to civil engineering design and analysis. The course introduces the students to the concepts of engineering mechanics of materials and the behavior of the materials and structures under applied loads.

Course Outcome:

CO1	Interpret the concepts of stress and strain at a point as well as the stress-strain relationships for homogenous, isotropic materials.
CO2	Analyze the stresses and strains associated with thin-wall spherical and cylindrical pressure vessels.
CO3	Demonstrate the capability to conduct experiments, as well as to analyze and interpret data
CO4	Ability to classify a component to meet desired needs within realistic constraints of safety.

COURSE CONTENTS:

Module-1: [6L]

Review of Basic Concepts of Stress and Strain: 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; Bulk Modulus: Factor of safety. Beam Statics: 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

Module-2: [9L]

Symmetric Beam Bending: Basic kinematic assumption, moment of inertia, elastic flexure formulae and its application, Bending and shear stress for regular sections, shear centre, centre of gravity [3L+2T]

Deflection of statically determinate beams: Fundamental concepts: Elastic curve, moment Curvature relationship, governing differential equation, boundary conditions: Direct integration solution [3L+1T]

Module-3: [10L]

Analysis of determinate plane trusses: Concepts of redundancy, Analysis by method of joints,

Method of sections. [3L+1T]

Two Dimensional Stress Problems: Principal stresses, maximum shear stresses, Mohr's circle of stresses, construction of Mohr's circle, applications. [4L+2T]

Module-4: [11L]

Introduction to thin cylindrical & spherical shells: Hoop stress and meridonial - stress and volumetric changes. [2L+2T]

Torsion: Pure torsion, torsion of circular solid shaft and hollow shafts, torsional equation, torsional rigidity, closed coil helical; springs [2L+1T]

Columns: 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+1T]

Text / Reference Books:

Sl No	Name	Author	Publisher
1	Elements of Strength of Material	S. P. Timoshenko & D.H.	EWP Pvt. Ltd
2	Engineering Mechanics of Solids	E. P. Popov	Pearson Education
3	Strength of Materials	R. Subramanian	OXFORD University Press
4	Strength of Material	S S Bhavikatti	Vikas Publishing House Pvt. Ltd
5	Engineering Mechanics I by	J. L. Mariam	John Willey
6	Engineering Mechanics	I. H. Shames	PHI
7	Fundamentals of Strength of Material	Nag & Chandra	WIE

CO-PO mapping

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	3	3	3	-	-	-	-	-	1	-	2	2	3	2
CO2	3	3	3	2	1	-	-	-	-	1	-	3	2	3	2
CO3	2	3	3	3	1	1	-	-	1	1	1	2	2	3	2
CO4	3	2	3	3	1	-	2	-	-	-	-	1	2	3	2

COURSE NAME: GENDER, CULTURE AND DEVELOPMENT
COURSE CODE: HSMC 302
CONTACT: 2:0:0
TOTAL CONTACT HOURS: 24 HRS
CREDITS : 2

Prerequisite: None

Course Outcomes: On successful completion of the learning sessions of the course, the learner will be able to:

CO1: Provide an analysis of the location of women in the processes of economic development; to understand what economic development is, the scales or levels at which it occurs, and the centrality of gender at every level.
CO2: Examine theoretical and conceptual frameworks for that analysis.
CO3: Reflect upon linkages between the global economy and the gendered macro and micro process of development and transitions from 'government' to 'governance.'
CO4: Explain the usefulness of a rights based approach to gender justice.
CO5: Provide basis for research, practical action and policy formulation and or evaluating for evaluating directions and strategies for social change from a gender perspective.

Course Content

I-Introduction to Gender (6L)
What is Gender?
Ideas of Gender Discrimination
Ways of Promoting Gender Equality
The 3rd Gender & Gender Sensitization
Issues of Gender Discrimination at the Corporate Workplace—Case Studies

II-Encouraging Gender Equality(6L)
Providing Equal Opportunities
Using Gender-sensitive Language
Moving away from Gender Stereotypes
Providing Counselling to People Resistant to Gender Equality
Issues of Empowering Women & LGBT in the Corporate Workplace

III-Introduction to Culture(6L)
Concepts of Culture & Culture Mapping
Cultural Tropes
Language, Literature & Culture
Popular Culture & Cultural Icons
Cultural Alienation
Issues of Dominant Culture vs Suppressed Cultures—Case Studies

IV-Culture in the Corporate World(6L)

Cultural Diversity in the Corporate Workplace
Internal Corporate Cultures
Globalization vs Local Cultures
Culture Sensitization in the Workplace
Issues of Cultural Representation in the Corporate Workplace—Case Studies

Sample Topics for Case Studies:

-*Kulturkampf* and Jews in Nazi Germany
-Dalits and Harijans in Pre-independent India
-Chinese community in 21stc India
-Diaspora communities in USA, UK and Canada

https://www.successfulculture.com/case-studies/

https://www.bmefcolleges.edu.in/uploads/v3n2sl13.pdf

https://dspace.mit.edu/bitstream/handle/1721.1/47094/cultureinorganiz00dyer.pdf?s.

Text Books:

1. Beneria, Lourdes. (2004). Gender, Development, and Globalization: Economics as if All People Mattered. Roultedge Press. (GDGE)
2. Molyneux and Razavi. (2002). Gender Justice, Development and Rights. Oxford University Press (GJDR or WGD)
3. Visvanathan, Duggan,Wiegersma and Nisonoff. (2011). The Women, Gender and Development Reader. 2nd Edition. Zed Press (WGD)

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	-	2	1	-	-	-	2	3	3	1	-	2
CO2	3	2	-	1	3	2	-	1	2	-	3	3	2	-	1
CO3	3	2	2	-	2	3	1	-	2	1	3	3	3	1	-
CO4	3	1	-	2	-	-	-	2	-	3	3	3	2	-	2
CO5	3	2	-	1	-	1	2	-	2	-	3	3	3	1	-

COURSE NAME: PHYSICS-II LAB
COURSE CODE: PH (CE) 391
CONTACT: 0:0:2
CREDITS : 1.00

Pre requisites: Basic Knowledge of Physics-I Lab.

Course Outcome:

At the end of the course students' will be able to

CO1 : demonstrate experiments allied to their theoretical concepts
CO2 : conduct experiments using semiconductors , dielectric and ferroelectrics, ultrasounds
CO3 : classify various types of magnetic materials
CO4 : participate as an individual, and as a member or leader in groups in laboratory sessions actively
CO5 : analyze experimental data from graphical representations , and to communicate effectively them in Laboratory reports including innovative experiments

Examination Scheme (Practical): End Semester Exam: 60 Internal Assessment:40

LIST OF EXPERIMENT:

***At least 7 experiments to be performed during the semester**

Experiments on Module 1: Electric and Magnetic properties of materials

1. Study of dipolar magnetic field behavior using deflection magnetometer.
2. Study of hysteresis curve of a ferromagnetic material using CRO.
3. Use of paramagnetic resonance and determination of Lande-g factor using ESR setup.
4. Measurement of Curie temperature of the given sample.
5. Determination of dielectric constant of given sample (frequency dependent)

Experiments on Module 2: Ultrasound (4L)

6. Determination of velocity of ultrasonic wave using piezoelectric crystal.

Module 3: Display, Optical Instruments & optielctronic devices

7. Measurement of specific charge of electron using CRT.

Experiments on Module 4: Quantum Mechanics-II

8. Determination of Stefan's radiation constant.
9. To study current-voltage characteristics, load response, areal characteristics and spectral response of photo voltaic solar cells & measurement of maximum workable power.
10. Determination of band gap of a semiconductor.
11. Determination of Hall co-efficient of a semiconductor and measurement of Magnetoresistance of a given semiconductor
12. Study of I-V characteristics of a LED.
13. Study of I-V characteristics of a LDR

In addition to regular 7 experiments it is **recommended that each student should carry out at least one experiment beyond the syllabus/one experiment as Innovative experiment.

Probable experiments beyond the syllabus:
1. Determination of thermal conductivity of a bad conductor by Lees and Chorlton's method.
2. Determination of thermal conductivity of a good conductor by Searle's mothod.
3. Study of transducer property: Determination of the thermo-electric power at a certain temperature of the given thermocouple.

CO-PO Mapping:

CO	PO 1	PO2	PO 3	PO4	PO5	PO6	PO 7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	2											2	2		
CO2	2	2		3									2	2	
CO3			2									2			2
CO4									3						
CO5										2					
PH(ME) 391	2	2	2	3					3	2		2	2	2	2

COURSE NAME: NUMERICAL METHODS LAB
COURSE CODE: M(CS) 391
CONTACT: 0:0:3
CREDITS : 1.50

Prerequisite: Any introductory course on programming language (example. C/ Matlab).

Course Objective: The purpose of this course is to provide basic programming skills for solving the problems in numerical methods.

Course Outcome (CO):
On successful completion of the learning sessions of the course, the learner will be able to:

CODES	DESCRIPTIONS
CO1	Understand the theoretical workings of numerical techniques with the help of C/ Matlab
CO2	Execute basic command and scripts in a mathematical programming language
CO3	Apply the programming skills to solve the problems using multiple numerical approaches.
CO4	Analyze if the results are reasonable, and then interpret and clearly communicate the results.

LIST OF EXPERIMENT:

1. Assignments on Newton forward /backward, Lagrange's interpolation.
2. Assignments on numerical integration using Trapezoidal rule, Simpson's 1/3 rule, Weddle's rule.
3. Assignments on numerical solution of a system of linear equations using Gauss elimination, Tridiagonal matrix algorithm, Gauss-Seidel iterations. Successive over Relaxation (SOR) method, LU Factorization method.
4. Assignments on numerical solution of Algebraic Equation by Bisection method, Regula-Falsi method, Secant Method, Newton-Raphson method
5. Assignments on ordinary differential equation: Euler's method, Euler's modified method, Runge-Kutta methods, Taylor series method and Predictor-Corrector method.
6. Assignments on numerical solution of partial differential equation: Finite Difference method, Crank–Nicolson method.

Implementation of numerical methods on computer through C/C++ and commercial Software Packages: Matlab / Scilab / Labview / Mathematica/NAG (Numerical Algorithms Group)/Python.

CO-PO Mapping:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	2	1	-	-	-	-	-	-	-	-	1	2	2	-
CO2	3	2	2	-	-	-	-	-	-	-	-	1	2	2	-
CO3	3	2	2	-	-	-	-	-	-	-	-	1	2	2	-
CO4	3	3	2	3	-	-	-	-	-	-	-	1	2	2	-

COURSE NAME: ENGINEERING GEOLOGY LAB
COURSE CODE: CE(CS) 392
CONTACT: 0:0:3
CREDITS : 1.5

Pre requisites: Student should have the knowledge about Engineering geology theory.
Course Objective:
To make the students capable to identify and study properties of rock and minerals. They also should be able to use modern tools line microscope.

Course Outcome:

CO1	Student should acquire knowledge about engg. Properties of rocks and their minerals.
CO2	Student should be able to identify rocks and minerals
CO3	Student should be able to use modern tools live microscope to explore samples.
CO4	Student should be able to interpret map.

LIST OF EXPERIMENT:
Identification of Rocks and Minerals [Hand Specimens]
Identification of Rocks and Minerals [Hand Specimens]
Study of Geological maps, interpretation of geological structures
Thickness problems, Borehole problems
Text / Reference Books:

Sl no	Name	Author	Publisher
1	Engineering and General Geology	Parvin Singh	Katson publishing house Delhi 1987
2	Engineering Geology for Civil Engineers	D. Venkat Reddy	Oxford, IBH, 1995.
3	Principles of petrology	Tyrell	Asia, Bombay
4	Structural Geology	Marland P. Billings	Wiley eastern Prentice-Hall, U.S.A.
5	Ground Water hydrology	Todd D.K.	John Wiley & Sons, Second edition,1980.

CO-PO mapping

CO	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO7	PO 8	PO9	PO1 0	PO1 1	PO1 2	PSO1	PS O2	PS O3
CO1	3	2	1	2	1	-	1	1	1	1	1	1	2	2	-
CO2	3	2	2	3	2	1	2	-	1	1	-	1	2	2	-
CO3	2	2	1	3	3	2	-	1	1	1	1	1	2	2	-
CO4	2	2	2	1	1	3	1	1	-	1	-	1	2	2	-

COURSE NAME: SURVEYING PRACTICE
COURSE CODE: CE 391
CONTACT: 0:0:3
CREDITS : 1.50

Pre requisites: Student should have knowledge about the basic Basic Survey Theory

Course Objective: Student will be able to to function as a member of a team and Have the ability to use techniques, skills, and modern engineering tools necessary for engineering practice.

Course Outcome:

CO1	To interpret horizontal measurement with the help of Chain & Compass Surveying in the field.
CO2	To enumerate about Plane Table surveying.
CO3	To estimate vertical measurement with the help of Leveling in the field.
CO4	To apply indirect methods& demonstration of minor instruments.
CO5	To apply knowledge about Theodolite & Curve.

LIST OF EXPERIMENT:

Chain surveying

Preparing index plans, Location sketches, Ranging, Preparation of map, Getting outline of the structures by enclosing them in triangles/quadrilaterals, Distance between inaccessible points, Obstacles in chain survey.

Compass surveying

Measurement of bearings, Preparation of map, Distance between two inaccessible points by chain and compass, Chain and compass traverse

Plane Table survey

Temporary adjustments of plane table and Radiation , Intersection, Traversing/Resection methods.

Leveling

Reduced Level calculation with Dumpy and Auto level for Differential leveling, Profile leveling and plotting the profile,

Contouring:

Direct contouring, Indirect contouring(Method of Interpolation).

Theodolite Traversing byusing Theodolite. Measurements of Horizontal & Vertical angles.

Circular Curves- Setting outof Simple Circular Curves.

Text / Reference Books:

Sl No.	Title	Author
1	Surveying:- Vol - I & II	B.C. Punmia
2	Surveying & Leveling	R. Subramanian (OXFORD)
3	Surveying& Leveling Vol - I [Part I & II]	T.P.Kanetkar & Kulkarni
4	Surveying:- Vol - I & II	S.K. Duggal
5	Fundamental of Engineering Survey	J.K. Ghosh (Studium Press, Roorkee)
6	Higher Surveying	Dr. A. M. Chandra
7	Surveying	R.B. Gupta & B.K. Gupta
9	Plane and Geodetic Surveying (Vol - I & II)	David Clark
10	Fundamental of Surveying	S. K. Roy
11	Surveying	Saikia & Das (PHI)

CO-PO mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	-	-	2	1	1	3	2	2	1	3	3	3
CO2	3	3	3	-	-	2	1	1	3	3	3	1	3	3	3
CO3	3	3	3	-	-	2	1	1	3	2	3	1	3	3	3
CO4	3	3	3	-	1	2	1	1	3	3	3	2	3	2	3
CO5	3	3	3	-	1	2	1	1	3	2	3	2	3	3	3

2nd Year 2nd Semester

Sl. No.	Category	Course Code	Course Title	Hours per week				Credits
				L	**T**	**P**	**Total**	
A. THEORY								
1	Basic Science course	M 401	Mathematics III	3	0	0	3	3
2	PC	CE401	Structural Analysis	3	0	0	3	3
3	PC	CE402	Concrete Technology	3	0	0	3	3
4	PC	CE403	Soil Mechanics	3	0	0	3	3
5	PC	CE404	Building Material and Construction	3	0	0	3	3
6	Humanities and Social Sciences including Management courses	HSMC 403	Universal Human Values 2: Understanding Harmony	3	0	0	3	3
B. PRACTICAL								
7	Engineering Science course	M (CS) 491	Object oriented Programmig Using Java Lab	0	0	3	3	1.5
8	PC	CE491	Building Planning And Drawing	0	0	3	3	1.5
9	PC	CE492	Civil Engineering Lab-I	0	0	3	3	1.5
10	PC	CE493	Soil Mechanics Lab-I	0	0	3	3	1.5
11	PC	CE494	Quantity Surveying, Specifications and Valuation	0	0	3	3	1.5
12	PROJECT	PR 491	Theme based Project IV	0	0	1	1	0.5
13	PROJECT	PR492	Skill Development IV: Soft Skill & Aptitude-I	1	0	0	1	0.5
C. MANDATORY ACTIVITIES / COURSES								
14	MC	MC 401	Environmental Science	0	0	3	3	3 Units
	TOTAL CREDIT WITHOUT MOOCS COURSES							26.5
D.MOOCS COURSES								
15	MOOCS COURSES	HM401	MOOCS COURSE-II	3	1	0	4	4
TOTAL CREDIT WITH MOOCS COURSES								**30.5**

**** MOOCS COURSES for HONOURS/MINOR Degree are Program specific and to be taken from MOOCS BASKET**

COURSE NAME: MATHEMATICS- III
COURSE CODE: M 401
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS : 3

Prerequisite:

The students to whom this course will be offered must have the concept of (10+2) standard calculus, basic probability and differential equations.

Course Objectives:

The objective of this course is to disseminate the prospective engineers with advanced techniques for solving ordinary differential equations and basic techniques for solving partial differential equations. It also aims to equip the students with concepts and tools of calculus of complex variables, Fourier series and Fourier transform, and probability distribution as an intermediate to the advanced level of applications that they would find useful in their disciplines.

Course Outcome (COs):

On successful completion of the learning sessions of the course, the learner will be able to:

CODES	DESCRIPTIONS
CO1	Recall the underlying principle and properties of Fourier series, Fourier transform, probability distribution of a random variable, calculus of complex variable, partial differential equation and ordinary differential equation.
CO2	Exemplify the variables, functions, probability distribution and differential equations and find their distinctive measures using the underlying concept of Fourier series, Fourier transform, probability distribution of a random variable, calculus of complex variable, partial differential equation and ordinary differential equation.
CO3	Apply Cauchy's integral theorem and the residue theorem to find the value of complex integration, and compute the probability of real world uncertain phenomena by indentifying probability distribution that fits the phenomena.
CO4	Solve partial differential equation using method of separation of variables and ordinary differential equation using techniques of series solution and special function (Legendre's and Bessel's).
CO5	Find the Fourier series and Fourier transform of functions by organizing understandings of underlying principles and also evaluate the integral using Parseval's identity.

Course Content: **MODULE I:** ***Fourier series and Fourier Transform: (10 Lectures)*** **Fourier series:** Dirichlet's Conditions; Euler's Formula for Fourier Series; Fourier Series for functions of period 2π; Sum of Fourier series (examples); Theorem for the convergence of Fourier series (statement only); Fourier series of a function with its periodic extension; Half range Fourier series: Construction of half range Sine series and half range Cosine Series; Parseval's identity (statement only) and related problems. **Fourier Transform:** Fourier Transform, Fourier Cosine Transforms, Fourier Sine Transforms (problems only); Properties of Fourier Transform: Linearity, Shifting, Change of Scale, Modulation (problems only); Fourier Transform of Derivatives (problems only); Convolution Theorem (statement only), Inverse of Fourier Transform (problems only).	**10L**
MODULE II: ***Probability Distributions: (8 Lectures)*** Random Variable: Discrete and Continuous (definition & examples); Probability Distribution (definition & examples); Probability Mass Function, Probability Density Functionand Distribution Function for a single random variable only (definition, properties & related problems); Expectation, Varianceand Standard Deviation for a single random variable only (definition, properties & related problems); Binomial Distribution, Poisson Distribution, Binomial Approximation to Poisson Distribution and Normal Distribution (problems only), Mean, Variance and Standard Deviation of Binomial, Poisson and Normal Distribution (problems only).	8L
MODULE III: ***Calculus of Complex Variable: (10 Lectures)*** Functions of a Complex Variable (definition and examples); Concept of Limit, Continuity and Differentiability (problems only); Analytic Functions (definition and examples); Cauchy-Riemann Equations (statement only& related problems); Sufficient condition for a function to be analytic (statement only & related problems). Concept of Simple Curve, Closed Curve, Smooth Curve & Contour; Some elementary properties of complex integrals (problems only); Cauchy's Theorem (statement only & related problems); Cauchy's Integral Formula(statement only & related problems); Cauchy's Integral Formula for the derivative of an analytic function(statement only & related problems); Cauchy's Integral Formula for the successive derivatives of an analytic function (statement only & related problems); Taylor's series and Laurent's series (problems only). Zero of an Analytic Function and its order (definition & related problems); Singularities of an Analytic Function: Isolated Singularity and Non-isolated Singularity (definition & related problems); Essential Singularities, Poles (Simple Pole and Pole of Order □) and Removable Singularities (definition & related problems); Determination of singularities and their nature (problems only); Residue (definition & examples); Determination of the residue of a given function; Cauchy's Residue theorem (statement only & related problems).	**10L**

MODULE IV: ***Partial Differential Equation (PDE) and Series Solution of Ordinary Differential Equation (ODE): (8 Lectures)*** **Solution of PDE:** Method of Separation of Variables. **Solution of Initial Value & Boundary Value Problem:** One Dimensional Wave Equation, One Dimensional Heat Equation, Two Dimensional Laplace Equation. **Series solution of ODE:** General method to solve $\square_0\square'' + \square_1\square' + \square_2\square = 0$ and related problems to Power series method**,** Bessel's Function, Legendre Polynomial.	**8L**

Project Domains:

1. Study of physical processes through PDE and ODE.
2. Application of calculus of complex variable in real world engineering problems.
3. Study of uncertainty in real world phenomena using probability distribution.
4. Application of Fourier series and Fourier transform in engineering problems.

Text Books:

1. Herman, R. L. *An Introduction to Fourier Analysis*, Chapman and Hall/CRC, 2016.
2. Grafakos, L. *Classical Fourier Analysis*, Springer, India, Private Ltd.
3. Das, N.G. *Probability and Statistics*; The McGraw Hill Companies.
4. Gupta, S. C. and Kapoor, V. K. *Fundamentals of Mathematical Statistics*, Sultan Chand & Sons.
5. Mathews, J. H. and Howell, R. W. *Complex Analysis for Mathematics & Engineering,* Jones & Bartlett Pub, 2006.
6. Chowdhury, B. *Elements of Complex Analysis*, New Age International, 1993.
7. Raisinghania, M .D. *Advanced Ordinary & Partial Differential. Equation*; S. Chand Publication.
8. Ross, S. L. *Differential Equations*, John Willey & Sons.
9. Grewal, B. S. *Higher Engineering Mathematics*, Khanna Pub.
10. Kreyszig, E. *Advanced Engineering Mathematics*, John Wiley & Sons, 2006.

Reference Books:

1. Gray, R. M. and Goodman, J. *Fourier Transforms: An Introduction for Engineers*, Springer, US, 1995.
2. Lipschutz & Lipson, *Schaum's Outline in Probability (2ndEd)*, McGraw Hill Education.
3. Spiegel, M. R. *Theory and Problems of Probability and Statistics (Schaum's Outline Series)*, McGraw Hill Book Co.
4. Goon, A.M., Gupta M .K. and Dasgupta, B. *Fundamental of Statistics*, The World Press Pvt. Ltd.
5. Soong, T. T. *Fundamentals of Probability and Statistics for Engineers*, John Wiley & Sons Inc, 2004.
6. Delampady, M. *Probability & Statistics*, Universities Press.
7. Spiegel, M. R. *Theory and Problems of Complex Variables (Schaum's Outline Series)*, McGraw Hill Book Co.
8. Sneddon, I. N. *Elements of Partial Differential Equations,* McGraw Hill Book Co.
9. Boyce, W. E. and DiPrima, R. C. *Elementary Differential Equations and Boundary Value Problems*, Wiley India, 2009.
10. Rao, B. *Differential Equations with Applications & Programs*, Universities Press.
11. Murray, D. *Introductory Courses in Differential Equations*, Universities Press.

CO-PO Mapping:

CO	PO 1	PO2	PO 3	PO4	PO 5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	1	1	-	-	-	-	-	-	-	-	1	**2**	**2**	**-**
CO2	3	2	1	-	-	-	-	-	-	-	-	1	**2**	**2**	**-**
CO3	3	2	2	-	-	-	-	-	-	-	-	1	**2**	**2**	**-**
CO4	3	2	2	-	-	-	-	-	-	-	-	1	**2**	**2**	**-**
CO5	3	3	2	3	-	-	-	-	-	-	-	1	**2**	**2**	**-**

COURSE NAME: STRUCTURAL ANALYSIS
COURSE CODE: CE 401
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS : 3

Pre requisites: Students must have knowledge in engineering mechanics, solving of free body diagrams and application of different structural aspects of materials in any type of structures like support reactions, bending moments, stresses, torsion etc.

Course Objective: To provide knowledge about determinate and indeterminate structures and how to calculate degree of indeterminacy of a structure, applications and analysis of determinate and indeterminate structures in various aspects.

Course Outcome:
CO1. Learn about determinate and indeterminate structures and determination of degree of static and kinematic indeterminacy for any type of structures.
CO2. Analysis of any structure by strain energy method.
CO3. Analysis of determinate and indeterminate structures by different methods.

Course contents:

Module-1: [3L] Determination of stability of any type of structure, Determinate and Indeterminate structures, Degree of indeterminacy for different types of structures: Beams, Frames,Trusses.	**3L**
Module-2: [6L] Analysis of determinate structures: Portal frames, arches.	**6L**
Module-3: [6L] ***Strain energy:***Due to axial load, bending and shear, Torsion; Castigliano's theorems, theorem of minimum potential energy, Muller Breslau Principle, principle of virtual work, Maxwell's theorem of reciprocal deflection, Betti's law	**6L**
Module-4: [6L] ***Deflection of determinate structures:***Moment area and Conjugate beam method, Energy methods,Unit load method for beams, Deflection of trusses and simple portal frames	**6L**
Module-5: [6L] ***Influence line diagrams***: Statically determinate beams and trusses under series of concentrated and uniformly distributed rolling loads, criteria for maximum and absolute maximum moments and shears.	**6L**
Module-6: [3L] ***Analysis of statically Indeterminate beams:*** Theorem of three moments. Energy Method, Force Method, Analysis of two hinged arch.	**3L**
MODULE –7: [6L] ***Analysis of statically indeterminate structures:*** Moment distribution method, Slope Deflection Method, Approximate method of analysis of structures-portal and cantilever	**6L**

method.

Text / Reference Books:

Sl no	Name	Author	Publishers
1	Engineering Mechanics of Solids	By E. P. Popov	Pearson Education
2	Basic structural Analysis	C.S. Reddy	TMH
3	Statically indeterminate structures	C. K. Wang	McGraw-Hill
4	StructuralAnalysis (Vol I& Vol II)	S S Bhavikatti	Vikas Publishing House Pvt. Ltd
5	Structural Analysis	Ramammurtham	
6	Structures	Schodek & M. Bechhold	Pearson Education

CO-PO mapping

CO	PO1	PO2	PO3	PO 4	PO5	PO 6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	3	3	2	-	1	2	1	2	3	3	2	**2**	**2**	**-**
CO2	3	3	3	3	1	2	1	1	2	1	2	2	**2**	**2**	**-**
CO3	3	3	3	2	2	2	1	2	3	3	2	2	**2**	**2**	**-**

COURSE NAME: CONCRETE TECHNOLOGY
COURSE CODE: CE 402
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS : 3

Pre requisites: Student should have knowledge about the building materials and construction.

Course Objective: The objective of this course is to produce knowledge to the student ingredients of concrete, specific

Course Outcome:

CO1	Identify the functional role of ingredients of concrete
CO2	Student should be able to gather knowledge to mix design philosophy
CO3	Student will be able to differentiate various types of cement used for various specific purpose
CO4	Student will be able to apply fundamental knowledge in the freshand hardened properties of concrete
CO5	Student will be able to design ordinary and control concretes, replacement of cement and their specific applications

Course contents:

Module-1: [6L] ***Introduction:-*** Concrete as a Structural Material, Good Concrete Manufacture of Portland Cement, Chemical Composition of Cement, Hydration of Cement, Heat ofHydration [4L]	**6L**
Module-2: [9L] ***Types of Cement***:– ordinary, Rapid hardening, low-heat, sulphate resisting, Portland slag, Portland pozzolana, super sulphated cement, white cement .Tests on cement and cement paste – fineness, consistency, setting time, soundness, strength.[3L] ***Water &Aggregates***– Classification, Mechanical and Physical Properties, Deletarious Substances, Alkali-Aggregate Reaction, Sieve Analysis, Grading Curves, Fineness modules, Grading Requirements. Testing of Aggregates – Flakiness, Elongation Tests, Aggregate Crushing Value, Ten Percent Fines Value, Impactm Value, Abrasian Value.Quality of Water – Mixing Water, Curing Water, Harmful Contents.[3L]	**9L**

Module-3: [11L] ***Properties of Fresh Concrete***– Workability, Factors Affecting Workability, Slump Test Compacting Factor Test, Flow Table Test, Segregation, Bleeding, Setting Time, Mixing and Vibration of Concrete, Mixers and Vibrators, curing, Methods, Maturity. [3L] ***Strength & durability of Concrete***– Water/Cement ratio, Gel/Space ratio, Strength in Tension, Compression, Effect of Age on Strength, Relation between Compressive and Tensile Strength, Fatigue Strength, Stress Strain Relation and Modules of Elasticity, Poisson's Ratio, Shrinkage and Creep, Compression Test on Cubes, Cylinders, Non-Destructive Tests. [3L]	**11L**
Module-4: [10L] ***Permeability of concrete.***Chloride & Sulphate attack on concrete, carbonation of concrete [2L] ***Admixtures*** – different types (chemical and mineral), effects, uses, Retarders and Super plasticizers. Mix Design by I.S. 10262(2009) Code method. [4L] ***Special concrete***: Light-weight, Polymer and Fiber-reinforced concrete. [2L]	**10L**

Text / Reference Books:

SL NO	NAME	Author	publisher
1	Concrete Technology	Neville	Pearson Education
2	Concrete Technology	M.S. Shetty	S.Chand
3	Concrete Technology	A. R. Santakumar	OXFORD University Press
4	Concrete Technology	M.L. Gambhir	Tata McGraw Hill
5	Text book of Concrete Technology	P.D. Kulkarni	Tata McGraw Hill

CO-PO mapping :

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	3	-	-	2	-	-	-	1	3	**2**	**2**	**-**
CO2	3	3	3	2	3	1	2	-	-	1	1	2	**2**	**2**	**-**
CO3	3	1	2	1	3	-	-	1	-	1	-	1	**2**	**2**	**-**
CO4	3	-	2	-	3	2	2	-	-	-	-	2	**2**	**2**	**-**
CO5	3	3	-	2	2	2	3	-	1	1	-	2	**2**	**2**	**-**

COURSE NAME: SOIL MECHANICS
COURSE CODE: CE 403
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS : 3

Pre requisites: Student should have knowledge about the basic of strength of materials, physics and chemistry

Course Objective: To provide students with basic understanding of physical and mechanical properties of soil, together with knowledge of basic engineering procedures to identify factors controlling soil behavior and methods to determine soil properties. Students will acquire basic knowledge in engineering design of geotechnical systems

Course Outcome:

CO1	Identify the fundamental differences in engineering behavior between cohesive and cohesion less soils
CO2	Compute the groundwater seepage and distribution of groundwater pressure.
CO3	Calculate the applied stress beneath the ground surface.
CO4	Demonstrate that you know the fundamental difference in the strength and deformation characteristics of cohesive and cohesion less soils.
CO5	Analyze field and laboratory data to determine the strength and deformation properties of cohesive and cohesion less soils.
CO6	Determine settlements due to consolidation of soil

Course contents: SOIL MECHANICS

Module-I: [4L+1T] ***Origin & formation of Soil:-***Types, Typical Indian Soil, Fundamental of Soil Structure, Clay Mineralogy. [2L] ***Soil as a Three Phase System :-***Weight- Volume Relationship, Measurement of Physical Properties of Soil: Insitu Density, Moisture Content, Specific Gravity, Relative Density.[2L+1T]	**5L**
Module-II: [6L+1T] ***Particle Size Distribution :-***By Sieving, Sedimentation Analysis. [2L] ***Index Properties of Soil***:- Attarbergs Limits- Determination of Index Properties of Soil by Casagrandes Apparatus, Cone Penetrometer,Soil Indices.[2L] ***Soil Classification :-***As per Unified Classification System, As per IS Code Recommendation, AASHTO Classification, Field Identification of Soil, Consistency of Soil. [2L+1T]	**7L**
Module-III: [6L+3T] ***Soil Moisture :-***Darcy,s Law, Capillarity in Soil, Permeability, Determination of Coefficient of Permeability of Soil in Laboratory, Permeability for Stratified Deposits. [2L+1T] ***Effective Stress Principles***:- Definition of Effective Stress, Estimation of Effective Pressure Due to different conditions [2L+1T]	**9L**

Two Dimensional Flow Through Soil :-Laplace's Equations, Flow nets, Flow Through Earthen Dam,estimation of Seepage, Uplift due to Seepage, Design of Fillers, Critical Hydraulic Gradient, Quick Sand condition[2L+1T]	
Module-IV: [4L+2T] ***Stress Distribution In Soil :-***Bousinesqs & Westergaads Assumption & Formula for Determination of stress due to Point Loads, Stress Beneath Line, Strip & Uniformly Loaded Circular - Pressure Bulbs, Newmarks charts- Use For Determination of Stress due to Arbitrarily Loaded Areas, Contact Stress distribution for various types of Loading & on Different Types of Soils. [2L+1T] **Compaction of Soil :-** Principles of Compaction, IS Light & Heavy Compaction Test, Field Compaction Equipments, Various methods of field Compaction Control. [2L+1T]	**6L**
Module-V: [6L+3T] ***Compressibility & Consolidation of Soil***: - Terzaghi's Theory of One Dimensional Consolidation, CompressibilityCharacteristics of Soils, Compression Index, Coefficient of Compressibility & Volume change, Coefficient of Consolidation, Degree & rate of Consolidation, Consolidemeter & Laboratory One Dimensional Consolidation Test as per latest IS Code, Determination of Consolidation Parameters, Secondary Consolidation. [4L+2T] **Shear Strength of Soil**:- Basic Concept of Shear Resistance & Shear Strength of Soil, Mohr- Columb's Theory, Laboratory Determination of Soil Shear Parameter-Direct Shear, Tri-axial Test, Unconfined Compression, Vane Shear Test, Sensitivity & thixotropy of clay. [2L+1T]	**9L**

Text / Reference Books:

Sl no	Name	Author	Publishers
1	Text book of Soil Mechanics & Foundation Engineering	V.N.S. Murthy	CBS Publisher's & Distributors
2	Principles of Foundation Engineering	B.M. Das	Thomson Book
3	Principles of Geotechnical Engineering	B. M. Das	Thomson Book Store
4	Basic & Applied Soil Mechanics	Gopal Ranjan & A.S.R.Rao	Willes EasternLtd
5	Soil Mechanics	Lambe & Whitman	WIE
6	Hand Book of Bureau of Indian Standard IS –1904, 6403, 8009, 2950, 2911 etc		

CO-PO mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	1	1	1	1	1	1	2	3	3	3
CO2	2	2	3	3	2	3	1	1	2	2	2	3	2	3	2
CO3	2	2	3	2	2	1	1	3	2	1	1	2	1	1	1
CO4	3	3	3	3	3	2	1	3	2	1	3	3	2	2	2
CO5	2	3	1	2	1	3	1	2	2	2	2	2	2	2	2
CO6	3	3	3	3	2	2	2	2	3	2	2	3	2	2	2

COURSE NAME: BUILDING MATERIAL AND CONSTRUCTION
COURSE CODE: CE404
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS : 3

Pre requisites: No Pre Requisite required (NPR)

Course Objective: The objective of this course is know the student about the basic building materials, properties and their applications., to know the smart building materials, external paints and their uses to understand different types of masonries and their applications

Course Outcome:

CO1	Students will summaries basic knowledge about various kind of materials used in construction work.
CO2	Students will differentiate about different types of building foundation i.e. shallow and deep foundation, their mechanisms and uses.
CO3	summaries knowledge about various structural members of a building like-walls, door, window, stair, flooring, roof etc.
CO4	Extend to apply their knowledge at the time of decision making for application of structural member including material used.

COURSE CONTENTS:

Module-1: [9L]

Bricks: Classification, Characteristics of good bricks, Ingredients of good brick earth, Harmful substance in brick Earth, Different forms of bricks, testing of bricks as per BIS. Defects of bricks. Fly ash bricks [2L+1T]

Aggregates: Classification, Characteristics, Deleterious substances, Soundness, Alkali – aggregates reaction, Fine aggregates, coarse aggregates, testing of aggregates [2L+1T]

Lime: Impurities in limestone, Classification, Slaking and hydration, Hardening, Testing, Storage, Handling, **Cement:** OPC: Composition, PPC, Slag cement, Hydration, setting time **Concrete**: Types, ingredients, W/C ratio, Workability, Different grades in cement concrete, Tests on cement concrete [2L+1T]

Module -2: [9L]

Mortars: Classification, Uses, Characteristics of good mortar, Ingredients. Cement mortar, Lime mortar, Lime cement mortar, special mortars [2L+1T]

Wood and Wood Products: Classification of Timber, Structure, Characteristics of good timber, Seasoning of timber, Defects in Timber, Diseases of timber, Decay of Timber, Preservation of

Timber Testing of Timber, Veneers , Plywood, Fibre Boards, Particle Boards, Chip Boards , Black Boards, Button Board and Laminated Boards, Applications of wood and wood products [2L+1T]

Paints, Enamels and Varnishes: Composition of oil paint, characteristic of an ideal paint, preparation of paint, covering power of paints, Painting: Plastered surfaces, painting wood, surfaces, painting metal Surfaces. Defects, Effect of weather, enamels, distemper, water wash and colour wash, Varnish, French Polish, Wax Polish. **Miscellaneous Materials**: Gypsum: Classification, Plaster of Paris, Heat and sound insulating materials, Geo-synthetics [2L+1T]

Module -3: [9L]

Foundations: Function of Foundations, Essential requirement of good foundation, Different types of shallow and deep Foundations. Uses of Spread foundation, pile and well foundation [2L+1T]

Brick masonry: Definitions, Rules for bonding, Type of bonds – stretcher bond, Header bond, English bond, Flemish Bond, Comparison of English Bond and Flemish Bond (one and one and half brick thick wall). Cavity wall [2L+1T]

Wall, Doors and Windows: Load bearing wall, Partition wall, Reinforced brick wall Common types of doors and windows of timber and metal [2L+1T]

Module -4 [9L]

Stairs: Technical Terms, Requirements of good stair, Dimension of steps, Classification, Geometric design of a dog legged stair case, Elevation and cross section of different type of stair cases. [2L+1T]

Flooring: Components of a floor, selection of flooring materials, Brick flooring, Cement concrete flooring, mosaic, marble, Terrazzo flooring, Tiled roofing [2L+1T]

Plastering and Pointing: Plastering with cement mortar, Defects in plastering, pointing, white washing, colour washing, Distempering, **Roofs:** Types, Pitched roofs and their sketches, Lean – to roof, coupled and collared roofs, King Post – Truss, Queen post truss and Simple steel Truss , Roof Covering materials: AC sheets GI sheet [2L+1T]

Text / Reference Books:

Sl no	Name	Author	Publisher
1	Building Materials	S.K. Duggal	
2	Building Materials	P.C. Varghese	PHI
3	Engineering Materials	S.C. Rangwala	
4	Concrete Technology	M. S. Shetty	
5	Concrete Technology[	A.M. Nevile & J.J. Brooks	Pearson Education
6	Building Construction	B.C. PUNMIA	

CO-PO mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	2	-	-	-	1	-	-	-	-	-	-	**2**	**2**	**-**
CO2	2	3	1	-	-	-	-	-	-	-	-	-	**2**	**2**	**-**
CO3	3	2	1	-	-	-	-	-	-	-	-	-	**2**	**2**	**-**
CO4	2	3	1	-	-	-	-	-	-	-	-	-	**2**	**2**	**-**

COURSE NAME: UNIVERSAL HUMAN VALUES 2: UNDERSTANDING HARMONY
COURSE CODE: CE403
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS : 3

Prerequisite: None

Course Outcomes: On successful completion of the learning sessions of the course, the learner will be able to:

CO1: Develop holistic perspective based on self-exploration about themselves (human being),family, society and nature/existence.
CO2: Cultivate the harmony in the human being, family, society and nature/existenc.
CO3: Strengthen self-reflection.
CO4: Build commitment and courage to act.

Course Content

Module 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education 8L

Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and ExperientialValidation- as the process for self-exploration. Continuous Happiness and Prosperity- A look at basic Human Aspirations. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario. Method to fulfil the above human aspirations: understanding and living in harmony at variouslevels. Practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.

Module 2: Understanding Harmony in the Human Being - Harmony in Myself! 6L

Understanding human being as a co-existence of the sentient 'I' and the material 'Body'. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer). Understanding the characteristics and activities of 'I' and harmony in 'I'. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail. Programs to ensureSanyam and Health. Practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Ensuring health vs dealing with disease discussion.

Module 3: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship 7L

Understanding values in human-human relationship; meaning of Justice (nine universal values in

relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship. Understanding the meaning of Trust; Difference between intention and competence. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family. Practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Elicit examples from students' lives.

Module 4: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence **8L**

Understanding the harmony in the Nature. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self- regulation in nature. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space. Holistic perception of harmony at all levels of existence. Practice sessions to discuss human being as cause of imbalance in nature (film "Home" canbe used), pollution, depletion of resources and role of echnology etc.

Module 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics **7L**

Natural acceptance of human values. Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order.

Competence in professional ethics:

a. Ability to utilize the professional competence for augmenting universal human order

b. Ability to identify the scope and characteristics of people- friendly and eco-friendly production systems,

c. Ability to identify and develop appropriate technologies and management patterns for above production systems.

Case studies of typical holistic technologies, management models and production systems. Strategy for transition from the present state to Universal Human Order:

a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers

b. At the level of society: as mutually enriching institutions and organizations.

Practice Exercises and Case Studies in Practice (tutorial) Sessions to discuss the conduct as an engineer or scientist etc.

Text Books:

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books,New Delhi, 2010

Reference Books

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj - PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	-	2	1	-	-	-	2	3	3	1	-	2
CO2	3	2	-	1	3	2	-	1	2	-	3	3	2	-	1
CO3	3	2	2	-	2	3	1	-	2	1	3	3	3	1	-
CO4	3	1	-	2	-	-	-	2	-	3	3	3	2	-	2

COURSE NAME: OBJECT ORIENTED PROGRAMMING USING JAVA LAB
COURSE CODE: M(CS) 491
CONTACT: 0:0:3
CREDITS: 1.5

Prerequisites:

1. Computer Fundamentals
2. Basic understanding of Computer Programming and related Programming Paradigms
3. Problem Solving Techniques with proper logic Implementation.

Course Objectives:

- It demonstrates that how can you change the implementation of an object without affecting any other code by increasing data security and protecting unwanted data access. (Encapsulation).
- It allows you to have many different functions, all with the same name, all doing the same job, but depending upon different data. (Polymorphism).
- It guides you to write generic code: which will work with a range of data, so you don't have to write basic stuff over, and over again. (Generics).
- It lets you write a set of functions, then expand them in different direction without changing or copying them in any way. (Inheritance)

Course Outcome(s):

CO1: Create the procedure of communication between Objects, classes & methods.
CO2: Understand the elementary facts of Object Orientation with various characteristics as well as several aspects of Java.
CO3: Analyze distinct features of different string handling functions with various I/O operations.
CO4: Discuss simple Code Reusability notion w.r.t. Inheritance, Package and Interface.
CO5: Apply Exception handling, Multithreading and Applet (Web program in java) programming concept in Java.

Course Contents:

Module 1:Java Basics:

1. Simple Java programming using operators, control statements & loops, array.
2. Programming on class, object, and method, access specifier.
3. Programming on constructor, method/constructor overloading.
4. Programming on this keyword, call by value & call by reference, static variables & methods, inner classes.

Module 2: Basic String handling & I/O:

1. Programming to show the use of String class methods - charAt(), compareTo(), equals(), equalsIgnoreCase(), indexOf(), length() , substring(), toCharArray(), toLowerCase(), toString(), toUpperCase(), trim(), valueOf() methods.
2. Programming to show the use of StringBuffer class methods - append(), capacity(), charAt(), delete(), deleteCharAt(),ensureCapacity(), getChars(), indexOf(), insert(), length(), setCharAt(), setLength(), substring(), toString() methods.
3. Programming on Command line arguments.
4. Programming using keyboard input by implementing BufferedReader& Scanner classes.

Module 3: Inheritance, Interface and Java Packages:

1. Programming on Simple Inheritance, super and final keywords, super() method.
2. Programming on method overriding, dynamic method dispatch,abstract classes & methods, multiple inheritance by using interface.
3. Programming on importing system package, creating user-defined package, importing user-defined package, using protected access specifier, subclassing an imported class of a package, using same names for classes of different packages, adding multiple public classes to a package.

Module 4: Exception handling, Multithreading and Applet Programming:

1. Programming on exception handling using try-catch block, implementing throw and throws keywords, using finally block, creating user-defined exception.
2. Programming on creating child threads i) by extending thread class ii) by implementing runnable interface, creating child threads by assigning thread priorities.
3. Programming on creating simple applet to display some message, creating applet two add 2 integers, creating applet to do GUI based programming.

Textbooks:

1. Herbert Schildt – "Java: The Complete Reference " – 9th Ed. – TMH
2. E. Balagurusamy – " Programming With Java: A Primer " – 3rd Ed. – TMH.

Reference Books:

1. R.K Das – " Core Java for Beginners " – VIKAS PUBLISHING.
Rambaugh, James Michael, Blaha – " Object Oriented Modelling and Design " – Prentice Hall, India

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	-	-	-	1	-	-	1	**2**	**2**	**-**
CO2	3	2	2	-	1	-	-	-	1	-	-	2	**2**	**2**	**-**
CO3	2	3	2	3	-	-	-	-	2	-	-	-	**2**	**2**	**-**
CO4	1	-	-	-	-	-	-	-	1	2	-	2	**2**	**2**	**-**
CO5	2	1	1	-	1	-	-	-	2	-	-	2	**2**	**2**	**-**

COURSE NAME: BUILDING PLANNING AND DRAWING
COURSE CODE: CE 491
CONTACT: 0:0:3
CREDITS : 1.50

Pre requisites: Student should have knowledge about building materials and construction and also mathematics

Course Objective: The objective of this course is to make student able to Learn to sketch and take field dimensions and to take data and transform it into graphic drawings and Auto Cad skills.

Course Outcome:

CO1	Prepare simple layout of buildings.
CO2	Produce working drawings for individual components like doors and windows etc.
CO3	Develop line diagram, building section, elevation, key plan and sectional elevation.
CO4	Illustrate hand drafting any parts of a building and implement the regulations for layout of plan.

LIST OF EXPERIMENT:

Foundations - Spread foundation for walls and columns; Footing for a RCC column, raft and pile foundations

Doors and Windows - Glazed and paneled doors of standard sizes; Glazed and paneled windows of standard sizes; special windows and ventilators

Stairs- Proportioning and design of a dog-legged, open well RCC stair case for an office / Residential building; Details of reinforcements for RCC stair cases; Plan and elevation of straight run, quarter turn, dog-legged and open well staircases.

Roofs - Types of sloping roof, lean-to roofs, RCC roof with details of reinforcements

Trusses - King post and Queen post trusses.

Functional Design of Buildings -To draw the line diagram, plan, elevation and section of the following: Residential Buildings (flat & pitched roofs), Office Buildings (flat roof), School.The designs must show positions of various components including lift well and their sizes. Introduction to drawing by using software package.

Text / Reference Books:

Sl No	Title	Author
1	Principles of Building Drawing	Shah & Kale
2	Text Book of Building Construction	Sharma & Kaul
3	Building Construction	B C Punmia
4	Civil engineering drawing	M.Chakrabory

CO-PO mapping

CO	PO1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PS O1	PS O2	PSO 3
CO1	3	2	-	1	2	-	-	-	1	-	-	1	**2**	**2**	**-**
CO2	3	2	-	1	2	-	-	-	1	-	-	1	**2**	**2**	**-**
CO3	3	2	-	1	2	-	-	-	1	-	-	1	**2**	**2**	**-**
CO4	3	2	-	1	2	-	-	-	1	-	-	1	**2**	**2**	**-**

COURSE NAME: CIVIL ENGINEERING LAB-1
COURSE CODE: CE 492
CONTACT: 0:0:3
CREDITS : 1.50

Pre requisites: Student should have the basic knowledge about concrete technology theory

Course Objective: The objective of this course is to understand the characteristics and behavior of civil engineering materials used in buildings and infrastructure. Students will learn standard principles and procedure to design prepare and/or test materials such as concrete mix design including field test methods for fresh concrete. Know how to select materials based on their properties and their proper use for a particular facility under prevailing loads and environmental conditions.

Course Outcome:

CO1	Identify the functional role of ingredients of concrete
CO2	Apply this knowledge to mix design philosophy to get different grade of concrete
CO3	Student should be able to test of different concrete property to specify quality of concrete
CO4	Student shall learn to work in a team to achieve the objective

LIST OF EXPERIMENT:

Tests on cement –specific gravity, fineness, soundness, normal consistency, setting time, compressive strength on cement mortar Cubes.
Tests on fine aggregate –specific gravity, bulking sieve analysis, fineness modulus, moisture content, bulk density, voids and Deleteriousmaterials.
Tests on coarse aggregate-specific gravity, sieve analysis, fineness modulus, bulk density and voids.
Tests on Fresh Concrete: Workability : Slump, Vee-Bee, Compaction factortests
Tests on Fresh Concrete: Workability : Slump, Vee-Bee, Compaction factortests
Hardened Concrete: Compressive strength on Cubes, Split tensile strength, Static modulus of elasticity, Flexure tests , Non destructive testing (Rebound hammer & Ultrasonic pulse velocity)
Mix Design-As per IS 10262(2009) method

Text / Reference Books:

SL NO	NAME	Author	publisher
1	Concrete Technology	Neville	Pearson Education
2	Concrete Technology	M.S. Shetty	S.Chand
3	Concrete Technology	. R. Santakumar	OXFORD University Press
4	Concrete Technology	M.L. Gambhir	Tata McGraw Hill
5	Text book of Concrete Technology	P.D. Kulkarni	Tata McGraw Hill

CO-PO mapping:

CO	PO1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PS O1	PS O2	PSO 3
CO1	3	2	2	2	2	-	-	-	1	1	-	1	**2**	**2**	**-**
CO2	3	2	2	2	2	1	1	1	1	-	-	1	**2**	**2**	**-**
CO3	3	2	2	2	2	1	-	-	1	-	-	1	**2**	**2**	**-**
CO4	1	1	1	1	1	-	1	1	3	2	2	1	**2**	**2**	**-**

COURSE NAME: SOIL MECHANICS LAB – I
COURSE CODE: CE 493
CONTACT: 0:0:3
CREDITS : 1.50

Pre requisites: Student should have the basic knowledge about Basic Soil Mechanics theory

Course Objective: Provide civil engineering students with the basic knowledge to carry out field investigations and to indentify soils in geotechnical engineering practice and educate civil engineering students in performing and interpretation laboratory tests for evaluating soil property.

Course Outcome:
CO1: Identify soils with reference to their characteristics
CO2: Describe the behavior and effect of water in soils
CO3: Examine modes of soil behavior
CO4: Calculate and plot soil strength parameters
CO5: Interpret different methods of improving soil stability

LIST OF EXPERIMENT:

1. Field identification of different types of soil as per Indian standards [collection of field samples and identifications without laboratory testing], determination of natural moisture content.
2. Determination of specific gravity of i) Cohesion less ii) cohesivesoil
3. Determination of In situ density by core cutter method & sand replacementmethod.
4. Grain size distribution of cohessionless soil by sieving & fine-grained soil by hydrometer analysis.
5. Determination of Atterberg's limits (liquid limit, plastic limit & shrinkagelimit).
6. Determination of co- efficient of permeability by constant head permeameter (coarse grained soil) & variable head permeameter (fine grainedsoil).
7. Determination of compaction characteristics of soil.

Reference

1. Soil Testing by T.W. Lamb (John willey)
2. SP-36 (Part-I & Part-II)
3. Measurement of Engineering properties of soil by E. Saibaba Reddy & K. Rama sastri.(New age International publication.

CO-PO mapping:

CO	PO 1	PO2	PO 3	PO4	PO 5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	1	2	3	3	2	1	-	1	3	2	2	3	2	3
CO2	3	3	2	2	3	2	1	1	-	2	3	1	3	3	3
CO3	3	2	1	2	1	3	1	2	-	2	1	2	2	2	3
CO4	2	3	2	3	1	1	2	1	2	1	2	3	2	2	2
CO5	2	3	3	2	2	1	1	1	2	1	2	2	2	2	2

COURSE NAME: QUANTITY SURVEYING, SPECIFICATIONS AND VALUATION
COURSE CODE: CE 494
CONTACT: 0:0:3
CREDITS : 1.5

Pre requisites: Student should have knowledge about building construction and material details.

Course Objective: The objective of this course is to give the students basics knowledge of estimating and valuation of civil engineering works. After completing this course the students will also be able to analyze the rates and estimate the various construction works

Course Outcome:

CO1: Student will be able to prepare specification for using materials of construction and its items ofworks.
CO2: Student will be able to illustrate a detailed estimation of material consumption and abstracts for entire construction projects
CO3: Student will learn how to analyze the rates for different items of work including labor and material.
CO4: Interpret fundamental concepts of valuation
CO5: Students will be able to identify various legal issues related to construction.

LIST OF EXPERIMENT:

Unit I: Different types of estimates, Concept of items of work, unit of measurement, unit rate of payment. Quantity estimate of a single storied building. Bar bending schedule. Details of measurement and calculation of quantities with cost, bill of quantities, abstract of quantities. Quantity estimate of Road, Underground reservoir, Surface drain, Septictank

Unit II: Analysis and schedule of rates for Earthwork, brick flat soling, DPC, PCC and RCC, brick work, plastering, flooring andFinishing.

Unit III: Specification of materials: Brick, cement, fine and coarse aggregates; Specification of works: PCC, RCC, First class brickwork, cement plastering and pointing, white washing, colour washing, distempering, lime punning, painting andvarnishing

Unit IV: Basic concept of Values and cost, gross income, outgoing, net income, scrap value, salvage value, market value, Book Value, Sinking fund, capitalized value, Year of purchase, depreciation, obsolescence, deferred income, freehold and leasehold property, Mortgage, rent fixation, valuationtable.

Text / Reference Books:

B. N. Datta, Costing, Estimation and Valuation, UBSPublication
S. C. Rangwala, Estimating & Costing (Civil Engg.), CharotarPublication
G. S. Birdie, A text book of Estimating & Costing, Dhanpat Rai &Sons
S. C. Rangwala, Valuation of Real properties, CharotarPublication
Estimating, Costing, Specification & Valuation In Civil Engineering byM.chakrabory

CO-PO mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	2	2	1	2	1	-	-	-	2	2	**2**	**2**	**-**
CO2	3	3	3	2	-	-	-	-	-	-	1	2	**2**	**2**	**-**
CO3	3	3	3	1	-	-	-	-	-	-	2	2	**2**	**2**	**-**
CO4	3	3	3	2	-	-	-	-	-	-	2	2	**2**	**2**	**-**
CO5	3	3	3	2	1	2	-	-	2	2	2	2	**2**	**2**	**-**

COURSE NAME: ENVIRONMENTAL SCIENCE
COURSE CODE: MC401
CONTACT: 0:0:3

Pre requisites: NIL

Course Objective:

- Be able to understand the natural environment and its relationships with human activities.
- Be able to apply the fundamental knowledge of science and engineering to assess environmental and health risk.
- Be able to understand environmental laws and regulations to develop guidelines and procedures for health and safety issues.
- Be able to solve scientific problem-solving related to air, water, noise & land pollution.

Course Outcome:

CO1-To understand the natural environment and its relationships with human activities.
CO2-To apply the fundamental knowledge of science and engineering to assess environmental and health risk.
CO3-To develop guidelines and procedures for health and safety issues obeying the environmental laws and regulations.
CO4-Acquire skills for scientific problem-solving related to air, water, noise & land pollution.

1.General

11 L

1.1 Natural Resources: Forest Resource, water resource, mineral resource, energy resources: alternative source of energy

1.2 Population Growth: Exponential Growth, logistic growth, Maximum sustainable yield, demography

1.3 Disaster Management: Types of disasters (Natural & Man-made), Floods, Earthquake, Tsunamis, Cyclones, landslides (cause, effect & control)

1.4 Ecology & Ecosystem: Elements of ecology, definition of ecosystem- components types and function, Food chain & Food web,

Structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems

1.5 Environmental Management: Environmental impact assessment, Environmental laws and protection act of India(The Environment protection Act, Air pollution Act, Water Act, Wildlife Protection Act) ,

Hazardous waste(management and Handling) Rules.

2. Air pollution and control **10L**

2.1 Sources of Pollutants: point sources, nonpoint sources and manmade sources primary & secondary pollutant

2.2 Types of air pollutants: primary & secondary pollutant ; Suspended particulate matter, oxides of carbon, oxides of nitrogen, oxides of sulphur, particulate, PAN, Smog (Photochemical smog and London smog),

2.3 Effects on human health & climate: Greenhouse effect, Global Warming, Acid rain, Ozone Layer Depletion

2.4 Air pollution and meteorology: Ambient Lapse Rate, Adiabatic Lapse Rate, Atmospheric stability & Temperature inversion

2.5 control of air pollution (ESP, cyclone separator, bag house, catalytic converter, scrubber (ventury),

3. Water Pollution **9L**

3.1 Classification of water (Ground & surface water)

3.2 Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, heavy metals, pesticides, volatile organic compounds.

3.3 Surface water quality parameters: pH, DO, 5 day BOD test, BOD reaction rate constants, COD. Numerical related to BOD

Lake: Eutrophication [Definition, source and effect].

3.4 Ground water: Aquifers, hydraulic gradient, ground water flow (Definition only),ground water pollution (Arsenic & Fluoride; sources, effects, control)

3.5 Quality of Boiler fed water: DO, hardness, alkalinity, TDS and Chloride

3.7 Layout of waste water treatment plant (scheme only).

4. Land Pollution **3L**

4.1 Types of Solid Waste: Municipal, industrial, commercial, agricultural, domestic, hazardous solid wastes (bio-medical), E-waste

4.2 Solid waste disposal method: Open dumping, Land filling, incineration, composting, recycling (Advantages and disadvantages).

4.3 Waste management: waste classification, waste segregation, treatment & disposal

5. Noise Pollution **3L**

5.1 Definition of noise, effect of noise pollution on human health,

5.2 Average Noise level of some common noise sources

5.3 Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent noise level, L_{10} (18 hr Index) .

5.4 Noise pollution control.

References/Books

1. A Textbook of Environmental Studies, Shashi Chawla. Tata McGraw Hill Education Private Limited
2. Environmental Studies, Dr. J P Sharma, University Science Press
3. Environmental Engineering, J K Das Mohapatra, Vikas Publication

CO-PO mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	-	-	2	3	3	-	-	1	2	**2**	**2**	**-**
CO2	3	3	3	1	1	2	3	3	-	-	1	2	**2**	**2**	**-**
CO3	3	3	3	2	1	2	3	3	-	-	1	2	**2**	**2**	**-**
CO4	1	1	1	1	2	2	3	3	-	-	1	2	**2**	**2**	**-**

3rd Year 1st Semester

Sl. No.	Category	Course Code	Course Title	Hours per week				Credits
				L	**T**	**P**	**Total**	
A. THEORY								
1	Humanities and Social Sciences including Management courses	HSMC 504	Economics for Engineers	2	0	0	2	2
2	PC	CE501	Structural Design-I	3	0	0	3	3
3	PC	CE502	Foundation Engineering	3	0	0	3	3
4	PC	CE503	Transportation Engineering-I	3	0	0	3	3
5	PE	CE504	A. Hydraulics B. Water Supply and Plumbing C. Waste Water and Treatment	3	0	0	3	3
B. PRACTICAL								
7	PC	CE 591	Soil Mechanics Lab-II	0	0	3	3	1.5
8	PC	CE 592	Civil Engineering Lab-II	0	0	3	3	1.5
9	PC	CE 593	Transportation and Highway Engineering Lab	0	0	3	3	1.5
10	PE	CE594	A. Hyrdaulics Lab / B. Water Supply and Plumbing Lab/ C. Waste Water lab	0	0	3	3	1.5
11	PROJECT	PR 591	Minor Project I	0	0	3	3	1
12	PROJECT	PR 592	Skill Development V: Soft Skill & Aptitude-II	1	0	0	1	0.5
C. MANDATORY ACTIVITIES / COURSES								
14	MC	MC 501	Intellectual Property Right	0	0	3	3	3 Units
	TOTAL CREDIT WITHOUT MOOCS COURSES							21.5
D. MOOCS COURSES**								
15	MOOCS COURSES	HM501	MOOCS COURSE-III	3	1	0	4	4
TOTAL CREDIT WITH MOOCS COURSES								**25.5**

**** MOOCS COURSES for HONOURS/MINOR Degree are Program specific and to be taken from MOOCS BASKET**

COURSE NAME: ECONOMICS FOR ENGINEERS
COURSE CODE: HSMC 504
CONTACT: 2:0:0
TOTAL CONTACT HOURS: 24 HRS
CREDITS : 2

Pre requisites: NIL

Course Objective:

- To develop decision making skills using basic economic Principles
- To educate the students in evaluating various Business Projects

Course Outcome:

CO1 : To learn the identification of various uses for scares resources.
CO2 : To understand key economic concepts and implement them in real life problems.
CO3 : To design sustainable and effective economic models in real life projects.
CO4 : To apply critical thinking skills in analysing financial data and their impacts.

Course contents:

Module – 1: Introduction 1L Economics- Nature, Scope, Uses, Micro Economics and Macro Economics.	**1L**
Module – 2 Theory of Demand and Supply 3L Concept of demand, Determinants of demand, Individual and Market Demand, Law of demand and its Exception; Concept of Supply, Shift in Demand and Supply Curve, Movement along the demand and supply curve, Determinants of equilibrium price and quantity, Elasticity of Demand and Supply.	**3L**
Module – 3 Theory of Production and Costs 7L Concept of Production function, types of Production function, Laws of return to scale and variable Proportion, Basic understanding of different markets, Determination of equilibrium price under perfect competition & monopoly in short run and long run; Price Discrimination.	**7L**
Module-4 Macroeconomic Aggregates and Concepts 3L Concepts of National Income, GDP, GNP, Concept of Business Cycle.	**3L**
Module -5 Inflation 2L Concept, Causes and Remedies of Inflation and Unemployment, basic concept of Philips Curve	**2l**
Module-6 –Theory of Investment 3L Basic concept of Investment, Business Fixed Investment, Accelerator Theory, Tobin's q	**3L**
Module -7 Accounting 3L Basic concept of Journal, Preparation of Income Statement and Balance Sheet	**3L**
Module – 8 Cost Volume Profit Analysis 2L Contribution, P/V Ratio, Break-Even Point, Margin of Safety, Short term decision making: Make or Buy, Shut-down point, Export Pricing, Opportunity and Sunk cost.	**2L**

Text / Reference Books:

1. Economics, by Lipsey and Chrystal, Oxford University Press
2. Modern Accountancy, vol.-I-, by Hanif &Mukherjee, TataMgrowHill

References:

1. Modern Economic Theory, by K.K. Dewett, S.Chand
2. Principles of Economics, by H.L. Ahuja, S. Chand
3. Engineering Economics, by R.PaneerSeelvan, PHI
4. Economics for Engineers, by Dr. Shantanu Chakraborty &Dr. Nilanjana singharoy, Law Point Pub
5. Macro Economics, by Mankiw, Macmillan Learning

CO-PO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	-	-	2	3	3	-	2	3	2	2	2	2	2	-
CO2	2	2	3	2	3	-	-	-	-	-	3	2	2	2	2	-
CO3	2	-	3	2	-	3	-	-	2	-	-	-	2	2	2	-
CO4	-	2	2	3	2	3	-		-	-	3	2	-	2	2	-

COURSE NAME: STRUCTURAL DESIGN – I
COURSE CODE: CE 501
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS : 3

Pre requisites: Student should have knowledge about how to solve analysis of structural problem.

Course Objective:

1. Student will be able to perform analysis and design of reinforced concrete members and connections and be able to identify and interpret the appropriate relevant industry design codes.
2. To become familiar with professional and contemporary issues in the design and construction of reinforced concrete members.

Course Outcome:

CO1 : Exhibit the knowledge of concrete design philosophies, by working and limit state methodology
CO2 : Design the structural details of beam and slab
CO3 : Design the structural details of column.
CO4 : : Design the structural details of foundation
CO5 : Interpret and use the I.S Code specifications

Course contents:

Module-I: [1L+1T] Introduction: Principles of design of reinforced concrete members - Working stress and Limit State method of design.	**2L**
Module-II: [2L+2T] 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.	**4L**
Module-III: [2L+2T] 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).	**4L**
Module-IV: [2L+2T] Analysis, design and detailing of singly reinforced rectangular , "T"," L" and doubly reinforced beam sections by limit state method.	**4L**
Module-V: [2L+2T] Design and detailing of one-way and two-way slab panels as per IS code provisions	**4L**
Module-VI: [2L+2T] Design and detailing of continuous beams and slabs as per IS code provisions	**4L**
Module-VII: [2L+2T] Staircases: Types; Design and detailing of reinforced concrete doglegged staircase	**4L**
Module-VIII: [2L+2T] 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**

Module-IX: [3L+3T] Shallow foundations: Types; Design and detailing of reinforced concrete isolated square and Rectangular footing for columns as per IS code provisions by limit state method.	**6L**
Limit state method should be followed for serial number 4 to 9 as above as per IS 456 - 2000	

Text / Reference Books:

Name	Author	Publishers
IS: 456- 2000 "Indian Standard for Plain and reinforced concrete – code of practice	Bureau of Indian Standard	
SP:16 Design Aid to IS 456		
Reinforced Concrete Design by	Pillai and Menon	TMH
Reinforced concrete Limit state design	Ashok K. Jain,Arun kv jain,B.C. Punmia	Laxmi publication
Reinforced concrete	S.N.Sinha	TMH
Fundamentals of reinforced concrete	N.C.Sinha and S.K. Roy	S.Chand &Co
Limit State Design of Reinforced Concrete	P. C. Varghese	PHI
Reinforced Concrete	S. K. Mallick and A. P. Gupta	Oxford IBH
Reinforced cement Concrete Design	Neelam Sharma	S.K hataria & sons

CO-PO mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	3	3	3	2	1	1	2	1	3	**1**	**1**	**3**
CO2	2	2	2	2	1	3	2	2	2	2	2	2	**2**	**2**	**2**
CO3	2	2	1	2	3	2	1	3	2	2	2	3	**2**	**2**	**3**
CO4	2	1	2	2	2	2	3	2	2	2	1	2	**2**	**3**	**2**
CO5	2	2	2	3	2	2	2	1	1	2	2	2	**2**	**2**	**3**

COURSE NAME: FOUNDATION ENGINEERING
COURSE CODE: CE 502
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS : 3

Pre requisites: Student should have knowledge about basic of Soil Mechanics

Course Objective:

Application of soil mechanics and other related techniques to design of foundation. Methods and site and soil exploration; bearing capacity and settlements; shallow and deep foundation; bracing and retaining structures. Case studies.

Course Outcome:

CO1 : Describe bearing capacity of soil and settlement analysis of soil.
CO2 : Define earth pressure theories
CO3 : Analysis of slope stability
CO4 : Classify piles & their loading capacity for deep foundation.
CO5 : Demonstrate the fundamental Knowledge of Site investigation and soil exploration

Course contents:

Module-1: **Earth Pressure Theories: -**Plastic equilibrium of soil, Earth pressure at rest, Active & passive Earth pressure, Rankin's & Coulombs earth pressure theories, wedge method of analysis, estimation of earth pressure by graphical construction (Culmann method).	**4L**
Module-2: **Retaining Wall & sheet pile structures:**Proportions of retaining walls, stability checks, cantilever and anchored sheet piles, free earth and fixed earth method of analysis of anchored bulk heads, coffer dam structures types.	**8L**
Module-3: **Stability of slopes:**Analysis of finite and infinite slopes, Swedish And friction circle method, Taylor's stability number, Bishop's method of stabilityanalysis.	**4L**
Module-4: **Site Investigation & Soil Exploration:**Planning of sub-surface explanation, methods, sampling, samples, Insitu tests: SPT, SCPT, DCPT, field vane shear, Plate load test.	**4L**
Module-5: **Shallow foundations :**Safe bearing capacity, Terzaghi's bearing capacity theory, effect of depth of embedment, water table, eccentricity of load, foundation shape on bearing capacity, Bearing capacity as per 1S 6403	**4L**
Module-6: **Settlement analysis of shallow foundation:**Immediate and consolidation settlement, correction for rigidity and dimensional effects, settlement in various	**4L**

types of soil, IS-1904 and 8009 recommendations, Allowable bearingcapacity	
Module-7: **Deep foundations:**Pile: Types, load transfer mechanism Determination of load carrying capacities of piles by static and dynamic formulae, Recommendations of IS 2911, Pile group: Group efficiency, Negative skin friction, pile load test.	**8L**

Text / Reference Books:

Name	Author	Publishers
Principles of Geotechnical Engineering	B. M. Das	Thomson Book Store
Text book of Soil Mechanics & Foundation Engineering	V.N.S. Murthy	CBS Publisher's & Distributors
Geotechnical Engineering – Principles and Practice	Coduto	Pearson Education
Soil Mechanics	Lambe & Whitman	WIE
Basic & Applied Soil Mechanics	Gopal Ranjan & A.S.R.Rao	Willes EasternLtd
SP 36 (Part I) Numerical Problems – Geotechnical Engineering	Rao & Venkatramaiah	University Press

CO-PO mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	1	1	1	2	3	1	2	3	3	2	3
CO2	2	2	2	3	2	2	1	2	3	1	2	3	3	2	3
CO3	2	2	1	2	1	1	1	1	2	1	1	2	2	2	3
CO4	2	1	1	2	3	2	1	1	2	1	2	2	2	2	2
CO5	3	2	3	2	2	2	2	2	3	2	3	3	3	3	3

COURSE NAME: TRANSPORTATION ENGINEERING-I **COURSE CODE: CE 503** **CONTACT: 3:0:0** **TOTAL CONTACT HOURS: 36 HRS** **CREDITS : 3**	
Pre requisites: Knowledge on IRC codes, Loading pattern base on IRC, Traffic features etc.	
Course Objective: Introduction of IRC loading Introduction of Traffic Engineering. Utility of study of traffic management. Basic concept of Railway track, railway governing body and engineering fundamentals.	
Course Outcome: **CO1** : Understanding of traffic loading pattern **CO2** : Understanding of traffic engineering and traffic management **CO3** : Basic concept of railway engineering **CO4**:Understanding of Loading Pattern of Bridge **CO5**:Knowledge about IRC Guidelines	
Course contents:	
Module-I: **INTRODUCTION OF DIFFERENT TYPES OF LOADING FOR BRIDGE DESIGN BASED ON IRC GUIDELINES:** Definition and Basic Forms, Component of bridge, classification of bridge, short history of bridge development. I.R.C Loads. Analysis of IRC Loads, Impact factors, other loads to be considered, Importance of Hydraulic factors in Bridge Design.	**6L**
Module- II: **TRAFFIC ENGINEERING:** Traffic Engineering : Road user and vehicle characteristics; Traffic flow characteristics – Traffic Volume, Speed, Headway, Concentration and Delay; Traffic surveys & studies; Traffic estimation; Statistical applications in traffic engineering analysis; Parking; Road intersections – Basic traffic conflicts, classification of at-grade intersections, channelization, rotaries, traffic signals, signs and marking; Road Safety; Traffic System Management.	**10L**
Module–III: **TRANSPORTATION MANAGEMENT:** Functions of IRC, Central Road Research Institute. Motor Vehicle Act, Jayakar committee Recommendations, Saturation system, Population unit and productivity units. Highway cost analysis, Transportation Demand Analysis, Preparation of Project Report.	**6L**
Module- IV: **INTRODUCTION OF RAILWAY ENGINEERING:** Basic Terminologies of Railway Engineering, Different types of Railway planning, Classification of Indian Railways, Classification of Indian Railways based on speed criteria, Undertakings Under Ministry Of Railways, Initiatives By Indian Railways For Development Of Tourism Sector, Global Trains Of Tomorrow, Construction And Renewal Of Track, Development of High And Super High Speeds, Modernization Of Track For High Speeds,	**14L**

Administration Of Indian Railways, Railway Expenses, Rates and Fares.

Text / Reference Books:

Name	Author	Publishers
High Way Engineering	Khanna& Justo	Nemchand& Brothers, Roorkee
Principles of Transportation Engineering	P. Chakraborty& A. Das	PHI
Transportation Engineering	C.J Khisty& B.K Lall	-
I.S Specifications on Concrete , Aggregate & Bitumen	Bureau of Indian Standard	
Relevant latest IRC Codes (IRC-37 – 2001, IRC 58 – 2002, IRC 73 - 1980, IRC 86 - - 1983, IRC 106 – 1990, IRC 64 – 1990, IRC 15- 2002 Indian Road Congress	-	-

CO-PO mapping

CO	PO 1	PO2	PO 3	PO4	PO 5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	3	3	2	3	1	1	1	3	3	3	3	3	3	3
CO2	3	3	3	2	2	2	1	1	3	2	3	2	3	2	3
CO3	3	1	2	1	2	3	2	2	1	3	3	3	3	3	3
CO4	3	2	2	1	2	3	2	3	2	3	3	3	2	3	2
CO5	3	2	2	3	3	3	3	3	3	2	3	3	3	3	3

COURSE NAME: HYDRAULICS
COURSE CODE: CE504A
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS : 3

Pre requisites: Basic knowledge of Fluid Mechanics

Course Objective:

Students will understand and be able to apply fundamental concepts and techniques of hydraulics and hydrology in the analysis, design, and operation of water resources systems.

Course Outcome:

CO1 : Students will be able to recognize with different water resources terminology like hydrology, ground water, hydraulics of pipelines and open channel.
CO2 : Students will be able to explain and be able to use the energy and momentum equations.
CO3 : Students will be able to separate flow in closed pipes, and design and recommend of pipes including sizes.
CO4 : Students will be able to summarize pumps classification and be able to select a system curve used in pump selection.

Course contents:

Module-1: Center of pressure, Stability of floating bodies, Meta center, Difference between weir and barrage, Types of weirs, Selection of site.	**4L**
Module-2: Weir and notches, Rectangular, Triangular, Submerged weirs, Theories of seepage and design of weirs and barrages. Failures of hydraulic structure founded on pervious foundation.	**8L**
Module-3: Friction in pipes, Head loss due to friction, Drag-weisbach Equation, Variation of friction factor with wall roughness, Hydraulics structure for canals --- Canal falls---Necessity, locations, Types, Trapezoidal notches fall.	**4L**
Module-4: Water hammer---speed of pressure wave, Slow and rapid closer Cross drainage work, Necessity, type, selection of suitable type (Introduction only)	**4L**
Module-5: Steady uniform flow in open channel, Mannings and Bazin's formula, Hydraulically efficient cross section, Varied flow through open channel, gradually varied & rapidly varied flows. Dam (General): Definition, classification of Dams, Types of Earthen Dams, Methods of Construction,	**8L**
Module 6: Introduction of Hydraulic Turbines and various type of Pumps. Gravity Dam: Typical cross- section, Concept of High and low Gravity Dam.	**8L**

Text / Reference Books:

Name	Author	Publishers
Fluid Mechanics	Modi & Seth	Standard Book House, New Delhi
Fluid Mechanics	A.K.Jain	Khanna Publishers, New Delhi
Fluid Mechanics & Machinery	H. M. Raghunath	CBS Publishers, New Delhi
Fluid Mechanics and Fluid Machines	S. K. Som & G. Biswas	Tata McGraw Hill.
Fluid Mechanics, Hydraulics and Fluid Machines	S. Ramamrutham	Dhanpat Rai
Water Supply Engineering	Santosh Kumar Garg	Khanna Publishers

CO-PO mapping

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**-**
CO2	**2**	**3**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**-**
CO3	**3**	**2**	**1**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**-**
CO4	**2**	**3**	**1**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**-**

COURSE NAME: WATER SUPPLY AND PLUMBING
COURSE CODE: CE504B
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS : 3

Pre requisites: Student should knowledge about hydraulic

Course Objective:

Student should be able to make technology choice to deal with water quality issues, operate and maintain working treatment systems and do troubleshooting of the problems in these systems. The student will be able to apply the knowledge gained from the subject in EIA studies for water component and water pollution control strategies.

Course Outcome:

CO1 : Student will be able to apply appropriate treatment to raw water i.e. surface water/ground water useful for domestic as well as drinking purpose, industries liquid waste and reuse ofwater.
CO2 : Student will be able to calculate and recommend the pipe- network for water supply and Sewage disposal effectively.
CO3 : Student may clarify and identify the impurities present in water used for domestic, different types of industrial as well as constructionworks.
CO4 : Student will able to produce and select water distribution and sewer-network system.

Course contents:

Unit I: Water Demands and Importance Necessity of Planned Water Supply. – Various Types of Water Demands,Water Requirements of a town or acity,The Per Capita Demand ,Factors affecting per Capita Demands, Variations in Demands, Effects of Variations in Demand on the Design Capacities of Different Components of a Water Supply Scheme, Design Periods, Population Data and Population Growth, Population Forecasting Method	**6L**
Unit II: Sources of Water and Study of Sources of Water -Hydrologic Cycle, Precipitation, Types of Precipitation, Rainfall and Measurement, Average Annual Rainfall, Minimum Rainfall, Index of Wetness, Run off and Estimation of Run off, Surface Sources of water, Subsurface Sources of Water, Development of Ground Water, Various Forms of Underground Sources, Wells, Open Wells,Dug Well, Tube Wells, Comparative Study of Surface and SubsurfaceSupplies	**6L**
Unit III: Intake Structure – Definition and Introduction, Types of Conduits, Hydraulics of Flow and Design of Pressure Pipes as Gravity Mains, Flow in Pipe System, Various types of Pipe System,PipeAppurtenances	**3L**
Unit IV: Conduits for Transporting Water-Definition and Introduction, Types of Conduits, Hydraulics of Flow and Design of Pressure Pipes as Gravity Mains, Flow in Pipe System, Various types of Pipe System, Pipe Appurtenances	**3L**
Unit V: Water Quality - Characteristics of Water, Water Borne Diseases and their control Quality Standards for Municipal and Industrial Supply.	**4L**
Unit -VI Purification of Water Supplies-Screening, Course and Fine Screens, Theory of Sedimentation, Sedimentation Tanks, Sedimentation Aided with Coagulation ,Analysis of Flocculent Settling, Chemicals used for Coagulation, Coagulation Sedimentation Plant. Sedimentation Tank, Filtration, Filter Material, Types of Filters, Rapid Gravity Filter, Slow	**6L**

Sand Filter, Rapid Gravity Filter and Pressure Filter. Disinfection Methods, Chlorination, Methods of Removing Temporary Hardness and Permanent Hardness, Removal of Iron, Manganese, De-fluoridation of Water, Removal of Radioactive from water, Desalination of Brakish Water.	
Unit -VII Distribution System, Layouts of Distribution System, Requirements, Arrangement of Distribution Pipes and Other Accessories, Method of Distribution System, Pressure in Distribution System, Systems of Supply	**4L**
Unit -VIII Water Supply Plumbing Systems in Buildings and Houses, Plumbing Systems in Water Supplies, The House Water Connections, Stop Cocks, Water Taps and Bib Cocks, Pipe Fittings, Pipe Fittings, Storage of Water Buildings, Design Considerations for Water Piping Systems	**4L**

Text / Reference Books:

Name	**Author**	**Publishers**
Engineering Hydrology	K. Subramanya	Tata McGraw-Hill
A Text Book of Hydrology-	P. Jaya Ram Reddy	Laxmi Publications-New Delhi
Hydrology & Water Resource Engineering-	S.K Garg	Khanna Publishers.
Hydrology Principles, Analysis and Design	H. M. Raghunath.	
Hydraulics of Groundwater	J. Bear	McGraw-Hill
Water Resources Engineering Through Objective Questions	K. Subramanya	Tata McGraw-Hill

CO-PO mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO2**	**PSO3**
CO 1	**3**	**2**	**1**	**-**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**-**
CO 2	**2**	**3**	**2**	**-**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**-**
CO 3	**3**	**2**	**2**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**-**
CO 4	**3**	**2**	**2**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**-**

COURSE NAME: WASTE WATER AND TREATMENT
COURSE CODE: CE504C
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS : 3

Pre requisites: Fluid Mechanics or an equivalent course in fluid flow or hydraulics.

Course Objective:

Explore the relationship between the natural water cycle and human water use, and understand the principles of water resources planning and total water management. Describing the physical, chemical, and biological processes necessary for designing and managing drinking water treatment processes and water conveyance and distribution systems and the physical, chemical, and biological processes necessary for designing and managing primary, secondary, tertiary and advanced wastewater treatment processes and solids handling systems.

Course Outcome:

CO1 : Students will be able to summarize the quality parameters typically used to differentiate wastewater and judge the different classes of treated wastewater
CO2 : Students will be able to describe various types of process units used for preliminary, primary and secondary treatment and explain how they achieve the target level of treatment
CO3 : Students will be able to identify and summarize emerging technologies for advanced wastewater treatment and water recycling
CO4 : Students will be able to differentiate water and wastewater treatment on solid wastes management.

Course contents:

Unit I: Estimating the Design Sewage Discharge -Estimating Sewage Discharge, Design Periods for Different Components of a Sewerage Scheme, Future Forecasts and Estimating Design Sewage Discharge, Variations in Sewage Flow and their Effects.	**6L**
Unit II: Hydraulic Design of Sewers and S.W Drain Sections-Difference in the Design of Water Supply Pipes and Sewer Pipes and Sewer Pipes, Hydraulic Formulas for Determining Flow Velocities in Sewers, Effect of flow variations on Velocity in a Sewer, Hydraulic Characteristics of Circular Sewer, Various Forms of Underground Sources, Use of Tables and Nomograms for Hydraulic Computations for the Design of Sewers, Limitation on Depth of Flow, Egg Shaped Sewer .	**8L**
Unit III: Quality and Characteristics of Sewage-Decomposition of Sewage, Characteristics of Sewage	**4L**
Unit IV: Disposing of the Sewage Effluents-Disposal by Dilution, Disposal of Wastewaters in Rivers and Self, Disposal on Land for Irrigation, Dilution Method Vs Land Disposal Method .	**6L**
Unit V: Treatment of Sewage-Classification of Treatment Processes, Screening, Types of Screens, Their Designs and Cleaning, Grit Removal basins, Grit Chambers, Sedimentation, Principle of Sedimentation, Sedimentation Tank, Sedimentation Aided with Coagulation, Contact Beds for Biological Filtration of Sewage, Trickling Filters for Biological Filtration of Sewage, Recirculation of Treated Sewage and its Use in High Rate Trickling Filters, Secondary Treatment Through Activated Sludge Process, Secondary Treatment Through Rotating Biological Contractors, Oxidation Ponds and Aeration Lagoons, Anaerobic Stabilization Units Secondary Sedimentation, Sludge and its Moisture Content, Sludge Digestion Process,.	**12L**

Text / Reference Books:

Name	Author
Waste Water Treatment and Water Management : Water Treatment and Management	Anamika Srivastava
INDUSTRIAL WASTE WATER TREATMENT	A. D. Patwardhan

CO-PO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	-	-				1		1		1	2	2	-
CO2	2	1	2	2		2			1	1	2		2	2	-
CO3	1	1	1	1	2	1	1	2		2		2	2	2	-
CO4	-	2	1	-	2		2		2		1	1	2	2	-

COURSE NAME: SOIL MECHANICS LAB-II
COURSE CODE: CE 591
CONTACT: 0:0:3
CREDITS : 1.50

Pre requisites: Basic course on soil mechanics with understanding of soil parameters, behavior and response against loading.

Course Objective: Students will be able to access unconfined compressive strength of soil, shear parameter of soil by direct shear test and undrained shear strength by vane shear test . Students will be familier with fractional test standard penetration test.

Course Outcome:

CO1: Ability to caculate the compressive strength of soil
CO2: Ability to determine shear strength of soil
CO3: Ability to understand standard penetration test
CO4: Ability to understand consolidation parameters of soil
CO5: Ability to perform all the test for determing shear strength of soil

LIST OF EXPERIMENT:

1. Determination of compressibility characteristics of soil by Oedometer test (co-efficient of consolidation & compression Index)
2. Determination of unconfined compressive strength of soil
3. Determination of Shear parameter of soil by Direct shear test
4. Determination of undrained shear strength of soil by Vane shear test.
5. Determination of shear parameter of soil by Triaxial test (UU)
6. Standard Penetration Test
7. Expt No. 6 by large groups in the field.

Text / Reference Books:

Soil testing by T.W. Lamb (John Willey)
SP-36 (Part-I & Part –II)
Soil Mechanics Laboratory Manual by B. M. Das, OXFORD UNIVERSITY PRESS
Measurement of engineering properties of soil by E.Jaibaba Reddy & K. Ramasastri.

CO-PO mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	1	2	1	2	2	2	1	2	3	3	2	3
CO2	3	3	2	2	2	1	2	2	2	2	2	3	3	2	3
CO3	2	2	1	1	2	2	2	3	2	2	2	3	2	2	3
CO4	3	3	3	2	3	2	3	2	2	2	3	3	2	2	3
CO5	3	3	2	2	2	2	3	2	2	2	3	3	2	2	3

COURSE NAME: CIVIL ENGINEERING LAB-II
COURSE CODE: CE 592
CONTACT: 0:0:3
CREDITS : 1.50

Pre requisites: Student should have the basic knowledge about building material and construction and also should have knowledge about basic concrete property.

Course Objective: The objective of this course is to understand the characteristics and behavior of civil engineering materials used in buildings and infrastructure. Students will learn standard principles and procedure to design prepare and/or test materials such as concrete mix design including field test methods for fresh concrete. Know how to select materials based on their properties and their proper use for a particular facility under prevailing loads and environmental conditions.

Course Outcome:

CO1: Test of beams for deflection, flexure and shear
CO2: Experiments on Concrete, including Mix design
CO3: Illustrate knowledge on Non destructive testing (NDT) equipments – Rebound hammer, Ultra sonic pulse velocity meter

LIST OF EXPERIMENT:

Determination of physical properties of bricks:
Size, shape, weight, water absorption, efflorescence test, crushing strength test

Determination of physical properties of Coarse Aggregate:
Abrasion, Crushing and Impact Test of Coarse Aggregate

Determination of physical properties of Structural Steel: Stress
Strain Behavior for the tensile test of Mild Steel and HYSD Bar

Structural Behavior of RC Beam:
Load deflection behavior of flexural beam member for flexure

Survey using Total Station
RDM(Remote Distance Measurement), REM(Remote Elevation Measurement), Horizontal & Vertical Angle determination using Total Station

Text / Reference Books: Properties of concrete by A.M Neville, Trans-Atlantic Publications

CO-PO mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	3	3	-	1	1	2	3	-	1	**2**	**2**	**-**
CO2	3	2	3	2	2	1	1	-	2	1	2	2	**2**	**2**	**-**
CO3	3	2	2	2	3	2	2	2	1	-	2	1	**2**	**2**	**-**

COURSE NAME: TRANSPORTATION & HIGHWAY ENGINEERING LAB
COURSE CODE: CE 593
CONTACT: 0:0:3
CREDITS : 1.50

Pre requisites: Student should have the basic knowledge about Highway&Transportation engineering.

Course Objective: The objective of this course is to understand the characteristics and behavior of highway materials used in highway engineering. Students will learn standard principles and procedure to design prepare and/or test materials such as B.M. & S.D.B.C. mixdesign including Marshal Stability Test. Know how to select materials based on their properties and their proper use for a particular facility under prevailing loads and environmental conditions.

Course Outcome:

CO1: Identify the functional role of different materials of highway engineering.
CO2: Apply this knowledge to mix design philosophy to get different suitable B.M. & S.D.B.C. Mix.
CO3: Student should be able to test of existing highway and examine the quality of that highway by Benkelman Beam Test.
CO4: Student shall learn to work in a team to achieve the objective.

LIST OF EXPERIMENT:

1. **Tests on highway materials –** Aggregates- Impact value, los-Angeles Abrasion value water absorption, Elongation & Flakiness Index.
2. **Bitumen & bituminous materials –** Specific Gravity, Penetration Value, Ductility, Softening Point, Loss on Heating, Flash & Fire Point Test.
3. **Stripping value test**
4. **Design of mix gradation** for mix seal surfacing Design of B.M. &S.D.B.C. Mix
5. **Marshal Stability Test.**
6. **Benkelman Beam Test.**

Text / Reference Books:

Highway material testing(Laboratory Manual)by S.K. Khanna and CE.G. Justo
Relevant IS & I.R.C. codes.
BIS codes on Aggregates & Bituminous materials

CO-PO mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	3	2	2	2	1	-	1	1	3	3	2	2
CO2	3	3	3	3	2	2	2	1	1	2	1	3	3	3	2
CO3	3	3	3	3	3	2	2	2	1	3	2	3	2	3	3
CO4	-	3	3	3	2	2	2	3	3	3	3	3	1	3	3

COURSE NAME: HYDRAULICS LAB
COURSE CODE: CE594A
CONTACT: 0:0:3
CREDITS : 1.50

PRE-REQUISITES:

Knowledge of Hydraulics

COURSE OBJECTIVES:

1. Exposure to the principles of Hydraulics in flow measurements.
2. Ability to critically observe/ examine and Measure the discharges through flow measuring devices.
3. Ability to understand the working principles of pumps

COURSE OUTCOMES:

Student will be able to :

CO-1- Know principles of Flow measurement

CO-2- Able to critically observe / examine and measure the discharge through flow measuring devices

CO-3-Understand the working principles of pumps

LIST OF GRADED PRACTICAL EXERCISES

Following is the list of experiments:.

1. Identification with the equipments used in hydraulics lab
2. Use of manometer and piezometer
3. Determination of frictional losses in a pipe
4. Determination of co-efficient of discharge using venturimeter
5. determination of co-efficient of discharge using Orificemeter (Horizontal type)
6. determination of co-efficient of discharge using Orificemeter (Vertical type)
7. Determination of co-efficient of discharge using V- Notch
8. Determination of co-efficient of discharge using Rectangular notch
9. Determination of co-efficient of discharge using Trapezoidal Notch
10. Determination of co-efficient of discharge using Impact of jet on Vanes

11. Demonstrating the working of Centrifugal pumps
12. Demonstrating the working of Reciprocating pumps

REFERENCE BOOKS:

1. Hydraulic Lab Manual Compiled – T.T.T.I. – Chennai – 113.
2. Ghosh and Talapohia – Experimental Hydraulic – Khanna Publishers – New Delhi

CO-PO mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	2	1	-	-	-	-	-	-	-	-	-	2	2	-
CO 2	2	3	1	-	-	-	-	-	-	-	-	-	2	2	-
CO 3	3	2	1	-	1	-	-	-	-	-	-	-	2	2	-

COURSE NAME: WATER SUPPLY AND PLUMBING LAB
COURSE CODE: CE594B
CONTACT: 0:0:3
CREDITS : 1.50

PRE-REQUISITES:

Knowledge water supply system and Plumbing fixtures

COURSE OBJECTIVES:

1. Ability to understand the working principles of pumps
2. Know the various fixtures used in plumbing operation

COURSE OUTCOMES:

After completing the course student will be able to :

CO-1 Understand the working principles of piping
CO-2 Know how to execute plumbing work
CO-3 Handle complex water supply problems.
CO-4 Understand working principles of pumps.

LIST OF GRADED PRACTICAL EXERCISES

PLUMBING LAB

1. Identifying pipe fittings used in water supply (With actual models displayed on board)
2. Cutting, Threading and Joining of GI pipes/ Cutting and joining of PVC pipes using solvents
3. Study of working of water meter
4. Identification and study on bore-well fittings
5. Study of bathroom fittings connection from an existing water supply main (Listing the materials required, drawing a neat sketch of the connection with details)
6. Making suction and delivery pipe connections to a centrifugal pump,making indents, drawing a neat sketch of the connection with details.
7. Identification and study on pumps used in wells
8. Variation in the discharge rate in a sump tank and OHT (Delivery head, Suction head and Pressure head concept)

REFERENCE BOOKS:

3. Hydraulic Lab Manual Compiled – T.T.T.I. – Chennai – 113.
4. Ghosh and Talapohia – Experimental Hydraulic – Khanna Publishers – New Delhi
5. Central Public Health Engg Organisation(CPHEO) water supply Manual
6. National environmental engineering Institute (NEERI) water supply manual
7. Water supply engineering by-Birdie
8. Water supply and sewage disposal by – S.K.Garg

CO-PO mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	2	1	-	1	1	-	-	-	-	-	-	2	2	-
CO 2	2	3	2	-	1	1	-	-	-	-	-	-	2	2	-
CO 3	3	2	2	-	1	-	-	-	-	-	-	-	2	2	-
CO 4	3	2	2	-	1	-	-	-	-	-	-	-	2	2	-

COURSE NAME: WASTE WATER LAB
COURSE CODE: CE594C
CONTACT: 0:0:3
CREDITS : 1.50

PRE-REQUISITES:

The detail syllabus for waste water analysis laboratory is as follows."

COURSE OBJECTIVE:

- To analyse the physical, chemical and biological characteristics of water and wastewater
- To quantify the dosage requirement for coagulation process
- To study the growth of micro-organism and its quantification
- To quantify the sludge

COURSE OUTCOME:

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

CO1- Quantify the pollutant concentration in water and wastewater
CO2-Suggest the type of treatment required and amount of dosage required for the treatment
CO3- Examine the conditions for the growth of micro-organisms

COURSE CONTENT:

1. Physical, Chemical and biological characteristics of water and wastewater
2. Jar test
3. Chlorine demand and residual test
4. Growth of micro-organism

LIST OF EXPERIMENTS:

1. Determination of pH, Turbidity and conductivity
2. Determination of Hardness
3. Determination of Alkalinity and Acidity
4. Determination of Chlorides
5. Determination of Phosphates and Sulphates
6. Determination of iron and fluoride
7. Determination of Optimum Coagulant dosage
8. Determination of residual chlorine and available chlorine in bleaching powder
9. Determination of Oil, and Grease
10. Determination of suspended, settleable, volatile and fixed solids
11. Determination Dissolved Oxygen and BOD for the given sample
12. Determination of COD for given sample

Text / Reference Books:

Name	Author
Waste Water Treatment and Water Management : Water Treatment and Management	Anamika Srivastava
INDUSTRIAL WASTE WATER TREATMENT	A. D. Patwardhan

CO-PO mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	1	-	-				1		1		1	2	2	-
CO 2	2	1	2	2		2			1	1	2		2	2	-
CO 3	1	1	1	1	2	1	1	2		2		2	2	2	-

COURSE NAME: INTELLECTUAL PROPERTY RIGHT
COURSE CODE: MC 501
CONTACTS: 0:0:3
TOTAL CONTACT HOURS: 24

Prerequisite: None

Course Outcomes: On successful completion of the learning sessions of the course, the learner will be able to:

CO1: Explain fundamental aspects of Intellectual property Rights to students
CO2: To disseminate knowledge on patents, patent regime in India and abroad and registration aspects
CO3: To disseminate knowledge on copyrights and its related rights and registration aspects
CO4: To disseminate knowledge on trademarks and registration aspects
CO5: To disseminate knowledge on Design, Geographical Indication (GI), Plant Variety and Layout Design Protection and their registration aspects
CO6: To aware about current trends in IPR and Govt. steps in fostering IPR

Course Content

Module 1: ***4 hrs***
Overview of the IPR: Introduction and the need for intellectual property right (IPR) - Kinds of Intellectual Property Rights: Patent, Copyright, Trade Mark, Design, Geographical Indication, Plant Varieties and Layout Design – Genetic Resources and Traditional Knowledge – Trade Secret - IPR in India : Genesis and development – IPR in abroad - International organizations. agencies and treaties,

Module 2: ***4 hrs***
Patents- Trips Definition, kind of inventions protected by patent-Patentable and Non patentable inventions. Elements of Patentability: Novelty , Non Obviousness (Inventive Steps), Le8al requirements for patents — Granting of patent - Rights of a patent-exclusive right. Patent application process: Searching a patent- Drawing of a patent- Filing of a patent- Types of patent applications- Parent document: specification and Claims.
Registration Procedure, Rights and Duties of Patentee, Restoration of lapsed Patents, Surrender and Revocation of Patents, Infringement, Remedies & Penalties

Module 3: ***4 hrs***
Trademarks- Concept of Trademarks - Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks) - Non Registrable Trademarks - Registration of Trademarks - Rights of holder and assignment and licensing of marks - Infringement, Remedies & Penalties - trade mark registration processes.

Module 4:
Copyrights- ***4 hrs***
Right and protection covered by copyright - Law of copy rights: Fundamental of copyright law. originality **of material,** rights of reproduction, rights to perform the worth publicly, copy right ownership issues, obtaining copy right registration, notice of copy right. International copy right law. Infringement of Copyright under Copyright Act
The Role arid Liabilities of lPRs in India - Cyberlaw issues: Criminal law. data safety, online privacy.

Health privacy, Freedom of expression and human rights, net neutrality, national security.

Module 5: ***4 hrs***

Geographical Indication of Goods: Types, why and how GI need protection and GI laws. Indian GI act. Industrial Designs: protection. Kind of protection provided by industrial designs. Integrated Circuits

Module 6: ***4 hrs***

India`s New National IP Policy, 2016 – Govt. of India step towards promoting IPR – Govt. Schemes IPR – Career Opportunities in IP - IPR in current scenario with case studies

Text book:

1. Fundamentals oflP for Engineers: K.Bansl& P.Bansal
2. Nithyananda, K V. (2019). Intellectual Property Rights: Protection and Management. India, IN: Cengage Learning India Private Limited.
3. Neeraj, P., & Khusdeep, D. (2014). Intellectual Property Rights. India, IN: PHI learning Private Limited.

Reference book:

1. Ahuja, V K. (2017). Law relating to Intellectual Property Rights. India, IN: Lexis Nexis.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		1	2	3			2		2	3	3	1	2	3
CO2	3	1		1			1		1		3	3		1	
CO3	3		1	2	3			2		2	3	3	1	2	3
CO4	3	1		1			1		1		3	3		1	
CO5	3		2		2	3				2	3	3	2		2
CO6	3	2		1				2	2		3	3		1	

3rd Year 2nd Semester

Sl. No.	Category	Course Code	Course Title	Hours per week				Credits
				L	**T**	**P**	**Total**	
A. THEORY								
1	Humanities and Social Sciences including Management courses	HU 605	Principles of Management	2	0	0	2	2
2	PC	CE 601	Structural Design – II	3	0	0	3	3
3	PC	CE 602	Construction Planning And Management	3	0	0	3	3
4	PE	CE603	A.Bridge Engineering B.Pre stressed Concrete C.Structural Dynamics and Earthquake Engineering	3	0	0	3	3
5	PE	CE604	A. Infrastructure Planning & Design B. Public Transport System C. Transportation Engineering-II	3	0	0	3	3
6	OE	CE605	A.Operations Research B.Human Resource Management C.Studies On Six Sigma	3	0	0	3	3
B. PRACTICAL								
7	PC	CE691	Structural Design and Detailing	0	0	3	3	1.5
9	PC	CE692	Computer Aided Design	0	0	3	3	1.5
10	PE	CE693	Structural Lab	0	0	3	3	1.5
11	PROJECT	PR 691	Minor Project II	0	0	3	2	1
12	PROJECT	PR 692	Skill Development VI: Soft Skill & Aptitude-III	1	0	0	1	0.5
C. MANDATORY ACTIVITIES / COURSES								
13	MC	MC 601	Constitution of India	3	0	0	3	3Units
	TOTAL CREDIT WITHOUT MOOCS COURSES							23.0
D.MOOCS COURSES**								
14	MOOCS COURSES	HM601	MOOCS COURSE-IV	3	1	0	4	4
TOTAL CREDIT WITH MOOCS COURSES								**27.0**

**** MOOCS COURSES for HONOURS/MINOR Degree are Program specific and to be taken from MOOCS BASKET**

COURSE NAME: PRICIPLES OF MANAGEMENT
COURSE CODE: HU 605
CONTACT: 2:0:0
TOTAL CONTACT HOURS: 24 HRS
CREDITS : 2

Course Objective:
To acquaint the students with the steps involved in the planning, implementation, scheduling and control of projects.

Course Outcomes:
At the end of this course student will demonstrate the ability to:
CO-1: To identify the resources needed for each stage, project development including involved stakeholders, tools and supplementary material

CO-2: To understand internal stakeholders with information regarding project costs by considering factors such as estimated cost, variances and profits

CO-3: To understand the time needed to successfully complete a project, considering factors such as task dependencies and task lengths

CO-4: To distinguish among the various tools for improving quality and how each should be used.

CO-5: To implement project management knowledge, processes, lifecycle and the embodied concepts, tools and techniques in order to achieve project success.

UNIT-I: Project Management Concepts Attributes of a Project, Project Life Cycle, The Project management Process, Global Project Management, Benefits of Project Management, Needs Identification.
2L
UNIT-II: Project Selection, Preparing a Request for Proposal, Soliciting Proposals, Project organization, the project as part of the functional organization, pure project organization, the matrix organization, mixed organizational systems.
4L
UNIT-III: Project Planning and Scheduling: Design of project management system; project work system; work breakdown structure, project execution plan, work packaging plan, project procedure manual; project scheduling; bar charts, line of balance (LOB) and Network Techniques (PERT / CPM)/ Resource allocation, Crashing and Resource Sharing.
8L

UNIT-IV: Project Monitoring/Control and Project Performance: Planning, Monitoring and Control; Design of monitoring system; Computerized PMIS (Project Management Information System). Coordination; Procedures, Meetings, Control; Scope/Progress control, Performance control, Schedule control, Cost control, Performance Indicators; Project Audit; Life Cycle, Responsibilities of Evaluator/ Auditor, Responsibilities of the Project Manager. Project Quality Management: Concept of Project Quality, TQM in Projects, Project Audit

6L

UNIT-V: Cost Management estimating, budgeting, and controlling costs.

4L

Reference Books:

1. Projects: Preparation, Appraisal, Budgeting and Implementation- Chandra, P. (2017). 8th Edition, Tata Mcgraw.
2. PERT & CPM principle and applications- L.S. Srinath , E.W.P. Ltd. New Delhi. 3. Network Analysis Techniques - S.K. Bhatnagar, Willey Eastern Ltd.
4. Project Management – K Nagrajan – New Age International Ltd.
5. Professional Construction Management Barrie-Paulson-McGraw Hill Institute Edition.
6. Project Management – Ahuja H.N. – John Wiely, New York.
7. Project Management-Planning and Control---Rory Burkey 4th ed.—Wiley, Ind
8. Text Book of Project Management, Macmillan- Gopalkrishnan P. and Rama Mmoorthy
9. Project Management for Business and Technology – Principles and Practice- Nicholas John M, Prentice Hall India, 2nd Edn.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	2	3	3	3	2	3	2	2	2	2	-
CO2	2	3	-	2	-	-	2	-	3	-	3	-	2	2	-
CO3	2	-	3	2	-	3	-	-	2	-	3	-	2	2	-
CO4	-	2	-	3	2	3	-	2	-	-	-	-	2	2	-
CO5	2	-	-	-	3	2	-	-	2	-	3	-	2	2	-

COURSE NAME: STRUCTURAL DESIGN – II
COURSE CODE: CE 601
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS : 3

Pre requisites: A basic concept of material properties and behavior with basic knowledge of structural analysis and structural elements behaviorunder different loading pattern. Knowledge of stress and strain with fundamental concept of Engineering mechanics.

Course Objective: Students will be able to analyse the behaviour of steel structure under different type of loading.To design a connection using IS:800-2007 and satisfy the serviceability and strength parameters.To acquire the knowledge to design tension ,compression, members columns, beams. Using the codal Stipullation and basic knowledge of structural analysis students will be able to design plate girders and gentry girders considering lateral buckling.

Course Outcome:

CO1 : Understand various types of design methodology as per limit and working stress method
CO2: Interpret different type of connections
CO3 : Design compression, tension and beam members
CO4 : Analyze column bases
CO5 : Design plate girder, uses of stiffeners

Course contents:

Module-I: **Materials and Specification:-**Rolled steel section, types of structural steel, specifications, Residual stress	**2L**
Module-II: **Structure connections:** Riveted, welded and bolted including High strength friction grip bolted joints– types of riveted & bolted joints, assumptions, failure of joints,efficiency of joints, and design of bolted riveted, fillet and butt welded joints for axial load, IS code provisions. **Eccentric connection:-** Riveted & bolted joints subjected to torsion & shear, tension & shear, design of riveted, bolted & welded connection.	**6L**
Module-III: **Tension members:** Design of tension members, I.S code provisions. Permissible stresses, Design rules, Examples	**4L**
Module-IV: **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, and Connection details.	**6L**
Module-V: **Beams:** Permissible stresses in bending, compression and tension, lateral buckling. Design of rolled steel sections, plated beams. Simple Beam end connections, beam -Column connections. I.S code provisions	**6L**

Module-VI: **Plate girders:** Design of webs & flanges, Concepts of curtailment of flanges – Riveted & welded web stiffeners, web flange splices - Riveted, welded& bolted. I.S code provisions	**6L**
Module-VII: **Gantry Girder:** Design gantry girder considering lateral buckling – I.S code provisions.	**6L**
IS 800 – 2007 to be followed for all IS code provisions.	

Text / Reference Books:

Name	Author	Publishers
Design Of Steel Structures	S.K.Duggal	Tata Mc-Graw Hill , New Delhi
Design of Steel structures	N. Subramanian	Oxford University Press
Design of steel structures	A.S.Arya and J.L.Ajmani	Nemchand& Bros.
Design of steel structures	Vol. I & II Ramachandra	
Design of steel structures	PasalaDayaratnam	A.H.Wheeler& Co Ltd. 1990
Design of steel structures	B.S.Krishnamachar and D.AjithaSinha	Tata McGraw – Hill publishing Co. Delhi.
Design of steel structures	Ramamurtham	
IS 800 – 2007(Latest Revised code) Bureau of Indian Standard		
S.P.: 6(1) – 1964 Structural Steel Sections Bureau of Indian Standard		

CO-PO mapping

CO	PO 1	PO2	PO 3	PO4	PO 5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	3	3	3	3	3	2	1	1	2	1	2	**1**	**1**	**2**
CO2	2	2	3	3	1	3	2	2	2	2	2	2	**2**	**2**	**3**
CO3	2	2	1	3	3	3	1	2	2	2	2	2	**2**	**2**	**3**
CO4	2	1	2	3	2	2	2	2	2	2	1	2	**2**	**2**	**3**
CO5	2	2	2	3	2	2	2	1	1	2	2	2	**2**	**2**	**3**

COURSE NAME: CONSTRUCTION PLANNING AND MANAGEMENT
COURSE CODE: CE 602
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS : 3

Pre requisites: Basic course in construction material and methodology with understanding of structural elements and their uses and sequence of construction, erection. Basic knowledge of quantity Estimation and valuation.

Course Objective: Students will gain knowledge on planning, Regulation and by laws for construction. students will be familiar with fire protection, construction plant and equipments. students will be able to plan and schedule construction project by CPM and CEAT. some knowledge on management and departmental procedures of PWD, EMD and SD and familiarity Cost Analysis, project cost, cost slopes and time optimization.

Course Outcome:

CO1 : Students will be able to successfully apply business and Management skills in positions within the construction industry.
CO2: Use industry resources including associations and organizations.
CO3 : Practice informed decision- making in personal and professional endovers.
CO4 : Manage a quality construction project from start to completion while maintaining budget, schedule, and safety requirements.

Course contents:

Module-I: **Planning**: General consideration, Definition of aspect, prospect, roominess, grouping, circulation Privacy, acclusion	**4L**
Module-II: **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	**4L**
Module-III: **Fire Protection**: Fire fighting arrangements in public assembly buildings, planning, offices, auditorium	**4L**
Module-IV: **Construction plants & Equipment**: Plants & equipment for earth moving, road constructions, excavators, dozers, scrapers, spreaders, rollers, their uses. Plants &Equipment for concrete construction: Batching plants, Ready Mix Concrete, concrete mixers, Vibrators etc., quality control	**6L**
Module-V: **Planning & scheduling of constructions Projects:** Planning by CPM &PERT, Preparation of network, Determination of slacks or floats. Critical activities. Critical path, project duration .expected mean time, probability of completion of project, Estimation of critical path, problems	**6L**
Module-VI: **Management**: Professional practice, Definition, Rights and responsibilities of owner,	**6L**

engineer, Contractors, types of contract	
Module-VII: **Departmental Procedures:** Administration, Technical and financial sanction, operation of PWD, EMD and SD, Acceptance of tenders, Arbritation, cost Analysis, Direct and Indirect project costs, Total costs- cost slopes. Crushing cost and time optimization	**6L**

Text / Reference Books:

Name	Author	Publishers
Construction Planning, Equipments and methods	Puerifoy	R.L. McGraw Hill
Management in construction industry	P.P.Dharwadkar	Oxford and IBH Publishing company New Delhi
Construction Management, Critical path Methods in Construction	J.O.Brien	Wiley Interscience
PERT and CPM	L.S. Srinath	-
Project planning and control with PERT and CPM' Construction equipments and its management	B.C.Punmia and K.K.Kandelwal	S.C.Sharma
National Building code BIS	-	-

CO-PO mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO 3
CO 1	**2**	**2**	**2**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**-**
CO 2	**2**	**2**	**2**	**2**	**1**	**2**	**2**	**-**	**2**	**2**	**2**	**-**	**2**	**2**	**-**
CO 3	**2**	**2**	**1**	**2**	**3**	**2**	**2**	**-**	**2**	**1**	**1**	**-**	**2**	**2**	**-**
CO 4	**-**	**-**	**1**	**1**	**1**	**-**	**-**	**-**	**2**	**1**	**3**	**-**	**2**	**2**	**-**

COURSE NAME: BRIDGE ENGINEERING
COURSE CODE: CE603A
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS : 3

Pre requisites: Student should have knowledge about how to solve analysis of structural problem, reinforced concrete structure design and steel structure design.

Course Objective: Student will be able to know about the bridges and perform analysis of different types of bridges and also able to design of reinforced concrete and steel bridges of different types.

Course Outcome:

CO1 : Exhibit the knowledge of the history of bridges and know about the IRC guidelines.
CO2: Design the RCC bridges of different type.
CO3 : Design the Balanced Cantilever Bridges.
CO4 : Design the steel bridges of different type. schedule, and safety requirements.
CO5 : Exhibit the knowledge of Composite Bridges and Cable Stayed Bridges.

Course contents:

Module-I: [4L] **Introduction:** Definition and Basic Forms, Component of bridge, classification of bridge, short history of bridge development. I.R.C Loads. Analysis of IRC Loads, Impact factors, Other loads to be considered, Importance of Hydraulic factors in Bridge Design.	**4L**
Module-II: [4L] **Reinforced concrete solid slab bridge:** Introduction, General design features, Effective width method. Simply supported and cantilever Slab Bridge, analysis and design.	**4L**
Module-III: [3L] **Box Culvert:** Introduction, Design method and Design example.	**3L**
Module-IV: [4L] **Beam and Slab Bridges:** Introduction, Design of interior panel of slab. Pigeauds method, Design of longitudinal girder, Calculation of longitudinal moment, design example.	**4L**
Module-V: [3L] **Balanced Cantilever Bridges:** General Features, Arrangement of supports, design features Articulation, Design example.	**3L**
Module-VI: [3L] **Steel Bridges:** General features, types of stress, Design example.	**3L**
Module-VII: [3L] **Plate Girder Bridge:** Elements, design, lateral bracing, Box- girder Bridges.	**3L**
Module-VIII: [6L] **Composite Bridges:** General aspects, method of construction, analysis of composite section, shear connectors, design of composite beam.	**6L**
Module-IX: [6L] **Cable Stayed Bridge:** General features, Philosophy of design.	**6L**

Text / Reference Books:

Name	Author	Publishers
Bridge engineering	Krishnaraju	-
Principle & Practice of Bridge Engineering	S.P. Bindra	DhanpatRai Pub
Essentials of bridge engineering	D.J. Victor	-
Bridge engineering	Ponnuswamy	-
Design of Bridge Structures	T.R. Jagadesh, M.A. Jayaram	-
Design of concrete bridges	Aswani, Vizirani , Ratwani	-
Design of steel structures	Arya&Ajmani	-
Concrete Structures	Vaziram&Ratwani	-
Structures design and drawing	Krishnamurthy	-
Relevant IS & IRC codes	-	-

CO-PO mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	**3**	**3**	**3**	**2**	**-**	**2**	**2**	**1**	**-**	**3**	**3**	**2**	**2**	**2**	**-**
CO2	**3**	**3**	**3**	**3**	**-**	**2**	**-**	**-**	**-**	**2**	**2**	**2**	**2**	**2**	**-**
CO3	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**2**	**2**	**2**	**-**
CO4	**3**	**3**	**3**	**2**	**-**	**2**	**-**	**3**	**-**	**-**	**2**	**2**	**2**	**2**	**-**
CO5	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**2**	**2**	**2**	**-**

COURSE NAME: PRESTRESSED CONCRETE
COURSE CODE: CE603B
CONTACT: 3:1:0
TOTAL CONTACT HOURS: 36HRS
CREDITS : 3

Pre requisites: Basic understanding of R.C.C. design and analysis with fundamental knowledge of limit state behavior of R.C.C. with basic knowledge of structural analysis

Course Objective: Students will gain knowledge on pre-stressed concrete behavior analysis methods, stress calculation, losses, limit state design criteria and methods. student will be familiar with anchorage zone stress in post tension member. Basic knowledge on composite construction of pre-stressed and in situ concrete. Preliminary idea on partial pre-stressing and non stressed reinforcement.

Course Outcome:

CO1 : The student will get basic concept of pre-stressing materials and procedures.
CO2: Detail understanding on losses in prestressed
CO3 : Become familiar with IS Codes on Prestressing.
CO4 : Understand design of various parts of a prestressed structure for many kind of loading.
CO5 : Detail Idea on anchorage zone and composite members

Course contents:

Module-I: [6L] **Introduction of Pre-stressed concrete**: Materials, pre-stressing system, analysis of prestress and Bending stress, losses Shear and torsion al 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	**6L**
Module-II: [6L] **Limit state design criteria:** Inadequacy of elastic and ultimate load method, criteria for limit states,strength and serviceability. Design of sections for flexure: methods by Lin and Magnel	**6L**
Module-III: [6L] **Anchorage Zone stresses in post tensioned members:** Stress distribution in end block, anchorage zone reinforcement	**6L**
Module-IV: [6L] **Composite construction of pre-stressed and in-situ concrete:** Types, analysis of stresses Statically Indeterminate structures: advantages of continuous member, effect of pre stressing, methods of achieving continuity and method of analysis of secondary moments	**6L**
Module-V: [6L] **Pre-stressed concrete poles and sleepers:**Design of sections for compression and bending	**6L**
Module-VI: [6L] **Partial pre-stressing and non pre-stressed reinforcement**	**6L**

Text / Reference Books:

Name	Author	Publishers
Prestressed Concrete	N Krishna Raju	McGraw Hill
Design of Prestressed Structures	T.Y.Lin and N.H.Burns	Wiley Eastern Ltd
Fundamentals of Prestressed Concrete	N.C.Sinha and S.K.Roy	-
Prestressed Concrete	S.Ramamurthan	-

CO-PO mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	3	2	2	-	-	-	1	-	-	-	-	-	2	2	-
CO 2	3	2	1	2	-	-	1	-	-	-	-	-	2	2	-
CO 3	-	2	1	-	1	3	1	-	-	-	-	-	2	2	-
CO 4	2	2	3	2	2	-	1	-	-	-	-	-	2	2	-
CO 5	2	2	1	2	2	-	1	-	-	-	-	-	2	2	-

COURSE NAME: STRUCTURAL DYNAMICS & EARTHQUAKE ENGINEERING
COURSE CODE: CE603C
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS : 3

Pre requisites: Student should knowledge about earthquake ,retrofitting and dynamics of the structure

Course Objective: Student should be able to deal dynamic behaviour and dynamics of structure as well as earthquake resistant design properly.

Course Outcome:

CO1 : Student will be able know Degrees of freedom, Undamped single degree freedom system, Damped single degree freedom system

CO2: Student will be able to know about Response of single degree freedom system due to harmonic loading

CO3 : Student will be able to know about Duhamel's Integral, Response due to constant force, Rectangular load, Introduction to numerical evaluation of Duhamel's integral of undamped system. **CO4** : Student will able to know about Fundamentals: Elastic rebound theory, Plate tectonics, Definitions of magnitude, Intensity, Epicenter etc., Seismographs, Seismic zoning, Response of Simple Structural Systems

CO5 : Student will able to know about Principles of earthquake resistant design

Course contents:

Module-I: **Theory of vibrations:** Degrees of freedom, Undamped single degree freedom system, Damped single degree freedom system, Natural frequency, modes of vibration, Introduction to multiple degree freedom system	**7L**
Module-II: **Response of single degree freedom system due to harmonic loading:** Undamped harmonic excitation, Damped Harmonic excitation	**7L**
Module-III: **Response due to Transient loading:** Duhamel's Integral, Response due to constant force, Rectangular load, Introduction to numerical evaluation of Duhamel's integral of undamped system.	**7L**
Module-IV: **Elements of seismology:** Fundamentals: Elastic rebound theory, Plate tectonics, Definitions of magnitude, Intensity, Epicenter etc., Seismographs, Seismic zoning, Response of Simple Structural Systems	**7L**
Module-V: **Principles of earthquake resistant design:** Terminology, General principles and Design criteria, Methods of Analysis, Equivalent lateral force method of Analysis for multistoried building as per Indian Standard Code of Practice, Introduction to Response Spectrum Method, Fundamental concepts of Ductile detailing	**8L**

Text / Reference Books:

Name	Author	Publishers
Structural Dynamics (Theory and Computation)	Mario Paz	CBS Publishers and Distributor
Dynamics of Structure (Theory and Application to Earthquake Engineering)	A.K.Chopra	Pearson Education
Elements of Eathquake Engineering	Jai Krishna, A. R. Chandrashekhar and Brijesh Chandra N.C.Sinha and S.K.Roy	South Asian Publishers
Earthquake Resistant Design	D. J. Dowrick	John Willey & Sons
IS 1893 (Part 1): 2002, IS 3920, IS 4326 - Bureau of Indian Standard	-	-

CO-PO mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	**3**	**3**	**2**	**2**	**3**	**3**	**1**	**2**	**3**	**3**	**3**	**3**	**2**	**2**	**3**
CO2	**3**	**3**	**3**	**2**	**2**	**2**	**3**	**1**	**3**	**2**	**3**	**2**	**2**	**3**	**3**
CO3	**2**	**2**	**3**	**2**	**1**	**2**	**3**	**3**	**2**	**3**	**2**	**2**	**3**	**2**	**2**
CO4	**3**	**3**	**2**	**3**	**2**	**2**	**1**	**2**	**3**	**2**	**2**	**2**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**3**	**3**	**1**	**1**	**1**	**3**	**3**	**2**	**3**	**2**	**2**	**3**

COURSE NAME: INFRASTRUCTURE PLANNING & DESIGN
COURSE CODE: CE604A
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS : 3

Pre requisites: Basic Civil Engineering knowledge in design and construction management.

Course Objective: To provide students with the demanding business environments and economy, infrastructure planning & design which must utilize current technologies and deliver the highest performance at the lowest cost. Infrastructure is composed of public and private physical improvements such as roads, railways, bridges, tunnels, water supply system and sewers.

Course Outcome*:*

CO1 : Students will summarise basic knowledge about the role of infrastructure in economic development, India's infrastructural capacity and its scenario in adequacy and quality.
CO2 : Students will understand application of techniques to estimate supply and demand for infrastructure along with stratergic planning required in urban, regional and national levels
CO3 : To know the common aspects of rural and urban infrastructure management and to fuse them into an integrated infrastructure management.
CO4 : Assessment of risk management, understanding the stakeholders concerns and overviewing of policies involved in infrastructure management.

Course contents:

Module-1: [6L+3T] **Introduction to Infrastructure Planning and management:**Definition of basic terminologies, role of infrastructure in economic development, present scenario in India [2L+1T] **Development of infrastructure capacity:**Build-operate-transfer (BOT) schemes, concessions, development gain, public and private funding and quantification of demand and supply of various types of infrastructure [2L+1T] **Indian scenario in respect of infrastructure**: The importance of its infrastructure at present and its requirements in future to develop progressively. [2L+1T]	**9L**
Module -2: [6L+3T] **Infrastructure planning:**Goals and objectives of infrastructure planning, identification and quantification of factors influencing infrastructural demand. [2L+1T] **Perspectives on planning:**A technical perspective, a political perspective and a combination of both perspectives at work.[2L+1T] **Planning indicators:**Use of econometric, social and land use indicators and models to forecast the demand and level of service of infrastructure. Identification and prioritization of preferred areas for development. [2L+1T]	**9L**
Module -3: [7L+3T]	**10L**

Infrastructure Management: Usage of Cost-benefit Analysis (**CBA**) to arrive at sustainable and feasible investment decisions.[2L+1T] **Evaluation techniques:**The economic evaluation versus financial evaluation of two major essential turnkey projects with help of case study. Public unease and private finance.[2L+1T] **Integrated infrastructure management**: health assessment through expert committee and implementation of suggestive remedial measures, sizing of each infrastructure component, ordering, installation, initial configuration, optimization and their follow up for each incidents along with remedies to create a new management model. [3L+1T]	
Module -4 [6L+2T] **Participation in infrastructure projects**: Public-Private Sector Participation in infrastructure projects and their overview. Risk management in infrastructure projects. [2L+1T] **Infrastucturesector overview:**Analysis of highways, railways, waterways, airports, urban and rural infrastructure: roads, housing, water supply and sanitation systems withhelp of prominent casestudies.[4L+1T]	**8L**

Text / Reference Books:

Name	Author	Publishers
Infrastructure Planning and Finance: A Smart and Sustainable Guide for local practitioners	Vicki Elmer, Adam Leigland	Routledge
Infrastructure planning	James Parkin	Thomas Telford
Public Infrastructure Asset Management	Ralph Haas, W. Ronald Hudson, and Waheed Uddin	McGrawhill publications
Public- private partnership projects in infrastructure	Jeffrey delmon	Cambridge University Press
Infrastructure Planning Handbook	Alvin.S Goodman ,Makarand Hastak	MH/ASCE Press

CO-PO mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	**2**	**-**	**-**	**-**	**2**	**3**	**-**	**3**	**2**	**2**	**3**	**2**	**2**	**2**	**-**
CO 2	**1**	**2**	**-**	**-**	**2**	**1**	**2**	**1**	**2**		**1**	**2**	**2**	**2**	**-**
CO 3	**3**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**2**	**2**	**2**	**-**
CO 4	**2**	**-**	**2**	**2**	**3**	**2**	**3**	**2**	**3**	**2**	**1**	**2**	**2**	**2**	**-**

COURSE NAME: PUBLIC TRANSPORT SYSTEM
COURSE CODE: CE604B
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS : 3

Pre requisites: Basic knowledge of Civil Engineering

Course Objective:

- Explain different transit modes, routing management activities including demand analysis.
- Provide information on functioning, designing and scheduling of transit terminal design, fleet management, and cost benefit analysis and bus transit operation.
- Provide information on loading and unloading transit platforms, traffic management techniques and IPT service improvements.
- Explain demand management techniques, intersection management techniques, planning for pedestrian, bicycle and parking management.

Course Outcome:

CO1 : Able to remember transit modes, management activities and demand analysis.
CO2 : Capable of designing transit terminal units, fleet management and cost analysis.
CO3 : Capable of planning and scheduling transit terminal platform for loading and un loading, selecting suitable traffic management techniques.
CO4 : Capable of selecting different demand management techniques, intersection management techniques and small area management.

Course contents:

Module 1: **System and Technologies:** Urban passenger transportation modes, transit classifications and definitions, theory of urban passenger transport modes, rail transit, bus transit, Para transit and ride sharing, designing for pedestrians, trends in transit rider ship and use of different modes.	**8L**
Module 2: **Comparing Alternatives:** Comparing costs, comparative analysis, operational and technological characteristics of different rapid transit modes, evaluating rapid transit **Planning:** Transportation system management, system and service planning, financing public transportation, management of public transportation, public transportationmarketing.	**10L**
Module 3: **Transit System Evaluation:** Definition of quantitative performance attributes, transit lane capacity, way capacity, station capacity, theoretical and practical capacities of major transit modes, quantification of performance	**8L**
Module 4: **City Traffic:** Classification of transportation systems, conventional transportation systems, unconventional transportation systems, prototypes and tomorrow's solutions, analysis and interpretation of information on transportation systems, perspectives of future transportation.	**10L**

Text / Reference Books:

Name	Author	Publishers
Public Transportation	George E. Gray and Lester A. Hoel	Prentice Hall, New Jersey
Urban Public Transportation Systems and Technology	Vukan R Vuchic	Prentice Hall Inc., New Jersey
City Traffic - A Systems Digest'	Horst R. Weigelt, Rainer E. Gotz, Helmut H. Weiss	Van Nostrand Reinhold Company, New York
Metropolitan Transportation Planning'	John W. Dickey	Tata McGraw-Hill Publishing Co. New Delhi

CO-PO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	3	3	-	-	-	-	-	-	2	2	2	-
CO2	3	2	2	2	1	-	-	-	-	-	-	2	2	2	-
CO3	2	2	2	2	2	-	-	-	-	-	-	1	2	2	-
CO4	3	2	2	3	2	-	-	-	-	-	-	3	2	2	-

COURSE NAME: TRANSPORTATION ENGINEERING-II
COURSE CODE: CE604C
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS : 3

Pre requisites: Student should have knowledge about measurement and mathematical knowledge

Course Objective: The objective of this course is appreciate of the need for lifelong learning through the discussion of recent changes and studies of highway and transportation engineering, also have the ability to apply knowledge of mathematics, science, and engineering to understand the design techniques and equipment used in highway engineering.

Course Outcome:

CO1	Students will receive the introduction and history of highway engineering and economics also which will remain correct for long period of time.
CO2	Students will calculate and design the different component of the highway such as sight distances, horizontal curves, superelevation, extra widening, transition curves and gradient, vertical curves etc.
CO3	Students will learn about the design criteria of pavements by IRC guideline.
CO4	Students will get the knowledge about the traffic engineering and components of traffic.
CO5	Students will examine and test materials of highway such as Soil, Stone Aggregate, Bitumen, Marshal Stability Test etc. Also get knowledge about construction of highway.

Course contents:

Module-I: [6L]

Introduction to Highway Engineering– Role of Transportation, Modes of transportation, History of Road Development, Nagpur Road Plan, Bombay Road Plan and Lucknow Road Plan, Road Plan 2021, Road Patterns, Jayakar Committee Report, saturation system, Population unit and productivity units, factors controlling highway alignment; engineering surveys for highway alignment and location.

Module-II: [3L]

Highway Economics- Highway financing (pay as you go method and credit financing method), quantifiable and non-quantifiable benefits to highway users, cost of vehicle operation, annual cost method, and benefit-cost ratio method.

Module-III: [9L]

Highway Geometric Design- Cross section elements, design factors, carriageway, camber, shoulder, PIEV theory, sight distances, horizontal curves, superelevation, extra widening, transition curves and gradient, vertical curves.

Module-IV: [9L]

Pavement Design– Evaluation of soil sub grade, sub-base, base and wearing courses; design factors for pavement thickness, failure of flexible and rigid pavements. IRC method of flexible pavement design (IRC 37-2001 & IRC 37-2012) Westergaard's analysis of wheel load stresses in rigid pavements; frictional stresses and warping stresses; IRC method for design of rigid pavements (IRC 58-2011).

Module-V: [3L]

Traffic Engineering- Traffic Characteristics, Volume studies, speed studies, capacity, density, traffic control devices.

Module-IV: [6L]

Highway Materials and Construction- Tests on Soil, Stone Aggregate, Bitumen, Marshal Stability Test, tar and asphalt, Road construction methods, water bound macadam, surface dressing, bituminous carpeting, bituminous bound macadam and asphaltic concrete, cement concrete road construction.

Text Books:

High Way Engineering Khanna & Justo Nemchand & Brothers, Roorkee

Reference Books:

Principles of Transportation Engineering P. Chakraborty & A. Das PHI
Transportation Engineering- C.J Khisty& B.K Lall.
I.S Specifications on Concrete , Aggregate & Bitumen Bureau of Indian Standard
Relevant latest IRC Codes (IRC-37 – 2001, IRC 58 – 2002, IRC 73 - 1980, IRC 86 - - 1983, IRC 106 – 1990, IRC 64 – 1990, IRC 15- 2002 Indian Road Congress

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	3	1	2	2	3	3	3	3	**2**	**2**	**-**
CO2	3	3	3	2	2	2	2	2	3	2	3	2	**2**	**2**	**-**
CO3	-	-	-	-	-	-	-	-	-	-	-	-	**2**	**2**	**-**
CO4	3	3	3	3	2	2	2	2	3	2	2	2	**2**	**2**	**-**
CO5	3	3	3	3	2	3	2	2	3	2	1	2	**2**	**2**	**-**

COURSE NAME: OPERATIONS RESEARCH
COURSE CODE: CE605A
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS : 3

Pre requisites: Basic concepts of Probability distribution , statistical estimation, regression analysis and ANOVA, Basic Mathematics

Course Objective:

1) To study various optimization techniques in real world problems related to civil engineering
2) To study the inventory models
3) To study about assigning jobs to people in an efficient way
4) To study about sequencing techniques
5) To understand transportation model utility in construction industry

Course Outcome:

CO1 : At the end of the course, the students will be able to identify and develop operational research models from the verbal description of the real System.
CO2: Apply the mathematical tools that are needed to solve optimisation problems.
CO3 : Use mathematical software to solve the proposed models.
CO4 : Develop a report that describes the model and the solving technique, analyse the results and propose recommendations in language understandable to the decisionmaking processes in Management Engineering.

Course contents:

Module 1: Introduction: Definition and scope of operations research (OR), OR model, solving the OR model, art of modeling, phases of OR study. Linear Programming: Two variable Linear Programming model and Graphical method of solution, Simplex method, Dual Simplex method, special cases of Linear Programming, duality, sensitivity analysis.	**8L**
Module 2 : Transportation Problems: Types of transportation problems, mathematical models, transportation algorithms, Assignment: Allocation and assignment problems and models, processing of job through machines.	**6L**
Module 3: Network Techniques: Shortest path model, minimum spanning Tree Problem, Max-Flow problem and Min-cost problem. Project Management: Phases of project management, guidelines for network construction, CPM and PERT.	**8L**
Module 4: Theory of Games: Rectangular games, Minimax theorem, graphical solution of 2 x n or m x 2 games, game with mixed strategies, reduction to linear programming model. Quality Systems: Elements of Queuing model, generalized poisson queing model, single server models.	**6L**
Module 5: Inventory Control: Models of inventory, operation of inventory system, quantity discount. Replacement: Replacement models: Equipments that deteriorate with time, equipments that fail with time.	**8L**

Text / Reference Books:

Name	Author	Publishers
Operations Research	Wayne L	Thomson Learning,2003.
Operations Research-An Introduction	Hamdy H. Taha	Pearson Education,2003
Operations Research	R. Panneer Seevam	PHI Learning, 2008
Total Quality Management	V.K.Khanna	New Age International, 2008
Linear Programming and Theory of Games	P. M. Karak	ABS Publishing House
Linear Programming and Theory of Games	Ghosh and Chakraborty	Central Book Agency
Operations Research	M. V. Durga Prasad	CENGAGE Learning

CO-PO mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	-	-	-	-	-	3	2	-	3	-	-	3	2	2	-
CO 2	-	-	-	-	-	1	-	1	-	3	-	1	2	2	-
CO 3	-	-	-	-	-	2	-	-	-	-	-	1	2	2	-
CO 4	-	-	-	-	-	3	2	-	3	3	-	2	2	2	-

COURSE NAME: HUMAN RESOURCE MANAGEMENT
COURSE CODE: CE605B
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS : 3

Pre requisites: Basic concepts of Management and Planning

Course Objective:

1) Explain the importance of human resources and their effective management in organizations
2) Demonstrate a basic understanding of different tools used in forecasting and planning human resource needs
3) Outline the current theory and practice of recruitment and selection and demonstrate the ability to prepare a selection strategy for a specific job.
4) Evaluate a benefits package that supports the organization's strategy in line with HRM cost-containment policies and practices and Recommend actions based on results of the compensation analysis and design compensation schemes that are cost effective, that increase productivity of the work force, and comply with the legal framework
5) Explain their understanding of the administrative complexities of providing a full array of benefits to employees and the ways and means of delivering these benefits

Course Outcome:

CO1 : To understand principles, processes and practices of human resource management.
CO2: To identify problems or barriers which complicate and distort the effectiveness of human resource planning.
CO3 : To understand various provisions contained in labour legislation relating to Industrial relations.
CO4 : Apply HR concepts and techniques in strategic planning to improve organizational performance.

Course contents:

Module- 1: Introduction **8L** Human Resource Management- Objectives, Scope and Significance of HRM, Functions of HRM, Problems and Prospects in HRM, Environmental scanning.	**8L**
Module-2: Planning, training and development **10L** Human Resource Planning, Demand Forecasting Techniques, Supply Forecasting Techniques, Analysing work and designing jobs, Recruitment and Selection, Interviewing Candidates. Human Resource Development, Orientation, Training and Development, Management Development, Performance Appraisal and Employee Compensation, Factors Influencing Employee Remuneration and Challenges, Incentives and benefits	**10L**
Module-3: Labour Laws **10L** Contract Labout Act, Equal Remuneration Act, Minimum Wage, Payment of wage, Gratuity, Bonus payment, Industrial Disputes and Discipline.	**10L**
Module-4: Managing Ethical Issues in Human Resource Management **8L** Workers Participation in Management, Employee safety and health, Managing Global Human Resources and Trade Unions ,International HRM, Future of HRM and Human Resource Information Systems.	**8L**

Text / Reference Books:

1. Aswathappa, Human Resource Management — TMH., 2010.
2. Garry Dessler and Biju Varkkey ,Human Resource Management, PEA., 2011.
3. Noe & Raymond ,HRM: Gaining a Competitive Advantage, TMH, 2008.
4. Bohlander George W, Snell Scott A, Human Resource Management, Cengage Learning, 2009.
5. William J Bruns Jr. "Performance Measurement, Evaluation and Incentives", Tata McGraw
6. Monappa A, "Personnel Management", Tata McGraw Hill, New Delhi, 1997
7. Rao T, "HRD in the New Economic Environment", Tata McGraw Hill

CO-PO mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	2	-	-	2	-	-	-	-	3	2	-	3	2	2	-
CO 2	-	2	-	3	-	2	-	2	-	3	-	2	2	2	-
CO 3	-	2	-	3	-	-	-	-	-	3	2	2	2	2	-
CO 4	2	-	-	-	-	3	2	-	-	2	3	-	2	2	-

COURSE NAME: STUDIES ON SIX SIGMA
COURSE CODE: CE605C
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS : 3

Pre requisites: Basic concepts of Management and Planning

Course Objective:

1. To translate the selection, application and implementation of a Six Sigma project including roles and responsibility of team members
2. Collect appropriate data from process to support problem solving.
3. Create details flowchart and process maps.
4. Demonstrate ability to control and monitor process.

Course Outcome:

CO1 : Understand requirement of implementation of Six Sigma.
CO2: Relate Six Sigma concept to the overall business mission and objective.
CO3 : Understand Six Sigma methodology including DMAIC.
CO4 : Employ Six Sigma skills to lead a successful process improvement project for a meaningful result

Course contents:

Module 1: Introduction – General History of Six Sigma, Evolution and Value of Six Sigma, The Basics and meaning of Six Sigma, Basic Concepts of variation.	**4L**
Module 2 : Six sigma Roles and responsibilities, Implementing Six Sigma, Six Sigma Roadmap, Process Mapping, Lean Principles and Value Stream Mapping, Selection and defining Six Sigma Projects.	**4L**
Module 3: Becoming a Customer and Market-Driven Enterprise, Voice of the customer, Customer Expectations and Needs, Linking Six Sigma Projects to Strategies	**3L**
Module 4: Attributes of Good Metrics, Using Resources Wisely, Project Management Using the DMAIC and DMADV Models	**3L**
Module 5: The Lean enterprise, The History of Lean, Understanding lean, Lean & Six Sigma, The seven elements of waste	**3L**
Module 6: The Define Phase – Defining a process, Critical to Quality Characteristics, Cost of Poor Quality, Basic Six Sigma Metrics, Pareto Analysis	**3L**
Module 7: The Measure Phase – Process Definition, Cause and effect / Fishbone Diagram, Basic Probability and Statistics, X-Y Diagram, Normal Distribution and Normality, Precision & Accuracy, Process Capability	**4L**
Module 8: The Analyze Phase- Pattern of Variation, Multi-Vari Analysis, Inferential Statistics, Sampling	**4L**

Techniques & Uses, Central Limit Theorem, Hypothesis Testing, Confidence Intervals, Analysis of Variance (ANOVA)	
Module 9: Improve Phase: Simple linear Regression, Correlation, Regression Equations, Residual analysis, Multiple and Non- linear regression, Data transformation, Box Cox.	**4L**
Module 10: The Control Phase: Lean Controls, Control Methods for 5S, Kanban, Poka – Yoka (Mistake Proofing), Statistical process Control (SPC), Data collection of SPC, Six Sigma Control Plans, Cost benefit analysis, Elements of control Plan, Elements of Response Plan.	**4L**

Text / Reference Books:

Name	Author	Publishers
Simplified six sigma methodology tools and implementation	N. Gopala Krishnan	PHI
Eight steps to problem solving- six sigma	Mohit Sharma	Zorba Books
Six Sigma Handbook	PYZBEK	-
ASQ Certified Six Sigma Handbook	American Society of Quality	-

CO-PO mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	**3**	**1**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**2**	**-**
CO 2	**2**	**1**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**2**	**-**
CO 3	**3**	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**2**	**-**
CO 4	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**2**	**2**	**2**	**1**	**2**	**2**	**-**

COURSE NAME: STRUCTURAL DESIGN AND DETAILING
COURSE CODE: CE 691
CONTACT: 0:0:3
CREDITS : 1.50

Pre requisites: Student should knowledge about rcc and steel structure design of various structural components and building structure.

Course Objective: Student should be able to design structural components and RCC and steel structure .Students will be able to understand about the members of structure , different loading condition how it behaves and where to use such member

Course Outcome:

CO1: Design principle of R.C.C. sections. Limit state method of design Loads and stresses to be considered in the design as per I.S. code provision.
CO2: Design & detailing of a i) simply supported R.C.C Beam ii) Continuous T- Beam
CO3: Student should be able to Design & Detailing of columns, isolated and combined footing.
CO4: Design of different units: Slab, beam column, roofing and staircase from floor plan of a multistoried frame building, typical detailing of a two way floor slab.
CO5: Problems on general consideration and basic concepts

LIST OF TOPICS:

1. General considerations: Design principle of R.C.C. sections. Limit state method of design Loads and stresses to be considered in the design as per I.S. code provision.
2. Design & detailing of a i) simply supported R.C.C Beam ii) Continuous T- Beam.
3. Design & Detailing of columns, isolated and combined footing
4. Design & detailing of a i) simply supported one way slab ii) One way Continuous slab.
5. Design of different units: Slab, beam column, roofing and staircase from floor plan of a multistoried frame building, typical detailing of a two way floor slab.
6. Problems on general consideration and basic concepts
7. Discussion on different loads (i.e. wind load, Dead load, live load and others) as per IS875
8. Design & drawing of the following components of a roof truss:

Members of the roof truss. Joints of the roof truss members, Purlins, Gable bracings, Column with bracings, Column base plate, Column foundation

Text Books/ Reference Books:

R.C.C design: Punmia, Jain, Jain
Design Of Steel Structures - S.K.Duggal Tata Mc-Graw Hill , New Delhi New Delhi
Reinforeced cement concrete design- Nilam shrama
Design of Steel structures N. Subramanian Oxford University Press
Design of steel structures A.S.Arya and J.L.Ajmani Nemchand& Bros.,

CO-PO mapping:

CO	PO 1	PO2	PO 3	PO4	PO 5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	2	2	2	2	1	1	2	1	1	1	2	2	2	2
CO2	3	2	2	2	2	2	2	2	2	2	2	1	2	3	3
CO3	3	2	2	2	2	1	1	1	2	1	2	2	3	2	3
CO4	3	1	1	1	1	2	1	1	3	2	2	2	3	2	3
CO5	3	3	3	1	1	1	2	2	2	2	2	2	3	2	2

COURSE NAME: COMPUTER AIDED DESIGN
COURSE CODE: CE 692
CONTACT: 0:0:3
CREDITS : 1.50

Pre requisites: Fundamentals of computer operation with basic knowledge of Structure Analysis and Design for different structural components with basic knowledge of engineering drawing.

Course Objective: Students will be familiar with features of detailing and design of structure by using software detailing of different structural elements and analysis and design of those by using softwares.

Course Outcome:

CO1: Students will be able to integrate the role of graphic communication in the engineering design process
CO2: Students will be able to use CAD software to generate a computer model and technical drawing for a simple, well-defined part or assembly.
CO3: Students will be able to apply basic concepts to develop construction (drawing) techniques and produce 2D Orthographic Projections
CO4: Understand and demonstrate dimensioning concepts and techniques
CO5: Become familiar with the use of Blocks, Design Center, and Tool Palettes, Solid Modeling concepts and techniques

LIST OF LESSONS:

1. Introduction and important features of a software dealing with analysis and design of structures
2. Analysis and design of a multistoried building using software.
3. Preparation of detailed drawings of different structural elements including ductility detailing.
4. RCC Slab, beam, column and footing design.
5. Design and detailing of Steel Structures.
6. Analysis, Design and Detailing of Isolated and combined RC Footings

Text Books/ Reference Books:

1. Design of RCC Buildings usingSTAAD Prp V8i with
   Indian Example: Static and Dynamic Methods – T.S.Sharma – Educreation Publishing
2. Exploring Bentley STAAD Pro
   CONNECT Edition - - Prof. Sham Tickoo Purdue Univ. – Cadcim Technologies
3. Analysis and Design of Structures:
   A Practical Guide to Modelling – D. Trevor Jones – Bentley

CO-PO mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO 1	3	3	2	1	3	1	1	1	3	3	1	3	3	3	3
CO 2	3	3	3	1	2	2	1	-	2	2	2	3	3	3	3
CO 3	3	3	3	1	3	2	2	-	3	3	2	3	3	3	3
CO 4	2	2	2	1	2	2	1	2	3	2	2	3	3	3	3
CO 5	3	3	2	2	3	1	2	1	3	3	2	3	3	3	3

COURSE NAME: STRUCTURAL LAB
COURSE CODE: CE693
CONTACT: 0:0:3
CREDITS : 1.00

PRE REQUISITES

Student should knowledge about structural analysis.

COURSE OBJECTIVE:

Prepare students to understand and take up various test procedures and behaviours under different loading conditions for different members.

COURSE OUTCOME:

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

CO1- Demonstrate the method and findings of tension and compression tests

CO2- Understand the deflection behavior of members under bending.

CO3- Explain the method of bending tests on mild steel beam and concrete beam.

CO4- Demonstrate the method and findings of deflection of Plates under various load application points.

CONTENT:

Experiment no.1 – Stress – Strain behavior for the tensile test of mild steel and Hysd Bars.

Experiment no 2 – Load deflection behavior of a flexural beam member under varying load application points

Experiment no. 3 – Buckling and crushing of steel compression members

Experiment no. 4. – Buckling and crushing of RCC compression members

Experiment no. 5 – Load deflection pattern study for plate under various load application points.

Text / Reference Books:

Sl no	Name	Author	Publishers
1	Engineering Mechanics of Solids	By E. P. Popov	Pearson Education
2	Basic structural Analysis	C.S. Reddy	TMH
3	Statically indeterminate structures	C. K. Wang	McGraw-Hill
4	StructuralAnalysis (Vol I& Vol II)	S S Bhavikatti	Vikas Publishing House Pvt. Ltd
5	Structural Analysis	Ramammurtham	
6	Structures	Schodek & M. Bechhold	Pearson Education

CO-PO mapping

CO	PO1	PO2	PO3	PO 4	PO5	PO 6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	3	3	2	-	1	2	1	2	3	3	2	**2**	**2**	**-**
CO2	3	3	3	3	1	2	1	1	2	1	2	2	**2**	**2**	**-**
CO3	3	3	3	2	2	2	1	2	3	3	2	2	**2**	**2**	**-**
CO4	3	3	3	2	2	2	1	2	3	3	2	2	**2**	**2**	**-**

COURSE NAME: CONSTITUTION OF INDIA
COURSE CODE: MC 601
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 32

Pre requisites: NA

Course Outcome:

CO1: Develop human values, create awareness about law ratification and significance of Constitution
CO2: Comprehend the Fundamental Rights and Fundamental Duties of the Indian Citizen to implant morality, social values and their social responsibilities.
CO3: Create understanding of their Surroundings, Society, Social problems and their suitable solutions.
CO4: Familiarize with distribution of powers and functions of Local Self Government.
CO5: Realize the National Emergency, Financial Emergency and their impact on Economy of the country.

Course content:

1. Meaning of the constitution law and constitutionalism (2L)
2. Historical perspective of the Constitution of India (2L)
3. Salient features and characteristics of the Constitution of India (1L)
4. Scheme of the fundamental rights (2L)
5. The scheme of the Fundamental Duties and its legal status (2L)
6. The Directive Principles of State Policy – Its importance and implementation (2L)
7. Federal structure and distribution of legislative and financial powers between the Union and the States (3L)
8. Parliamentary Form of Government in India – The constitution powers and status of the President of India (2L)
9. Amendment of the Constitutional Powers and Procedure (2L)
10. The historical perspectives of the constitutional amendments in India (2L)
11. Emergency Provisions: National Emergency, President Rule, Financial Emergency (3L)
12. Local Self Government – Constitutional Scheme in India (3L)
13. Scheme of the Fundamental Right to Equality (2L)
14. Scheme of the Fundamental Right to certain Freedom under Article 19 (2L)
15. Scope of the Right to Life and Personal Liberty under Article 21. (2L)

Text / Reference Books:

1. Introduction to Constitution of India, D.D. Basu, Lexis Nexus
2. The Constitution of India, PM Bhakshi, Universal Law

CO-PO mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	3	2	3	-	-	-	2	2	2	-
CO2	-	-	-	-	-	3	2	3	-	-	-	2	2	2	-
CO3	-	-	-	-	-	3	2	3	-	1	-	2	2	2	-
CO4	-	-	-	-	-	3	2	3	-	1	-	2	2	2	-
CO5	-	-	-	-	-	3	2	3	-	1	-	2	2	2	-

4th Year 1st Semester

Sl No	Course Code	Paper Code	Theory	Contact Hours /Week				Credit Points
				L	T	P	Total	
A. THEORY								
1	PE	CE701	A. Water Resource Engineering B. Hydrology and Irrigation Engineering C.Hydraulic Structure	3	0	0	3	3
2	PE	CE702	A. Water and Wastewater Engineering B. Environmental Engineering C.Water Pollution and its Control	3	0	0	3	3
3	OE	CE703	A.Engineering Materials B.Electrical And Electronics Measurement C.Material Handling	3	0	0	3	3
4	OE	CE704	A. Urban Planning B. APPLICATION OF IOT IN CIVIL ENGINEERING	3	0	0	3	3
B. PRACTICAL								
5	PE	CE791	Environmental Engineering Lab	0	0	0	3	1.5
6	OE	CE792	Advanced Programming for Problem solving	0	0	3	3	1.5
7	PROJECT	PR 791	Major Project-I	0	0	0	4	2
8	PROJECT	PR 792*	Industrial Training / Internship	0	0	0	0	1
9	PROJECT	PR 793	Skill Development VII: Seminar & Group Discussion	1	0	0	1	0.5
C. MANDATORY ACTIVITIES / COURSES								
10	MC	MC 781	Entrepreneurship & Innovation Skill	0	0	3	3	3 Units
TOTAL CREDIT WITHOUT MOOCS COURSES								18.5
D.MOOCS COURSES**								
11	MOOCS COURSES	HM701	MOOCS COURSE-V	3	1	0	4	4
TOTAL CREDIT WITH MOOCS COURSES								**22.5**

***Collective Data from 3rd to 6th Semester (Summer/Winter Training during Semester Break & Internship should be done after 5th Semester or 6th Semester). All related certificates to be collected by the training/internship coordinator(s).**

**** MOOCS COURSES for HONOURS/MINOR Degree are Program specific and to be taken from MOOCS BASKET**

COURSE NAME: WATER RESOURCE ENGINEERING
COURSE CODE: CE701A
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS : 3

Prerequisite: Introduction to Fluid Mechanics in Civil Engineering.

Course Outcome: CO1. The Student should Understand the fundamentals of flow in open channels.
CO2.TheStudentswilllearntheconceptsofirrigation.
CO3. The student should understand estimating the different water requirement of different types of crops
CO4. The student should learn the design of irrigation channels soil conservation, flood control and other water management projects.
CO5. The Student should understand about groundwater resources, aquifers and wells.

Course Objectives: Students will gain knowledge on the hydrologic cycle, rainfall Calculation and measurement and frequency analysis of rainfall intensity curve. students will also be familiar with direct and indirect method of stream flow measurement to acquire the basic engineering technique of calculating hydrograph S curve flood routing. students will gain knowledge on irrigation methods duty, delta and crop seasons. To acquire knowledge on Canal irrigation and design of Alluvial channel by silt theories kennedy's method, lacey's theory. Familiarity with water logging and Drainage with basic knowledge on groundwater flow, Darcy's law, well , tube well.

Course Contents

Module 1 History of hydrology, Measurement of Rainfall, Rain gauges, Estimation of missing Rainfall data, Checking of consistency, Optimum number of Rain gauges. Calculation of average rainfall over area- different methods, Frequency analysis of rainfall intensity duration curve, depth-area-duration relationship, maximum intensity/ depth-duration-frequency relationship, Probable maximum precipitation, Rainfall mass curve, Hyetograph, Examples.	**6L**
Module 2 Evaporation, evapotranspiration and infiltration: Process, evaporimeters, evaporation equations, methods for reduce evaporation losses, measurement of evapotranspiration, evapotranspiration equation, Potential Evapotranspiration (PET), Actual evapotranspiration (AET), Blaney-Criddle method, Modified Penman's method, Forms of subsurface water, aquifer properties, geological formation of aquifers, Well hydraulics: steady state flow in wells, equilibrium equation for confined and unconfined aquifers, aquifer tests, measurement of drawdown. Examples.	**8L**

Module3 Stream-Flow measurement: Direct and indirect methods, Examples, Stage discharge relationship, SCS-CN method of estimating run-off volume, run-off hydrograph, Factors affecting runoff hydrograph, components of hydrograph, Factors affecting run-off, estimation of run-off, rainfall - runoff relationship, Examples.	**4L**
Module 4 Types of Irrigation system and their detail description, Crops and crop seasons in India, cropping pattern, duty and delta, relationship in duty & delta, Duty at various places, measures for improving Duty of water, Water requirements for crops, Base period, quality of Irrigation water, frequency of irrigation, Methods of applying water to the field: surface, sub-surface, sprinkler and Drip irrigation. Examples.	**6L**
Module 5 Irrigation canals: design principles of irrigation canals, navigation canals and drainage canals. Design of unlined alluvial channels by silt theories: Introduction, Sediment Load, Suspended load and its measurement, Bed load and its measurement, Kennedy's theory, procedure for design of channel by Kennedy's method, Lacey's theory, design procedure by Lacey's theory, Cross section of an irrigation canal, balancing depth. Example.	**8L**
Module 6 Lining of Irrigation canals: Objectives, advantages and disadvantages of canal lining, economics and requirement of canal lining. Water logging and drainage: causes, Effects and prevention of water logging. Types of open drains and closed drains, canal outlets, land reclamation. Example.	**4L**

Text / Reference Books:

Name	Author	Publishers
Irrigation Engineering & Hydraulic structures	S.K Garg	
Fluid Mechanics	A.K.Jain	

CO-PO mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	**1**	**2**	**2**	**-**	**-**	**2**	**3**	**-**	**1**	**2**	**-**	**1**	**2**	**2**	**-**
CO 2	**2**	**-**	**1**	**2**	**1**	**1**	**-**	**2**	**2**	**-**	**2**	**2**	**2**	**2**	**-**
CO 3	**-**	**1**	**1**	**2**	**3**	**2**	**1**	**-**	**2**	**1**	**-**	**-**	**2**	**2**	**-**
CO 4	**1**	**2**	**-**	**1**	**1**	**3**	**1**	**2**	**1**	**-**	**1**	**2**	**2**	**2**	**-**
CO 5	**-**	**1**	**1**	**-**	**1**	**-**	**-**	**-**	**-**	**2**	**1**	**1**	**2**	**2**	**-**

COURSE NAME: HYDROLOGY AND IRRIGATION ENGINEERING
COURSE CODE: CE701B
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS : 3

Pre requisites: Basic course in Hydraulic Engineering with emphasis on behavior and utilization of groundwater with basic knowledge of interpretation of charts and mathematics.

Course Objective: Students will gain knowledge on the hydrologic cycle, rainfall Calculation and measurement and frequency analysis of rainfall intensity curve. students will also be familiar with direct and indirect method of stream flow measurement to acquire the basic engineering technique of calculating hydrograph S curve flood routing. students will gain knowledge on irrigation methods duty, delta and crop seasons. To acquire knowledge on Canal irrigation and design of Alluvial channel by silt theories kennedy's method, lacey's theory. Familiarity with water logging and Drainage with basic knowledge on groundwater flow, Darcy's law, well , tube well.

Course Outcome:

CO1 : The student will be able to acquire knowledge of Hydrological Cycle and its component.
CO2 : The student will be able to understand irrigation water, use of irrigation water in farm land, different irrigation methods; effective usage of water resources.
CO3 : The student will be able to analyse Ground water and Surface water conveyance system.
CO4: The Student will learn Canal Irrigation, canal Lining and effect and prevention of water logging.

Course contents:

Module 1 History of hydrology, Measurement of Rainfall, Rain gauges, Estimation of missing Rainfall data, Checking of consistency, Optimum number of Rain gauges. Calculation of average rainfall over area- different methods, Frequency analysis of rainfall intensity duration curve, depth-area-duration relationship, maximum intensity/ depth-duration-frequency relationship, Probable maximum precipitation, Rainfall mass curve, Hyetograph, Examples.	**6L**
Module 2 Evaporation, evapotranspiration and infiltration: Process, evaporimeters, evaporation equations, methods for reduce evaporation losses, measurement of evapotranspiration, evapotranspiration equation, Potential Evapotranspiration (PET), Actual evapotranspiration (AET), Forms of subsurface water, aquifer properties, geological formation of aquifers, Well hydraulics: steady state flow in wells, equilibrium equation for confined and unconfined aquifers, aquifer tests, measurement of drawdown. Examples.	**5L**
Module 3 Stream-Flow measurement: Direct and indirect methods, Examples, Stage discharge relationship, SCS-CN method of estimating run-off volume, run-off hydrograph, Factors affecting runoff hydrograph, components of hydrograph, Factors affecting run-off, estimation of run-off, rainfall -runoff relationship, Examples.	**4L**

Module 4 Types of Irrigation system and their detail description, Crops and crop seasons in India, cropping pattern, duty and delta, relationship in duty & delta, Duty at various places, measures for improving Duty of water, Water requirements for crops, Base period, quality of Irrigation water, frequency of irrigation, Methods of applying water to the field: surface, sub-surface, sprinkler and Drip irrigation. Examples.	**6L**
Module 5 Classification of Rivers, River regime theory, effects of dam on river regime, Control and River training works, Behavior of Rivers. Examples.	**5L**
Module 6 Irrigation canals: design principles of irrigation canals, navigation canals and drainage canals. Design of unlined alluvial channels by silt theories: Introduction, Sediment Load, Suspended load and its measurement, Bed load and its measurement, Kennedy's theory, procedure for design of channel by Kennedy's method, Lacey's theory, design procedure by Lacey's theory, Cross section of an irrigation canal, balancing depth. Example.	**5L**
Module 7 Lining of Irrigation canals: Objectives, advantages and disadvantages of canal lining, economics and requirement of canal lining. Water logging and drainage: causes, Effects and prevention of water logging. Types of open drains and closed drains, canal outlets, land reclamation. Example.	**5L**

Text / Reference Books:

Name	Author	Publishers
Irrigation Engineering & Hydraulic structures	S.K.Garg	Khanna Publications.
Fluid Mechanics	A.K.Jain	

CO-PO mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO 1	2	3	-	2	2	-	-	2	1	3	1	2	**2**	**2**	**-**
CO 2	1	2	1	-	3	-	3	2	2	1	2	-	**2**	**2**	**-**
CO 3	1	-	2	3	-	3	1	1	1	2	3	3	**2**	**2**	**-**
CO 4	-	1	3	1	1	2	2	1	1	1	1	2	**2**	**2**	**-**

COURSE NAME: HYDRAULIC STRUCTURE
COURSE CODE: CE701C
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS : 3

Pre requisites:

Basic course on hydraulics with emphasis on fluid behavior pressure losses and application of theories in real scenario knowledge of seepage and groundwater calculation.

Course Objective:

Students will acquire knowledge on different elements of Hydraulic structure, diversion headwork, weirs, barrages.
Familiarity with hydraulic design of canals, Ogee fall and cross drainage works.
Aqua knowledge on dams, earthen dams, method of construction, type, failure causes, seepage control in earthen Dam, gravity dam.
Familiarity with spillways and its requirement capacity.

Course Outcome:

CO1 : Students will able to analyze and design hydraulic structures using of practice.
CO2 : Students will able to Apply the basic design principles to engineering design practice
CO3 : To define basic theories of hydraulic structure design concepts- cross drainage works, canal falls etc.
CO4 : To define basic theories of hydraulic structure design concepts- dams, culverts, siphons etc.
CO5 : To identify seepage under hydraulic structures and protection methods.

Course contents:

Module-1: Diversion Head works: Necessity, Difference between weir and Barrage, Type of Weirs, Selection of site, layout and description of each part, Effects of construction of a weir on the river regime, causes of failure of weirs on permeable foundation and their remedies	**4L**
Module-2: Theories of seepage and Design of weirs and Barrages: Failure of Hydraulic Structures Founded on Pervious foundations: i) By piping ii) By Direct uplift, Bligh's creep theory of seepage flow, Khosla's theory & concept of flow-nets, concept of exit gradient and critical exit gradient, Khosla's method of independent variable for determination of pressures and exit gradient for seepage below a weir or a barrage, necessary corrections, examples.	**8L**
Module-3: Hydraulic structures for canals: Canal falls, Description of ogee fall, Trapezoidal-notch fall, Syphon well drop. Examples	**2L**
Module-4: Cross-Drainage Works: Necessity, types, selection of a suitable type (Introduction only)	**2L**
Module-5: Dam (General): Definition, classification of Dams, factors governing selection of type of dam, selection of suitable site for a dam. Earthen Dams: Introduction, Types of Earthen Dams, Methods of Construction, Causes of failure, Design Criteria, Determination of line of seepage or phreatic line in Earthen Dam, seepage control in Earthen Dam, Examples.	**8L**

Module 6: Gravity Dam: Definition, Typical cross- section, Forces acting on Gravity Dam, Combination of forces for design, Mode of failure and criteria for structural stability of Gravity Dams, Principal and shear stresses. Elementary profile of a Gravity Dam, Concept of High and low Gravity Dam, Examples	**6L**
Module 7: Spillways: Types, Location, Essential requirements, spillway capacity. Components of spillway, Energy Dissipators, Stilling basins (Indian standard)	**6L**

Text / Reference Books:

Name	Author	Publishers
Hydrology & Water resources Engineering	S.K. Garg	Khanna Publication
Water resource Engineering	M.C. Chaturvedi	
Irrigation and Hydraulic Structure	S.K Garg	

CO-PO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	**2**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**-**
CO 2	**2**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**-**
CO 3	**2**	**1**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**2**	**-**
CO 4	**2**	**2**	**3**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**2**	**-**
CO 5	**1**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**-**

COURSE NAME: WATER AND WASTEWATER ENGINEERING
COURSE CODE: CE702A
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS : 3

Pre requisites: Fluid Mechanics or an equivalent course in fluid flow or hydraulics.

Course Objective:

Explore the relationship between the natural water cycle and human water use, and understand the principles of water resources planning and total water management. Describing the physical, chemical, and biological processes necessary for designing and managing drinking water treatment processes and water conveyance and distribution systems and the physical, chemical, and biological processes necessary for designing and managing primary, secondary, tertiary and advanced wastewater treatment processes and solids handling systems.

Course Outcome:

CO1 : Students will be able to summarize the quality parameters typically used to differentiate wastewater and judge the different classes of treated wastewater

CO2 : Students will be able to describe various types of process units used for preliminary, primary and secondary treatment and explain how they achieve the target level of treatment

CO3 : Students will be able to identify and summarize emerging technologies for advanced wastewater treatment and water recycling

CO4 : Students will be able to differentiate water and wastewater treatment on solid wastes management.

Course contents:

Module I: Water quality parameters, Water quality standards; conventional contaminants and emerging contaminants; Water treatment: Source selection process, selection of treatment chain, plant siting, Treatability studies. General considerations for source of drinking water; Water demand forecasting; Determination of reservoir capacity; Economic sizing of pumping mains/pumping station.	**4L**
Module 2: Sources of water, Quality and quantity of surface water**,** Reservoir storage capacity, Ground water Flow, Ground water Yield, Infiltration Gallery, Classification of different types of wells, Formation of cavity in wells, Measurement of open well yield, Tube wells, Different type tube wells and its failure, Artesian well.	**4L**
Module-3: Principles of Water Treatment process: Historical overview of water treatment, Considerations for layout of treatment plant, Sedimentation, Coagulation & Flocculation processes, Disinfection/ Chlorination, Water Softening, Filtration, removal of Dissolved Solids, Fluoride, Iron and Manganese etc. Water Pollution control and its Legislation.	**6L**
Modulet 4: Estimating the Design Sewage Discharge -Estimating Sewage Discharge, Design Periods for Different Components of a Sewerage Scheme, Future Forecasts and Estimating Design Sewage Discharge, Variations in Sewage Flow and their Effects.	**4L**
Module 5: Hydraulic Design of Sewers and S.W Drain Sections-Difference in the Design of Water Supply Pipes and Sewer Pipes and Sewer Pipes, Hydraulic Formulas for Determining Flow Velocities in Sewers, Effect of flow variations on Velocity in a Sewer, Hydraulic Characteristics of Circular Sewer, Quality and Characteristics of Sewage-Decomposition of Sewage,	**6L**
Module 6: Disposing of the Sewage Effluents-Disposal by Dilution, Disposal of Wastewaters in Rivers and Self, Disposal on Land for Irrigation, Dilution Method Vs Land Disposal Method	**6L**
Module 7: Municipal Wastewater Treatment Technologies Municipal wastewater treatment Pre-treatment, Primary treatment , Secondary treatment, Activated Sludge Process, Trickling Filters, Oxidation Pond, Waste Stabilisation Pond ,Advanced treatments for Sewage., Sludge and its Moisture Content, Sludge Digestion Process,	**6L**

Text / Reference Books:

Name	Author
Waste Water Treatment and Water Management : Water Treatment and Management	Anamika Srivastava
INDUSTRIAL WASTE WATER TREATMENT	A. D. Patwardhan

CO-PO mapping

CO	PO 1	PO2	PO 3	PO4	PO 5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	1	2	3	2	-	-	2	1	3	1	-	-	2	2	-
CO2	2	1	1	-	3	2	-	2	-	2	3	2	2	2	-
CO3	-	1	-	-	2	1	1	-	1	1	1	2	2	2	-
CO4	2	1	-	3	1	2	2	2	-	-	1	1	2	2	-

COURSE NAME: ENVIRONMENTAL ENGINEERING
COURSE CODE: CE702B
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS : 3

Pre requisites:

The basic concept of hydraulics with knowledge of pressure, loss etc calculation. Fundamentals of chemistry and preliminary knowledge of Quantity estimation.

Course Objective:

Students will gain knowledge on water demand and source of water they will acquire knowledge on water quality and its parameters. To be familiar with water distribution Network and water treatment procedures and methodology. Students will be familiar with sewage and Drainage and will be able to design sewer. Students will be acquainted with wastewater characteristics, pollution and wastewater treatment.

Course Outcome:

CO1 : Students will be able to understand key current environmental problems like level of pollution
CO2 : Be able to identify and value the effect of the pollutants on the environment: atmosphere, water and soil.
CO3 : Be able to analyze an industrial activity and identify the environmental problems.
CO4 : Be able to plan strategies to control, reduce and monitor pollution.
CO5 : Be able to select the most appropriate technique to purify and/or control the emission of pollutants.
CO6 : Be able to apply the basis of an Environmental Management System (EMS) to an industrial activity

Course contents:

Module - 1. Water demands: -Water demands; Per capita demand; Variations in demand; Factors affecting demand; Design period; Population forecasting	**3L**
Module - 2. Sources of water: Surface water sources; ground water sources.	**3L**
Module - 3. Water Quality: Impurities in water; Water quality parameters; Standards for potable water.	**3L**
Module-4. Conveyance of water: Hydraulic design of pressure pipes	**3L**
Module -5. Water Treatment: Typical flow chart for surface and ground water treatments; Aeration, Plain sedimentation, Sedimentation with coagulation, Water Softening, Filtration, Disinfection.	**6l**
Module -6. Water Distribution: Analysis of distribution network; Storage and distribution reservoirs; Capacity of reservoirs.	**6L**
Module – 7. Sewage and Drainage: Definition of Common Terms, Quantity estimation for sanitary sewage and storm sewage.	**3L**
Module – 8. Sewer Design: Hydraulic design of sewers, Partial flow diagrams and Nomograms	**3L**
Module – 9. Wastewater Characteristics & Water pollution: Physical, chemical and biological characteristics, DO, BOD and COD, pollution characteristics of typical industries, suggested treatment	**3L**
Module – 10. Wastewater Treatment: Typical flow chart for wastewater treatment; Primary Treatments; Secondary Treatments: Activated Sludge Process, Trickling Filter Process, Septic	**3L**

Tank.

Text / Reference Books:

Sl no	Name	Author	Publishers
1	Environmental Engineering	S.K .Garg,	Khanna Publishers
2	Water Supply, Waste Disposal and Environmental Pollution Engineering	A.K.Chatterjee	Khanna Publishers.
3	Environmental Engineering, Vol.II	P. N. Modi	-
4	Environmental Modelling	Rajagopalan	Oxford University Press.
5	Environmental Engineering	P. V. Rowe	TMH

CO-PO mapping

CO	PO 1	PO2	PO 3	PO4	PO 5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	1	2	3	1	1	3	3	3	1	1	1	2	1	2	3
CO2	2	2	3	2	1	3	3	2	1	1	1	2	1	2	3
CO3	3	3	3	3	2	2	3	2	3	3	3	2	3	3	3
CO4	3	3	3	3	3	2	3	2	3	2	3	2	3	3	2
CO5	3	3	3	3	3	1	3	2	2	3	3	1	3	3	3
CO6	3	3	3	2	3	3	2	1	2	3	3	1	3	3	2

COURSE NAME: WATER POLLUTION AND ITS CONTROL
COURSE CODE: CE702C
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS : 3

Pre requisites:

. This course is intended for undergraduates and first year graduate students. It is a science- based course that the students to be comfortable with mathematical calculations, physics and chemistry. Students who do not feel comfortable with these prerequisites will need to do outside self-study to progress satisfactorily through the course.

Course Objective:

1. The focus of the course is to provide basics of air and water pollution sources, properties, measurement and control
2. The course will provide the students the knowledge of currently available air and water pollution control technologies and devices
3. The theory behind the control methods, design of pollution control devices and efficiency analysis, as well as their applications.

Course Outcome:

CO1 : Identify sources, types and quantities of pollutants and determine their impact on the environment
CO2. Analyse pollutant transport issues in the environment and Development of transport equations
CO3. Describe the operational principles of pollution measurement devices and discover their respective application
CO4. Analyse and select appropriate treatment process for specific effluents emerging from industries
CO5. Analyse and select and design various pollution control devices

Course contents:

Module-I: Water quality parameters, Water quality standards; conventional contaminants and emerging contaminants; Water treatment: Source selection process, selection of treatment chain, plant siting, Treatability studies. General considerations for source of drinking water; Water demand forecasting; Determination of reservoir capacity; Economic sizing of pumping mains/pumping station.	**6L**
Module- II: Sources of water, Quality and quantity of surface water**,** Reservoir storage capacity, Ground water Flow, Ground water Yield, Infiltration Gallery, Classification of different types of wells, Formation of cavity in wells, Measurement of open well yield, Tube wells, Different type tube wells and its failure, Artesian well.	**6L**
Module-III: Principles of Water Treatment process: Historical overview of water treatment, Considerations for layout of treatment plant, Sedimentation, Coagulation & Flocculation processes, Disinfection/ Chlorination, Water Softening, Filtration, removal of Dissolved Solids, Fluoride, Iron and Manganese etc.	**8L**
Module-IV: Introduction to Water Pollution, Classification of Pollution, Water pollutants and sources, Water quality assessment, Effects of oxygen demanding wastewaters Dissolved oxygen and self-purification of rivers or streams.	**4L**

Module-V: Municipal Wastewater Treatment Technologies Municipal wastewater treatment Pre-treatment, Primary treatment , Secondary treatment, Activated Sludge Process, Trickling Filters, Oxidation Pond, Waste Stabilisation Pond ,Advanced treatments for Sewage.	**4L**
Module-VI: Industrial Wastewater Treatment Technologies Classification of industrial effluents Specific treatment process. Treatment of wastes from, Tanneries, Distilleries, Sugar mills, Pharmaceutical industries.	**4L**
Module-VII: Prevention for Water pollution, Water Pollution Legislation, Water Management, Local Water Balance Reshaping.	**4L**

Text / Reference Books:

Name	Author	Publishers
1. Environmental pollution and control engineering,	C.S. Rao,	New Age International , 2007
2. Environmental Engineering, A Design Approach,	A.P. Sincero, G.A. Sincero	Prentice Hall of India , 2002

CO-PO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	**1**	**2**	**1**	**1**	**2**	**-**	**-**	**3**	**-**	**1**	**1**	**2**	**2**	**2**	**-**
CO 2	**2**	**-**	**-**	**2**	**1**	**2**	**3**	**1**	**1**	**2**	**2**	**1**	**2**	**2**	**-**
CO 3	**-**	**2**	**1**	**1**	**2**	**2**	**1**	**1**	**2**	**-**	**-**	**-**	**2**	**2**	**-**
CO 4	**1**	**1**	**2**	**-**	**-**		**-**	**-**		**1**	**2**	**1**	**2**	**2**	**-**
CO 5	**-**	**-**	**1**	**2**	**1**	**1**	**1**	**-**	**2**	**-**	**1**	**2**	**2**	**2**	**-**

COURSE NAME: ENGINEERING MATERIALS
COURSE CODE: CE703A
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS : 3

Pre requisites: Knowledge of materials and metals, Definition of crystal, Knowledge of alloys etc.

Course Objective: Introduction and behaviour of metals and crystals structure.
Introduction of phase diagram.
Introduction of Iron Carbide system and metal alloys.
Mechanical properties and different types of treatments of metals and materials.
Use of polymers.

Course Outcome*:*
CO1 : Understanding the behaviour and properties of materials
CO2 : Understanding the features of crystals and alloys
CO3 : Uses of polymers, ceramic etc

Course contents:

Module-I: **Introduction:** Material Science—its importance in engineering; Classification of Materials—metals, polymers, ceramics, composites; Advanced materials—semiconductors, smart materials, nano-materials; Review atomic structure, Atomic bonding in solids—bonding forces and energies; ionic/covalent/metallic bonding.	**3L**
Module-II: **Crystal Structure:** Fundamental concepts; Unit cells; seven crystal systems; single crystal, poly crystalline and non-crystalline materials; Metallic crystal structures—FCC, atomic packing factor, BCC & HCP structures.	**3L**
Module-III: **Imperfections in Metals:** Point defects due to vacancy & impurities, alloys, solid solutions; Dislocations—lineardefects, interfacial defects, grain boundaries.	**2L**
Module-IV: **PhaseDiagrams:** Definition and basic concepts; solubility limit; Phase equilibrium, one component phase diagram, binary phase diagram, interpretation of phase diagrams.	**2L**
Module-V: **Iron-carbon System:** allotropy of iron, iron-iron carbide phase diagram, properties and uses of plain carbon steel.	**2L**

Module-VI: **Classification of Metals and Alloys- compositions, general properties and uses:** **Ferrous alloys:** Classification–low carbon steels, medium carbon steels, high carbon steels, stainless steels, alloy steels, tool and die steel, cast irons. **Non-ferrous alloys:** Copper & Copper alloys; Aluminum alloys; Zinc alloys; Nickel alloys; Lead & Tin alloys.	**4L**
Module-VII: **Mechanical Properties of Materials:** Elastic properties of materials—tensile and compressive stress and strain, stress-strain behaviour, modulusofelasticity (Young's modulus), yield strength, tensile strength, plastic deformation, true stress and strain; Ductility; Resilience;Toughness,impacttests; Hardness Brinell, Rockwell and Vickers hardness and their testing procedures, correlation between hardness and tensile strength; Fatigue strength; Effect of temperature on tensile strength & impact properties, creepfailure.	**4L**
Module-VIII: **HeatTreatment:**Definition and purposes; Heat treatment processes for steels— Hardening, structural change during heating and cooling, factors affecting hardening; Tempering; Austempering; Normalizing; Annealing—fullannealing, spheroidisinganneal ing, stress–relieving, recrystallisationannealing; Precipitationor Age Hardening of non-ferrous alloys.	**6L**
Module-IX: **Polymers & Elastomers:** Definition; How polymers are made- polymerization; Polymer molecular structures; Thermoplastics & Thermosets; Special characteristics like low sp.gravity, optical, electrical & thermal property, decorative color, easy formability, low corrosion etc. Use of polymer sand elastomers.	**2L**
Module-X: **Ceramic Materials:** What is ceramics; common ceramic materials and their characteristics; How ceramics are made—sintering and vitrification process; Ceramic structures; Properties and applications.	**2L**
Module-XI: **Composite materials:** What is composites; Polymers matrix and their applications; Metal matrix and ceramic matrix composites and their applications; How composites are made.	**2L**
Module-XII: **Corrosion and Degradation of Engineering Materials:** Definition; Types ofcorrosion—uniform, pitting, crevice, galvanic, stress corrosion cracking and erosion;Corrosion control — material selection, environment control, proper design.	**2L**
Module-XIII: **Materials Selection Methodology:** Selection of material based on required properties, availability and cost of material, environmental issues.	**2L**

Text / Reference Books:

Name	Author	Publishers
Materials Science and Engineering	W.D. Callister and adapted by R. Balasubramaniam	Willey India, 2010 Ed.
Engineering Materials	properties and selection by Budinski & Budinski, 9th Ed.,	Prentice Hall India
Engineering Materials and Metallurgy	R.Srinivasan	2nd Ed., Tata McGraw Hill
Materials & Processes in Manufacturing	E.P.Degarmo and adapted by Black & Kosher	10th Ed., Wiley India.
Materials Science and Engineering	V.Raghavan	5th Ed., Prentice Hall India

CO-PO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3
CO 1	3	3	3	2	3	1	1	1	3	3	3	3	2	2	-
CO 2	3	3	3	2	2	2	1	1	3	2	3	2	2	2	-
CO 3	1	1	1	1	3	2	3	2	3	3	2	1	2	2	-

COURSE NAME: ELECTRICAL & ELECTRONICS MEASUREMENT
COURSE CODE: CE703B
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS : 3

Pre requisites: Concepts of basic Electrical Engineering

Course Objective:

- To learn the operation and construction of different type of measuring instruments.
- To understand the basic of wattmeter and energy meter.
- To learn the concept of various type of electronic instruments.
- To develop gain knowledge on measurement of power and energy.
- To relate the working of different types of instruments
- To develop an understanding of the operation principle of CRO.

Course Outcome:

CO1 : Understand the basics of Electrical measuring system and their classification
CO2 : Student will be able to measurement of voltage and current by the use of CT and PT for extending instruments ranges.
CO3 : Understand and measure of Resistance, Inductance, Capacitance, Power, and Energy
CO4 : Student will be able to understand the function of cathode ray oscilloscope with block diagram.
CO5 : Internal and general repairing of instruments and problem solving capacity

Course contents:

MODULE I Measurements: Method of measurement, Measurement system, Classification of instruments, Definition of accuracy, Precision, Resolution, Speed of response, Error in measurement, and noise Analog meters: General features, Construction, Principle of operation and torque equation of Moving coil, Moving iron, Electrodynamometer, Induction instruments • Principle of operation of the Electrostatic, Thermoelectric, Rectifier type instruments, Extension of instrument ranges and multipliers.	**6L**
MODULE II Instrument transformer: Disadvantage of shunt and multipliers, Advantage of Instrument transformers, Principle of operation of Current & Potential transformer, errors. Measurement of Power: Principle of operation of Electrodynamics & Induction type wattmeter. Wattmeter errors. Measurement of resistance: Measurement of medium, low and high resistances, Megger.	**10L**
MODULE III Measurement of Energy: Construction, theory and application of AC energy meter, testing of energy meters. Explain working and application of DC bridge: Wheatstone bridge, Kelvin's double bridgeAC Bridges: Measurement of Inductance, Capacitance and frequency by AC bridges. (Maxwell's bridge, Hay bridge, Schering bridge)	**12L**

MODULE IV Cathode ray oscilloscope (CRO): Measurement of voltage, current, frequency & phase by oscilloscope. Frequency limitation of CRO. Sampling and storage oscilloscope, Double beam CRO. Electronic Instruments: Advantages of digital meter over analog meters, Digital voltmeter, Resolution and sensitivity of digital meters, Digital multimeter, Digital frequency meter, Signal generator.	**8L**

Text / Reference Books:

Name	**Author**	**Publishers**
A course in Electrical & Electronic Measurements & Instrumentation,	A.K. Sawhney	Dhanpat Rai & sons.
Electrical Measurement & Measuring Instruments,	E.W. Golding & F.C. Wides,	Wheeler Publishing.
Electronic Instruments,	H.S. Kalsi,	Tata Mc-Graw hill, 2nd Edition
Sensors & Transducers,	D. Patranabis, PHI,	2nd edition.
Digital Instrumentation	A.J. Bouwens,	Tata Mc-Graw hill.
Modern Electronic instrumentation & Measuring instruments,	A.D. Heltric & W.C. Copper,	Wheeler Publication
Instrument transducers,	H.K.P. Neubert,	Oxford University press.

CO-PO mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**2**	**2**	**2**	**3**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**2**	**-**
CO2	**3**	**2**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**2**	**-**
CO3	**2**	**2**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**2**	**-**
CO4	**3**	**2**	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**2**	**-**
CO5	**3**	**2**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**2**	**-**

COURSE NAME: MATERIAL HANDLING
COURSE CODE: CE703C
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS : 3

Pre requisites: Student should have knowledge about the materials and the working principals of machines.

Course Objective: To inculcate the essentials of Civil Engineering field to the students of all branches of Engineering
To provide the students an illustration of significance of the civil engineering practices.
Classification of materials and mechanical handling
Basic concept of cranes, EOT, conveyor
Load handling attachments of machines and elementary design of AGV.

Course Outcome:
CO1: Ability to identify about the materials and the load characteristics.
CO2: Understanding the working principal of different types of conveyors, elevators
CO3: Understanding the working principal of Cranes, load handling instrument.
CO4: Understanding the principal and design of AGV, EOT

Course contents:

Module 1: Classification of Material, Bulk and unit load characteristics, Classification of mechanical handling equipment's	**6L**
Module 2: Different types of elevators, working principles and simple calculations of elevators, Theory of Belt conveyor, construction, salient parts, capacity and elementary design of conveyor.	**6L**
Module 3: Construction and elementary design of screw conveyor, Scrapper conveyor and trolley conveyor, Gravity chute, feeder and other accessories of conveyors	**8L**
Module 4: Classification and elements of cranes, Pulley block, wire ropes, chains, sheaves, sprockets and drum, Load handling attachments. Hand operated winch with spur, Hoisting pully block	**8L**
Module 5: Electric overhead travelling crane (EOT), Travelling mechanisms, Hoisting mechanisms. Jib and pillar cranes, Derricks and mobile cranes. Forklift trucks and manipulators, Flexible robotised handling systems, Automated guided vehicles (AGV), principles and elementary design.	**8L**

Text / Reference Books

Name	Author	Publishers
Introduction to Materials Handling,	S. Ray,	New Age Int. Pub.
Mechanical Handling of Materials,	T. K. Ray,	Asian Books Pvt. Ltd.
Materials Handling: Principles and Practices,	T.H. Allegri	CBS Publishers and Distributors.
Material Handling System Design,	J.A. Apple	John Wiley & Sons

CO-PO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	2	-	-	-	-	2	-	2	2	-
CO2	2	3	-	2	2	-	-	-	-	-	-	2	2	2	-
CO3		2	3	-	-	2	-	-	-	-	2	-	2	2	-
CO4	2	1	3	-	-	3	-	-	-	-	-	2	2	2	-

COURSE NAME: URBAN PLANNING
COURSE CODE: CE704A
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS : 3

Pre requisites: Student should knowledge about the procedure of urban planning.

Course Objective:

Student should be able to deal with The urban planning methods properly.

Course Outcome:

CO1 : Student will be able know the introduction of the man and Environment ,Biological and behavioral responses to human settlements, Role

CO2 : Student will be able to know about planning thought behind Jaipur and Delhi Studies of selected examples to include concentric city, , CIAM, linear industrial city and contemporary India Cities

CO3 : Student will be able to know about definitions of town planning, levels of planning and steps for preparation of a town plan

CO4 : Student will able to know about design of regional hubs like shopping malls, sub divisional hospitals, etc.

Course contents:

Module 1 -[6L+2T] Man and Environment ,Biological and behavioral responses to human settlements,Role of River Banks in growth of human settlement. Western world: River valley settlements, Greek, Roman, Medieval, Renaissance and modern.	**8L**
Module 2 -[6L+2T] Indus valley civilization - Mohenjodaro, Harappa, Extracts from Chanakya's Arthasastra, Manasara's Vastushastra, planning thought behind Jaipur and Delhi Studies of selected examples to include concentric city, , CIAM, linear industrial city and contemporary India Cities	**8L**
Module 3 -[9L+4T] Definitions of town planning, levels of planning and steps for preparation of a town plan, survey techniques in planning, concepts, functions, components and preparation of a development plan. Planning concepts related to garden city, neighbourhood planning, satellite towns and ribbon development. Concepts in Regional and Metropolitan planning, land subdivision regulations and zoning, nature of regulations and control, the comprehensive role of urban design in town planning process.	**10L**
Module 4 –[9L+4T] Design of regional hubs like shopping malls, sub divisional hospitals , etc.	**10L**

Text / Reference Books:

Name	Author
Urban Transportation: Planning, Operation and Management	S Ponnuswamy and Johnson Victor
Transportation Planning: Principles, Practices and Policies	Pradeep Kumar Sarkar and Vinay Maitri

CO-PO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	2	1	-	-	2	-	-	-	3	2	-	2	2	-
CO 2	2	3	-	2	2	-	2	-	3	-	-	2	2	2	-
CO 3		2	3	-	-	2	-	2	-	3	2	-	2	2	-
CO 4	2	1	3	-	-	3	-	-	-	1	-	2	2	2	-

COURSE NAME: INTRODUCTION TO INTERNET OF THINGS
COURSE CODE: CE704B
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS : 3

Prerequisite:
1. Fundamental knowledge in computer networking.
2. Basic knowledge of Microcontroller fundamentals.

Course Objective(s):
Students will understand the concepts of Internet of Things and can able to build IoT applications.

Course Outcome(s):
On completion of the course students will be able:

CO1 Understand and differentiate the concepts of Internet of Things and Internet
CO2 Identify appropriate MAC protocols and routing protocols while solving a problem
CO3 Analyze and compare the basic protocols in wireless sensor network and IoT
CO4 Solve different real life problems in different domains based upon the concept of IoT and sensor network
CO5 Implement basic IoT applications on embedded platform

Content
Module 1: [7L]
Fundamental of IoT
The Internet of Things, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Design challenges, Development challenges, Security challenges, Other challenges.

Module 2: [6L]
Wireless Sensor Network
Network & Communication aspects, Wireless medium access issues, MAC protocol , routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination.

Module 3: [7L]
IoT and M2M
A Basic Perspective– Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. M2M to IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.

Module 4: [7L]
IoT Architecture
Introduction, Architecture Reference Model- Introduction, Reference Model and architecture, IoT reference Model, IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and

Operational View, Other Relevant architectural views.

Module 5: [5L]
IoT Applications for Value Creations
Introduction to Arduino and Raspberry Pi, Cloud Computing, Fog Computing, Connected Vehicles, Data Aggregation for the IoT in Smart Cities,Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT in health care, Value for Industry, smart home Management.

Module 6: [4L]
Internet of Things Privacy, Security and Governance
Introduction, Overview of Governance, Privacy and Security Issues, Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in smart cities, Security. Data analytics in IoT.

Text books:
1.Vijay Madisetti and ArshdeepBahga, “Internet of Things (A Hands-on-Approach)”, 1st Edition, VPT, 2014.
2.Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1st Edition, Apress Publications, 2013.

Reference books:
1.Cuno Pfister, Getting Started with the Internet of Things, O‟Reilly Media, 2011, ISBN: 978-1-4493-9357-1
2.Waltenegus Dargie,ChristianPoellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice"

CO-PO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2								**2**	**2**	**-**
CO2	3	3	3	3	2								**2**	**2**	**-**
CO3	3	3	3	2	2		1						**2**	**2**	**-**
CO4	3	3	3	3	3	2	2						**2**	**2**	**-**
CO5	3	3	3	3	3	2	2		2	2	1	1	**2**	**2**	**-**

COURSE NAME: ENVIRONMENTAL ENGINEERING LAB
COURSE CODE: CE791
CONTACT: 0:0:3
CREDITS : 1.50

Pre requisites: Basic course of environmental engineering with preliminary knowledge of chemistry. Knowledge of different impurities and different dissolved solids with chemical behavior of that element.

Course Objective: Students will gain hands on knowledge on different test of water like total solids, turbidity, chloride, carbonate, hardness, fluoride, Iron, residual chlorine demand, BOD, COD, DO, organic matter, nitrate, phosphate and bacteriological quantity of water.

Course Outcome:

CO1: To enumerate various economic, financial, social and sustainable tools in infrastructure management.
CO2: Identify appropriate test for environmental problems
CO3: Statistically analyze and interpret laboratorial results
CO4: Apply the laboratorial results to problem identification, quantification, and basic environmental design and technical solutions.
CO5: Understand and use of water and wastewater sampling procedures and sample preservations.

LIST OF EXPERIMENT:

EXPERIMENT NO.	EXPERIMENT NAME	TYPE OF TEST
1.	Determination of turbidity for a given sample of water	PHYSICAL
2.	Determination of solids in a given sample of water: Total Solids, Suspended Solids and Dissolved Solids	
3.	Determination of pH for a given sample of water	CHEMICAL
4.	Determination of concentration of Chlorides in a given sample of water	
5.	Determination of carbonate, bi-carbonate and hydroxide alkalinity for a given sample of water	
6.	Determination of hardness for a given sample of water	
7.	Determination of concentration of Fluorides in a given sample of water	
8.	Determination of concentration of Iron in a given sample of water	
9.	Determination of the Optimum Alum Dose for a given sample of water through Jar Test	

10.	Determination of the Residual Chlorine in a given sample of water	
11.	Determination of the Chlorine Demand for a given sample of water	
12.	Determination of the Available Chlorine Percentage in a given sample of bleaching powder	
13.	Determination of amount of Dissolved Oxygen (DO) in a given sample of water	
14.	Determination of the Biochemical Oxygen Demand (BOD) for a given sample of wastewater	
15.	Determination of the Chemical Oxygen Demand (COD) for a given sample of wastewater	
16.	Determination of Organic matter / Organic Carbon for a given sample of water	
17.	Determination of Phosphate for a given sample of water	
18.	Determination of Nitrate for a given sample of water	
19.	Determination of Sulphate for a given sample of water	
20.	Determination of bacteriological quality of water: presumptive test, confirmative test and Determination of MPN	BACTERIOLOGICAL

Text / Reference Books:

Name	Author	Publishers
1. Environmental Engineering. Volume-1 and Volume-2. 2.	Garg, S.K.	Khanna Publishers
Environmental Engineering.	Peavy, H.S, Rowe, D.R, Tchobanoglous, G	McGraw Hill International Edition / Tata McGraw Hill Indian Edition

CO-PO mapping:

CO	PO 1	PO2	PO 3	PO4	PO 5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	1	2	3	2	3	3	3	2	1	2	2	1	2	2	2
CO2	3	3	3	3	2	1	3	3	3	2	1	2	2	2	2
CO3	3	3	3	3	2	2	3	3	2	3	2	2	3	3	3
CO4	3	3	3	3	3	3	3	1	3	2	3	3	3	3	3
CO5	2	2	3	3	1	2	3	1	3	1	3	1	3	2	1

COURSE NAME: ADVANCED PROGRAMMING FOR PROBLEM SOLVING
COURSE CODE: CE792
CONTACT: 0:0:3
CREDITS : 1.50

Pre requisites: Number system, Boolean Algebra, Basic C programming concepts.

Course Objective: Students will be able to understand the algorithms for arithmetic and logical problems and translate the algorithms to C programs and able to test and execute the programs and correct syntax and logical errors during compile and run time.

Course Outcome:

CO1: To formulate the algorithms for arithmetic and logical problems and translate the algorithms to C programs.
CO2: To be able to test and execute the programs and correct syntax and logical errors during compile and run time.
CO3: To implement conditional branching, iteration and recursion.
CO4: To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
CO5: To use arrays, pointers, structures, unions and files to formulate algorithms and programs and apply programming to solve searching and sorting problems.

LIST OF EXPERIMENT:

Experiment should include but not limited to the following:

- Writing C Programs on variable types, type conversions and simple computational problems using arithmetic expressions.
- Writing C Programs on various problems involving if-then-else structures to implement branching and logical expressions.
- Writing C Programs on loops (for, while, do-while) to implement iterative problems.
- Writing C Programs on 1D array and various searching and sorting techniques.
- Writing C Programs to implement String operations.
- Writing C Programs to implement matrix operations using 2D array.
- Writing C Programs to implement user defined function concept and to implement various programs using ‘call-by-value’ and ‘call-by-reference’.
- Writing C Programs to implement recursion concept to understand the advantages of recursion.
- Writing C Programs to implement various properties of pointers.
- Writing C Programs to implement self defined structures.
- Writing C Programs to implement dynamic memory allocation.
- Writing C Programs to implement file operations.

Text / Reference Books:

Text Books:

1. Kanetkar Y. - Let us C, BPB Publication, 15th Edition
2. E Balagurusamy – Programming in ANSI C, TMH, 3rd Edition

Reference Book:

K R Venugopal & S R Prasad – MASTERING C, TMH, 2nd Edition

CO-PO mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	3	-	-	-	-	-	3
CO2	3	3	3	2	-	-	-	-	3	-	-	-	-	-	3
CO3	3	3	3	3	-	-	-	-	3	-	-	-	-	-	3
CO4	3	3	3	3	-	-	-	-	3	-	-	-	-	-	3
CO5	3	3	3	3	-	3	-	-	3	-	2	-	-	-	3

COURSE NAME: ENTREPRENEURSHIP & INNOVATION SKILL
COURSE CODE: MC701
CONTACTS: 0:0:3
TOTAL CONTACT HOURS: 24

Prerequisite: None

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

CO1: Comprehend the role of bounded rationality, framing, causation and effectuation in entrepreneurial decision making.
CO2: Demonstrate an ability to design a business model canvas.
CO3: Evaluate the various sources of raising finance for startup ventures.
CO4: Explain the fundamentals of developing and presenting business pitching to potential investors.

Course Content

Module 1: **4 hrs**
Introduction to Entrepreneurship: Entrepreneurs; entrepreneurial personality and intentions - characteristics, traits and behavioral; entrepreneurial challenges. Entrepreneurial Opportunities: Opportunities. discovery/ creation, Pattern identification and recognition for venture creation: prototype and exemplar model, reverse engineering.

Module 2: **4 hrs**
Entrepreneurial Process and Decision Making: Entrepreneurial ecosystem, Ideation, development and exploitation of opportunities; Negotiation, decision making process and approaches, Effectuation and Causation; Advantage and Limitations of Entrepreneurship; Process of Entrepreneurship.

Module 3: **4 hrs**
Crafting business models and Lean Start-ups: Introduction to business models; Creating value propositions-conventional industry logic, value innovation logic; customer focused innovation; building and analyzing business models; Business model canvas, Introduction to lean startups, Business Pitching.

Module 4: **4 hrs**
Organizing Business and Entrepreneurial Finance: Forms of business organizations; organizational structures; Evolution of Organisation, sources and selection of venture finance options and its managerial implications. Policy Initiatives and focus; role of institutions in promoting entrepreneurship.

Module 5: **4 hrs**
Entrepreneurs as problem solvers: Innovations and Entrepreneurial Ventures – Global and Indian; Role of Technology – E-commerce and social media; Social Entrepreneurship – Concept; Entrepreneurship – The Indian Scenario.

Module 6: **4 hrs**
Project/Case Study: (Any One)
1. Visit of the District Industries Centre and prepare a report of activities and programs undertaken by them
2. Conduct a case study of any entrepreneurial venture in your nearby area.
3. Field Visit: Visit any business firm near your locality; interact with the owner of the business firm and prepare a field report on parameters like: type of business, scale of business, product/service dealing in, target customer, problems faced and measures to solve the faced challenges. 4. Know your State Handicraft and Handlooms as a means of economic activity

Text Books:

1. Bessant, J. (2003) High Involvement Innovation: Building and Sustaining Competitive Advantage Through Continuous Change. Chicester: John Wiley & Sons.
2. Bygrave, W and Zackarakis, A (2013) Entrepreneurship, 3rd Edition, John Wiley and Co. Drucker, P. (1999) Innovation and Entrepreneurship, Butterworth Heinemann, Oxford.
3. Fagerberg, J, Mowery, DC and Nelson, RR (2005) The Oxford Handbook of Innovation, Oxford University Press, NY.
4. Hisrich, R.D., Peters, M.P., and Shepherd, D. (2013) Entrepreneurship, McGraw-Hill Irwin, Boston.
5. Kuratko, D. (2013) Entrepreneurship: Theory, Process, and Practice, 9th Edition, Wiley online library.
6. Moore, Geoffrey, (1999) Crossing the Chasm, Harper & Collins.
7. Porter, ME, Competitive Advantage: Creating and Sustaining Superior Performance, Free Press, New York, NY, 1985

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		1	2	3			2		2	3	3	1	2	3
CO2	3	1		1			1		1		3	3		1	
CO3	3		2		2	3				2	3	3	2		2
CO4	3	2		1				2	2		3	3		1	

4th Year 2nd Semester

Sl No	Course Code	Paper Code	Theory	Contact Hours /Week				Credit Points
				L	T	P	Total	
A. THEORY								
1	PE	CE801	Dynamics of Soil & Foundation Finite Element Analysis Advanced Structural Analysis	3	0	0	3	3
2	OE	CE802	Advanced Foundation Engineering Advanced Transportation Engineering Pavement Design	3	0	0	3	3
3	OE	CE803	Metro System and Engineering Air & Noise Pollution And Control Remote Sensing And GIS	3	0	0	3	3
B. PRACTICAL								
4	PROJECT	PR 891	Major Project-II	0	0	0	12	6
5	PROJECT	PR 892	Grand Viva	0	0	0	0	1
C. MANDATORY ACTIVITIES / COURSES								
8	MC	MC 881	Essence of Indian Knowledge Tradition	0	0	3	3	3 Units
TOTAL CREDIT								16

COURSE NAME: DYNAMICS OF SOIL & FOUNDATION
COURSE CODE: CE801A
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS : 3

Pre requisites:

Knowledge of Basic Soil Mechanics / Fundamental Geotechnical Engineering.

Course Objective:

The aim of the course to train the students, with the background of basic degree in civil engineering, in the field of soil dynamics. The emphasis is given for (i) the design of foundations and isolation systems subjected to different kinds of vibrations, (ii) determination of dynamic properties of soils by using laboratory and non-destructive field tests, and (iii) liquefaction assessment.

Course Outcome:

CO1 : Understand the dynamic behaviour of foundations.
CO2 : Design foundations and isolation systems subjected to different kinds of vibrations.
CO3 : Determine dynamic properties of soils by using laboratory and non-destructive field tests.
CO4 : Design machine foundations.
CO5 : Assess the liquefaction potential of a given site.

Course contents:

Module-I: **Introduction:** Principles of design of reinforced concrete members - Working stress and Limit State method of design. Introduction: Types of Machine Foundations, General requirement of Machine foundations, Dimensional criteria, Design data, Permissible amplitude, Permissible Bearing pressure	**4L**
Module-II: **Fundamental of vibrations:** Degrees of freedom, Natural frequency, Undamped single degree freedom system, Damped single degree freedom system, Transmissibility, Response to ground motion, Introduction to multiple degree freedom system	**6L**
Module-III: Dynamic properties of Soil, Laboratory and field evaluation of soil properties as per IS codes;	**6L**
Module-IV: **Analysis and design of Block type Machine Foundation:** Modes of Vibrations, Methods of Dynamic Analysis, Design considerations for dynamically loaded foundations and constructional features; Design procedures for foundations for hammers, reciprocating engines , Vibration Isolation and damping	**10L**
Module-V: **Liquefaction of soils:** Definition, Causes and effects of Liquefaction, Evaluation of Liquefaction potential, Mitigation of Liquefaction Hazards	**6L**
Module-VI: **Propagation of elastic waves in soils:** Mechanism of wave propagation, Body waves, Surface waves, Rayleigh waves	**4L**

Text / Reference Books:

Sl no	Name	Author	Publishers
1	Foundation Analysis & Design	J.E. Bowels	McGraw Hill
2	Principles of Foundation Engineering	B.M. Das	Thomson Book
3	Foundation Design Manual	N. V. Nayak	Dhanpat Rai Publication Pvt. Ltd
4	Foundations for Machines: Analysis and design	ShamsherPrakash, Vijay K Puri	Wiley Series in Geotechnical Engineering
5	Advance Foundation Engineering	N. Som& S. C. Das	
6	Hand Book of Machine Foundation	P. Sirinivashalu& C.V.Vaiddyanathan	Tata McGraw Hill

CO-PO mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	1	2	2	1	2	2	3	2	2	3
CO2	3	3	1	2	2	2	2	2	3	2	1	3	2	2	3
CO3	3	3	2	2	3	2	2	3	3	2	2	3	3	2	3
CO4	3	3	3	2	1	2	2	2	2	2	2	3	3	3	3
CO5	3	3	3	2	2	3	3	2	2	2	2	3	3	3	3

COURSE NAME: FINITE ELEMENT ANALYSIS
COURSE CODE: CE801B
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS : 3

Pre requisites: Basic knowledge of structural analysis for determinate and indeterminate structures, trusses and behavior of plates and preliminary knowledge of standard structural software and computer uses knowledge of matrices algebra.

Course Objective:

Students will gain knowledge on finite element analysis, finite element formulation techniques, element properties and numerical integration. Students will be able to formulate stiffness matrices and analysis of continuous beam and simple plane frame. To acquire knowledge on FEM for two dimensional analysis, FEM for plates and introduction of standard FEM in civil engineering.

Course Outcome:

CO1: Obtain an understanding of the fundamental theory of the FEA method.
CO2: Developed the ability to generate the governing FE equations for systems governed by partial differential equations.
CO3 : Make the students to apply the knowledge of mathematics, science and engineering to do the analysis of simple and complex elastic structures using the finite element analysis.
CO4: Learn and apply finite element solutions to structural, thermal, dynamic problem to develop the knowledge and skills needed to effectively evaluate finite element analysis

Course contents:

Module-I: [3L+1T] Introduction to Finite Element Analysis: Introduction, Basic Concepts of Finite Element Analysis, Steps in Finite Element Analysis, Fundamental concepts of Elasticity	**4L**
Module-II: [3L+1T] Finite Element Formulation Techniques: Virtual Work and Variational Principle, GalerkinApproach, Displacement Approach, Stiffness Matrix and Boundary Conditions	**4L**
Module-III: [6L+2T] Element properties: Concepts of shape functions: Natural Coordinates, one dimensional, Triangular, Rectangular Elements Isoparametric Formulation: Isoparametric Elements, Stiffness Matrix of Isoparametric Elements, Numerical Integration: One Dimensional, Two Dimensional	**6L**
Module-IV: [9L+3T]] Formation of stiffness matrices and analysis of Truss, Continuous Beam and Simple Plane Frame.	**10L**
Module-V: [4L+2T] FEM for two dimensional analyses:Constant Strain Triangle, Linear Strain Triangle, Rectangular Elements	**4L**
Module-VI: [3L+1T] FEM for Plates: Introduction to Plate Bending Problems, Finite Element Analysis of Thin Plate	**4L**
Module-VII: [3L+1T] Introduction to application of standard FEM software in civil Engineering	**4L**

Text / Reference Books:

Name	Author	Publishers
Finite Element Method with Applications in Engineering	Y. Desai et. al	Pearson
Introduction to Finite Element in Engineering	Chandrapatla&Belegundu	Pearson Education
A First Course in Finite Element Method	D. L. Logan	Thomson
Surveying:	Bannister, Raymond & Baker	Pearson Education
Concepts and Applications of Finite Element Analysis	R. D. Cook et. al	Wiley India
Finite Element Analysis – Theory and Programming	C. S. Krishnamoorthy	Tata Mcgraw Hill
Matrix, Finite Element,Computer and Structural Analysis	M. Mukhopadhyay Oxford and IBH Publishing Co. Pvt. Ltd.	New Delhi, India
Finite Element Procedures	K. J. Bathe PHI,	New Delhi, India

CO-PO mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	**3**	**2**	**2**	**2**	**3**	**3**	**2**	**2**	**3**	**3**	**3**	**2**	**3**	**3**	**3**
CO2	**3**	**3**	**3**	**3**	**2**	**2**	**2**	**3**	**2**	**3**	**3**	**3**	**3**	**2**	**3**
CO3	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**2**	**3**	**2**	**2**	**2**	**2**	**3**	**2**
CO4	**2**	**2**	**2**	**3**	**2**	**2**	**2**	**2**	**1**	**1**	**2**	**1**	**1**	**3**	**2**

COURSE NAME: ADVANCED STRUCTURAL ANALYSIS
COURSE CODE: CE801C
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS : 3

Pre requisites: Studentshould have knowledge about the subjects Strength of Materials and Structural Analysis-I & II.

Course Objective:

1. Learning the concept of Matrix method of analysis
2. Learning dynamic analysis of structural frames for wind loads.
3. Learning the theories of special structures like Plates & Shells.
4. Introduction to the advanced theories of elasticity.

Course Outcome:

CO1 : Students will understand matrix method of analysis.
CO2 : Students will learn to evaluate wind loads on structures.
CO3 : Students will learn to analyse plates and shell structures.
CO4 : Students will be able to apply knowledge of elasticity in different coordinate systems.

Course contents:

Module-I: **Matrix methods of analysis**: Matrix formulation of redundant beam analysis (Clapeyrons three moment theorem. Stiffness and flexibility approaches for beams, simple portal frame, trusses by matrix formulation.	**10L**
Module-II: **Dynamic analysis of structural frames:** Wind analysis of structures by using I.S. Code provisions. IS 875-III to be followed for the Wind Load calculations.	**6L**
Module-III: **Theory of plates and shells:** Thin plate analysis. Differential equation of bending under point and uniformly distributed load, various support systems. Rectangular and circular plates. Membrane analysis of thin shell, meridional & hoop stress, shell of revolution, cylindrical shell, applications.	**10L**
Module-IV: **Theory of Elasticity :** Three dimensional stress and strain analysis, stress - strain transformation, stress invariants; equilibrium and compatibility equations, boundary conditions; Two dimensional problems in Cartesian and Polar coordinates. Beam bending problems; Energy principles, variational methods and numerical methods.	**10L**

Text / Reference Books:

Name	Author	Publishers
Structural analysis (A Matrix approach)	Pandit Gupta	
Advanced structural analysis	Debdas Menon	

CO-PO mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	3	2	2	2	3	3	3	2	2	2	2	2	2	3
CO2	3	2	2	2	3	3	1	1	3	3	2	2	3	3	2
CO3	3	2	3	3	3	1	3	2	3	3	3	3	3	2	2
CO4	3	2	2	2	2	3	2	2	2	3	3	1	2	3	3

COURSE NAME: ADVANCED FOUNDATION ENGINEERING
COURSE CODE: CE802A
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS : 3

Pre requisites:

Basic knowledge of soil mechanics with emphasis on soil behavior, parameters, test procedure. Knowledge on foundation and bearing capacity and settlement analysis. Preliminary knowledge on vibration and dynamics of structures.

Course Objective:

Students will gain knowledge on soil exploration and site investigation, with bearing capacity from SPT and SCPT and plate load test data. Students will be able to design beams on elastic foundation and raft Foundation as per IS:2950 .
Familiarity with deep Foundation-pile, laterally loaded piles by as per codal provisions and load carrying capacity and settlement analysis.
Students will acquire knowledge on retaining wall and sheet pile structures.
Familiarity with design of foundation for vibration control and foundation on expansive soils.

Course Outcome:

CO1 : Determine suitable soil parameters
CO2 : Design and analyze foundation systems using conventional methods
CO3 : Design a budget and proposal for a Geotechnical investigation
CO4 : Design appropriate foundation systems based on ground-investigation data and be able to select correct soil parameters for the designs
CO5 : Understand limitations and uncertainties in geotechnical design

Course contents:

Module-I: **Soil Exploration and Site Investigation** Planning of soil exploration programme, Field testing, Preparation of bore-log and soil investigation report, Geo-physical exploration: Seismic refraction survey electrical resistively method	**4L**
Module-II: **Shallow Foundations** Bearing Capacity from SPT and SCPT and Plate load Test data, Proportioning of footing based on settlement criteria. Beams on elastic foundation: Infinite beam, Finite beam, Modulus of sub-grade reaction and effecting parameters. Raft Foundation: Settlement and Bearing Capacity analysis, Analysis of flexible and rigid raft as per IS 2950.	**10L**
Module-III: **Deep Foundations** Pile: Tension piles, Laterally loaded piles: Elastic continuum approach, Ultimate load Analysis, Deflection and maximum moment as per IS 2911, Pile load test Drilled Shaft: Construction procedures, Design Considerations, Load Carrying Capacity and settlement analysis, Caissons: Types, Sinking and control.	**6L**

Module-IV: **Retaining walls and sheet pile structures** Gravity, cantilever and counter fort retaining walls: Stability checks and design Sheet Pile Structures: Cantilever sheet piling, Anchored sheet piling: Free and fixed earth support methods of Analysis, Braced Excavation	**8L**
Module-V: **Design of foundation for vibration control** Elements of vibration theory, Soil- springs and damping constants, dynamic soil parameters, Types of Machine foundations, General consideration in designing dynamic bases.	**4L**
Module-VI: **Foundations on expansive soils**: Problems and Remedies	**4L**

Text / Reference Books:

Name	Author	Publishers
Foundation Analysis & Design	J.E. Bowels	McGraw Hill
Principles of Foundation Engineering	B.M. Das	Thomson Book
Foundation Design Manual	N. V. Nayak	Dhanpat Rai Publication Pvt. Ltd
Foundations for Machines: Analysis and design	Shamsher Prakash, Vijay K Puri	Wiley Series in Geotechnical Engineering
Advance Foundation Engineering	N. Som& S. C. Das	
Hand Book of Machine Foundation	P. Sirinivashalu & C.V.Vaiddyanathan	Tata McGraw Hill

CO-PO mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	3	2	1	2	1	2	2	3	3	2	3	3
CO2	3	3	3	2	2	1	2	2	2	1	3	3	3	3	3
CO3	3	1	1	2	2	2	3	3	3	2	3	3	3	2	3
CO4	3	3	3	3	3	2	3	2	2	2	2	3	3	3	3
CO5	3	3	3	3	3	1	2	2	2	2	2	3	2	2	3

COURSE NAME: ADVANCED TRANSPORTATION ENGINEERING
COURSE CODE: CE802B
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS : 3

Pre requisites: Basic knowledge of on transportation engineering with fundamentals of pavement design alignment survey and testing procedure of road material understanding basic methodology of transportation models and uses.

Course Objective: Students will gain knowledge on traffic Engineering and transportation planning. Familiarity with railway engineering location survey, Geometric design ,signaling and track maintenance. To acquire knowledge on Airport engineering- runways, taxiways, aprons, wind rose diagram, design and taxiway and terminal building.

Course Outcome:

CO1 : Learn about highway engineering and traffic engineering.
CO2 : Learnn about airport engineering
CO3 : Learn about Railway engineering.

Course contents:

Module-I: Traffic Engineering : Road user and vehicle characteristics; Traffic flow characteristics – Traffic Volume, Speed, Headway, Concentration and Delay; Traffic surveys & studies; Traffic estimation; Statistical applications in traffic engineering analysis; Parking; Road intersections – Basic traffic conflicts, classification of at-grade intersections, channelization, traffic signals, signs and marking; Road Safety	**8L**
Module-II: Transportation planning: Transportation planning at different levels; Transport Project planning – Planning studies and investigation; Elements of Urban Transportation Planning; Transport Demand Analysis; Preparation of Project Report	**10L**
Module-III: Railway Engineering : Location surveys & alignment, Permanent way components, Gauges, Geometric Design, Points & crossings, Stations & Yards, Signaling, Track Maintenance	**10L**
Module-IV: Airport Engineering : Functional areas of airports: Runways, Taxiways, , Aprons, Terminal buildings; Classification of Airports; Airport site selection; Design of Runway, Runway orientation, Wind Rose diagram; Design of Taxiway and Terminal Building	**8L**

Text / Reference Books:

Name	Author	Publishers
Transportation Engineering	Vazirani&Chandola	-
Transportation Engineering	Khisty and Lal PHI	-
A Text Book of Railway Engineering	S.P. Arora & S.C. Saxena	-
Railway Engineering	Satish Chandra	Oxford University press
Airport planning and Design	S.K.Khanna&M.G.Arora	
Airport Transportation Planning & Design-.	Virendra Kumar &Satish Chandra	Galgotia Publication Pvt. Ltd. New Delhi

CO-PO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	-	3	-	-	3	3	3	2	2	2	-
CO2	3	2	2	2	-	-	2	2	2	-	1	2	2	2	-
CO3	3	2	2	2	-	1	-	-	1	-	2	2	2	2	-

COURSE NAME: PAVEMENT DESIGN
COURSE CODE: CE802C
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS : 3

Pre requisites: Concept of different types of pavement and its features based on IRC.

Course Objective:

i) Introduction of different types pavements and its performance
ii) Introduction of traffic loading in pavement design.
iii) Description of characteristics of pavement materials.
iv) Design of different types of pavement.

Course Outcome:

CO1: Understanding the pavement performance under different circumstances.
CO2: Concept of pavement design.

Course contents:

MODULE – I: **Principles of Pavement Design**: Types of Pavements, Concept of pavement performance, Structural and functional failure of pavement, Different types of pavement performance, Different pavement design approaches.	**8L**
Module- II: **Traffic Consideration in Pavement Design**: Vehicle types, Axle configurations, Contact shapes and contact stress distribution, Concept of standard axle load, Vehicle damage factor, Axle load surveys, Estimation of design traffic.	**6L**
Module- III : Pavement Material Characterization: Identification of different type of materials Field and laboratory methods for characterization of pavement materials	**6L**
Module- IV: Analysis and Design of Flexible Pavements: Selection of appropriate theoretical model for flexible pavements, Analysis of different layers of flexible pavements based on linear elastic theory, Different methods of design of flexible pavements, IRC guidelines (IRC-37).	**8L**
Module –V: Analysis and Design of Rigid Pavements: Selection of appropriate theoretical models for rigid pavements, Analysis of wheel load stresses, curling, temperature differential, Critical stress combinations, Different methods of design of rigid pavements, IRC guidelines (IRC-58)	**4L**
Module- VI: Pavement Overlay Designs : Overlay design as per Indian Roads Congress guidelines (IRC-81) Overlay design as per AASHTO-1993 guidelines.	**4L**

Text / Reference Books:

Name	Author
Principles of Pavement Design	E.J.Yoder and M.W. Witczak , Wiley publisher.
Pavement Analysis and Design Y. H. Huang Prentice-Hall	
Highway Engineering	Khanna and Justo Nem Chand
IRC-37, IRC-58, IRC-73, IRC-81, IRC-106 and other relevant IRC codes	

CO-PO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO 1	3	3	3	2	3	1	1	1	3	3	3	3	2	2	-
CO 2	3	3	3	2	2	2	1	1	3	2	3	2	2	2	-

COURSE NAME: METRO SYSTEM AND ENGINEERING
COURSE CODE: CE803A
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS : 3

Pre requisites: Basic idea of transportation engineering

Course Objective:

- Urban Transport :An overview of urban transport policy, the characteristics of ROAD & METRO schemes and the influences on ROAD & METRO policies.
- A brief review of some key technical issues inherent in ROAD & METRO schemes and their potential impact on PPP design and implementation.

Course Outcome:

On completion of this course, the students will be able to:
CO1 : To Integrate skills required for Urban Mass Mobility planning & formulation.
CO2 : Analyzing the issues & challenges in the Urban Transport and Mobility Sector
CO3 : To analyze the benchmarking process as applied in Urban Transport projects.

Course contents:

MODULE – I: An overview of Metro System, Need for Metros, Basic planning, Routing studies	**4L**
Module – II: Overview and construction methods for: Elevated and underground Stations; Viaduct spans and bridges; Underground tunnels;	**5L**
Module – III: Description on construction and utility of Depots; Commercial and Service buildings. Initial Surveys & Investigations; Basics of Construction Planning & Management,	**6L**
Module – IV: Construction Quality & Safety Systems. Traffic integration, multimodal transfers and pedestrian facilities; Environmental and social safeguards; Track systems-permanent way. Facilities Management.	**6L**
Module – V: ELECTRONICS AND COMMUNICATION ENGINEERING Signaling systems; Automatic fare collection; Operation Control Centre (OCC and BCC); SCADA and other control systems; Platform Screen Doors.	**5L**
Module – VI: MECHANICAL & TV + AC Rolling stock, vehicle dynamics and structure; Tunnel Ventilation systems; Air conditioning for stations and buildings; Fire control systems; Lifts and Escalators	**5L**
Module – VII: ELECTRICAL: OHE, Traction Power; Substations- TSS and ASS; Power SCADA; Standby and Back-up systems; Green buildings, Carbon credits and clear air mechanics	**5L**

Text / Reference Books:

Name	Author	Publishers
Track Design Handbook for Light Rail Transit	Transportation Research Boards	-
ACCESSIBILITY IN CITIES:	TRANSPORT AND URBAN FORM	-
HARVARD CASE STUDIES		

CO-PO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3
CO 1	3	3	2	3	3	2	3	3	2	3	3	2	2	2	-
CO 2	3	3	-	3	3	-	3	3	-	3	3	-	2	2	-
CO 3	3	2	3	3	2	3	3	2	3	3	2	3	2	2	-

COURSE NAME: AIR & NOISE POLLUTION & CONTROL
COURSE CODE: CE803B
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS : 3

Pre requisites: Basic knowledge of environment pollution and its causes with preliminary knowledge of chemistry knowledge on different impurities are pollutants of air.

Course Objective: Students will acquire knowledge on air pollution, sources and control of particulates, gaseous pollutant and self cleansing properties of the environment. Familiarity with noise pollution, measurement, sources and control. Acquire knowledge on global environmental issues like ozone depletion, acid rain, greenhouse effect.
Familiarity with administrative control on environment with function of State and Central Pollution Control Boards and clearance process for industries and infrastructural projects. Some knowledge on environmental laws and Environmental Impact Assessment.

Course Outcome*:*
CO1 : To learn about the air pollutants, sources and its effects.
CO2 : To have a clear understanding on the air quality standards and its techniques.
CO3 : To determine the fluid resistance for organic materials.
CO4 : To find the Properties of air pollution and its control measures.
CO5 : To learn about the effects and the sources of noise pollution.

Course contents:

Module-I: **Introduction**: Environment. Pollution, Pollution control	**6L**
Module-II: **Air Pollution**: Air Pollutants: Types, Sources, Effects; Air Pollution Meteorology: Lapse Rate, Inversion, Plume Pattern; Air Pollution Dispersion Model: Point Source Gaussian Plume Model, Stability Classes, Stability Charts, Design of Stack Height.	**6L**
Module-III: **Air pollution Control**: Self cleansing properties of the environment; Dilution method; Engineered Control of Air Pollutants: Control of the particulates, Control of Gaseous Pollutants, Control of Air pollution from Automobiles.	**6L**
Module-IV: **Noise Pollution:** Definition; Sound Pressure, Power and Intensity; Noise Measurement: Relationships among Pressure, Power and Intensity, Levels, Frequency Band, Decibel Addition, Measures of community Noise i.e. L_N, L_{eq}, L_{dn},, L_{NP}; Sources, ; Effects; Control.	**5L**
Module-V: **Global Environmental Issues**: Ozone Depletion, Acid Rain, Global Warming-Green House Effects	**4L**
Module-VI: **Administrative Control on Environment:** Functions of Central and State Pollution Control Boards; Environmental Clearance Process for Industries and Infrastructural Projects	**5L**

Module-VII: **Environmental Laws:** Water Act, Air Act, Motor Vehicle Act	**4L**

Text / Reference Books:

Name	Author	Publishers
Environmental Engineering	S.K. Garg	
Environmental Engineering	P.V.Rowe	

CO-PO mapping

CO	PO 1	PO2	PO 3	PO4	PO 5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	1	1	3	2	1	3	3	3	1	3	2	2	2	2	2
CO2	2	3	3	3	2	3	3	2	2	3	2	2	3	3	2
CO3	3	3	3	3	3	2	3	1	2	1	2	3	3	3	3
CO4	3	3	3	3	2	1	3	3	3	2	3	3	3	3	3
CO5	3	3	3	3	3	3	3	2	3	2	3	3	3	2	3

COURSE NAME: ADVANCED SURVEY
COURSE CODE: CE803C
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36 HRS
CREDITS : 3

Pre requisites: Student should knowledge about remote sensing and GIS.

Course Objective:

Student should be able to make technology choice to deal with the technology behind remote sensing and know about GIS.

Course Outcome:

CO1 : Student will be able know the introduction of the remote sensing and Geodetics, Triangulation, Trilateration, Tachometry etc.
CO2 : Student will be able to know and apply the photogrammetric survey and analyze the problems.
CO3 : Student will be able to know and apply the satellite survey. Also analyze and evaluate the problems.
CO4 : Student will able to know about the astronomy and GPS system.
CO5 : Student will able to know about GIS concept.

Course contents:

Module-I: [5L] **INTRODUCTION:** Definition and types of remote sensing, Tachometry (Planimetry/ altimetry), Triangulation (Frame work / adjustment), Trilateration (EDM/ Total Station), Geodetics (physical/ geometrical geodesy), Error Analysis (causes / law of weights), Numerical example	**5L**
Module-II: **PHOTOGRAMMETRIC:** Camera System (phototheodolite/ aircraft), Ground photograph (oblique/orthogonal streophoto), Aerial photograph (perspective scale/ flight planning), distortion (relief / tilt), Geometrix (parallax / mapping), application (topographics / interpretation), Numerical examples	**7L**
Module-III: **SATELLITE SURVEY:** Satellite Sensing (Sensors / platforms), energy sources (electromagnetic / atmospheric interaction), visual interpretation (Band width), digital processing (imageries / enhancement), data integration (multi-approach / GIS), microwave imaging (active system / radars), applications	**7L**
Module-IV: **ASTRONOMY:** Celestial sphere (star-coordinates / transformation), field astronomy (azimuth, solar and polar method), 3D computation (local vs global), spherical trigonometry, Multilateration, Observation, Corrections in astronomy, Correlation of low, medium, remote objects, Global Positioning Systems.	**10L**
Module-V: **GEO INFORMATICS:** GIS concept (Introduction/ definition), planning and management, spatial data model, database and DBMS, linking of attributes, geospatial analysis, modern trends	**7L**

Text / Reference Books:

Name	Author	Publishers
Remote Sensing and Image	Thomas M. Lillesand	Wiley India Edition
Geospatial Analysis: a Comprehensive Guide to Principles, Techniques and Software Tools	De Smith, M. J., Goodchild, M. F., & Longley, P.	
Introduction to Remote Sensing	Gonzalez, R.C., P. Wintz, 1987. Lillesand, T.M. and Kiefer, R.W.	John Wiley and Sons,

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	3	1	1	1	3	3	3	3	3	3	3
CO2	3	3	3	2	2	2	1	1	3	2	3	2	3	3	3
CO3	1	1	1	1	1	-	-	-	1	1	1	2	3	2	3
CO4	3	3	2	3	2	2	1	1	3	2	2	2	3	3	3
CO5	3	3	2	3	2	1	1	1	3	2	1	2	3	2	2

COURSE NAME: ESSENCE OF INDIAN KNOWLEDGE TRADITION
COURSE CODE: MC 881
CONTACT: 3:0:0

Pre requisites: Have some knowledge of Indian societal culture

Course Objective: The course aims at imparting basic principles of thought process, reasoning and inferencing. Sustainability is at the core of Indian Traditional Knowledge Systems connecting society and nature. Holistic life style of yogic science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions. Part-I focuses on introduction to Indian Knowledge Systems, Indian perspective of modern scientific world-view, and basic principles of Yoga and holistic health care system.

Course Outcome:

CO1: Identify the concept of Traditional knowledge and its importance.
CO2: Explain the connection between Modern Science and Indian Knowledge System.
CO3: Understand the importance of Yoga for health care.
CO4: Interpret the effect of traditional knowledge on environment.

COURSE CONTENT:

MODULE-I: Basic structure of Indian Knowledge Syste
Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, Indigenous Knowledge (IK), characteristics, traditional knowledge vis-avis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge

MODULE-2: Modern Science and Indian Knowledge System
Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge

MODULE-3: Yoga and Holistic Health care
Yoga for positive health, prevention of stress related health problems and rehabilitation, Integral approach of Yoga Therapy to common ailments.

MODULE-4: Traditional Knowledge and Environment
Traditional knowledge and engineering, Traditional medicine system, Importance of conservation and sustainable development of environment, Management of biodiversity

Text / Reference Books:

- V. Sivaramakrishnan (Ed.), Cultural Heritage of India-course material, Bharatiya Vidya Bhavan, Mumbai. 5th Edition, 2014
- Swami Jitatmanand, Modern Physics and Vedant, Bharatiya Vidya Bhavan
- Swami Jitatmanand, Holistic Science and Vedant, Bharatiya Vidya Bhavan
- Fritzof Capra, The Wave of life
- VN Jha (Eng. Trans.), Tarkasangraha of Annam Bhatta, International Chinmay Foundation, Velliarnad, Arnakulam
- Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkata
- RN Jha, Yoga-darshanam with Vyasa Bhashya, Vidyanidhi Prakashan, Delhi 2016 RN Jha,
- Science of Consciousness Psychotherapyand Yoga Practices, Vidyanidhi Prakashan, Delhi

CO-PO mapping:

CO	PO 1	PO 2	PO 3	PO4	PO 5	PO6	PO 7	PO8	PO 9	PO1 0	PO1 1	PO1 2	PS O1	PS O2	PS O3
CO1	-	-	-	-	-	1	-	-	2	1	2	1	**2**	**2**	**-**
CO2	-	-	-	-	-	-	-	3	2	1	2	2	**2**	**2**	**-**
CO3	-	-	-	-	-	-	-	-	2	2	-	1	**2**	**2**	**-**
CO4	-	-	-	-	-	-	-	-	1	2	-	1	**2**	**2**	**-**