SIR PADAMPAT SINGHANIA UNIVERSITY

UDAIPUR

School of Engineering

Department of Civil Engineering

<u>Vision</u>

To establish an outstanding center of national and international reputation that brings out civil engineers with high technical competencies; to offer specialized courses dealing with the contemporary issues and cater to the societal needs; to promote consultancy and high-end research to meet the current and future challenges in the field of civil engineering.

<u>Mission</u>

To serve the society by imparting quality of education and skills to its students.

To prepare our students to be the technical, business and global leaders of tomorrow by inculcating technical, communication skills and teamwork.

To promote research and consultancy for industrial and societal needs.

To instill moral, ethical and professionalism values among the students.

B. Tech. Degree Programme

Course Structure

(2021-2025)

Overview

Civil Engineering is one of the oldest engineering disciplines which is primarily responsible for the construction of society's infrastructure (e.g., buildings, roads, dams, canals, etc.). Civil engineers play a vital role in the progress and development of the modern society by designing, constructing, maintaining, and managing infrastructure. The civil engineer must acquire a specific set of skills and knowledge to fulfil its mandate to benefit the society. Civil engineers play a key role in planning, designing and supervising construction projects such as roads (Expressways, national and state highways), railway infrastructure, metro rail infrastructure, bridges (railways and highways), airports, dams, canals, tunnels, water supply, and wastewater systems.

Programme Educational Objectives (PEO's)

PEO1 To make students proficient in the fundamentals of necessary mathematical tools, scientific basics, and fundamental knowledge in the context of Civil Engineering.

PEO2 To impart required skills to the students so that they can apply it in developing safe, sustainable, economical, and environmentally sound solutions to Civil Engineering problems.

PEO3 To enable students professionally in their careers through continued development of technical and management skills and assumption of roles and responsibility in professional service.

PEO4 To make the students eligible for employment as a practicing engineer in fields such as building planning, designing, managing, & quality testing of construction materials.

Program Outcomes (PO's)

PO1: **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal and environmental considerations.

PO4: **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: **Individual and teamwork:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

## Program Specific Outcomes (PSO's)

PSO 1: The ability to Identify, formulate, analyze, and design sustainable solutions to solve complex civil engineering problems by applying advanced tools, techniques, and software's to meet societal needs.

PSO 2: The ability to demonstrate knowledge of various engineering and management techniques for effective construction and management of infrastructure facilities.

Credit Structure

Sr. No.	Category	Credits (%)
1	Humanities and Social Sciences including Management courses (HU/BM)	07 (3.73%)
2	Basic Science courses (BSC)	29 (15.42%)
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc. (ESC)	20 (10.64%)
4	Professional core courses (PCC)	68 (36.17%)
5	Professional Elective courses relevant to chosen specialization/branch (PEC)	15 (7.98%)
6	Open subjects – Electives from other technical and /or emerging subjects (OE)	09 (4.79%)
7	Project work, seminar and internship in industry or elsewhere (PRJ)	24 (12.76%)
8	Mandatory Courses [Environmental Sciences, Induction training, Anandam etc.] (MC)/Value addition courses (VC)	16 (8.51%)
	Total Credits	188
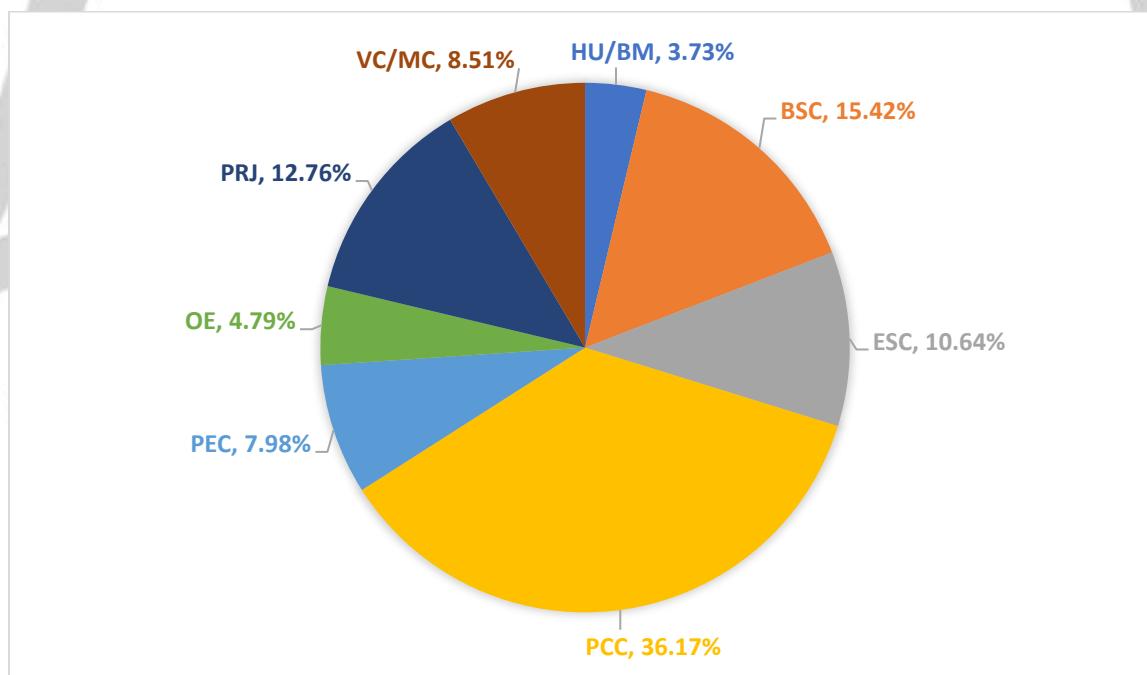
Distribution of Total Credits & Contact Hours in all Semesters

S. No.	Semester	Credits/Semester	Contact hours/week (after assigning Term Work/Active learning component)
1	I	22	25
2	II	28	31/32
3	III	25	26
4	IV	23	22
5	V	26	25
6	VI	25	22
7	VII	27	16
8	VIII	12	-
Total		188	-

Course Structure: B. Tech. 2021-2025

Semester - I

S. No.	Course Code	Cate-gory	Course Title	L	T	P	S	Credit (s)	Hrs/Week
1	PH-100X CH-1004 MA-1004	BSC	Physics-I* Chemistry-I Mathematics-I	3 3 3	0 0 1	1 1 0	0 0 0	4 4 4	14
2	ME-1201	ESC	Workshop Practice-I	0	0	1	0	1	2
3	CS-1201	ESC	C Programming	2	0	1	0	3	4
4	EC-1201	ESC	Introduction to IOT	0	0	1	0	1	2
5	HU-1011	HUMC	Professional and Business Communication	2	1	0	0	3	3
6	AM-2001	VC	Anandam – an exercise of trusteeship	-	-	-	2	2	-
							Total	22	25

*Options for Physics-I (Choose anyone)

PH-1003: Introduction to Electromagnetic Theory

PH-1004: Introduction to Mechanics

PH-1005: Oscillation, Waves and Optics

PH-1006: Quantum Mechanics for Engineers

PH-1007: Semiconductor Physics

Semester - II

S. No.	Course Code	Category	Course Title	L	T	P	S	Credit (s)	Hrs/ Week
1	BM-1114 BM-1115 BM-1116	HUMC	(Options to choose any One) 1) Business Ethics 2) Business Environment 3) Principles of Management	1	0	0	0	1	1
2	PH-100X CH-100X MA-100X	BSC	(Option to Choose any Two) 1) Physics-II* 2) Chemistry-II** 3) Advanced Mathematics***	3 3 3	0 0 1	1 1 0	0 0 0	4 4 4	9/10
3	BT-0001	BSC	Biology for Engineers	1	0	0	0	1	1
4	ME-1203	ESC	Engineering Drawing	0	0	2	1	3	4
5	CS-1202 EC-1202 ME-1202 CE-1101	ESC	**Engineering Science course:** Workshop Practice-II (**Options to choose any Two**) 1)Computer Workshop 2)Electronics and Electrical Engineering Workshop 3)Mechanical Engineering Workshop 4)Civil Engineering Workshop	0 0	0 0	1 1	0 0	1 1	4
6	EC-1203	ESC	Basics of Electrical and Electronics Engineering (BEEE)	3	0	1	0	4	5
7	CS-1203 CS-1204 CS-1205	ESC	Computational Fundamentals (**Options to choose any one**) 1)Scilab Programming 2)Advanced Excel Computing 3)Introduction to Python Programming	0	0	1	1	2	2
8	HU-1012 HU-1013	HUMC	(**Options to choose any One**) 1) Oral and Written Communication Skills 2) Public Speaking	0	3	0	0	3	3
9	CH-1002	BSC	Environmental Studies	2	0	0	0	2	2
10	AM-2002	VC	Anandam – an exercise of trusteeship	-	-	-	2	2	-
							Total	**28**	**31/32**

*Options for Physics-II (Subject List same as Sem I, exclude the subject chosen in Sem. I)
PH-1003: Introduction to Electromagnetic Theory
PH-1004: Introduction to Mechanics
PH-1005: Oscillation, Waves and Optics
PH-1006: Quantum Mechanics for Engineers
PH-1007: Semiconductor Physics
**Options for Chemistry-II:
1. Chemistry-II (CH-1005)
2. Organic Chemistry for BT (CH-1006)
***Options for Advanced Mathematics:
1. Mathematics-II (MA-1005)
2. Data analytics & Interpretation (MA-1006)

Semester - III

S. No.	Category	Course Code	Course Title	L	T	P	S	Credit(s)	Contact Hours
1	BSC	MA-2010	Advanced Engineering Mathematics - I	3	1	0	0	4	4
2	ESC	CE-0201	Introduction to Civil Engineering	3	0	0	0	3	3
3	PCC	CE-1202	Strength of Materials	3	0	0	0	3	3
4	PCC	CE-1203	Strength of Materials Lab	0	0	1	0	1	2
5	PCC	CE-1204	Engineering Geology	3	0	0	0	3	3
6	PCC	CE-1205	Engineering Geology Lab	0	0	1	0	1	2
7	PCC	CE-1206	Fluid Mechanics	3	0	0	0	3	3
8	PCC	CE-1207	Fluid Mechanics Lab	0	0	1	0	1	2
9	PCC	CE-1208	Building Design & Drawing	2	0	0	1	3	2
10	PCC	CE-1209	Building Design & Drawing Lab	0	0	1	0	1	2
11	VC	AM-2003	Anandam-an exercise of trusteeship	-	-	-	2	2	-
						Total Credits			25
						Total Contact hours/week			26

Semester - IV

S. No.	Category	Course Code	Course Title	L	T	P	S	Credits	Contact Hours
1	BSC	MA-2014	Advanced Engineering Mathematics - II	3	1	0	0	4	4
2	PCC	CE-3210	Surveying	3	0	0	0	3	3
3	PCC	CE-3211	Surveying Lab	0	0	1	0	1	2
4	PCC	CE-4212	Structural Analysis	3	0	0	1	4	3
5	PCC	CE-4213	Structural Analysis Lab	0	0	1	0	1	2
6	PCC	CE-3214	Building Materials & Construction Technology	3	0	0	1	4	3
7	PCC	CE-3215	Building Materials & Construction Technology Lab	0	0	1	0	1	2
8	PEC	CE-XXXX	Department Level Optional Course - I	3	0	0	0	3	3
9	VC	AM-2004	Anandam-an exercise of trusteeship	-	-	-	2	2	-
						Total Credits		23	-
						Total Contact hours/week		22	

Semester - V

S. No.	Category	Course Code	Course Title	L	T	P	S	Credit(s)	Contact Hours
1	PCC	CE-2301	Theory of Reinforced Concrete Structures	3	1	0	1	5	4
2	PCC	CE-3302	Geotechnical Engineering	3	0	0	0	3	3
3	PCC	CE-3303	Geotechnical Engineering Lab	0	0	1	0	1	2
4	PCC	CE-2304	Applied Hydraulics	3	0	0	0	3	3
5	PCC	CE-2305	Applied Hydraulics Lab	0	0	1	0	1	2
6	PCC	CE-2306	Transportation Engineering	3	0	0	1	4	3
7	PCC	CE-2307	Transportation Engineering Lab	0	0	1	0	1	2
8	PEC	CE-XXXX	Department Level Optional Course - II	3	0	0	0	3	3
9	OEC	XX-XXXX	University Level Open Elective-I	3	0	0	0	3	3
10	VC	AM-2005	Anandam-an exercise of trusteeship	-	-	-	2	2	-
			Total Credits					26	-
			Total Contact hours/week					25	

Semester - VI

S. No.	Category	Course Code	Course Title	L	T	P	S	Credit(s)	Contact Hours
1	PCC	CE-3308	Design and Drawing of Steel Structures	3	0	0	1	4	3
2	PCC	CE-3309	Design and Drawing of Steel Structures Lab	0	0	1	0	1	2
3	PCC	CE-2310	Environmental Engineering	3	0	0	0	3	3
4	PCC	CE-2311	Environmental Engineering Lab	0	0	1	0	1	2
5	PCC	CE-3312	Water Resource Engineering	3	1	0	0	4	4
6	ESC	CE-2313	Software Applications in Civil Engineering	0	0	1	0	1	2
7	PEC	CE-XXXX	Department Level Optional Course – III	3	0	0	0	3	3
8	PRJ	CE-4100	Minor Project	0	0	0	3	3	-
9	OEC	XX-XXXX	University Level Optional Course-II	3	0	0	0	3	3
10	VC	AM-2006	Anandam-an exercise of trusteeship	-	-	-	2	2	-
			Total Credits					25	-
			Total Contact hours/week					22	

Semester - VII

S. No.	Category	Course Code	Course Title	L	T	P	S	Credit (s)	Contact Hours
1	PCC	CE-3401	Quantity Survey Estimation and Valuation	3	1	0	0	4	4
2	PCC	CE-2402	Construction Engineering & Management	2	1	0	0	3	3
3	PEC	CE-XXXX	Departmental Level Optional Course – IV	3	0	0	0	3	3
4	PEC	CE-XXXX	Departmental Level Optional Course – V	3	0	0	0	3	3
5	OEC	XX-XXXX	University Level Optional Course – III	3	0	0	0	3	3
6	PRJ	CE-4200	Major Project	0	0	0	6	6	-
7	PRJ	CE-3300	Summer Internship	-	-	-	3	3	-
8	VC	AM-2007	Anandam-an exercise of trusteeship	-	-	-	2	2	-
			Total Credits					27	-
			Total Contact hours/week						16

Semester - VIII

S. No.	Category	Course Code	Course Title	L	T	P	S	Credit(s)	Contact Hours
1	PRJ	CE-4300	Thesis/Industrial Training	-	-	0	12	12	-
						Total Credits		12	-

List of Department Level Optional Course(s) - I

S. No.	Course Code	Course Title	L	T	P	S	Credit(s)
1	CE-1021	Civil Engineering- Societal & Global Impact	3	0	0	0	3
2	CE-1022	Sustainability Concepts in Civil Engineering	3	0	0	0	3

List of Department Level Optional Course(s) - II

S. No.	Course Code	Course Title	L	T	P	S	Credit(s)
1	CE-1031	Supplementary Cementitious Materials	3	0	0	0	3
2	CE-1032	Green Building & Technologies	3	0	0	0	3

List of Department Level Optional Course(s) - III

S. No.	Course Code	Course Title	L	T	P	S	Credit(s)
1	CE-3033	Pavement Design	3	0	0	0	3
2	CE-3034	Bridge Engineering	3	0	0	0	3

| 3 | CE-3035 | Repair & Rehabilitation of Structures | 3 | 0 | 0 | 0 | 3 |

List of Department Level Optional Course(s) - IV

S. No.	Course Code	Course Title	L	T	P	S	Credit(s)
1	CE-3041	Prestressed Concrete & Industrial Structures	3	0	0	0	3
2	CE-2042	Urban Transportation Planning	3	0	0	0	3
3	CE-3043	Solid Waste Management	3	0	0	0	3

List of Department Level Optional Course(s) - V

S. No.	Course Code	Course Title	L	T	P	S	Credit(s)
1	CE-3044	Contracts Management	3	0	0	0	3
2	CE-2045	Ground Improvement Techniques	3	0	0	0	3
3	CE-3046	Design of Foundations & Retaining Structures	3	0	0	0	3

List of University Level Optional Course(s) – I

S. No.	Course Code	Course Title	L	T	P	Credit(s)
1	HU-3011	Fun with Drama	3	0	0	3
2	HU-3012	Indian Writings in English	3	0	0	3
3	HU-3013	Language through Literature & Films	3	0	0	3

S. No.	Course Code	Course Title	L	T	P	Credit(s)
4	MA-3001	Mathematical Statistics	3	0	0	3
5	PH-3204	Chaos in Engineering Systems	3	0	0	3
6	BT-2351	Bioprocess Engineering	3	0	0	3
7	EC-2290	Battery Management Systems	3	0	0	3
8	EE-2290	Non-Conventional Energy Sources	3	0	0	3
9	EE-2291	Applications of Power Electronics In Renewable Energy	2	0	1	3
10	EE-2293	Advanced Electrical Machines	3	0	0	3
11	CS-3001	Simulation & Modelling	3	0	0	3
12	CS-3002	Text Analytics	3	0	0	3
13	ME-1204	Economics for Engineers	3	0	0	3
14	ME-1205	Technology & Society	3	0	0	3

List of University Level Optional Course(s) – II

S. No.	Course Code	Course Title	L	T	P	Credit(s)
1	HU-3014	Intercultural Communication	3	0	0	3
2	HU-3015	Interview Skills	3	0	0	3
3	MA-3004	Modern Algebra	3	0	0	3
4	PH-3202	Nanomaterials	3	0	0	3
5	CS-3003	Management Information System	3	0	0	3
6	CS-3004	Cyber Security and Laws	3	0	0	3
7	EC-2291	Building IoT Applications	2	0	1	3
8	CE-3047	Disaster Management and Mitigation Measures	3	0	0	3
9	EE-2294	Energy Audit & Management	3	0	0	3
10	EE-2295	Distributed Generation & Microgrid	3	0	0	3
11	ME-3233	Solar Energy and Application	3	0	0	3

S. No.	Course Code	Course Title	L	T	P	Credit(s)
12	ME-3234	Project Management	3	0	0	3

List of University Level Optional Course(s) – III

S. No.	Course Code	Course Title	L	T	P	Credit(s)
1	HU-3016	Interpersonal Communication	3	0	0	3
2	HU-3017	Soft Skills	3	0	0	3
3	HU-2011	Professional Mannerisms and Grooming	3	0	0	3
4	MA-3002	Optimization Techniques	3	0	0	3
5	MA-3003	Graph Theory	3	0	0	3
6	MA-3005	Special Functions	3	0	0	3
7	BM-2203	Strategic Management	3	0	0	3
8	BM-2102	Basics of Financial Services	3	0	0	3
9	BM-2201	Business Planning & Entrepreneurial Management	3	0	0	3
10	CS-4001	Research Methodology	3	0	0	3
11	CS-4002	Digital Business Management	3	0	0	3
12	EC-2293	Robotics & Automation	2	0	1	3
13	CE-3048	Environmental Management	3	0	0	3
14	EE-2296	Testing of Electrical Equipment	3	0	0	3
15	EE-2297	Control System Components	3	0	0	3
16	ME-4203	Flexible Manufacturing System	3	0	0	3
17	ME-3235	Operation Research	3	0	0	3
18	BT-2351	Green Technology	3	0	0	3
19	PH-3101	Molecular Spectroscopy	3	0	0	3
20	CH-2101	Medicinal plants in drug discovery	3	0	0	3

Value-Added Courses (Optional)

S. No.	Semester	Course Code	Course Title	L	T	P	S	Credit(s)
1	II	EP-2001	Project Endeavour	-	-	-	1	3
2	III	EP-2002	Project Endeavour	-	-	-	1	3
3	IV	EP-4001	Project Endeavour	-	-	-	2	3
4	V	EP-2003	Project Endeavour	-	-	-	1	3
5	VI	EP-4002	Project Endeavour	-	-	-	2	3
6	VII	EP-2004	Project Endeavour	-	-	-	1	3
7	VIII	EP-4003	Project Endeavour	-	-	-	2	3

Detailed Syllabus for B. Tech. Degree Programme

in

Civil Engineering

Semester-I

(Engineering Science Courses)

ME-1201   L-T-P-S-C
Workshop Practice-I   0-0-1-0-1
Prerequisite   Nil

Objective: *To familiarize with the basic manufacturing processes and study the various tools and equipment used in fitting, welding and machine shop. This course also deals with hands-on training in fitting, welding and machine shop.*

 Laboratory Outcome: *Students will be able to:*

1. Describe materials, working principles, tools, specifications and processes under fitting, welding and turning shops

2. Create jobs of mild steel as per given dimensions using fitting, welding and turning operations.

PO1	PO2	PO9	PO10	PO12	PSO1
1	1	1	1	1	1

List of Experiments

S. No.	Title of the Experiment	Name of Shop
1	To Instruct the students for workshop and introduction to Fitting Shop.	

2	To Study the Holding tools, measuring, marking tools, cutting and striking tools in fitting shop.		
3	To study filing, sawing, drilling and tapping operation in fitting shop.	Fitting Shop (14 Hours)	
4	To measure the various dimension of the given work pieces and finishing of two sides of a surface of a square piece by filing.		
5	To perform drilling and tapping operation tools in Fitting shop.		
6	To make a square -Fit (Male part) from the given mid steel work pieces		
7	Introduction to welding processes		
8	To prepare a square Lap joint using Shielded Metal Arc Welding	Welding Shop (06 Hours)	
9	To prepare a square Butt joint using Shielded Metal Arc Welding		
10	Study of Lathe machine	Machine Shop (04 Hours)	
11	To demonstrate Turning, Chamfering & Facing operations on a centre lathe machine.		

Text/Reference Books
1. Choudhary S.K., Elements Of Workshop Technology Vol-1 & 2 January 2010
   by Media   Promoters & Publisher (P) Ltd.
2. Chapman W.A., Workshop Technology, Part 1, Volume-1, Edward Arnold Publishers.
3. Raghuwanshi B.S., A Course in Workshop Technology Vol -I & II, Dhanpat Rai Publications

 *Digital Material

1. https://www.google.co.in/books/edition/MECHANICAL_WORKSHOP_PRACTICE/Jgkr6HcY6oC?hl=en&gbpv=1&dq=engineering+workshop&printsec=frontcover
2. https://easyengineering.net/introduction-to-basic-manufacturing-process-workshop technology/

Detailed Syllabus for B. Tech. Degree Programme

in

Civil Engineering

Semester - I

(Basic Science Course)

PH-1003   L-T-P-S-C
Introduction to Electromagnetic Theory   3-0-1-0-4

Prerequisite   Nil

Objective: *The objective of this course is to introduce the Electrostatics, Magnetostatics and Electromagnetic waves.*

Course Outcome: *Upon successful completion of this course, the student will be able to:*

CO-1: Recognize and classify the basic Electrostatic theorems and laws and to derive them.

CO-2: Discuss the behaviour of Electric fields in matter and Polarization concepts.

CO-3: Classify the basic Magneto static theorems and laws and infer the magnetic properties of matter.

CO-4: Summarize the concepts of Magnetostatics in a linear magnetic medium and qualitative discussion of magnetic field in presence of magnetic materials.

CO-5 To understand the Faraday's law in terms of EMF produced by changing magnetic flux

CO-6: To understand the Displacement current, Magnetic field due to time-dependent electric field and Maxwell's equations

CO-7: Students are expected to be familiar with Electromagnetic wave propagation and wave polarization.

PO1	PO2	PO12
1	1	1

Course Content

Module 1: Electrostatics in vacuum

Calculation of electric field and electrostatic potential for a charge distribution; Divergence and curl of electrostatic field; Laplace's and Poisson's equations for electrostatic potential and uniqueness of their solution and connection with steady state diffusion and thermal conduction; Practical examples like Faraday's cage and coffee-ring effect; Boundary conditions of electric field and electrostatic potential; method of images; energy of a charge distribution and its expression in terms of electric field.

Module 2: Electrostatics in a linear dielectric medium

Electrostatic field and potential of a dipole. Bound charges due to electric polarization; Electric displacement; boundary conditions on displacement; Solving simple electrostatics problems in presence of dielectrics – Point charge at the centre of a dielectric sphere, charge in front of a dielectric slab, dielectric slab and dielectric sphere in uniform electric field.

Module 3: Magnetostatics

Bio-Savart law, Divergence and curl of static magnetic field; vector potential and calculating it for a given magnetic field using Stokes' theorem; the equation for the vector potential and its solution for given current densities.

Module 4: Magnetostatics in a linear magnetic medium

Magnetization and associated bound currents; auxiliary magnetic field; Boundary conditions on $\vec{B}$ & $\vec{H}$ and Solving for magnetic field due to simple magnets like a bar magnet; magnetic susceptibility and ferromagnetic, paramagnetic, and diamagnetic materials; Qualitative discussion of magnetic field in presence of magnetic materials.

Module 5: Faraday's law

Faraday's law in terms of EMF produced by changing magnetic flux; equivalence of Faraday's law and motional EMF; Lenz's law; Electromagnetic breaking and its applications; Differential form of Faraday's law expressing curl of electric field in terms of time-derivative of magnetic field and calculating electric field due to changing magnetic fields in quasi-static approximation; energy stored in a magnetic field.

Module 6: Displacement current, Magnetic field due to time-dependent electric field and Maxwell's equations

Continuity equation for current densities; Modifying equation for the curl of magnetic field to satisfy continuity equation; displace current and magnetic field arising from time-dependent electric field; calculating magnetic field due to changing electric fields in quasi-static approximation. Maxwell's equation in vacuum and non-conducting medium; Energy in an electromagnetic field; Flow of energy and Poynting vector with examples. Qualitative discussion of momentum in electromagnetic fields.

Module 7: Electromagnetic waves

The wave equation; Plane electromagnetic waves in vacuum, their transverse nature and polarization; relation between electric and magnetic fields of an electromagnetic wave; energy carried by electromagnetic waves and examples. Momentum carried by electromagnetic waves and resultant pressure. Reflection and transmission of electromagnetic waves from a non-conducting medium vacuum interface for normal incidence.

Text/Reference Books
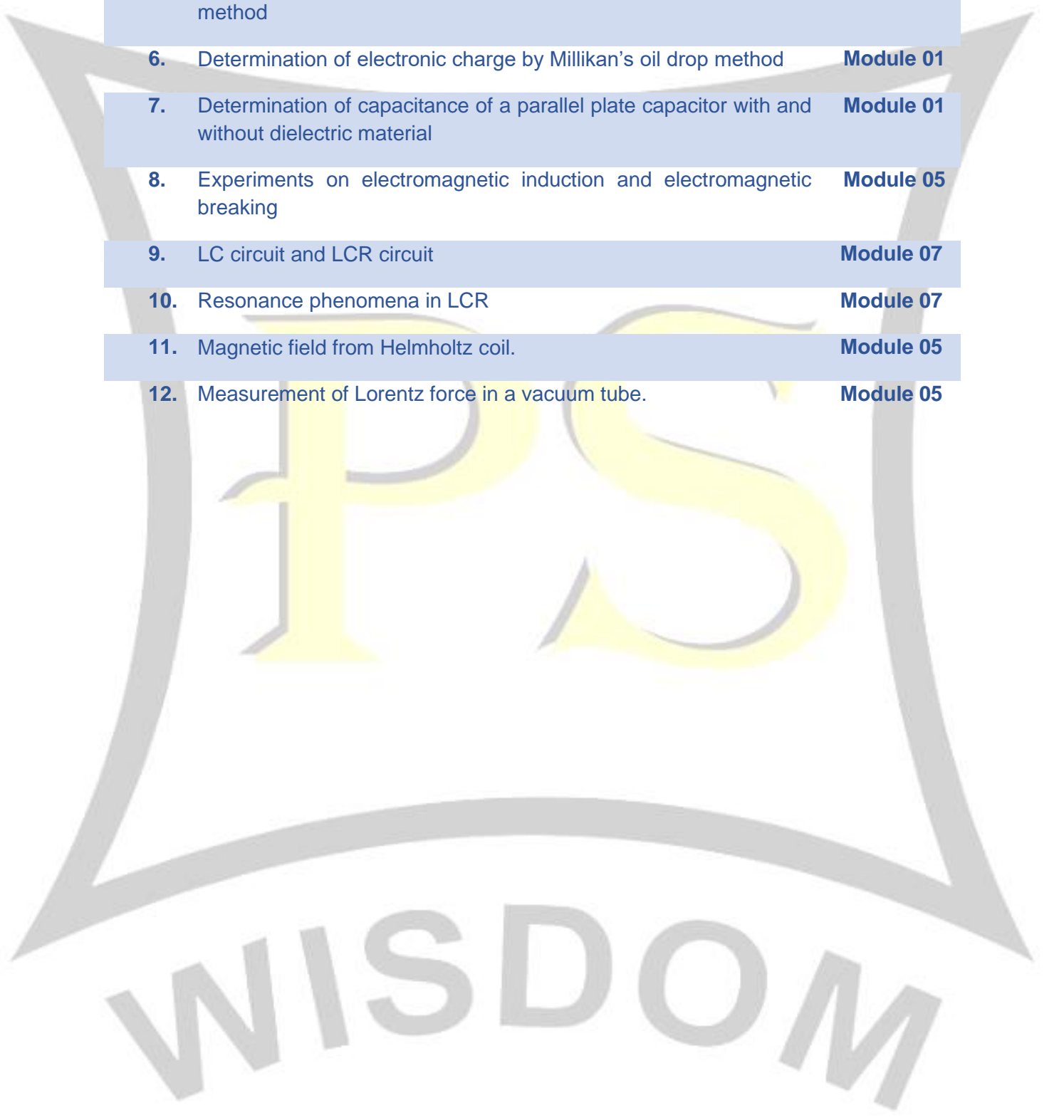
1. Griffiths D. Introduction to Electrodynamics. 4th Ed. Pearson.2015.
2. Halliday & Resnick. Electrodynamics.. Wiley.2011.
3. Saslow W. Electricity, magnetism and light. Academic Press; 1st Ed. 2002.

Digital Material
1. Power Point Slides covering the course lectures shall be uploaded on the local server connected through Intranet
2. Course content, video demonstration, problem sets etc. shall be made available on the course page of the Moodle site developed by the course teacher

List of Experiments (any ten)

S. No.	Title of the Experiment	Module
1.	Verification of Biot Savart's law	Module 03
2.	Study of variation of magnetic field along the axis of a circular coil and determination of the radius of the coil	Module 03
3.	Determination of frequency of AC mains using Sonometer	Module 01

4.	Determination of the characteristic constant or ballistic constant of a ballistic galvanometer	**Module 06**
5.	Determination of the ratio of e/m for the electron using the helical method	**Module 06**
6.	Determination of electronic charge by Millikan's oil drop method	**Module 01**
7.	Determination of capacitance of a parallel plate capacitor with and without dielectric material	**Module 01**
8.	Experiments on electromagnetic induction and electromagnetic breaking	**Module 05**
9.	LC circuit and LCR circuit	**Module 07**
10.	Resonance phenomena in LCR	**Module 07**
11.	Magnetic field from Helmholtz coil.	**Module 05**
12.	Measurement of Lorentz force in a vacuum tube.	**Module 05**

Detailed Syllabus for B. Tech. Degree Programme

in

Civil Engineering

Semester - I

(Basic Science Course)

PH-1004   L-T-P-S-C
Introduction to Mechanics   3-0-1-0-4

Prerequisite   Nil

Objective: *This course introduces the fundamental principles in mechanics. Structural design applications of a variety of problems are developed throughout the course using examples that elucidate the theory of mechanics.*

Course Outcome: *Upon successful completion of this course, the student will be able to:*

CO-1 Identify and manipulate forces and their resultants in one- two- and three dimensions.

CO-2 Recognise and classify moments and couples created by forces.

CO-3 Identify and analyses the mechanical problems in the non-inertial frames of reference and in rotating coordinate system.

CO-4 Understand the behaviours of the Harmonic oscillator, Damped harmonic motion and critically damped oscillators.

CO-5 Understand the concept of the rigid body in the plane and angular momentum about a point of a rigid body in planar motion.

CO-6 Students would be able to understand the concept of three-dimensional rigid body motion and Moment of inertia tensor.

PO1	PO2	PO12
1	1	1

Course Content

Module 1:

Transformation of scalars and vectors under Rotation transformation; Forces in Nature; Newton's laws and its completeness in describing particle motion; Form invariance of Newton's Second Law; Solving Newton's equations of motion in polar coordinates; Problems including constraints and friction; Extension to cylindrical and spherical coordinates

Module 2:

Potential energy function; F = - Grad V, equipotential surfaces and meaning of gradient; Conservative and non-conservative forces, curl of a force field; Central forces; Conservation of Angular Momentum; Energy equation and energy diagrams; Elliptical, parabolic and hyperbolic orbits; Kepler problem; Application: Satellite manoeuvres;

Module 3:

Non-inertial frames of reference; Rotating coordinate system: Five-term acceleration formula.Centripetal and Coriolis accelerations; Applications: Weather systems, Foucault pendulum.

Module 4:

Harmonic oscillator; Damped harmonic motion – over-damped, critically damped and lightly damped oscillators; Forced oscillations and resonance.

Module 5:

Definition and motion of a rigid body in the plane; Rotation in the plane; Kinematics in a coordinate system rotating and translating in the plane; Angular momentum about a point of a rigid body in planar motion; Euler's laws of motion, their independence from Newton's laws, and their necessity in describing rigid body motion; Examples.

Module 6:

Introduction to three-dimensional rigid body motion — only need to highlight the distinction from two-dimensional motion in terms of (a) Angular velocity vector, and its

rate of change and (b) Moment of inertia tensor; Three-dimensional motion of a rigid body wherein all points move in a coplanar manner: e.g. Rod executing conical motion with center of mass fixed — only need to show that this motion looks two-dimensional but is three-dimensional, and two-dimensional formulation fails.

Text/Reference Books

1. Harbola M.K. Engineering Mechanics. 2nd Ed.
2. Verma M.K. Introduction to Mechanics.
3. Kleppner D. & Kolenkow R. An Introduction to Mechanics.
4. Synge J.L & Griffiths B.A Principles of Mechanics.
5. Den Hartog JP.Mechanics
6. Meriam JL. Engineering Mechanics. Dynamics. 7th Ed.

Digital Material

1. Power Point Slides covering the course lectures shall be uploaded on the local server connected through Intranet
2. Course content, video demonstration, problem sets etc. shall be made available on the course page of the Moodle site developed by the course teacher

List of Experiments (any ten)

S. No.	Title of the Experiment	Module
1.	Determination of the height of a distant object/building with the help of sextant	Module 02
2.	Determination of velocity of ultrasonic waves using quartz crystal.	Module 04
3.	Determination of the characteristic constant or ballistic constant of a ballistic galvanometer.	Module 04
4.	Coupled oscillators	Module 04
5.	Experiments on an air-track	Module 02
6.	Experiment on moment of inertia measurement	Module 06
7.	Experiments with gyroscope	Module 05
8.	Resonance phenomena in mechanical oscillators	Module 03

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Civil Engineering

Semester - I

(Basic Science Course)

PH-1005   L-T-P-S-C
Oscillations, waves and optics   3-0-1-0-4

Prerequisite   Nil

Objective: *The course aims to introduce the basic concepts required for a mathematical description of oscillations and waves, and to provide expertise for solving the differential equations which arise in simple mathematical models for oscillations and waves*

Course Outcome: *Upon successful completion of this course, the student will be able to:*

CO-1 To understand the Mechanical and electrical simple harmonic oscillators

CO-2 To understand Non-dispersive transverse and longitudinal waves in one dimension and introduction to dispersion

CO-3 Gain knowledge on various theories of light and acquire skills to identify and apply formulas of optics and wave physics. Understand the properties of light like reflection, refraction, interference, diffraction etc.

CO-4 Understand the applications of diffraction and polarization, interference in design and working of interferometers.

CO-5 Gain knowledge on working of Laser and their applications in various fields such as in science, engineering and medicine.

PO1	PO2	PO12
1	1	1

Course Content

Module 1: Simple harmonic motion, damped and forced simple harmonic oscillator

Mechanical and electrical simple harmonic oscillators, complex number notation and phasor representation of simple harmonic motion, damped harmonic oscillator – heavy, critical, and light damping, energy decay in a damped harmonic oscillator, quality factor, forced mechanical and electrical oscillators, electrical and mechanical impedance, steady state motion of forced damped harmonic oscillator, power absorbed by oscillator.

Module 2: Non-dispersive transverse and longitudinal waves in one dimension and introduction to dispersion

Transverse wave on a string, the wave equation on a string, Harmonic waves, reflection and transmission of waves at a boundary, impedance matching, standing waves and their Eigen frequencies, longitudinal waves and the wave equation for them, acoustics waves and speed of sound, standing sound waves. Waves with dispersion, water waves, superposition of waves and Fourier method, wave groups and group velocity.

Module 3: The propagation of light and geometric optics

Fermat's principle of stationary time and its applications e.g. in explaining mirage effect, laws of reflection and refraction, Light as an electromagnetic wave and Fresnel equations, reflectance and transmittance, Brewster's angle, total internal reflection, and evanescent wave. Mirrors and lenses and optical instruments based on them, transfer formula and the matrix method.

Module 4: Wave optics

Huygens' principle, superposition of waves and interference of light by wave front splitting and amplitude splitting; Young's double slit experiment, Newton's rings, Michelson interferometer, Mach-Zehnder interferometer. Fraunhofer diffraction from a single slit and a circular aperture, the Rayleigh criterion for limit of resolution and its application to vision; Diffraction gratings and their resolving power

Module 5: Laser

Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion, different types of lasers: gas lasers (He-Ne, CO_2), solid-state lasers (ruby, Neodymium), dye lasers; Properties of laser beams: mono-chromaticity, coherence, directionality and brightness, laser speckles, applications of lasers in science, engineering and medicine.

Text/Reference Books
1. King G.C.Vibrations & Waves.
2. F.S. Berkeley. Waves. Crawford Jr., Physics Course Vol. III.

Digital Material

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2. Course content, video demonstration, problem sets etc. shall be made available on the course page of the Moodle site developed by the course teacher

List of Experiments (any ten)

S. No.	Title of the Experiment	Module
1.	Determination of velocity of ultrasonic waves using quartz crystal.	Module 01
2.	Determination of the characteristic constant or ballistic constant of a ballistic galvanometer.	Module 02
3.	Determination of wavelength of sodium light source using Newton's rings method.	Module 03
4.	Determination of wavelength of monochromatic light source using Fresnel's biprism.	Module 04

5.	Determination of the wavelength of monochromatic light using Michelson interferometer.	**Module 04**
6.	Determination of wavelength of laser using single slit diffraction.	**Module 05**
7.	Determination of the wavelength of prominent lines of mercury using plane transmission grating.	**Module 04**
8.	Determination of specific rotation of sugar solution using Polarimeter	**Module 04**
9.	Determination of refractive index and dispersive power of prism material using spectrometer.	**Module 04**
10.	Determination of numerical aperture of an optical fibre cable.	**Module 06**
11.	Determination of wavelength of He-Ne laser using millimetre scale as a grating.	**Module 06**
12.	Determination of wavelength of Diode laser using single slit / double slit and obtain diffraction patterns of different apertures.	**Module 06**
13.	Study of divergence of laser beam.	**Module 06**
14.	Determination of width of a slit using single slit diffraction experiment (laser source).	**Module 04**
15.	measurement of speed of light on a table top using modulation	

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Civil Engineering

Semester - I

(Basic Science Course)

PH-1006   L-T-P-S-C
Quantum Mechanics for Engineers   3-0-1-0-4

Prerequisite   Nil

Objective: *The objective of this course is to introduce the, quantum physics & their applications in understanding the wave nature of particle. It also introduces the concepts of molecular bonding and solids state physics.*

Course Outcome: *Upon successful completion of this course, the student will be able to:*

CO-1 Students would be able to understand the Wave nature of particles and the Schrodinger equation.

CO-2 To understand the Preliminaries Mathematical concept of the quantum mechanics

CO-3 Students would be able to describe the Quantum Mechanics and its applications.

CO-4 Students would be able to understand the concept of molecular bonding.

CO-5 To understand the solids and identify the application of solids.

PO1	PO2	PO12
1	1	1

Course Content

Module 1: Wave nature of particles and the Schrodinger equation

Introduction to Quantum mechanics, Wave nature of Particles, Time-dependent and time-independent Schrodinger equation for wavefunction, Born interpretation, probability current, Expectation values, Free-particle wavefunction and wave-packets, Uncertainty principle.

Module 2: Mathematical Preliminaries for quantum mechanics

Complex numbers, Linear vector spaces, inner product, operators, eigenvalue problems, Hermitian operators, Hermite polynomials, Legendre's equation, spherical harmonics.

Module 3: Applying the Schrodinger equation

Solution of stationary-state Schrodinger equation for one dimensional problems– particle in a box, particle in attractive delta-function potential, square-well potential, linear harmonic oscillator. Numerical solution of stationary-state Schrodinger equation for one dimensional problems for different potentials Scattering from a potential barrier and tunneling; related examples like alpha-decay, field-ionization and scanning tunneling microscope Three-dimensional problems: particle in three dimensional box and related examples, Angular momentum operator, Rigid Rotor, Hydrogen atom ground-state, orbitals, interaction with magnetic field, spin Numerical solution stationary-state radial Schrodinger equation for spherically symmetric potentials.

Module 4: Introduction to molecular bonding

Particle in double delta-function potential, Molecules (hydrogen molecule, valence bond and molecular orbitals picture), singlet/triplet states, chemical bonding, hybridization

Module 5: Introduction to solids

Free electron theory of metals, Fermi level, density of states, Application to white dwarfs and neutron stars, Bloch's theorem for particles in a periodic potential, Kronig-Penney model and origin of energy bands Numerical solution for energy in one-dimensional periodic lattice by mixing plane waves.

Text/Reference Books

1. Beiser A. Concepts of Modern Physics. 5th Ed. McGraw-Hill.1995.
2. Krane K.S. Modern Physics. 2nd Ed. John-Wiley. 1995.
3. Eisberg R. & Resnick R. Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles. 2nd Ed. John-Wiley. 1985.

Digital Material

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2. Course content, video demonstration, problem sets etc. shall be made available on the course page of the Moodle site developed by the course teacher

List of Experiments (any ten)

S. No.	Title of the Experiment	Module
1.	Determination of Planck's constant using light emitting diode.	Module 01
2.	Determination of the charge carrier concentration and Hall coefficient of a given semiconductor using Hall experiment setup.	Module 05
3.	Study of Diamond, ZnS, NaCl crystal structure	Module 05
4.	Study of HCP structure.	Module 05
5.	Study of Miller Indices, Plane, and direction	Module 05
6.	Frank-Hertz experiment	Module 01
7.	Photoelectric effect spectrum experiment	Module 01
8.	Recording hydrogen atom	Module 02

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Semester - I

(Basic Science Course)

PH-1007   L-T-P-S-C
Semi-conductor Physics   3-0-1-0-4

Prerequisite   Nil

Objective: *The objective of this course is to introduce the, quantum physics & their applications in understanding the wave nature of particle. It also introduces the concepts of molecular bonding and solids state physics.*

Course Outcome: *Upon successful completion of this course, the student will be able to:*

CO-1 Students would be able to understand the Electronic materials and their types.

CO-2 To understand the concept of the Semiconductors.

CO-3 Students would be able to understand the Light-semiconductor interaction and its applications.

CO-4 Students would be able to understand the measurements for carrier density, resistivity, and hall mobility.

CO-5 Learn the practical applications of Engineered semiconductor materials.

PO1	PO2	PO12
1	1	1

Course Content

Module 1: Electronic materials

Free electron theory, Density of states and energy band diagrams, Kronig-Penny model (to introduce origin of band gap), Energy bands in solids, E-k diagram, Direct and indirect bandgaps, Types of electronic materials: metals, semiconductors, and insulators, Density of states, Occupation probability, Fermi level, Effective mass, Phonons.

Module 2: Semiconductors

Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), Carrier generation and recombination, Carrier transport: diffusion and drift, p-n junction, Metal-semiconductor junction (Ohmic and Schottky), Semiconductor materials of interest for optoelectronic devices.

Module 3: Light-semiconductor interaction

Optical transitions in bulk semiconductors: absorption, spontaneous emission, and stimulated emission; Joint density of states, Density of states for photons, Transition rates (Fermi's golden rule), Optical loss and gain; Photovoltaic effect, Exciton, Drude model.

Module 4: Measurements

Four-point probe and van der Pauw measurements for carrier density, resistivity, and hall mobility; Hot-point probe measurement, capacitance-voltage measurements, parameter extraction from diode I-V characteristics, DLTS, band gap by UV-Vis spectroscopy, absorption/transmission.

Module 5: Engineered semiconductor materials

Density of states in 2D, 1d and 0D (qualitatively). Practical examples of low-dimensional systems such as quantum wells, wires, and dots: design, fabrication, and characterization techniques. Heterojunctions and associated band-diagrams

Text/Reference Books

1. Kittel C. Introduction to Solid State Physics. 7th Ed. John-Wiley Pvt. Ltd. 1995.

2. Pillai S. O. Solid State Physics. 6th Ed. New Age International Publishers Ltd. 2009.
3. Neamen D .Semiconductor physics and devices. 4th Ed. McGraw Hill. 2011.

Digital Material

1. Power Point Slides covering the course lectures shall be uploaded on the local server connected through Intranet
2. Course content, video demonstration, problem sets etc. shall be made available on the course page of the Moodle site developed by the course teacher

List of Experiments (any ten)

S. No.	Title of the Experiment	Module
1.	Determination of Planck's constant using light emitting diode.	Module 01
2.	Determination of temperature coefficient, reverse saturation current and energy band gap of a P-N junction.	Module 02
3.	Determination of the charge carrier concentration and Hall coefficient of a given semiconductor using Hall experiment setup.	Module 02
4.	Use of CRO for measurement of frequency, amplitude, and phase angle.	Module 03
5.	Study of Diamond, ZnS, NaCl crystal structure.	Module 04
6.	Study of HCP structure.	Module 04
7.	Study of Miller Indices, Plane and direction	Module 05

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Civil Engineering

Semester - I

(Basic Sciences Subjects)

MA 1004	L-T-P-S-C
Mathematics - I	3-1-0-0-4

Prerequisite   Nil

Objective:

- *To impart the necessary knowledge and understanding about the concepts of Matrices, Differential Calculus, Integral Calculus and Differential Equations.*

- *To provide sufficient exposure and practice for utilizing the learned concepts of Matrices, Differential Calculus, Integral Calculus and Differential Equations to solve the relevant problems and to enhance the problem-solving skills.*

Course Outcomes:

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

- **CO1:** *Explain the learned concepts, properties, relations, and theorems regarding all the topics.*
- **CO2:** *Examine the properties and theorems of Matrices and Differential Calculus to solve the associated problems.*
- **CO3:** *Examine the concepts of Integral Calculus and Differential Equations to work out the connected problems.*
- **CO4:** *Apply the studied notions, properties, formulas, and theorems pertaining to all the topics to resolve the linked problems.*

PO1	PO2	PO3	PO12
1	1	1	1

Course Content

Module 01: Matrices

Rank of a Matrix using Echelon forms, reduction to normal form, PAQ in normal form, system of homogeneous & non – homogeneous equations, their consistency & solutions. Linear dependent & independent vectors. Application of inverse of a matrix to coding theory. Characteristic polynomial, characteristic equation, characteristic roots and characteristic vectors of a square matrix, properties of characteristic roots and Eigen vectors of different types of matrices such as symmetric matrix, orthogonal matrix, Hermitian matrix, Skew-Hermitian matrix; Cayley Hamilton theorem (without proof) and its application; Similarity of matrices: Diagonalization, Functions of a square matrix, Minimal polynomial, and Derogatory matrix.

Module 02: Differential Calculus

Successive differentiation: nth derivative of standard functions. Leibnitz's Theorem (without proof) & problems. Taylor's Theorem (Statement only) & Taylor's series, Maclaurin's series (Statement only). Expansion of e^x, sin(x), cos(x), tan(x), sinh(x), cosh(x), tanh(x), log(1+x), $\sin^{-1}(x)$, $\cos^{-1}(x)$, $\tan^{-1}(x)$, Binomial series. Indeterminate forms, L- Hospital Rule, problems involving series.

Module 03: Partial Differentiation

Partial Differentiation: Partial derivatives of first & higher order. Total differentials, differentiation of composite & implicit functions. Euler's Theorem on Homogeneous functions with two & three independent variables (with proof). Deductions from Euler's Theorem. Applications of Partial Differentiation: Maxima & Minima of a function of two independent variables, Jacobian.

Module 04: Differential Equations of First Order & First Degree

Exact differential Equations, Equations reducible to exact form by using integrating factors. Linear differential equations (Review), equation reducible to linear form, Bernoulli's equation. Simple application of differential equation of first order & first degree to electrical & Mechanical Engineering problem (no formulation of differential equation).

Module 05: Linear Differential Equations with Constant Coefficients & Variable Coefficients of Higher Order

Linear Differential Equation with constant coefficient-complementary function, particular integrals of differential equation of the type f(D)y = X where X is e^{ax}, sin(ax+b), cos (ax+b), x^n, e^{ax} V, xV. Cauchy's homogeneous linear differential equation & Legendre's differential equation, Method of variation of parameters.

Module 06: Double-Triple Integration & Applications of Multiple Integrals

Rectification of plane curves. Double integration-definition, Evaluation of Double Integrals. Change the order of integration, Evaluation of double integrals by changing the order of integration & changing to polar form. Triple integration: definition & evaluation (Cartesian, cylindrical & spherical polar coordinates). Application of double integrals to compute Area, Mass, Volume. Application of triple integrals to compute volume.

Text/Reference Books
1. Ramana B.V. Higher Engineering Mathematics. 1st Ed. Tata McGraw-Hill Education.
2. Dass H.K. Higher Engineering Mathematics. 3rd Ed. S Chand & Co Ltd. 2014.
3. Grewal B.S. Higher Engineering Mathematics. 42nd Ed. Khanna Publishers. 2012.
4. Kreyszig E. Advanced Engineering Mathematics. 10th Ed. Wiley Eastern. 2012.
5. Thomas G.B. & Finney R.L. Calculus & Analytic Geometry. 9th Ed. Addison-Wesley. 1998.
6. Jain R.K. & Iyengar S.R.K. Advanced Engineering Mathematics. 3rd Ed. Narosa Publishing House. 2010.
7. Apostol T. M. Calculus - Vol.2. 2nd Ed. Wiley. 2003.

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Civil Engineering

Semester – I

(Basic Sciences Subject)

CH-1004   L-T- P-S-C
Engineering Chemistry-I   3-0-1-0-4

Prerequisite   Nil

Objective: *The subject deal with the concepts related to applied chemistry & develops a scientific attitude by means of distinguishing, analyzing & solving various engineering problems. It also provides in-depth knowledge of water chemistry, green chemistry, computational chemistry, colloids, polymers, and lubricants. The course also provides necessary knowledge of various instrumental analysis concept which are relevant to various industries.*

Course Outcome:

CO1. Apply the knowledge of water chemistry in the field of boiler science, water treatment, disinfection and water softening methods as well as it will be helpful in the field of biotechnology.

CO2. Apply the knowledge of polymers in the synthesis, properties and uses in the field of fabrication technology.

CO3.Apply the knowledge of lubricants, types, properties and mechanisms to avoid resistance.

CO4.Apply the concept of green and computational chemistry in various manufacturing products.

PO1	PO2	PO6	PO7	PO12
1	1	1	1	1

Course Content

Module 01: Water Chemistry

Impurities in water, Hardness of water, Determination of Hardness of water by EDTA method and problems. Softening of water by hot and cold lime soda method and numerical problems. Zeolite process and numerical problems. Ion Exchange process and numerical problems. Potable water standard as per BIS w.r.t. (i) pH, (ii) Alkalinity, (iii)TDS, (iv) Hardness; Drinking water or Municipal water- Treatment's removal of microorganisms by adding Bleaching powder, Chlorination (breakpoint chlorination), Disinfection by Ozone, Electrodialysis, Reverse Osmosis, and Ultra Filtration. BOD, COD- definition and significance, sewage treatment (only activated sludge process), Numerical problems related to COD.

Module 02: Lubricants & Lubrication

Introduction and functions of lubricants, Mechanism of lubrication, classification of lubricants. Properties and testing of lubricating oils, viscosity and viscosity index, determination of viscosity by Red wood viscometer, Flash and fire point, cloud and pour point. Emulsification, saponification number, iodine value.

Module 3 : Adhesives & Resins

Introduction to resins, commercially important resins used in building and civil engineering, Epoxy resin, Vinyl ester resin, Polyamides, polyesters, phenolic resin, amino resins. Recent development in Epoxy, Polyester and vinyl ester resins Thermoplastic and Thermosetting plastic; Compounding of plastic, Fabrication of plastic by Compression, Injection, Transfer and Extrusion moulding, Preparation, properties and uses of Phenol formaldehyde, PMMA, Kevlar, Rubbers: Natural rubber- latex, Drawbacks of natural rubber, Vulcanization of rubber, Preparation, properties and uses of Buna-S, Silicone and Polyurethane rubber.

Introduction and classification of Adhesives, their advantages and limitations, fundamental aspects of adhesion, mechanism of adhesion, Physical and chemical factors influencing adhesive action.

Module 04 : Green and Computational Chemistry

Introduction, Twelve Principles of Green chemistry, numerical on atom economy, synthesis, adipic acid and indigo.   Green solvents (ionic liquid supercritical CO_2), and products from natural materials. Application of green chemistry in industrial processes.

Introduction of Computational Chemistry, Overview of computational techniques currently used to predict the structure and properties of molecules.

Module 05: Colloidal Chemistry

Colloidal state, classification of colloidal solution, true solution, colloidal solution and suspensions, preparation of sol, Purification of colloidal solutions, General properties and optical properties, stability of colloids, coagulation of lyophobic sols, electrical properties of sols, kinetic properties of colloids: - Brownian movement, size of colloidal particle, emulsions, gels, colloidal electrolytes, and applications of colloids.

Module 06: Instrumental Analysis & Catalysis Concepts:

Basic principles and applications of pH metry, Conductometry, UV-Visible, spectrometry. Chromatography, Brief of various chromatography techniques, Atomic absorption Spectrometry etc. General introduction to preparation of solutions. Basic concepts of buffers and indicators.

Criteria for Catalysis - Homogeneous Catalysis, acid-base, Enzymatic catalysis, Catalysis by metal salts, Heterogeneous catalysis - concepts of promoters, inhibitors and poisoning, Physisorption, Chemisorption's, Surface area, industrially important process. Theories of Catalysis.

Text/Reference Books

1. Jain and Jain Engineering Chemsitry- (Dhanpat Rai)
2. Dara&Dara Engineering Chemistry- (S.Chand)
3. Engineering Chemistry- Wiley India(ISBN-9788126519880
4. Shashi Chawla .A Text Book of Engineering Chemistry- (DhanpatRai)

Digital Material

1. https://youtu.be/CWOJW4357Bg-   Water
2. https://youtu.be/CLMdkexbt3E -   Lubricants

List of Experiments

S.No	Title of the Experiment	Module
1.	To determine the temporary and permanent hardness of water sample	1
2.	Removal of hardness using ion exchange column	1
3.	To determine acid value of a lubricating oil	2

4.   To determine free acid pH of different solutions using pH meter.   6

5.   To determine metal ion concentration using colorimeter.   6

6.   To determine flash and fire point of a lubricating oil.   2

7.   To determine Chloride content of water by Mohr's method.   1

8.   To determine melting point or glass transition temperature of a polymer. 3

9.   Molecular weight of a polymer by Oswald Viscometer.   3

10.   To determine percentage of lime in cement.

11.   Hardening and setting of cement using Vicat'ss apparatus.

12.   Determination of viscosity of lubricating oil by Redwood's Viscometer.   3

Beyond the Syllabus Experiments

1. The Process of Making Soap.

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In

Civil Engineering

Semester – I

(Humanities & Management Courses)

HU-1011   L-T-P-S-C
Professional and Business Communication   2-1-0-0-3

Pre-requisite   Nil

Objectives: *To develop proficiency in LSRW skills; to enhance students' knowledge of grammar and vocabulary to read and write error-free language in real life situations*

Course Outcomes: *The student will be able to communicate with clarity, precision & confidence; apply effective communication skills in a variety of public & interpersonal settings*

Course Content

Module 01: **Communication Theory**

Concept and Meaning, Communication cycle, Objectives, Barriers to communication (linguistic and semantic, psychological, physical, mechanical, cultural), Methods of communication (verbal and non-verbal), Networks of communication (formal and informal), Emergence of communication as a key concept in the corporate and global world. Impact of technological advancements on communication.

Module 02: Listening
Purpose of Listening; Cognitive process of listening; Hearing vs Listening; Principles of effective listening; Types of Listening; Listening for Specific Purposes**;** Analyzing General and Domain Specific Information; Barriers to listening and overcoming them; Effective listening strategies

Module 03: Conversation Skills

Essentials and Challenges of an effective conversation; Conversation Climate; Articulation: Saying things the right way; Use of Intensifiers; Building verbal rapport; Conversational Postulate

Module 04: Reading

Reading - A communicative process; Reading with a purpose; Types of reading - Skimming and Scanning; Extensive Reading; Intensive Reading

Module 05: Grammar and Vocabulary

Common errors in English; Tenses; Modals; Determiners; Concord; Words followed by prepositions; Phrasal verbs

Enriching vocabulary through one-word substitutes, idiomatic expressions & phrases, Words often misspelt; Using Vocabulary in different contexts, Sentence Completion, Word Analogy and confusing words

Module 06: Writing

Writing Skills through Guided and Free Compositions; Clear & coherent development of ideas in a composition through an understanding of the process of writing from pre-writing through revision; Writing for impact and clarity

Module 07: Summarization and Comprehension

Art of condensation; Identification of main and supporting/sub points, presenting these in a cohesive manner; Forms of condensed writing
Reading Comprehension, Making inferences, Reading Graphics, Note-making, and Critical Reading.

Text/ Reference Books

1. Essentials of Business Communication. Pal R. & Korlahalli J. Sultan Chand & Sons. 2011.
2. Technical Communication. Raman M. & Sharma S. Oxford University Press. 2004.
3. Effective Technical Communication. Rizvi A. 11th Ed. Tata McGraw-Hill Publishing Company Ltd. 2005.

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Civil Engineering

Semester – I

(Engineering Science Courses)

CS-1201   L-T-P-S-C
C Programming   2-0-1-0-3

Pre-requisite   Nil

Objective: *The objective of this course is to familiarize the logic of structured programming approach and to provide exposure in developing algorithm, flowchart and thereby writing efficient codes for user defined problem.*

Course Outcome:

CO1: *Recollect various programming constructs and to develop C programs.*

CO2: *Design program connecting control statements, looping constructs and Functions in C.*

CO3: *Implement different operations on arrays, pointers, structures, unions & files and develop applications for real world problems.*

CO4: *Create /manipulate dynamics of memory by the use of pointers to construct various data structures.*

Course Content

Module 01: Fundamentals of C Programming

Algorithm & Flowchart: Three construct of Algorithm and flowchart: Sequence, Decision (Selection) and Repetition.

Character Set, Identifiers and keywords, Data types, Constants, Variables. Operators: Arithmetic, Relational and logical, Assignment, Unary, Conditional, Bitwise, Comma, other operators. Expression, statements, Library Functions, Preprocessor. Data Input and Output: getchar( ), putchar( ), scanf( ), printf( ), gets( ), puts( ), Structure of C program .

Module 02: Control Structures

Branching: If statement, If-else Statement, Multiway decision. Looping: while do-while, for. Nested control structure: Switch statement, Continue statement Break statement, goto statement.

Module 03: Functions and Parameters

Function: Introduction of Function, Function Main, Defining a Function, Accessing a Function, Function Prototype, Passing Arguments to a Function, Recursion. Storage Classes: Auto, Extern, Static, Register

Module 04: Arrays, String, Structure and Union

Array: Concepts, Declaration, Definition, Accessing array element, One-dimensional and Multidimensional array. String: Basic of String, Array of String, Functions in String.h Structure: Declaration, Initialization, structure within structure, Operation on structures, Array of Structure. Union: Definition, Difference between structure and union, Operations on a union

Module 05: Pointer and File

Pointer: Introduction, Definition and uses of Pointers, Address Operator, Pointer Variables, Dereferencing Pointer, Void Pointer, Pointer Arithmetic, Pointers to Pointers, Pointers and Array, Passing Arrays to Function, Pointers and Function, Pointers and two-dimensional Array, Array of Pointers, Dynamic Memory Allocation.

Files: Types of Files, File operation- Opening, Closing, Creating, Reading, Processing File.

List of Experiments

S. No.	Title of the Experiment	Module
1.	Algorithm and flowchart based problems	01
2.	Basic calculation, conversion based programs	01
3.	Decision making statement & operator based programs	02
4.	Loop based programs	02
5.	Multi way decision making statement based programs	02
6.	Function based programs	03
7.	Array based programs	04
8.	Strings based programs	04
9.	Structure based programs	04
10.	Pointers based programs	05
11.	File handling based programs	05

Text/Reference Books

1. Programming in ANSI C. Balaguruswamy E. Tata McGraw-Hill Edu.
2. Programming Techniques through C. Venkateshmurthy M. G. Pearson Pub.
3. Programming in C. Day P. & Gosh M. Oxford University Press.
4. Let Us C. Kanetkar Y. BPB Pub.
5. Basics of Computer Science. Forouzan B. Cengage Learning.

Digital Material

1. https://nptel.ac.in/courses/106104128/
2. https://www.tutorialspoint.com/cprogramming/

Detailed Syllabus for B. Tech. Degree Programme
In

Civil Engineering

Semester - II

(Engineering Science Courses)

EC-1201   L-T-P-S-C
Introduction to IoT   0-0-1-1-2

Prerequisite   Nil

Laboratory Outcome: *Student will be able to do hands on experiments and design with basic IoT devices.*

Description: *At least 6 experiments should be set to have well predefined inference and conclusion. The experiments should be student centric and attempt should be made to make experiments more meaningful, interesting. Simulation experiments are also encouraged. Experiment must be graded from time to time. Also each student (in group of 3/4) has to perform a Mini Project as a part of the laboratory and report of mini project should present in laboratory journal.*

List of Experiments

S. No.	Title of the Experiment	Module
1.	To familiarize with Arduino Mega 2560 board and Arduino IDE.	-
2.	To perform and understand Arduino Programming Examples :- a) Digital I/O b) Analog Read c) Parallel Data Read/Write d) Serial Data Read/Write e) Shifting of Data	-
3.	To perform and understand Arduino Programming Interfaces :- a) LCD b) Sensors	-

4.	To demonstrate the working Blue-Tooth module interface with Arduino.	-
5.	To demonstrate the working Wi-Fi module interface with Arduino.	-
6.	To practice AT commands for ESP8266 Wi-Fi module.	-
7.	To implement IoT application using Blynk.	-
8.	To implement IoT application using ThingSpeak.	-

Text/Reference Books

1. IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, Cisco Press, 2017.
2. Internet of Things – A hands-on approach, Arshdeep Bahga, Vijay Madisetti, Universities Press, 2015.

Detailed Syllabus for B. Tech. Degree Programme

In

Civil Engineering

Semester - II

(Engineering Science Courses)

ME-1202   L-T-P-S-C
Engineering Drawing Lab   0-0-2-1-3

Prerequisite   Nil

Objective: *The objective of this course is to teach and train proper understanding of the theory of projection, impart the knowledge of reading a drawing, improve the visualization skill and teach basic utility of computer aided drafting (CAD) tools.*

Course Outcome: Student will be able to

CO1. Identify the basic principles of projections in 2D drawings.

CO2. Understand & apply the basic principles of projections in converting 3D view to 2D drawing, read a given drawing, visualize an object from the given two views,

CO3. Recognize the CAD tool to draw different views of a 3D object, use CAD tool to draw an object in 3D.

PO1	PO2	PO9	PO10	PO12	PSO1	PSO2
1	1	1	1	1	1	1

LIST OF EXERCISE

Sl.No.	Name of Topics	No. of Drawing Sheets (A2 size)	Contact Hours
1	Introduction & overview of Engineering drawing	--	2

No.	Topic	Hrs	Marks
2	Lines, Lettering and Dimensioning Systems as per IS conventions	1	2
3	Engineering Scales- Plain & Diagonal scale	1	2
4	Engineering Curves – Conic sections, cycloids	2	2
5	Introduction to AUTOCAD- Basic Drawing and Editing Commands. Knowledge of setting up layers, Dimensioning, Hatching, plotting and Printing.	Drawing on Auto CAD software	4
6	Introduction of Orthographic Projections- Drawing of orthographic projections using Auto CAD.	Drawing on Auto CAD software	2
7	Exercise on Orthographic Reading using Auto CAD (Orthographic and Sectional Orthographic Projections)	Drawing on Auto CAD software	4
8	Projection of points & Projection of lines- Lines inclined to both the Reference Planes	1	2
9	Projection of planes--Triangular, Square, Rectangular, Pentagonal, Hexagonal and Circular planes inclined to either HP or VP only. (Exclude composite planes).	2	4
10	Projection of Solid - Prism, Pyramid, Cylinder, Cone Tetrahedron. Solid projection with the axis inclined to HP and VP.	1	2
11	Section of solids- Section of Cube, Prism, Pyramid, Cylinder, Cone, cut by plane perpendicular to at least one reference plane.	1	2
12	Development of Lateral Surfaces of Sectioned Solids: - Lateral surface development of Prism, Pyramid, Cylinder, Cone with section plane inclined to HP or VP only.	1	2
13	Isometric projection & Isometric Views: - Isometric View/Drawing of blocks of plain and cylindrical surfaces. Drawing of Isometric views using Auto CAD	Drawing on Auto CAD software	4
14	Introduction to 3D in AutoCAD	Drawing on Auto CAD software	4

Text/Reference Books
1. Engineering drawing - Lab Manual
2. Bhatt N.D., Engineering Drawing (Plane and solid geometry), Charotar Publishing House Pvt. Ltd.
3. Bhatt N.D.& Panchal V.M. , "Machine Drawing", Charotar Publishing House Pvt. Ltd.
4. Dhawan R.K.. Engineering Drawing, S.Chand Publishing House Pvt. Ltd.

5. Narayana K.L. Engineering Drawing Scitech Publications (India) Pvt Ltd
6. Shah M.B & Rana B.C , Engineering Drawing, Pearson Publications.

Digital materials

1. https://www.youtube.com/watch?v=cmR9cfWJRUU
2. https://www.youtube.com/watch?v=g_jKTv3pLp0
3. https://www.youtube.com/watch?v=37S-2wZ2r0Q

Detailed Syllabus for B. Tech. Degree Programme In

Civil Engineering

Semester – II

(Engineering Science Courses)

CS-1202   L-T-P-S-C
Computer Workshop   0-0-1-0-1

Prerequisite   Nil

Laboratory Outcome: *After completion of this course, student will be able to*

- *Understand the basic concept and structure of computer hardware and networking.*

- *Identify the existing configuration of the computers and peripherals.*

- *Upgrading the system as and when required.*

- *Apply their knowledge about computer peripherals to identify/rectify problems onboard.*

- *Integrate the PCs into local area network and re-install operating system and various application programs.*

- *Manage data backup and restore operations on computer and update application software.*

List of Experiments

S. No.	Title of the Experiment	Module
1.	Assembly of Computer: Introduction to hardware peripherals like RAM, ROM, keyboard, Mouse, processors, etc. Generation	01

	of processors. Working of SMPS. Study of various ports. Steps and precautions to assemble computer.	
2.	Assembly of Laptop Laptop hardware peripherals like RAM, ROM, keyboard, Mouse, processors, etc. Generation of processors. Study of various ports. Steps and precautions to assemble laptop.	02
3.	Computer Network Tools: Introduction to computer network. Study of various topologies. Preparing the network cable using crimping tools and connectors. Study of various network environments.	02
4.	Operating System and Software Installations: Introduction to operating system. Types of operating system (Windows and Linux). Window:-Evolution of operating system. Introduction to software. Types of software (MS office, VLC media player, Win rar), etc. Linux:- Evolution of operating system. Introduction to software. Types of software (open office, web browser, etc.) Case study of Installations step for operating system and application software's.	02
5.	Internet: Introduction and evolution of internet. Study of various internet-based services like email, social network, chat, etc. Introduction to cyber security and cyber laws.	03
6.	Server: Introduction to server. Difference between server and normal desktop. Evolution of servers. Study of various servers like email, data, domain, etc.	04

7.	Prepare the report of need of programming language in 21st century.	05

Text/Reference Books

1. Hardware and Software of Personal Computers by Sanjay K. Bose.

2. Fundamentals of Computers by V. Rajaraman.

3. Computer Studies - A first course by John Shelley and Roger Hunt

4. Computer Fundamentals, MS Office and Internet & Web

5. Technology by Dinesh Maidasani.

6. Modern Computer Hardware Course by M Lotia, P Nair, P Lotia.

Detailed Syllabus for B. Tech. Degree Programme
in
Civil Engineering

Semester – II

(Engineering Science Courses)

EC-1202	L-T-P-S-C
Electronics and Electrical Engineering Workshop	0-0-1-0-1

Prerequisite   Nil

Objective: *The aim of this course is to impart training to help the students develop engineering skill sets, inculcating respect for physical work and hard labor in addition to some amount of value addition by getting exposed to electrical and electronics engineering domains.*

Course Outcome: *Students will be able to perform different skill sets of electrical and electronics engineering domains.*

Course Content

Module 01: Electrical board wiring
House wiring, staircase wiring, wiring diagram for fluorescent tube light, Godown wiring and three phase wiring for electrical motors.

Module 02: PCB Laboratory Exercises
Layout drawing, Positive and negative film making, PCB etching and drilling, Tinning and soldering technique.

Term work:

Term work shall consist of respective reports and jobs of the trades selected, Laboratory work (Job and Journal) and Attendance (Practical and Theory).

Detailed Syllabus for B. Tech. Degree Programme
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Semester- II

(Engineering Science Courses)

ME-1203   L-T-P-S-C
Mechanical Engineering Workshop   0-0-1-0-1

Prerequisite   Nil

Objective: *To familiarize with the basic manufacturing processes and study the various tools and equipment used. This course also deals with hands-on training in carpentry, sheet metal and foundry shop.*

Laboratory Outcome: *Students will be able to…*

1. Describe materials, working principles, tools, specifications and processes under Carpentry, Sheet metal work and Foundry work.

2. Create jobs of as per given dimensions using carpentry, sheet metal and foundry shop.

PO1	PO2	PO9	PO10	PO12	PSO1
1	1	1	1	1	1

List of Experiments

S. No.	Title of the Experiment	Name of Shop
1	To study the basics of the carpentry and the seasoning process used for the carpentry.	
2	To study the marking tools, measuring tools, cutting tools, Planing tools used in carpentry shop.	

3	To study about the striking, supporting, holding tools, drilling and boring tools utilized in carpentry shop.	Carpentry Shop (14 Hours)
4	To prepare a T half Lap Joint as per given sketch.	
5	To prepare a cross half lap joint from given wooden piece as per drawing.	
6	To prepare a Mortise and Tenon joint from given wooden piece as per drawing.	
7	To prepare a dovetail lap joint from given wooden piece as per drawing.	
7	To study process and operation of the sheet metal work.	Sheet metal Shop (06 Hours)
8	To study tools and equipment using in the sheet metal work.	
9	To prepare a sheet metal product (Funnel).	
10	To study of foundry tools.	Foundry Shop (04 Hours)
11	To prepare Mould of a given wooden pattern in foundry shop.	

Text/Reference Books
1. Choudhary S.K., Elements Of Workshop Technology Vol-1 & 2 January 2010 by Media   Promoters & Publisher (P) Ltd.
2. Chapman W.A., Workshop Technology, Part 1, Volume-1, Edward Arnold Publishers.
3. Raghuwanshi B.S., A Course in Workshop Technology Vol -I & II, , Dhanpat Rai Publications

*Digital Material
1. https://www.google.co.in/books/edition/MECHANICAL_WORKSHOP_PRACTICE/Jgkr6HcY6oC?hl=en&gbpv=1&dq=engineering+workshop&printsec=frontcover
2. https://easyengineering.net/introduction-to-basic-manufacturing-process-workshop technology/

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in

Civil Engineering

Semester – II

(Engineering Science Courses)

CE-1101   L-T-P-S-C
Civil Engineering Workshop   0-0-1-0-1

Prerequisite   Nil

Objective: *The objective of this course is to enable students learn about resultant of forces, support reactions, quality of brick and cement, coefficient of friction, different building elements, concrete making, and chain surveying.*

Course Outcome: *On the completion of this course students must be able to determine the resultant of forces, support reaction for beam, quality of brick and cement and coefficient of friction. They should also be able to identify different building elements, make concrete and measure length using chain surveying.*

PO1	PO5	PO8	PO9	PO12	PSO2
1	1	1	1	1	1

List of Experiments

S. No.	Title of the Experiment
1.	Polygon law of coplanar forces.
2.	Inclined plane (to determine coefficient of friction).
3.	Support reaction for beam.
4.	Identification of different building elements.
5.	Field testing of cement.
6.	Field testing of brick.

7.	Manufacturing of concrete.
8.	Measurement of Length using Chain survey.

Text/Reference Books
1. Engineering Mechanics. Hibblar R.C. McMillan USA. 1994.
2. Surveying & Leveling. Vol. I & Vol. II. Kanetkar T.P. & Kulkarni S.V. Pune Vidyarthi Griha Prakshan. 1972.
3. Surveying. Vol. I & Vol. II. Punmia B.C. & Jain A.K. Laxmi Publication. 1996.
4. Concrete Technology: Theory and Practice: Shetty M.S., S. Chand.
5. Engineering Materials. Rangwala S.R. Charotar Publications. Anand.
6. Relevant BIS Codes of Practice. New Delhi.

Digital Material
1. Engineering Mechanics Lab. Virtual Labs. (http://eerc01-iiith.vlabs.ac.in).
2. https://nptel.ac.in/courses/105102088/

Detailed Syllabus for B. Tech. Degree Programme
in
Civil Engineering

Semester – II

(Engineering Science Courses)

EC-1203   L-T-P-S-C
Basics of Electrical and Electronics Engineering (BEEE)   3-0-1-0-4

Prerequisite   Nil

Objective: *The aim of this course is to develop an understanding of the basics of DC circuits & its applications, 1-Φ AC circuits & its applications, operation of 1-Φ transformer, 3-Φ AC circuits & its applications, and DC electrical machines.*

Course Outcome: *Students will be able to evaluate D.C. & 1-Φ AC circuits using network theorems, illustrate constructional features and operation of 1-Φ transformer, evaluate 3-Φ AC circuits, illustrate working principle of DC machines and conduct experiments on D.C. circuits and AC circuits.*

Course Content

Module 01: DC Circuits (Only Independent Sources)
Kirchhoff 's laws, Ideal and practical voltage and current source, Mesh and Nodal analysis, Super node and Super mesh analysis, Source transformation, Star-delta transformation, Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, (Source transformation not allowed for Superposition theorem, Mesh and Nodal analysis).

Module 02: AC Circuits
Generation of alternating voltage and currents, RMS and Average value, form factor, crest factor, AC through resistance, inductance and capacitance, R-L, R-C and R-L-C

series and parallel circuits, phasor diagrams, power and power factor, series and parallel resonance, Q factor and bandwidth.

Module 03: Three Phase Circuits

Three phase voltage and current generation, star and delta connections(balanced load only), relationship between phase and line currents and voltages, Phasor diagrams, Basic principle of wattmeter, measurement of power by one and two wattmeter methods.

Module 04: Single Phase Transformer

Construction, working principle, emf equation, ideal and practical transformer, transformer on no load and on load, phasor diagrams, equivalent circuit, OC and SC test, regulation and efficiency.

Module 05: DC Machines

Principle of operation of DC motors and DC generators, construction and classification of DC machines, emf equation.

List of Experiments (Minimum Six)

S. No.	Title of the Experiment	Module
1.	Mesh and Nodal analysis.	1
2.	Verification of Superposition Theorem.	1
3.	Verification Thevenin's Theorem.	1
4.	Study of R-L series and R-C series circuit.	2
5.	R-L-C series resonance circuit	2
6.	R-L-C parallel resonance circuit.	2
7.	Relationship between phase and line currents and voltages in three phase system (star & delta)	3
8.	Power and phase measurement in three phase system by one wattmeter method.	3
9.	Power and phase measurement in three phase system by two wattmeter method.	3
10.	OC and SC test on single phase transformer	4

Text/Reference Books

1. Engineering Circuit Analysis. Hayt W.H. & Kemmerly J.E. McGraw-Hill. 1993.
2. Circuits, Devices and Systems. Smith R.J. & Dorf R.C., John Wiley & Sons.1992.
3. Electronic Devices and Circuit Theory. Boylestad R.L. & Nashelsky L. 6th Ed. Prentice Hall India. 2001.
4. Digital Systems. Tocci R.J. 6th Ed. Prentice Hall India. 2001.
5. Electrical Engineering Fundamentals. Del T. V. Prentice Hall India. 1994.
6. Circuit Theory (Analysis and Synthesis). Chakrabarti A. Dhanpat Rai & Co. 2001.

Detailed Syllabus for B. Tech. Degree Programme
in

Civil Engineering

Semester – II

(Engineering Science Courses)

CS-1203   L-T-P-S-C
Scilab Programming   0-0-1-1-2

Prerequisite   Nil

Objective: *To familiarize the learners with the mathematical functions available in Scilab to do the numerical computations and can apply the knowledge in solving problems in the field of signal processing, image enhancement, numerical optimization, statistical analysis and modeling.*

Laboratory Outcome: *Students will be able to*

- *Develop programs in Scilab*
- *Evaluate, analyze and plot results*
- *Perform mathematical modelling in Scilab*

List of Experiments

S. No.	Title of the Experiment
1	Installation of Scilab
2	Implementation of Basic functions
3	Implementation of vector operations
4	Implementation of matrix operations
5	Implementation of programs related to conditional branching and iterations
6	Implementation of programs related to scripts and functions

7	Implementation of programs related to plotting 2D graphs
8	Implementation of Xcos
9	Implementation of programs related to file handling
10	Implementation of programs related to user defined Input and output
11	Implementation of programs related to Integration algorithms
12	Implementation of programs related to linear and nonlinear equations
13	Implementation of programs related to Interpolation Algorithms

Text/Reference Books

1. Introduction to Scilab: For Engineers and Scientists, Nagar S., APress.
2. SCILAB: A Beginer's Approach, Verma A. K., Cenage.
3. SCILAB(A Free Software to MATLAB), Ramachandran H. & Nair A. S., S. Chand & Company

*Digital Material

1. https://spoken-tutorial.org/tutorial-search/?search_foss=Scilab&search_language=English
2. https://www.scilab.org/tutorials

Detailed Syllabus for B. Tech. Degree Programme in

Civil Engineering

Semester – II

(Engineering Science Courses)

CS-1204   L-T-P-S-C
Advanced Excel Computing   0-0-1-1-2

Prerequisite   Nil

Laboratory Outcome: *At the end of the course students will be able to:*

1. *Examine spreadsheet concepts and explore the Microsoft Office Excel environment.*
2. *Learn all the necessary functions for creating and using basic spreadsheets.*
3. *Interface and learn the various methods for entering, sorting, filtering and editing, formatting data. Additionally, students will learn the various ways to write simple formulas and design charts.*

List of Experiments

S. No.	Title of the Experiment	Module
1.	Basics of Excel -Customizing common options in Excel - Absolute and relative cells -Protecting and un-protecting worksheets and cells	
2.	Working with Functions -Writing conditional expressions (using IF) -Using logical functions (AND, OR, NOT) -Using lookup and reference functions (VLOOKUP, HLOOKUP, MATCH, INDEX)	

3.	Data Validations- Specifying a valid range of values for a cell - Specifying a list of valid values for a cell - Specifying custom validations based on formula for a cell
4.	Working with Templates - Designing the structure of a template - Using templates for standardization of worksheets
5.	Sorting and Filtering Data - Sorting tables -Using multiple-level sorting -Using custom sorting - Filtering data for selected view (AutoFilter) -Using advanced filter options
6.	Working with Reports: -Creating subtotals -Multiple-level subtotals
7.	Formatting -Using auto formatting option for worksheets - Using conditional formatting option for rows, columns and cells
8.	Charts - Using Charts -Formatting Charts -Using 3D Graphs -Using Bar and Line Chart together -Using Secondary Axis in Graphs -Sharing Charts with PowerPoint / MS Word, Dynamically - (Data Modified in Excel, Chart would automatically get updated)

Text/Reference Books

1. Excel Workbook, second edition, edited by Alberto Clerici, Egea, 2017
2. Advanced Excel Essentials, edited by Jordan Goldmeier, Apress, 2014
3. Microsoft Official Academic Course, Microsoft Excel 2016,edited by Joyce J. Nielsen,Wiley,2016

Detailed Syllabus for B. Tech. Degree Programme in

Civil Engineering

Semester – II

(Engineering Science Courses)

CS-1204   L-T-P-S-C
Introduction to Python Programming   0-0-1-1-2

Pre-requisite   Nil

Laboratory Outcome: *At the end of this Lab, the students will be able to write, test and debug Python programs, implement conditionals and loops, use functions and represent Compound data using Lists, Tuples and Dictionaries, read and write data from & to files and use object-oriented programming concept to design programs.*

List of Experiments

S. No.	Title of the Experiment
1.	Program on input output operation
2.	Program on using different data types
3.	Program on various operators.
4.	Program on loops and iterations.
5.	Program on using a list and its operations.
6.	Program on using a dictionary and its related operations.
7.	Program on using tuple and its related operations.
8.	Program on using a function and its supportive operations.
9.	Program on using Class and Objects.
10.	Program on using concept of Object Oriented Programming.
11.	Program on using Files.

Text/Reference Books

1. Python Programming: A Modern Approach. Kurama V., Pearson.

2. Learning Python. Lutz M., 4th Ed., Orielly, 2010.

3. Introduction to Computer Science using Python: A Computation Problem-Solving Approach. Dierbach C., Wiley Publication.

4. Python Programming. Urban M. & Murach J., Shroff/Murach, 2016.

5. Think Python. Downey A., Green Tea Press.

6. Core Python Programming. Chun W., Pearson.

**Detailed Syllabus for B. Tech. Degree Programme
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Semester – II

**Options for Physics-II: Chose one out the remaining courses as shown in I
Semester**

Detailed Syllabus for B. Tech. Degree Programme
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Semester – II

(Basic Sciences Subject)

CH-1005   L-T- P-S- C
Engineering Chemistry-II   3-0-1-0-4

Prerequisite   Nil

Objective: *The objective of this course is to provide in-depth knowledge of necessary phenomenon related to chemical industry, fundamentals of inorganic, organic & applied chemistry applicable to various industries is included. The concepts of corrosion phenomenon, alloys and complete idea of various types of fuels used in the industry are also incorporated in the course. .*

Course Outcome:

CO1*. Illustrate composition and properties of different types of alloys and the process of powder metallurgy*

CO2*. Illustrate properties and applications of different types of composite materials.*

CO3*. Illustrate properties and classification of various types of fuels used in industries.*

CO4*.Illustrate various concepts of inorganic and organic chemistry in the chemical analysis*

PO1	PO2	PO6	PO12	PSO2
1	1	1	1	1

Course Content

Module 01: Corrosion

Introduction: Types of Corrosion (I) Dry or Chemical Corrosion i) Due to oxygen ii) due to other gases. (II) Wet or Electrochemical Corrosion: - Mechanism i) Evolution of hydrogen type ii) Absorption of oxygen. Types of Electro-Chemical Corrosion – Galvanic cell corrosion, Concentration cell corrosion (differential aeration), pitting corrosion, Intergranular corrosion, Stress Corrosion, Polarization. Factors affecting the rate of corrosion:- Nature of metal, position in galvanic series, potential difference, overvoltage, relative area of the anodic and cathodic parts, purity of metal, nature of the corrosion product, temperature, moisture, influence of pH, concentrations of the electrolytes. Methods to Decrease the rate of Corrosion: - Proper designing, using pure metal, using metal alloys, Cathodic protection – i) Sacrificial anodic protection, ii) Impressed current method, Anodic protection method, Metallic coatings, hot dipping, galvanizing, tinning, metal cladding, metal spraying, Electroplating, Cementation, Organic Coatings, Paints only constituents and their functions.

Module 02: Alloys and Metallurgy

Introduction, purpose of making alloys, Ferrous Alloys, plain carbon steel, heat resisting steels, stainless steels (corrosion resistant steels), effect of the alloying element, Ni, Cr, Co, Mg, Mo, W, and V. Non-Ferrous Alloys- Alloys of Al – i) Duralumin ii) Magnalumin. Alloys of Cu-Brasses– i) Commercial brass ii) German Silver. Bronzes – i) Gun metal ii) High – phosphorus bronze.

Introduction, General metallurgical operations (crushing and grinding, concentration of the ore, working of concentrated ore and purification or refining of ore). Metallurgy of IRON, COPPER & ALUMINIUM.

Module 3: Cement, Ceramic and Refractories

Introduction and classification of cements, Manufacture of Portland cement, Chemical composition of Portland cement, Vertical shaft Kiln technology, Setting and hardening of Portland cement, I.S.I specifications of Portland cement, Physical properties of Portland cement. Role of lime, plaster of Paris and gypsum in cement and decay of cement.

Introduction of refractories, classification of refractories, properties of refractories, measurement of refractoriness, manufacture of refractories. Some important high refractory materials (Fire clay bricks and Silica bricks).

Module 04: Fuels and Explosives

Solid fuels- proximate and ultimate analysis of coal and its significance. Gross and net calorific value, determination of calorific value by Bomb calorimeter. Metallurgical coke and its manufacture by Beehive and byproduct coke oven process. Liquid fuels- Advantages, refining and reforming of gasoline, Knocking, anti-knocking and octane number, cracking. Gaseous fuel- Advantages, manufacture of coal gas and oil gas, determination of calorific value by Junker's calorimeter.

Introduction and requisites of explosives, Oxygen balance, Classifications of explosives, Preparation, and applications of Primary, low and high explosives. Blasting fuses and applications of explosives. Application of explosives in civil and construction.

Module 05: Glass, Porcelain and Composite materials

Introduction and properties of glass, characteristics of glass and manufacture of glass. Types of glass.

Introduction of porcelain, composition, properties and applications of porcelain.

Introduction, classification of composite materials, constituents of composites, short fibre reinforced composites, particle-reinforced composites, Particulate composites, structural composites, advantages of composites and application of composites.

Text/Reference Books

1. 1.Engineering Chemsitry- Jain and Jain(Dhanpat Rai)
2. 2.Engineering Chemistry- Dara&Dara(S.Chand)
3. 3.Engineering Chemistry- Wiley India(ISBN-9788126519880
4. 4.A Text Book of Engineering Chemistry- Shashi Chawla(DhanpatRai)
5. 5.A Text Book of Green Chemistry- V.K. Ahluwalia(Springer)

Digital Material

1. https://youtu.be/-tTNrgLUdYs?list=PLvfdyaivecUGuljfNKj0qcfITjTggsWAI-   Corrosion
2. https://youtu.be/KgUmNQD6m5Q-   Alloys
3. https://youtu.be/jRVg4ue-_lc-   Fuels
4. https://youtu.be/vexA_Rscx2g-   Composite material

List of Experiments

S.No	Title of the Experiment	Module
1.	Estimation of Zn- Complexometric titration	2
2.	Estimation of Ni- Complexometric titration	2
3.	Estimation of Al- Complexometric titration	2
4.	Flue gas analysis using Orsat's apparatus.	3
5.	Estimation of Fe from plain carbon steel.	4
6.	Estimation of Ni by gravimetric method.	4
7.	Estimation of Sn- iodometric titration	4
8.	Estimation of Cu- iodometric titration	4
9.	Estimation of percentage moisture in coal.	3
10.	To determine percentage ash in coal.	3
11.	To estimate the emf of Cu-Zn system by potentiometry.	5
12.	Demonstration of Electroplating.	3

Beyond the Syllabus Experiments

1. The Process of Making Biodiesel.

Detailed Syllabus for B. Tech. Degree Programme

in

Civil Engineering

Semester – II

(Basic Sciences Course)

CH-1006   L-T- P-S-C
Applied Organic Chemistry   3-0-1-0-4
Prerequisite   Nil

Objective : *The student learns to appreciate the role of organic chemistry in the present-day world. He/she achieves academic excellence in organic chemistry and develops an interest in this branch to take up higher studies. It creates an awareness of the hazards of drug abuse and the significance of following a correct dosage regime.*

Learning Outcome: *Students learn about various organic compounds. Appreciation for traditional use of medicinal plants (Ayurveda) and the significance of conserving the plant diversity.*

PO1	PO2	PO6	PO7	PO12
1	1	1	1	1

Course Content:

Module1: Functional Groups and Reaction Mechanisms

Introduction to functional groups, chemical & physical properties, Reaction intermediates in organic chemistry, Electronic effects in organic compounds, Aromaticity with examples,SN1 & SN2 mechanism, Nucleophilic addition & substitution reactions at carbonyl group,E1 & E2 reactions in alcohols, Heterocyclic

compounds, Configuration & projection formula, Optical & geometrical isomerism, Tautomerism & its applications

Module 2: Stereochemistry

Concept of isomerism, *types of isomerism, optical isomerism, elements of symmetry, molecular chirality, enantiomers, stereo genic centers, optical activity, properties of enantiomers, chiral and achiral molecules with two stereo genic centers, distereoisomers, mesocompounds, resolution of enantiomers, racemization. Optical activity in compounds not containing asymmetric Carbon- biphenyl, allenes.

Relative and absolute configurations, sequence rules, D & L, R & S systems of assigning configuration. Geometrical isomerism; Nomenclature by E and Z system.

Module 3: Heterocyclic Compounds

Introduction: Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine. Methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic and nucleophilic substitution. Comparison of basicity of pyridine, piperidine and pyrrole. Introduction to condensed five and six membered heterocyclics. Preparation and reactions of Indole, quinoline and isoquinoline with special reference to Fischer indole synthesis, Skraup synthesis and Bischler-Napieralski synthesis. Electrophilic substitution reactions of indole, quinoline and isoquinoline.

Module 4: Organic Compounds of Nitrogen and Sulphur

Separation of a mixture of primary, secondary and tertiary amines. Hinsberg test; Structural features effecting basicity of amines. Preparation of alkyl and aryl amines (reduction of nitro compounds, nitriles), reductive amination of aldehydic and ketonic compounds. Gabriel-Phthalimide reaction, Hoffmann bromamide reaction. Reaction of amines with nitrous acid. Synthetic transformations of aryl diazonium salts, Sandmeyer's reaction, azo coupling.

Introduction to organosulphur compounds, methods of synthesis and reactions of thiols and thioether.

Module 5: Natural Products
Alkaloids

Occurrence, importance, general properties, structure, and synthesis of nicotine. Medicinal uses of Quinine, Morphine, Strychnine, Cocaine, Atropine, Reserpine and Nicotine.

Terpenoids

Occurrence, isolation, classification, Isoprene rule, structure, and synthesis of citral. Structures and uses of Menthol, Camphor, Limonene and beta-Carotene.

Drugs

Chemotherapy. Classification, preparation and uses of the following :

(i) Antipyretics and Analgesics : Aspirin, Paracetamol .

(ii) Sulpha drugs : Sulphanilamide

(iii)Antimalarials : Chloroquine

(iv) Antibiotics : Chloramphenicol.

Text / Reference Books

1. Organic chemistry by Morryson and boyd

2. Modern Organic Chemistry by D.R. Boyed.

3. Organic Chemistry Reaction Mechanism by Jerry March.

4. Organic chemistry vol I and II by I.L Finar.(Pearson)

Chemistry Lab:

A. **VOLUMETRIC ANALYSIS:**

1. Determine the strength of unknown Copper sulfate in gm/lit by titrating it against sodium thiosulfate using starch as indicator. You are provided with standard N/20 copper sulfate.
2. Determine the strength of unknown Potassium dichromate in gm/lit by titrating it against sodium thiosulfate using starch as indicator. You are provided with standard N/40 potassium dichromate.

3. Find out the strength of unknown FAS in Gms/lit by titrating it with potassium dichromate using N-phenyl anthranilic acid as internal indicator.

4. Find out the strength of unknown FAS in Gms/lit by titrating it with potassium dichromate using Potassium ferricynide as external indicator.

A. **WATER ANALYSIS:**

1. Estimate the percentage of available chlorine in the given water sample.

2. Find out the total, temporary and permanent hardness of given water sample by EDTA titration method using EBT as indicator.
3. Find out the alkalinity of the water sample in grams/liter using double indicator method.
4. Find out the acidity of the given water sample in grams/liter.

B. INSTRUMENTAL ANALYSIS:

1. Measure the pH values of the various water samples provided to you with the help of pH meter.

2. Find out the strength of HCl acid with the help of pH meter by titrating against NaOH by pH metry.

3. Find out the strength of HCl acid with the help of Conductometer by titrating against NaOH by Conductometry

4. Estimate the concentration of Na and K in the given sample using Flame photometer.

C. GRAVIMETRIC ANALYSIS:

1. Estimation of Barium as Barium sulfate gravimetrically

2. Estimation of Silver as Silver nitrate gravimetrically.

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Semester - II

(Basic Sciences Course)

MA-1005   L-T-P-S-C
Mathematics – II (Optional)   3-1-0-0-4

Prerequisite   Nil

Objective:

- *To impart the necessary knowledge and understanding about the concepts of Calculus, Quadratic Forms, Linear & non-linear Differential equations with variable coefficients, and partial differential equations.*

- *To provide sufficient exposure and practice for utilizing the learned concepts of Calculus, Quadratic Forms, Linear & non-linear Differential equations with variable coefficients, and partial differential equations to solve the relevant problems and to enhance the problem-solving skills.*

Course Outcomes:

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

- **CO1:** *Explain the learned concepts, properties, relations, and theorems regarding all the topics.*
- **CO2:** *Examine the properties and theorems of Calculus and Quadratic Forms to solve the associated problems.*
- **CO3:** *Examine the concepts of Linear & non-linear Differential equations with variable coefficients, and partial differential equations to work out the connected problems.*
- **CO4:** *Apply the studied notions, properties, formulas, and theorems pertaining to all the topics to resolve the linked problems.*

PO1	PO2	PO3	PO12	PSO2
1	1	1	1	1

Course Content

Module 01: Calculus

Concavity-Convexity, points of inflexions, Curvature: Intrinsic, Cartesian, parametric and Polar curves, Centre of curvature, Evolutes and involutes, Asymptotes of algebraic curves: parallel to axis, oblique and parallel asymptotes, Singular points: Cusp and Nodes, Curve tracing of standard curves: Cartesian and Polar. Beta & Gamma functions & their properties. Differentiation under integral sign with constant limits of integration.

Module 02: Quadratic Forms

Quadratic forms: linear transformation of a quadratic form, congruence of a square matrix, reduction to canonical form under congruent transformations, orthogonal transformation, determining the nature of a quadratic form, Application of Eigen values and Eigen Vectors.

Module 03: Differential Equations of First Order but not of First Degree

Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type. Singular solutions, Lagrange's equation of first order and higher degree

Module 04: Partial Differential Equations – First order

First order partial differential equations, Formation of PDEs by elimination of arbitrary constants and arbitrary functions, solutions of first order linear and non-linear PDEs: Solutions of linear first order pdes (Lagrange's method), Nonlinear first order pdes (four standard form and & Charpit's method)

Module 05: Advanced Linear Differential Equations with Variable Coefficients

Higher order linear differential equations with variable coefficients: Exact Linear differential equations, second order linear differential equations with variable coefficients: Solution when one part of C.F. is known, Normal form (Removal of first derivatives, Solution by changing the independent variable. Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.

Text/Reference Books

1. Higher Engineering Mathematics. Ramana B.V. 1st Ed. Tata McGraw-Hill Education.

2. Higher Engineering Mathematics. Dass H.K. 3rd Ed. S Chand & Co Ltd. 2014.
3. Higher Engineering Mathematics. Grewal B.S. 42nd Ed. Khanna Publishers. 2012.
4. Advanced Engineering Mathematics. Kreyszig E. 10th Ed. Wiley Eastern. 2012.
5. Calculus & Analytic Geometry. Thomas G.B. & Finney R.L. 9th Ed. Addison-Wesley. 1998.
6. Advanced Engineering Mathematics. Jain R.K. & Iyengar S.R.K. 3rd Ed. Narosa Publishing House. 2010.
7. Calculus - Vol.2. Apostol T. M. 2nd Ed. Wiley. 2003.

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Semester – II

(Basic Sciences Courses)

CH-1002   L-T- P-S-C
Environmental Studies   2-0-0-0-2

Prerequisite   Nil

Objective:

This paper introduces the students to the basics of Environmental science. Major issues like renewable & non-renewable sources of energy, pollution problems & social impact of the environment are discussed from a scientific perspective. This course also provides an insight on management of natural resources. Global issues like acid rain, ozone depletion, climate changes & population explosion are also discussed.

Course Outcome:

1. Illustrate Depleting Nature of Environmental Resources, Global Environmental Crisis

2. Adapt to 3R (Reuse, Recovery, Recycle).

3. Study different control measures related to Environmental Pollution.

4. Motivating students to participate in environment protection and environment improvement

5. Acquiring skills to help the concerned individuals in identifying and solving environmental problems.

PO2	PO5	PO6	PO7	PO12
1	1	1	1	1

Course Content

Module 01: Multidisciplinary Nature of Environmental Studies:

Scope and Importance Need for Public Awareness Depleting Nature of Environmental resources such as Soil, Water, Minerals, and Forests. Global Environmental Crisis related to Population, Water, Sanitation and Land. Ecosystem: Concept, Classification, Structure of Ecosystem, overview of Food chain, Food web and Ecological Pyramid.

Module 02: Sustainable Development

Concept of sustainable development Social, Economical and Environmental aspect of sustainable development. Control Measures: 3R (Reuse, Recovery, Recycle), Appropriate Technology, Environmental education, Resource utilization as per the carrying capacity.

Module 03: Environmental Pollution:

Air Pollution: Sources, Effects of air pollution with respect to Global Warming, Ozone layer Depletion, Acid Rain,Photochemical smog, Two Control Measures- Bag house Filter, Venturi scrubber .Case Study: Bhopal Gas Tragedy Water Pollution: Sources and Treatment, Concept of waste waters -Domestic &Industrial and treatment. Case Study: Minamata Disease. Land Pollution: Solid waste, Solid waste Management by Land filling, Composting.   Noise Pollution; Sources and Effects•   E-Pollution: Sources and Effects.

Module 04: Environmental Legislation:

Overview Ministry of Environment and Forests (MoE&F). Organizational structure of MoE&F.Functions and powers of Central Control Pollution Board.   Functions   and powers of State Control Pollution Board. Environmental Clearance, Consent and Authorization Mechanism. Environmental Protection Act Any two case studies pertaining to Environmental Legislation.

Module 05: Renewable sources of Energy:

Limitations of conventional sources of Energy. Various renewable energy source Solar Energy: Principle, Working of Flat plate collector & Photovoltaic cell.Wind Energy: Principle, Wind Turbines.

Module 06: Environment and Technology

Role of Technology in Environment and health   Concept of Green Buildings, Indoor air pollution   Carbon Credit: Introduction, General concept. Disaster management: Two

Events: Tsunami, Earthquakes, Techniques of Disaster Management Case Study: Earthquake in Japan

Text/Reference Books

1. Textbook of Environmental studies by Erach Bharucha, University Press.
2. Environmental Studies by R.Rajagopalan, Oxford University Press.
3. Essentials of Environmental Studies by Kurian Joseph &Nagendran, Pearson Education
4. Renewable Energy by Godfrey Boyle, Oxford Publications.
5. Perspective Of Environmental Studies, by Kaushik and Kaushik,New Age International
6. Environmental Studies by. Anandita Basak, Pearson Education
7. Textbook of Environmental Studies by Dave and Katewa, Cengage Learning
8. Environmental Studies by Benny Joseph, TataMcGraw Hill

Digital Material

1. Swayamprabha Channel no: 04 (NPTEL)Environmental Science

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Semester – II

(Basic Sciences Courses)

BT-1001   L-T- P-S-C
Biology for Engineers   1-0-0-0-1

Prerequisite   Nil

Objectives: *To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry. This course also deals with all forms of life that constitutes the building blocks.*

Course Outcomes: *After studying the course, the student will be able to:*

1. To understand the biological systems and their classifications using the parameters such as morphological, biochemical and ecological.
2. Understand the central role of genetics in Biological Science.
3. Understand the biomolecules as the building blocks of the cells and cell compositions.
4. Understand the important of enzymes in the biological systems.
5. Understand DNA as a genetic material in the molecular basis of information.

PO1	PO9	PO12
1	1	1

Course Content

Module 01: Introduction & Classification

Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology? Discuss how biological observations of 18th Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. These examples will highlight the fundamental importance of observations in any scientific inquiry.

Module 02: Classification:

Hierarchy of life forms at phenomenological level. A common thread weaves this hierarchy Classification. Discuss classification based on (a) cellularity- Unicellular or multicellular (b) ultrastructure- prokaryotes or eucaryotes. (c) energy and Carbon utilization -Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion – aminotelic, uricoteliec, ureotelic (e) Habitata- acquatic or terrestrial (e) Molecular taxonomy- three major kingdoms of life. A given organism can come under different category based on classification. Model organisms for the study of biology come from different groups. *E. coli, S. cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M. musculus*.

Module 03: Genetics

Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Emphasis to be give not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring. Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes. Discuss about the single gene disorders in humans. Discuss the concept of complementation using human genetics.

Module 04: Biomolecules

Monomeric units and polymeric structures; sugars, starch and cellulose, amino acids and proteins, nucleotides and DNA/RNA, two carbon units and lipids.

Module 05: Enzymes

Enzymology: How to monitor enzyme catalyzed reactions. How does an enzyme catalyze reactions? Enzyme classification. Mechanism of enzyme action. Discuss at

least two examples. Enzyme kinetics and kinetic parameters. Why should we know these parameters to understand biology? RNA catalysis.

Module 6: Information Transfer

Molecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA structure- from single stranded to double helix to nucleosomes. Concept of genetic code. Universality and degeneracy of genetic code. Define gene in terms of complementation and recombination.

Module 7: Macromolecular analysis

Proteins- structure and function. Hierarch in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements.

Module 08: Metabolism

Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergonic reactions. Concept of K_{eq} and its relation to standard free energy. Spontaneity. ATP as an energy currency. This should include the breakdown of glucose to CO_2 + H_2O (Glycolysis and Krebs cycle) and synthesis of glucose from CO_2 and H_2O (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy change.

Module 09: Microbiology

Concept of single celled organisms. Concept of species and strains. Identification and classification of microorganisms. Microscopy. Ecological aspects of single celled organisms. Sterilization and media compositions. Growth kinetics.

Text/Reference Books

1. Campbell N.A, Reece J.B, Cain M.L. Wasserman S.A, Minorsky, P.V, Jackson R.B. Biology: A global approach. Pearson Education Ltd.
2. Conn, E.E, Stumpf P.K, Bruening G, Doi, R.H. Outlines of Biochemistry 4th Ed. John Wiley & Sons, New York. 1987
3. Nelson D. L. & Cox M.M. Principles of Biochemistry 5th Ed. W.H. Freeman and Company. 2006.
4. Prescott L, Harley J.P and Klein C.A. Microbiology. 2nd Ed. Brown Publishers. 1995.

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Semester – II

(Humanities & Management Courses)

BM-1114   L-T-P-S-C
Business Ethics   1-0-0-0-1

Prerequisite   Nil

Objective: *The main aim of the course is to understand significance of ethics and ethical practices in businesses, for understanding of emerging need and growing importance of good governance and CSR by organisations.*

Learning Outcome: *The learner will be able to*

1. Significance of ethics and ethical practices in businesses.
2. Need and importance of good governance and CSR by organisations
3. CSR and Corporate Governance practiced by various organisations.

Course Content
Module 01: Introduction to Ethics and Business Ethics

Ethics: Concept of Ethics, Evolution of Ethics, Nature of Ethics- Personal, Professional, Managerial Importance of Ethics, Objectives, Scope, Types-Transactional, Participatory and Recognition

Business Ethics: Meaning, Objectives, Purpose and Scope of Business Ethics Towards Society and Stakeholders, Role of Government in Ensuring Business Ethics; Principles of Business Ethics, 3 Cs of Business Ethics-Compliance, Contribution and Consequences Myths about Business Ethics; Ethical Performance in Businesses in India

Module 02: Corporate Governance & CSR

Concept, History of Corporate Governance in India, Need for Corporate Governance Significance of Ethics in Corporate Governance, Principles of Corporate Governance, Benefits of Good Governance, Issues in Corporate Governance.

Theories- Agency Theory, Shareholder Theory, Stakeholder Theory and Stewardship Theory; Corporate Governance in India, Emerging Trends in Corporate Governance, Models of Corporate Governance, Insider Trading.

Meaning of CSR (Corporate Social Responsibility), Evolution of CSR, Types of Social Responsibility, Aspects of CSR- Responsibility, Accountability, Sustainability and Social Contract; Need for CSR; CSR Principles and Strategies.

Text/Reference Books

1. Laura P. Hartman, Joe DesJardins, Business Ethics, Mcgraw Hill, 2nd Edition

2. C. Fernando, Business Ethics – An Indian Perspective, Pearson, 2010

3. Joseph DesJardins, An Introduction to Business Ethics, Tata McGraw Hill, 2nd Edition

4. Richard T DeGeorge, Business Ethics, Pearson, 7th Edition

5. A.K. Gavai, Business Ethics, Himalaya Publishing House, 2008

6. S.K. Mandal, Ethics is Business and Corporate Governance, McGraw Hill, 2010

7. Laura Pincus Hartman, Perspectives in Business Ethics, McGraw Hill International Editions, 1998

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Semester – II

(Humanities & Management Courses)

BM-1115   L-T-P-S-C
Business Environment   1-0-0-0-1

Pre-requisite   Knowledge of Business

Objective: *The aim of this course is to acquaint the students with business, its nature, scope, and types. It discusses characteristics, scope and significance, components of business environment viz. micro and macro environment.*

Learning Outcomes*: Leaner will be able to*

1. Understand the complete view of business and its environment in present context.

2. Acquaint with key issues of micro and macro business environment.

Course Content

Module 01: Introduction to Business Environment

Business: Meaning, Definition, Nature & Scope, Types of Business Organizations.

Business Environment: Meaning, Characteristics, Scope and Significance, Components of Business Environment.

Micro and Macro Environment: Definition, Differentiation, Analysis of Business Environment, SWOT and PESTEL Analysis.

Introduction to Micro-Environment:

Internal Environment: Value system, Mission, Objectives, Organizational Structure, Organizational Resources, Company Image, Brand Equity.

External Environment: Firm, customers, suppliers, distributors, Competitors, Society.
Introduction to Macro Components: Demographic, Natural, Political, Social, Cultural,
Economic, Technological).

Text/Reference Books

1. Seikh Saleem, Business Environment, Pearson Education.
2. A. Nag, Macroeconomics for Management, S. Chand & Co., New Delhi.
3. P Subba Rao, International Business Environment, Himalaya publishing House,
Delhi
4. Economic Survey by Ministry of Finance, Government of India - Different issues
5. World Development Report by the World Bank - different issues.

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Semester – II

(Humanities & Management Courses)

BM-1116   L-T-P-S-C
Principles of Management   1-0-0-0-1

Pre-requisite   Nil

Objective: *The objective of the course is to provide the student with an understanding of basic management concepts, principles & practices.*

Learning Outcomes: *Leaner will be able to*

1. Understand Managerial Functions and Behavioural Approaches.

2. Learn business analysis tools like Five-force analysis, SWOT/TOWS/WOTS-UP,BCG Competitor Analysis.

Course Content

Module 01: Nature of Management

Management: Concept, Significance, Role & Skills, Levels of Management, Evolution of Management, Contribution of F.W Taylor, Henri Fayol and Contingency Approach.

Module 02: Management Fucntion and business analysis

Planning: Importance, Elements, Decision Making: Meaning, Process, Organizing: Concepts, Structure (Formal & Informal, Line & Staff and Matrix), Departmentation: Meaning, Basis and Significance, Leadership, Leadership Styles, Controlling: Meaning, Process and Techniques, Business analysis: Five-force analysis, SWOT/TOWS, BCG Matrix

Text/Reference Books

1. Principles of Management , Ramasamy , Himalya Publication , Mumbai
2. Principles of Management , Tripathi Reddy , Tata Mc Grew Hill
3. Management Text & Cases , VSP Rao , Excel Books, Delhi
4. Management Concepts and OB , P S Rao & N V Shah , AjabPustakalaya
5. Essentials of Management , Koontz II & W , Mc. Grew Hill , New York
6. Principles of Management-Text and Cases –Dr..M.SakthivelMurugan, New Age Publications

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Semester – II

(Humanities & Management Courses)

HU-1012   L-T-P-S-C
Oral and Written Communication Skills   0-3-0-0-3

Pre-requisite   Nil

Objectives: *To develop persuasive & professional communicative competence*

Course Outcomes: *To speak convincingly before an audience with the help of an expanded vocabulary & practice the unique qualities of professional rhetoric & writing style.*

Course Content

Module 01: Presentation Skills

Types of presentation; Effective strategies for effective presentations - audience analysis; organizing contents & use of media; Awareness of body language, time & space; Tone, variety of pitch, rate, volume & articulation.

Module 02: Business Correspondence

7 Cs of Written Communication, Letter Writing: Elements & Structure, Layouts - Block, Semi-Block, Indented & Hanging Indented; Personnel Correspondence: Statement of Purpose, Job Application Letter and Resume, Letter of Acceptance of Job Offer, Letter of Resignation

Module 03: Group Discussions

Group Discussion as a part of the selection process; GD phases - launch, mid-stream, consolidation & winding up; Classification of GD topics, Non-verbal communication in GD, Do's & don'ts of GD.

Module 04: Technical Report Writing

Characteristics & structure of a formal report; Classification & types of reports; Organization, Analysis & Interpretation of data; Writing reports on field work/visits to industries; Revising, Proofreading & Editing; References & Bibliographies.

Module 05: Proposal Writing

Writing effective business & technical proposals; Solicited & Unsolicited Proposals; Structure of a Formal Proposal.

Module 06: Manual Writing

Techniques to define an object; Writing instructions; Writing effective manuals; Technical writing essentials & common errors.

Module 07: Meetings & Documentation

Strategies for conducting effective meetings; Notice, Agenda, Minutes of the meeting.

Module 08: Storytelling

Express ideas effectively; Storytelling for personal brand; Impromptu Speaking

Module 09: Grammar

Voice, Reported Speech, Re - ordering of sentences, Technical & Business Vocabulary.

Text/ Reference Books

1. How to Prepare, Stage and Deliver Winning Presentations. Leech T. 2nd Ed. Prentice Hall. 2004.
2. How to Write Reports and Proposals. Forsyth P. 2nd Ed. Kogan Page. 2010.
3. Report Writing for Business. Lesiker R & Petit J. Mc Graw Hill. 1997
4. Technical Writing: Process and Product. Gerson SJ & Gerson SM. 5th Ed. Pearson. 2009.
5. Business Correspondence and Report Writing. Sharma R & Mohan K. McGraw Hill. 2010.

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Semester – II

(Humanities & Management Courses)

HU-1013   L-T-P-S-C
Public Speaking   0-3-0-0-3

Pre-requisite   Nil

Objectives: *To enhance persuasive & professional language; develop interpersonal skill competencies; understand complex arguments & articulate their own positions on a range of technical & general topics*

Course Outcomes: *The student will be able to apply effective communication skills in a variety of public, business & interpersonal settings; synthesize complex concepts & present them*

Course Content

Module 01: Public Speaking as Communication

Public speaking as expanded conversation; Power & distinctive features of public speaking.

Module 02: The Foundations of Public Speaking

Finding your voice; Becoming a better listener, Using language & nonverbal language effectively; 6Cs of language; Techniques to magnify your thoughts & opinions; Building credibility using evidence, reasoning & appeal to emotions; Creating STAR moments; Speech Designs

Module 03: Communication Apprehensions

Communication anxiety: Ways to control communication apprehensions

Module 04: Ethical Public Speaking

Respect for integrity of ideas; Avoiding plagiarism; Concern for listeners and developing an 'other' orientation; Ethical speaking & listening.

Module 05: Presentation Skills

Different ways to deliver the presentation; 4Ps; Formulating the specific purpose statement; Audience Analysis: Captivating, Inspiring & involving the Audience, Responsiveness & Reading (& Misreading) the Audience; Adapting to audience & situation; Creating meaningful content, Researching, gathering & structuring the content; Techniques for using supporting material (comparison, contrast & analogy); PROPAR approach.

Module 05: Presentation Aids

Role of presentation aids; Advantages & disadvantages of using aids; Types of aids; Presentation Media; Preparing presentation aids; Principles of design & colour; Delivering speech with PowerPoint.

Module 06: Varieties of Public Speaking

Informative, Persuasive & Ceremonial speaking; Speaking on special occasions; Group Discussions; Guidelines.

Text/ Reference Books

1. How to Prepare, Stage and Deliver Winning Presentations. Leech T. 2nd Ed. Prentice Hall. 2004.
2. 100 Things Every Presenter Needs to Know About People. Weinschenk S. Pearson. 2012.
3. The Quick and Easy Way to Effective Speaking. Carnegie D. Pocket Books New York. 1962.

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in
CE, ME, MIE & RTE

Semester - III

(Humanities & Basic Sciences Subjects)

MA-2010   L-T-P-S-C
Advanced Engineering Mathematics - I   3-1-0-0-4

Objective: *To understand and learn the concept of complex variables, C-R equations, harmonic functions and its conjugate and mapping in complex plane, the complex mapping, standard mappings, cross ratios and fixed point, the Laplace Transform, Inverse Laplace Transform of various functions, its application, solution of partial differential equations with applications and the concept of Fourier Series, its complex form and enhance the problem solving skill.*

Course Outcome: *Learner will be able to understand the complex variable theory, application of harmonic conjugate to get orthogonal trajectories and analytic function, plot the image of the curve by a complex transformation from z-plane to w-plane, expand the periodic function by using Fourier series and complex form of Fourier series, concept of Laplace transform and inverse Laplace transform of various functions and its application to solve ordinary differential equations, solution of partial differential equations with applications and apply all these concepts to the engineering problems.*

Course Content
Module 01: Laplace Transform
Function of bounded variation, Laplace Transform of standard functions such as 1, t^n, e^{at}, sin(at), cos(at), cosh(at), sinh(at). Linearity property of Laplace Transform, First Shifting property, Second Shifting property, Change of Scale property of L.T. (without proof) $L\{t^n f(t)\}, L\left\{\dfrac{f(t)}{t}\right\}, L\left\{\int_0^t f(u)\,du\right\}, L\left\{\dfrac{d^n f(t)}{dt^n}\right\}$. Heaviside Unit step function, Direct Delta function, Periodic functions and their Laplace Transform. Inverse Laplace

Transform: Linearity property, use of theorems to find inverse Laplace Transform, Partial fractions method and convolution theorem (without proof). Applications to solve initial and boundary value problems involving ordinary differential equations with one dependent variable.

Module 02: Complex variables

Functions of complex variable, Analytic function, necessary and sufficient conditions for f(z) to be analytic (without proof), Cauchy-Riemann equations in polar coordinates. Milne- Thomson method to determine analytic function f(z) when it's real or imaginary or its combination is given; Harmonic function, orthogonal trajectories; Mapping: Conformal mapping, standard transformations such as translation, rotation and magnification, inversion and reflection, linear transformation, bilinear transformation, cross ratio, fixed points.

Module 03: Complex Integration

Line integral of a function of a complex variable, Cauchy's theorem for analytic function, Cauchy's Goursat theorem (without proof), properties of line integral, Cauchy's integral formula and deductions; Singularities, Classification of singularities Taylor's and Laurent's series development (without proof); Residue at isolated singularity and its evaluation; Residue theorem, application to evaluate real integral of type: $\int_{0}^{2\pi} f(\cos\theta, \sin\theta)\, d\theta$ and $\int_{-\infty}^{\infty} f(x)\, dx$.

Module 04: Fourier Series

Orthogonal and orthonormal functions, Construction of orthonormal set; Dirichlet conditions; Fourier series of periodic function with period 2π and 2L; Fourier series of even and odd functions, Half range sine and cosine series; Parsvel's identities (without proof); Complex form of Fourier series.

Module 05: Partial Differential Equations

Classification of partial differential equations of second order, Heat equation, Wave equation, Laplace equation; Method of Separation of variables, Solution of one dimensional heat conduction equation, steady state configuration for heat flow, solution of one dimensional wave equation, transverse vibrations of an elastic string, Laplace equation in rectangular region, Use of Fourier series and applications of Laplace transform in solving these equations; Numerical Solution of Partial differential equations using Bender-Schmidt Explicit Method and simplified Crank-Nicolson implicit method.

Text/Reference Books

8. Higher Engineering Mathematics. Ramana B.V. 1st Ed. Tata McGraw-Hill Education.
9. Higher Engineering Mathematics. Dass H. K. 3rd Ed. S Chand & Co Ltd. 2014.
10. Higher Engineering Mathematics. Grewal B.S. 42nd Ed. Khanna Publishers. 2012.
11. Advanced Engineering Mathematics. Kreyszig E. 10th Ed. Wiley Eastern. 2012.
12. Advanced Engineering Mathematics. Jain R. K. & Iyengar S. R. K. 3rd Ed. Narosa Publishing House. 2010.
13. Fundamentals of Mathematical Statistics. Gupta S.C. & Kapoor V. K. 11th Ed. S. Chand & Sons. 2002.
14. Probability statistics and random processes. Veerarajan T. 3rd Ed. Tata McGraw-Hill Education. 2008.
15. Probability, Random Variables and Stochastic Processes. Papoulis A and Unnikrishna Pillai S. 4th Ed. McGraw-Hill. 2008.
16. Complex Variables and Applications. Brown J. W. and Churchill R. V. 7th Ed., Mc-Graw Hill. 2004.
17. Complex Variables- Introduction and Applications. Ablowitz M. J. and Fokas A. S. Indian Ed. Cambridge University Press. 1998.
18. Complex Analysis for Mathematics and Engineering. Mathews J. H. and Howell R. W. 3rd Ed., Narosa.1998.
19. Elements of Partial Differential Equations. Sneddon I.N. McGraw Hill.1957.
20. Elementary Applied Partial Differential equations with Fourier Series and Boundary Value Problem. Haberman R. 4th Ed. PH. 1998.

Detailed Syllabus for B. Tech. Degree Programme
in
Civil Engineering

Semester - III

(Engineering Science Course)

CE-0201   L-T-P-S-C

Introduction To Civil Engineering   3-0-0-0-3

Objective: *The objective of the course is to impart the knowledge and understanding of the branches of the civil engineering and its basic concept. The students should understand the enormous creative and innovative works in the all-pervasive field of civil engineering.*

Course Outcome: *On the completion of this course, students will be able to; Understand the significance and the area covered under the head of civil engineering, state the principles of surveying for civil engineering works and measure linear and angular dimensions to arrive at solutions to basic civil engineering problems; Give examples of the water management as well as outline and discuss the significance of dams, canal & transportation i.e. land, water, air; bridge, tunnel; Describe and Explain Building bye laws and principles of planning for residential and public buildings, fundamentals of construction techniques and building materials.*

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
1	1	0	0	0	1	1	1	1	1	0	1	0	1

Course Content

Module 01 Basics of Civil Engineering and surveying

Introduction, Basics of Civil engineering, Subbranches of civil engineering, Applications, Introduction to surveying, objectives, Divisions of Surveying, classifications, General principle of surveying, Measurement of horizontal distance, use of Chain, Errors in measurement, Angular Measurement, Types of bearings, Modern equipment

Module 02 Water Management and Transportation Engineering

Water Management: Sources and conservation of water, Introduction of dams and canal, Irrigation: methods, Rainwater harvesting, Transportation Engineering: Introduction, significance, drawback, Modes of Transport: Land Transport, road, railway, bridge, tunnels, Water Transport, Harbour, dock, Air Transport.

Module 03: Building: Components, Bye-laws, Planning

Introduction and Components of building, Introduction to Building bye laws, Planning Regulations and bye laws, Building Planning, Principles of planning.

Module 04: Fundamentals of Construction and Materials

Types of structure, Requirement of Earthquake resistant structure, Foundation types, Construction types, Building Materials: stone, Brick, Cement, Sand, Timber, Steel, Concrete, Plain Concrete, Reinforced Cement Concrete.

Text/Reference Books
1. The National Building Code, BIS, (2017)
2. Patil, B.S.(2004), Legal Aspects of Building and Engineering Contract
3. Kanetkar T.P. & Kulkarni S.V. (2004). Surveying & Leveling. Vol. I, Pune Vidyarthi Griha Prakshan
4. Bindra S.P. & Arora S.P (2015), Building Construction. Bindra S.P. & Arora S.P. Dhanpat Rai & Sons Delhi.
5. Rangwala S.R (2010), Engineering Materials.. Charotar Publications Anand.
6. Khanna S.K. Justo C.E.G. & Veeraraghavan(2014), Highway Engineering. Khanna S.K. Justo C.E.G. & Veeraraghavan A. Nem Chand and Bros. Roorkee.

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1. https://nptel.ac.in/courses/105/106/105106201/
2. https://nptel.ac.in/courses/105/106/105106206/
3. https://nptel.ac.in/courses/105/102/105102088/

Detailed Syllabus for B. Tech. Degree Programme
in
Civil Engineering

Semester - III

(Professional Core Course)

CE-1202   L-T-P-S-C

Strength of Materials   3-0-0-0-3

Pre-requisite   Engineering Mechanics

Objective:

The aim of this course is to study the engineering properties of the materials and solids and analyze the same to evaluate the stress –strain behavior & to analyze the internal forces for the statistically determinate and compound beams having internal hinges with different types of loading. This course will help learner to understand the concept and behavior of flexural members (beams) in flexure and shear, solid circular shaft for torsion, thin shells for internal stresses.

Course Outcome: *On completion of the course, the students will be able to understand and determine the engineering properties for metals and non-metals, concepts of shear force, bending moment, axial force for statically determinate beams and compound beams having internal hinges; and subsequently, its application to draw the shear force, bending moment and axial force diagrams. Students will also able to analyze the flexural members for its structural behavior under the effect of flexure (bending), shear and torsion either independently or in combination thereof, study the behavior of the structural member under the action of axial load, bending and twisting moment and the deformation behavior of axially loaded columns having different end conditions and further, evaluate the strength of such columns. The*

successful completion of the course will equip the students for undertaking the courses dealing with the analysis and design of determinate and indeterminate structures.

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
1	1	1	1	0	0	0	0	1	0	1	1	1	0

Course Content

Module 01: Simple Stresses and Strains

Stresses, Strains, Modulus of elasticity (E), Modulus of rigidity (G), Bulk Modulus (K), Yield Stresses, Ultimate Stress, Factor of safety, shear stress, Poisson's ratio. Relationship between E, G and K, bars of varying sections, deformation due to self-weight, composite sections, temperature stress.

Module 02: Shear Force and Bending Moment in Beams

Axial force, shear force and bending moment diagrams for statically determinate beams including beams with internal hinges for different types of loading.

Relationship between rate of loading, shear force and bending moment.

Module 03: Theory of Simple Bending: Moment of inertia, transfer theorem, polar moment of inertia. Flexure formula for straight beam, simple problems involving application of flexure formula, section modulus, moment of resistance, flitched beams. Strain Energy: Strain energy due to axial force, stresses in axial member and simple beams under impact loading.

Module 04: Shear Stresses in Beams: Distribution of shear stress across plane sections commonly used for structural purposes.

Theory of Simple Torsion: Torsion in circular shafts-solid and hallow, stresses in shaft when transmitting power. Concept of equivalent torsional and bending moment

Module 05: Direct and Bending Stresses

Application to member's subjected to eccentric loads, core of section, problems on chimneys, retaining walls, dams, etc. involving lateral loads.

Columns and Struts: Members subjected to axial loading, concept of buckling, Effective length, Euler's formula for columns and struts with different support conditions, Limitation of Euler's formula, Rankine's formula, Problems based on Euler's and Rankine's formulae.

Module 06: Principal Planes and Stresses

General equation for transformation of stress, principal planes and principal stresses, maximum shear stress, stress determination using Mohr's circle. Thin Cylindrical and Spherical Shells. Thin Cylindrical and spherical shells under internal pressure.

Text/Reference Books
1. Strength of Materials. Ramamrutham S. Dhanpatrai Publishers.
2. Strength of Materials. Rajput R.K. S. Chand Publications.
3. Mechanics of Structures: Vol-I. Junnarkar S. B.& Shah H.J. Charotar Publishers. Anand.
4. Strength of Materials: Subramanian, Oxford University Press
5. Strength of Materials. Rattan S.S. Tata Mc-Graw Hill. New Delhi.

Digital Material
1. https://nptel.ac.in/courses/105105108/
2. https://nptel.ac.in/courses/112107146/

Detailed Syllabus for B. Tech. Degree Programme

in
Civil Engineering

Semester - III

(Professional Core Course)

CE-1203   L-T-P-S-C
Strength of Materials Lab   0-0-1-0-1

Laboratory Outcome: *The aim of this laboratory course is to study the engineering properties of the materials and solids and analyze the same to evaluate the stress – strain behavior & to analyze the internal forces for the statistically determinate with different types of loading.*

Description: *This laboratory provides the basic knowledge of strength of materials and here, the students can perform different tests on different materials.*

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
1	1	1	0	0	0	0	1	1	0	0	1	1	0

List of Experiments

S. No.	Title of the Experiment	Module
1.	Tension test on mild steel bars (stress-strain behavior, Young's modulus determination)	01
2.	Tests on Tor Steel (Tension, bend and re-bend)	04
3.	Transverse Test on cast iron.	06

4.	Shear Test on mild steel, cast iron, and brass.	04
5.	Torsion Test on mild steel and cast-iron bar.	04
6.	Brinell Hardness test (any three-metal specimen)	06
7.	Rockwell Hardness test on mild steel.	06
8.	Izod / Charpy impact test (any three-metal specimen)	03

Text/Reference Books
1. Strength of Materials. Ramamrutham S. Dhanpatrai Publishers.
2. Strength of Materials. Rajput R.K. S. Chand Publications.
3. Mechanics of Structures. Vol. I. Junnarkar S. B.& Shah H.J. Charotar Publishers. Anand.
4. Strength of Materials. Subramanian, Oxford University Press
5. Strength of Materials. Rattan S.S. Tata Mc-Graw Hill. New Delhi.

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1. https://nptel.ac.in/courses/105105108/
2. https://nptel.ac.in/courses/112107146/
3. http://sm-nitk.vlabs.ac.in/

Detailed Syllabus for B. Tech. Degree Programme

in
Civil Engineering

Semester - III

(Professional Core Course)

CE-1204   L-T-P-S-C

Engineering Geology   3-0-0-0-3

Objective: *This course is designed to impart basic geological knowledge and to understand its significance in various civil engineering projects. The course will inspire the students to think clearly & critically the solution of the civil engineering problems in the context of geology. The course will help students to study of 'Theory of Plate Tectonics' which helps to explain much of the global-scale geology including the formation of mountains, oceans, different landforms and the occurrence and distribution of earthquakes, volcanoes, landslides etc.*

Course Outcome

On completion of the course, the students shall be able to understand the significance of geological studies for safe, stable and economic design of any civil engineering structure. The students shall also able tom demonstrate the knowledge of geology to explain major geological processes such as formation of mountain, ocean and the occurrence and distribution of earthquakes and volcanoes, explain various geological structures like folds, faults, joints, unconformity, their origin and distribution which are very essential in the design and construction of dams, tunnels and any other major civil engineering project. At the end of this course students will able to prepare effective reports mentioning advantages and disadvantages caused due to geological condition and can evaluate any site for civil engineering projects.

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
1	0	0	1	0	0	0	0	1	0	1	1	1	0

Course Content

Module 01: Introduction

Branches of geology useful to civil engineering, Importance of geological studies in various civil engineering Projects. Internal structure of the Earth and use of seismic waves in understanding the interior of the earth, Theory of Plate Tectonics. Agents modifying the earth's surface, study of weathering and its significance in engineering properties of rocks like strength, water tightness and durability etc. Brief study of geological action of river, wind, glacier, ground water and the related landforms created by them. Building stones- Requirements of good building stones and its geological factors, controlling properties, consideration of common rocks as building stones, study of different building stones from various formations of Indian Peninsula.

Module 02: Mineralogy and Petrology

Identification of minerals with the help of physical properties, rock forming minerals, megascopic identification of primary and secondary minerals, study of common ore minerals.

Igneous Petrology - Mode of formation, Texture and structure, Classifications, study of commonly occurring igneous rocks and their engineering application.

Sedimentary Petrology - Mode of formation, Textures, characteristics of shallow water deposits like lamination, bedding, current bedding etc., residual deposits, chemically and organically formed deposits, classification, study of commonly occurring sedimentary rocks and their engineering application.

Metamorphic Petrology - Mode of formation, agents and types of metamorphism, metamorphic minerals, rock cleavage, structures and textures of metamorphic rocks, classification and study of commonly occurring metamorphic rocks and their engineering application.

Module 03: Structural Geology, Stratigraphy and Indian Geology

Structural elements of rocks, dip, strike, outcrop patterns, outliers and inliers, study of joints, unconformities and their engineering consideration. Faults and folds, their

classification and importance in engineering operations. Determination of thickness of the strata with the help of given data.

General principles of Stratigraphy, geological time scale, Physiographic divisions of India and their characteristics. Stratigraphy of Deccan Volcanic province.

Module 04: Geological Investigation, study of dam and reservoir site

Preliminary Geological Investigation and their importance to achieve safety and economy of the projects like dams and tunnels, methods of surface and subsurface investigations, Excavations-Trial pit, trenches etc. Core Drilling - Geological logging, Inclined Drill holes. Electrical Resistivity method, Seismic method and their applications Strengths, stability, water tightness of the foundation rocks and its physical characters against geological structures at dam sites, favourable and unfavourable geological conditions for locating dam sites. Precautions over the unfavourable geological structures like faults, dykes, joints, unfavourable dips on dam sites and giving treatments, structural and erosional valleys.

Module 05: Tunnel Investigation and Ground Water Control

Importance of geological considerations while choosing tunnel sites and alignments of the tunnel, safe and unsafe geological and structural conditions, Difficulties during tunneling and methods to overcome the difficulties. Methods of tunneling in soft soil Sources, zones, water table, unconfined and Perched water tables. Factors controlling water bearing capacity of rocks, Pervious and Impervious rocks, Cone of depression and its use in Civil engineering. Artesian well (flowing and non-flowing) Springs seepage sites and geological structures. Different types of rocks as source of ground water Methods of artificial recharge of ground water, geology of percolation tank.

Module 06: Geological Disasters and Control Measures

Landslides: Types, causes and preventive measures for landslides, Landslides in Deccan region Volcano: Central type and fissure type, products of volcano and volcanic land forms. Earthquake: Earthquake waves, construction and working of seismograph, Earthquake zones of India, elastic rebound theory Preventive measures for structures constructed in Earthquake prone areas.

Text/Reference Books
1. Foundations of Engineering Geology. Waltham A. C. 1st Ed. Blackie Academic & Professional. Chapman & Hall. 1997.
2. General Geology for Engineers. Allan K., First revised Ed. Tata McGraw Hill. 2006.
3. Engineering Geology. Kesavulu P. 2nd Ed. Oxford University Press. 1999.

4. Text book of Engineering and General Geology. Singh P. Carson Publication.

Digital Material

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2. https://nptel.ac.in/courses/105105106/

Detailed Syllabus for B. Tech. Degree Programme
in
Civil Engineering

Semester - III

(Professional Core Course)

CE-1205   L-T-P-S-C
Engineering Geology Lab   0-0-1-0-1

Laboratory Outcome: *Students must be able to conduct laboratory experiments to collect, analyze, interpret and present the data.*

Description: *The purpose of the laboratory is to facilitate high-level research and development work within the field of geotechnics and soil mechanics with emphasis on soils laboratory testing, field testing and monitoring.*

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
1	0	0	1	1	0	0	1	1	0	0	1	1	0

List of Experiments

S. No.	Title of the Experiment	Module
1.	Study of physical properties of the minerals	01
2.	Identification of minerals- Quartz and its varieties, Orthoclase, Plagioclase, Muscovite, Biotite, Hornblende, Asbestos, Augite, Olivine, Tourmaline, Garnet, Actinolite, Calcite, Dolomite, Gypsum, Beryl, Bauxite, Graphite, Galena, Pyrite. Hematite, Magnetite, Chromite, Corundum, Talc, Fluorite, Kyanite.	02

3.	Identification of rocks: Igneous rocks-Granite and its varieties, Syenite, Diorite, Gabbro, Pegmatite. Porphyry, Dolerite, Rhyolite, Pumice, Trachyte, Basalt and its varieties, Volcanic Breccia, Volcanic tuffs. Sedimentary Rocks- Conglomerate, Breccia, Sandstone and its varieties, Shales, Limestones, Laterites. Metamorphic Rocks- Mica Schists, Hornblende Schists, Slate, Phyllite, Granite Gneiss, Augen gneiss, Marbles and Quartzite.	03
4.	Study of Geological maps (At least 5).	04, 05
5.	Study of core samples, RQD, Core logging.	04, 05
6.	At least two engineering problems based on field data collected during site investigation	04, 06

Text/Reference Books
1. Foundations of Engineering Geology. Waltham A. C. 1st Ed. Blackie Academic & Professional. Chapman & Hall. 1997.
2. General Geology for Engineers. Allan K., First revised Ed. Tata McGraw Hill. 2006.
3. Engineering Geology. Kesavulu P. 2nd Ed. Oxford University Press. 1999.
4. Text book of Engineering and General Geology. Singh P. Carson Publication.

Digital Material
1. https://nptel.ac.in/courses/105105170/
2. https://nptel.ac.in/courses/105105106/

Detailed Syllabus for B. Tech. Degree Programme
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Semester - III

(Professional Core Course)

CE-1206   L-T-P-S-C
Fluid Mechanics   3-0-0-0-3
Pre-requisite   Engineering Physics

Objective: *The aim of this course is to introduce & explain fundamentals of Fluid Mechanics, which is used in the applications of Aerodynamics, Hydraulics, Civil Engineering, etc. This course will also help to learn fluid properties & hydrostatic law & to understand the importance Various flow measuring devices and their applications.*

Course Outcome

On completion of this course the student will be able to define various properties of fluids, state and explain different types of laws and principles of fluid mechanics. They will interpret different forms of pressure measurement and Calculate Hydrostatic Force and its Location for a given geometry and orientation of plane surface and compute force of buoyancy on a partially or fully submerged body and analyse the stability of a floating body. They will also able to derive Euler's Equation of motion and Deduce Bernoulli's equation and measure velocity and rate of flow using various devices.

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	1	1	0	0	0	0	1	0	1	1	1	0

Course Content

Module 01: Properties of Fluids

Mass density, weight density, specific gravity, specific volume, viscosity, compressibility and elasticity, surface tension, capillarity, vapour pressure, types of fluids, basic concepts applicable to fluid mechanics.

Module 02: Fluid Statics

Pressure measurement: Pascal's law, hydrostatic law, pressure variation in fluids at rest. Absolute, atmospheric, gauge pressure, measurement of pressure using manometers. Hydrostatic pressure and force: horizontal, vertical and inclined surfaces. Buoyancy and flotation: Archimedes principle, Meta-centre, metacentric height, Stability of floating and submerged bodies.

Module 03: Fluid Kinematics

Fluid Kinematics: Types of fluid flow, description of flow pattern, Lagrangian methods, Eulerian method, continuity equation, velocity and acceleration of fluid particles, velocity potential and stream function, streamline, streak line, path line, equipotential lines and flow net, uses of flow net, rotational and irrotational motions, circulation and vorticity.

Module 04: Fluid dynamics

Control volume and control surface, Forces acting on fluid in motion, Navier Stokes Equation, Euler's Equation of motion, Integration of Euler's equations of motion, Bernoulli's Theorem and its derivation, Bernoulli's equation for compressible fluid and real fluid, practical applications of Bernoulli's Equation - Venturimeter, Orifice meter, nozzle meter, pitot tube, rotameter.

Module 05: Flow through pipes

Loss of head through pipes, Darcy-Weisbach equation, minor and major losses. Hydraulic gradient line and energy gradient line, pipes in series, equivalent pipes, pipes in parallel, flow through laterals, flow through branched pipes, three reservoir problem, siphon.

Module 06: Boundary layer theory

Development of boundary layer over flat surfaces. Boundary layer thickness, energy thickness and momentum thickness, Boundary layer separation and control. Introduction to flow around submerges body, drag and lift, terminal velocity of body.

Module 07: Laminar Flow

Reynolds experiment, critical velocity, laminar flow through circular pipes, flow between two parallel plates: stationary and moving. kinetic energy correction factor, and momentum correction factor. Dash pot mechanism.

Module 08: Turbulent Flow

Causes of turbulence, shear stress in turbulent flow, Prandtl's mixing length Theory, Hydro dynamically smooth and rough pipes, velocity distribution in smooth and rough pipes, Karman-Prandtl velocity distribution equation, Resistance to flow in smooth and rough pipes, resistance equation and Moody's diagram.

Text/Reference Books

5. Hydraulics & Fluid Mechanics. Modi P.N. & Seth S.M. Standard Book House. 1998.
6. Fluid Mechanics. Streeter V.L. & Wylie E.B. McGraw Hill. 1997.
7. Fluid Mechanics. B.F. White. McGraw Hill.1994.
8. Fluid Mechanics: *Bansal R.K.* Laxmi Publications (P) Ltd.

Digital Material

1. https://nptel.ac.in/courses/105101082/

Detailed Syllabus for B. Tech. Degree Programme
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Civil Engineering

Semester - III

(Professional Core Course)

CE-1207   L-T-P-S-C
Fluid Mechanics Lab   0-0-1-0-1

Laboratory Outcome: *The aim of this laboratory course is to introduce & explain experiments related to fundamentals of Fluid Mechanics, which is used in the applications of Aerodynamics, Hydraulics, Civil Engineering, etc. This course will also help to learn fluid properties, hydrostatic law and to understand the working of Various flow measuring devices and their applications.*

Description: *On completion of this course the student will be able to define various properties of fluids, state and explain different types of laws and principles of fluid mechanics. They will also able to understand applications of Bernoulli's equation and measure velocity and rate of flow using various devices.*

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	1	0	0	0	0	1	1	0	0	1	1	0

List of Experiments

S. No.	Title of the Experiment	Module
7.	Measurement of viscosity	01

8.	Study of Pressure Measuring Devices	02
9.	Determination of metacentric height.	02
10.	Verification of Bernoulli's theorem.	04
11.	Determination of coefficient of discharge through Venturimeter.	04
12.	Determination of coefficient of discharge through Orifice meter.	04
13.	Friction loss through pipes	05
14.	Minor losses through pipes	05

Text/Reference Books

1. Hydraulics & Fluid Mechanics. Modi P.N. & Seth S.M. Standard Book House. 1998.
2. Fluid Mechanics. Streeter V.L. & Wylie E.B. McGraw Hill. 1997.
3. Fluid Mechanics. B.F. White. McGraw Hill.1994.
4. Fluid Mechanics: *Bansal R.K.* Laxmi Publications (P) Ltd.

Digital Material

1. https://eerc03-iiith.vlabs.ac.in/
2. http://fm-nitk.vlabs.ac.in/

Detailed Syllabus for B. Tech. Degree Programme
in
Civil Engineering

Semester - IV

(Professional Core Course)

CE-1208   L-T-P-S-C
Building Design & Drawing   2-0-0-1-3
Pre-requisite   Engineering Drawing

Objective: *The objective of this course is to: remember and recall the intricate details of building design and drawing; gain an understanding of the basic concepts of building design and drawing; learn how to apply professional ethics and act responsibly pertaining to the norms of building design and drawing practices; identify, analyse, research literate and solve complex building design and drawing problems; design new solutions for complex building design and drawing problems and effectively communicate ideas related to building design and drawing, both orally as well as in written format like reports & drawings.*

Course Outcome: *Students will be able to: list down the types of structures and its various components (for eg. doors, windows, staircase, foundations etc.); explain various concepts pertaining to building design and drawing (for eg, principles of planning, architectural planning, green buildings etc.); apply principles of planning, architectural planning and building bye laws while designing and preparing building drawings; calculate and analyze various technical details of a building (for eg. carpet area, FSI etc.) from its drawings; design various components of buildings (for eg. staircases etc.) as well as buildings, given the requirements of the building owner and*

local D.C. laws; Students will be able to prepare drawings (for eg. plans, elevation, perspective views etc.) of the designed components of buildings as well as buildings as a whole.

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
1	0	1	0	1	1	1	0	0	1	0	1	0	1

Course Content

Module 01: Principles and Codes of Practices for Planning and Designing of Buildings (Residential and Public buildings)

Study of IS 962: 1989 – Code of Practice for Architectural and Building Drawings

Principles of planning for residential buildings

Classification of buildings:

Residential –Bungalows, Apartments/Flats etc.

Public – Education, Health, Offices/Commercial, Hotels, Hostels.

Study of building Bye-laws and documents / permissions required from commencement to completion of the building according to National Building Code (N.B.C.) of India and local Development Control (D.C.) rules

Study of sun path diagram, wind rose diagram and sun shading devices

Calculation of setback distances, carpet area, built-up area and floor space index (FSI)

Principles of planning for public buildings:

 i) Building for education: schools, colleges, institutions, libraries, etc.

 ii) Buildings for health: hospitals, primary health centres, etc.

 iii) Office buildings: banks, post offices, commercial complexes, etc.

 iv) Building for public residence: hostels, boarding houses, etc.

Module 02: Components and Services of a Building

Staircase (dog legged & open newel in details),

Foundations: stepped footing, isolated sloped footing and combined footing

Openings: doors and windows

Types of pitched roof and their suitability (plan and section)

Building services: Water supply, sanitary and electrical layouts

Module 03: Perspective Drawing

One-point perspective

Two-point perspective

Module 04: Town Planning, Architectural Planning & Built Environment

Objectives and principles (road systems, zoning, green belt etc.)

Master plan and slum rehabilitation

Architectural Planning: introduction and principles

Built Environment: introduction and principles

Module 05: Green Buildings

Introduction and overview

Certification methods (LEED and TERI)

Module 06: Computer Aided Drawing (CAD)

Advantages of CAD

Overview of the CAD software prevailing in the market (AutoCAD)

Text/Reference Books
1. Building Drawing with an Integrated Approach to Built Environment. Shah M.G. Kale C.M. & Patki S.Y. Tata McGraw-Hill Education.
2. Building Planning. Singh G. Standard Publishers & Distributors New Delhi.
3. Building Construction. Varghese P.C. PHI Learning Pvt. Ltd. 2008.
4. Building Construction. Punmia B.C. & Jain A.J. Laxmi Publications. 2005.
5. Building Drawing & Detailing. Balagopal T.S. Prabhu K. Paul V. & Vijayan C. Spades Publishers Calicut. 1987.

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2. https://nptel.ac.in/courses/112103019/41

Detailed Syllabus for B. Tech. Degree Programme
in
Civil Engineering

Semester - III

(Professional Core Course)

CE-1209   L-T-P-S-C
Building Design and Drawing Lab   0-0-1-0-1
Pre-requisite   Engineering Drawing

Laboratory Outcome: *Students must be able to remember and recall the intricate details of building design and drawing; gain an understanding of the basic concepts of building design and drawing.*

Description: *Students will be able to prepare drawings (for eg. plans, elevation, perspective views etc.) of the designed components of buildings as well as buildings as a whole.*

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
0	0	1	0	1	1	0	1	1	0	0	1	1	0

List of Experiments/Drawings

S. No.	Title of the Experiment	Module
1.	Ground floor plan, first floor plan, elevation, section passing through at least one sanitary unit & staircase, site plan, schedule of opening and construction notes of a residential building (bungalow or apartment) to be constructed as a (G+1) R.C.C. framed structure	01

2.	Ground floor plan, first floor plan, elevation, section passing through at least one sanitary unit & staircase, site plan, schedule of opening and construction notes of a public building (school or hostel or hospital or bank) be constructed as a (G+1) R.C.C. framed structure	01
3.	Roof plan, foundation plan (with section of a typical foundation), plan and section of staircase, one typical door and one typical window of either one of the two above drawings	02
4.	One point and two-point perspective	03
5.	CAD sheet of either one of the first two drawings	06

Text/Reference Books
1. Building Drawing with an Integrated Approach to Built Environment. Shah M.G. Kale C.M. & Patki S.Y. Tata McGraw-Hill Education.
2. Building Planning. Singh G. Standard Publishers & Distributors New Delhi.
3. Building Construction. Varghese P.C. PHI Learning Pvt. Ltd. 2008.
4. Building Construction. Punmia B.C. & Jain A.J. Laxmi Publications. 2005.
5. Building Drawing & Detailing. Balagopal T.S. Prabhu K. Paul V. & Vijayan C. Spades Publishers Calicut. 1987.

Digital Material
1. https://nptel.ac.in/courses/112103019/41

Detailed Syllabus for B. Tech. Degree Programme
in
CE, ME, MIE & RTE

Semester - IV

(**Humanities & Basic Sciences Subjects**)

MA-2014   L-T-P-S-C
Advanced Engineering Mathematics - II   3-1-0-0-4

Objective: *To inculcate an ability to relate engineering problems to mathematical context, provide a solid foundation in mathematical fundamentals required to solve engineering problems, study the basic principles of Vector analysis, linear and non-linear programming problems, probability, test of hypothesis and correlation between data and prepare students for competitive exams.*

Course Outcome: *Learner will be able to demonstrate matrix algebra and vector calculus with its specific rules, apply the concept of probability distribution and sampling theory, principles of matrices, curve fitting and vector calculus to the analysis of engineering problems, identify, formulate, and solve engineering problems and illustrate basic theory of correlations and regression.*

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
1	1	1	0	0	0	0	0	0	0	0	1	0	0

Course Content
Module 01: Vector calculus

Brief revision of Scalar and vector point functions, Gradient, divergence and curl, Irrotational vectors, scalar potential, solenoidal vectors, Directional derivatives; Line integrals, Circulation, Green's theorem (without proof) for plane regions and properties of line integrals; Surface integrals, Stokes theorem (without proof); Volume integrals,

Gauss divergence theorem (without proof) related identities and deductions. (No verification problems on Stoke's Theorem and Gauss Divergence Theorem).

Module 02: Linear Programming

Types of solutions to linear programming problems, standard form of L.P.P. Simplex method to solve L.P.P.; Big M method (Penalty method) to solve L.P.P, Duality, Dual simplex method and Revised simplex method to solve L.P.P.

Module 03: Non-Linear Programming

Unconstrained optimization, problems with equality constraints, Lagrange's Multiplier method, Problem with inequality constraints Kuhn-Tucker conditions.

Module 04: Probability Distributions

Discrete and Continuous random variables, Probability mass and density function, Probability distribution for random variables, Expected value, Variance; Probability distributions: Binomial, Poisson, Normal and exponential Distributions.

Module 05: Sampling theory

Sampling distribution, Test of Hypothesis, Level of significance, critical region, One tailed and two tailed tests, Interval Estimation of population parameters; Test of significance for Large samples: Test for significance of the difference between sample mean and population means, Test for significance of the difference between the means of two samples; Test of significance of small samples:-Student's t-distribution and its properties. Test for significance of the difference between sample mean and population mean, Test for significance of the difference between the means of two Samples, paired t-test; Chi square test, Test of goodness of fit and independence of attributes, Contingency table and Yate's correction; Analysis of Variance (F-Test): One way classification, Two-way classification (short-cut method).

Module 06: Correlation, regression, and Curve Fitting

Correlation, Co-variance, Karl Pearson Coefficient of Correlation and Spearman's Rank Correlation Coefficient (non-repeated and repeated ranks); Regression coefficient & Lines of Regression; Curve fitting by the method of least squares- fitting of the curves of the form: $y = a x + b$, $y = a x^2 + b x + c$ and $y = a e^{bx}$.

Text/Reference Books
1. Higher Engineering Mathematics. Ramana B.V. 1st Ed. Tata McGraw-Hill Education.
2. Higher Engineering Mathematics. Dass H. K. 3rd Ed. S Chand & Co Ltd. 2014.
3. Higher Engineering Mathematics. Grewal B.S. 42nd Ed. Khanna Publishers. 2012.

4. Advanced Engineering Mathematics. Kreyszig E. 10th Ed. Wiley Eastern. 2012.
5. Advanced Engineering Mathematics. Jain R. K. & Iyengar S. R. K. 3rd Ed. Narosa Publishing House. 2010.
6. Fundamentals of Mathematical Statistics. Gupta S.C. & Kapoor V. K. 11th Ed. S. Chand & Sons. 2002.
7. Operations Research. Gupta P.K. & Hira D.S. 7th Ed. S. Chand & Sons. 2014.
8. Probability statistics and random processes. Veerarajan T. 3rd Ed. Tata McGraw-Hill Education. 2008.
9. Probability, Random Variables and Stochastic Processes. Papoulis A and Unnikrishna Pillai S. 4th Ed. McGraw-Hill. 2008.

Detailed Syllabus for B. Tech. Degree Programme
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Semester - IV

(Professional Core Course)

CE-3210   L-T-P-S-C
Surveying   3-0-0-0-3

Objective: *The objective of this course is to explain and apply the knowledge of surveying instrument for conducting civil engineering works and to compute the surveying data.*

Course Outcome: *On the completion of this course students will be able to explain Basic surveying instruments for linear and angular measurement, techniques to conduct traverse survey and apply skills to interpret the data collected; Summarize the purpose of levelling and apply the knowledge of levelling in different surveying operations; Define and explain the advantage and disadvantage of plane table surveying, use of contouring and plane tabling in the field of civil engineering; Describe the use of theodolite and tacheometer, apply the knowledge of tacheometry for various civil engineering problems.*

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
1	1	1	0	1	0	0	0	1	0	0	1	1	0

Course Content

Module 01: Linear and Angular Measurement

Linear Measurement: Definition, principles of surveying, objectives, classification of surveying, conventional signs and symbols, surveying measurement and errors, corrections for wrong scales, Chaining, Ranging and offsetting; Angular Measurement:

Module 02: Measurement of Directions and Angles

Basic definitions, Types of traverses, meridians, bearings, magnetic and true bearings, compasses, Conversion of WCB into RB and vice-versa, prismatic and surveyor's, temporary adjustments, declination, local attraction, Traverse Survey and Computations of interior angles of a closed Traverse, correction for local attraction.

Module 03: Levelling and its application

Introduction to levelling, basic terms and definitions, types of instruments, construction and use of dumpy level, auto level, temporary and permanent adjustments, reduction of levels, plane of collimation (HI) and rise-fall methods, Types of levelling, Numerical problems.

Module 04: Plane Tabling and Contouring

Plane Table Surveying: Definition, accessories required for plane table surveying, merits and demerits, temporary adjustments, Different methods of plane table surveying, Errors in plane table surveying, Use of telescopic alidade.

Contouring: definitions, contour interval, equivalent, characteristics of contour lines, methods of contouring. Use of planimeter, Computation of volume by trapezoidal and prismoidal formula

Module 05: Tachometric surveying

Introduction of theodolite and tacheometer, Various parts and axis of transit, technical terms, temporary and permanent adjustments, horizontal and vertical angles measurements. advantages and suitability of tacheometry, different methods of tacheometry, stadia formula, Stadia method, Sub-tense bar method.

Module 06: Curves

Definitions of different terms, necessity of curves and types of curves Simple circular curves and compound curves, methods of setting out curves.

Text/Reference Books
1. Surveying & Leveling. Vol. I & Vol. II. Kanetkar T.P. & Kulkarni S.V. Pune Vidyarthi Griha Prakshan. 1972.
2. Surveying. Vol. I & Vol. II. Punmia B.C. & Jain A.K. Laxmi Publication. 1996.
3. Remote Sensing & Image Interpretation. Lillesand T.M. & Kiefer R.W. John Wiley & Sons. 1994.

4. Textbook of Highway Engineering. Sriniwasakumar R. University Press Hyderabad Reprinted. 2013.
5. Transportation Engineering (Vol.-I) Highway Engineering. Venkatramaiah C. University Press Hyderabad. 2016.
6. Principles of Transportation and Highway Engineering. Rao G.V. Tata McGraw Hill Publishing House Pvt. Ltd. New Delhi.
7. Principles, Practice and Design of Highway Engineering (Including Airport Engineering). Sharma S.K. S. Chand and Company Pvt. Ltd. New Delhi.
8. Principles of Transportation Engineering. Chakraborty Partha & Das A. Prentice Hall India Learning Pvt. Ltd. New Delhi. 2013.

Digital Material

1. https://nptel.ac.in/courses/105107122/1

Detailed Syllabus for B. Tech. Degree Programme
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Civil Engineering

Semester - IV

(Professional Core Course)

CE-3211   L-T-P-S-C
Surveying Lab   0-0-1-0-1

Laboratory Outcome: *Students must be able to conduct field experiments to collect, analyse, interpret and present the surveying data. Also, to study the functions of various surveying instruments, their least counts, possible errors, advantages, and limitations.*

Description: *The Surveying Laboratory has a wide variety of basic and modern surveying equipment, total stations, Digital theodolites, Digital planimeter and automatic levels for basic instructional and research purposes. Undergraduate students use above resources to obtain any topographic information that can help their capstone design projects, such as highway design and land development.*

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	1	0	1	0	0	0	1	0	0	1	1	0

List of Experiments (Any eights to be performed)

S. No.	Title of the Experiment	Module
1.	Ranging and Chaining	01
2.	Computing area of polygon by chain and cross staff survey	01

3.	Measuring bearing of closed traverse using Prismatic compass	02
4.	Simple and differential levelling using dumpy level	03
5.	Plane table surveying by various methods	04
6.	Determination of areas of irregular figures by planimeter	04
7.	Contour study	04
8.	Measurement of horizontal and vertical angle by theodolite	
9.	Additive & multiplying constants of given tacheometer	05
10.	Setting out a simple curve	06

Text/Reference Books
1. Surveying & Leveling. Vol. I & Vol. II. Kanetkar T.P. & Kulkarni S.V. Pune Vidyarthi Griha Prakshan. 1972.
2. Surveying. Vol. I & Vol. II. Punmia B.C. & Jain A.K. Laxmi Publication. 1996.
3. Remote Sensing & Image Interpretation. Lillesand T.M. & Kiefer R.W. John Wiley & Sons. 1994.

Digital Material

1. https://nptel.ac.in/courses/105107122/1
2. http://vlabcivil-iitr.co.in

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Semester - IV

(Professional Core Course)

CE-4212   L-T-P-S-C
Structural Analysis   3-0-0-1-4

Pre-requisite   Engineering Mechanics

Objective: *The objective of this course is to: analyze the statically determinate simple portal frame (both- rigid jointed and having an internal hinges); study the methods and evaluating rotation and displacement parameters in respect of beams and frames using various methods; analyze the three hinged arches; and cables, suspension bridges and three hinged stiffening girder; study the buckling behavior of the axially and transversely loaded beam-columns and its analyses; understand the concept and behavior of the beam and trusses under rolling loads and subsequently, to obtain the absolute maximum bending moment and understand the concept of unsymmetrical bending and shear center and its application in solving the problems of structural mechanics.*

Course Outcome

On completion of this course, the students will be able to: understand the behavior of various statically determinate structures including compound structures having an internal hinge for various loadings; analyze these structures to find out the internal forces such as axial force, shear force, bending moment, twisting moments, etc.; evaluate the displacements / deflections in beams and frames under the action of loads. They will be able to obtain the response of the beams under the action of moving

loads; analyze the structures such as arches and suspension bridges and study the behavior of eccentrically loaded columns; analyze the section with respect to unsymmetrical bending and shear center.

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	0	0	0	0	0	0	0	0	0	0	1	1	1

Course Content

Module 01: Axial force, shear force and bending moment

Concept of statically determinate structures; Axial force, shear force and bending moment diagrams for statically determinate frames with and without internal hinges.

General theorems and its application to simple structures

General theorems and principles related to elastic structures, types of strain energy in elastic structures, complementary energy, principle of virtual work, Betti's and Maxwell's reciprocal theorems, Castigliano's first theorem, principle of superposition. Application of Energy Approach to evaluate deflection in simple structures such as simple beams, portal frame, bent and arch type structures, etc.

Module 02: Deflection of Statically Determinate Structures Using Geometrical Methods

Deflection of cantilever, simply supported and overhanging beams for different types of loadings Using-Integration Approach including Double Integration method and Macaulay's Method, Geometrical Methods including Moment area method and Conjugate beam method.

Module 03: Deflection of Statically Determinate Structures Using Methods Based on Energy Principle

Application of Unit Load Method (Virtual Work Method/ Dummy Load Method) for finding out slope and deflection in beams. Application of Strain Energy Concept and Castigliano's Theorem for finding out deflection in such structures.

Application of Unit Load Method (Virtual Work Method) for finding out deflection of rigid jointed frames. Application of Strain Energy Concept and Castigliano's Theorem for finding out deflection in such frames.

Application of Unit Load Method (Virtual Work Method/ Dummy Load Method) for finding out deflection in pin jointed frames (trusses). Application of Strain Energy Concept and Castigliano's Theorem for finding out deflection in trusses.

Module 04: Rolling Load and Influence Lines for Statically Determinate Structures

Influence lines for cantilever, simply supported, overhanging beams and pin jointed truss including warren truss, criteria for maximum shear force and bending moment, absolute maximum shear force and bending moment under moving loads (UDL and Series of point loads) for simply supported girder.Three Hinged Elastic Arches Determination of normal thrust, radial shear and bending moment for parabolic and circular (semi and segmental) three hinged arches, Influence lines for normal thrust, radial shear and bending moment for three hinged parabolic arches.

Module 05: Cables, Suspension bridges and Three Hinged Stiffening Girder

Simple suspension cable, different geometries of cables, minimum and maximum tension in the cable supported at same/different levels, anchor cable, suspension cable with three hinged stiffening girder.

Module 06: Columns and Struts

Columns and struts subjected to eccentric loads, Secant formula, Perry's formula, struts with initial curvature.Unsymmetrical bendingProduct of inertia, principal moment of inertia, flexural stresses due to bending in two planes for symmetrical sections, bending of unsymmetrical sections.Shear centre for thin walled sections such as channel, tee, angle section and I- section.

Text/Reference Books

1.	Basic Structural Analysis. Reddy C.S. 2nd Ed. Tata McGraw Hill. 2006.
2.	Structural Analysis. Hibbeler R.C., Sixth Ed. Pearson Education. 2009.
3.	Structural Analysis. Negi L.S. & Jangid R.S. Tata McGraw Hill, New Delhi. 1997.

4. Mechanics of Structures: Vol-I. Junnarkar S. B.& Shah H.J. Charotar Publishers, Anand.
5. Strength of Materials: Ramamrutham S. Dhanpatrai and Publishers. Delhi
6. Theory of Structures: Ramamrutham S. Dhanpatrai and Sons. Delhi

Digital Material

https://nptel.ac.in/downloads/105101085/

Detailed Syllabus for B. Tech. Degree Programme
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Semester - IV

(Professional Core Course)

CE-4213   L-T-P-S-C
Structural Analysis Lab   0-0-1-0-1

Pre-requisite   Engineering Mechanics

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
1	0	0	0	0	0	0	0	0	0	0	1	1	1

Term Work

The term work shall comprise of neatly written report based on tutorials and assignments. The term work shall cover the entire syllabus in such a way that the students would attempt at least four problems on each sub-modules and contents thereof. At least twenty solved problem have to be validated by using available computer software. Or at least ten solved problem (validated by using available computer software) and Analysis of (G+2) portal frame with minimum three bays.

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Semester - IV

(Professional Core Course)

CE-3214   L-T-P-S-C

Building Materials & Construction Technology   3-0-0-1-4

Objective: *The objective of this course is to: study the manufacturing process, properties, and use of different types of building materials like cement, lime, mortar, concrete, stone, brick, timber, including materials such as paints and varnishes used for treatment of the surfaces so as to achieve good knowledge about the building materials; enable the students to identify various components of building masonry, roof and floor, staircase etc., their functions and methods of construction so as to achieve good knowledge about building construction; study the properties such as workability, durability and porosity of fresh and hardened concrete; understand the concept and optimization of mix design for different environmental conditions.*

Course Outcome

On completion of the course, the students will be able to: Identify and list the various building materials, their properties, and symbols; identify the properties of ingredients of concrete, interpret and design concrete mix for various grades; explain and interpret manufacturing process of basic construction materials and understand various masonry construction and finishes and perform tests on various materials.

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
1	0	0	0	0	0	0	0	0	0	0	1	1	1

Course Content

Module 01: Introduction

Classification of materials, building materials symbols and requirements of building materials and products: functional, aesthetical, and economical

Module 02: Manufacturing Process and Properties of Basic Construction Materials

Rocks (Stone) quarrying, milling and surface finishing, preservative treatments. Aggregate-Properties of coarse and fine aggregates and their influence on properties of concrete, properties of crushed aggregates.

Structural clay products -bricks, roofing tiles, ceramic tiles.

Concrete blocks, flooring tiles, paver blocks

Binder material: lime, cement: Manufacturing process and physical properties, plaster of Paris - properties and uses.

Mortar - Ingredients, preparation and uses.

Damp - proofing and water proofing materials

Module 03: Concrete

Grades of concrete, Manufacturing process, Properties of fresh and hardened concrete. Durability: Factors affecting durability.

Admixtures: Plasticizers, Super-plasticizers, Retarders, Accelerators, Mineral admixtures and other admixtures.

Module 04: Glass: Types and uses. Introduction to glass fibre reinforced plastic.

Timber: Varieties, defects in timber, preservative treatments and wood composites.

Module 05: Concrete mix design

Types of mix, Mix design for compressive strength by I.S. method

Ready mix concrete: Advantages of RMC, components of RMC plant, distribution and transport, handling and placing, mix design of RMC.

Module 06: Masonry Construction and Masonry Finishes: Classification and bonding of stone, brick and concrete blocks Masonry finishes -pointing, plastering and painting Formwork: Materials used, design considerations, shuttering, centering and staging, scaffolding. Types of form work: Slip form work, Cantilever and other modern form work Floor and roof: Different types and its suitability. Type of roofs, wooden and steel trusses and roof covering Different types of cladding.

Text/Reference Books

1. Building Construction. Bindra S.P. & Arora S.P. Dhanpat Rai & Sons. Delhi.
2. Engineering Materials. Rangwala S.R. Charotar Publications. Anand.
3. Building Construction. Rangwala S.R. Charotar Publications. Anand.
4. Concrete Technology: Theory and Practice: Shetty M.S., S. Chand.
5. Concrete Technology. Gambhir M.L. Tata McGraw Hill. New Delhi.
6. Concrete Technology: Neville A.M. & Brooks. J. J. ELBS-Longman.
7. Indian Standard of Concrete mix proportioning-guidelines (IS:10262-2009). BIS. New Delhi.
8. Concrete Technology. Shanthakumar A.R. Oxford University Press.
9. Engineering Materials: Rangwala S.R. Charotar Publications. Anand.
10. Specifications for different materials. BIS Publications. New Delhi
11. Relevant I.S. codes. Bureau of Indian standard. New Delhi.

Digital Material

1. https://nptel.ac.in/courses/105102088/
2. https://nptel.ac.in/downloads/105106053/

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Semester - IV

(Professional Core Course)

CE-3215   L-T-P-S-C
Building Materials and Construction Technology Lab   0-0-1-0-1

Laboratory Outcome: *Students must be able to conduct laboratory experiments to collect, analyze, interpret and present the data related to building materials like cement, bricks, tiles, concrete.*

Description: *The purpose of the laboratory is to enable the students to identify various components of building masonry, roof and floor, staircase etc., to achieve good knowledge about building construction, to study the properties such as workability, durability and porosity of fresh and hardened concrete, to understand the concept and optimization of mix design for different environmental conditions.*

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
1	0	0	0	0	1	0	0	0	0	0	1	1	1

List of Experiments (Any eight (08) to be performed)

S. No.	Title of the Experiment	Module
1.	Physical properties of cement: Fineness, consistency, setting time, Soundness, Compressive strength.	02

2.	Water absorption and compressive strength test of bricks.	02
3.	Water absorption and transverse load test on tiles.	02
4.	Compression test on timber (Parallel/ perpendicular to the grains).	04
5.	Effect of w/c ratio on workability, (slump cone, compaction factor, V-B test, flow table) and strength of concrete	03
6.	Effect of w/c ratio on strength of concrete,	03
7.	Study of admixtures and their effect on workability and strength of concrete	03
8.	Secant modulus of elasticity of concrete and indirect tensile test on concrete	03
9.	Nondestructive testing of concrete- some applications (hammer, ultrasonic)	03
10.	Mix design in laboratory.	05

Text/Reference Books
1. Building Construction. Bindra S.P. & Arora S.P. Dhanpat Rai & Sons. Delhi.
2. Engineering Materials. Rangwala S.R. Charotar Publications. Anand.
3. Building Construction. Rangwala S.R. Charotar Publications. Anand.
4. Concrete Technology: Theory and Practice: Shetty M.S., S. Chand.
5. Concrete Technology. Gambhir M.L. Tata McGraw Hill. New Delhi.
6. Concrete Technology: Neville A.M. & Brooks. J. J. ELBS-Longman.
7. Indian Standard of Concrete mix proportioning-guidelines (IS:10262-2009). BIS. New Delhi.
8. Concrete Technology. Shanthakumar A.R. Oxford University Press.
9. Engineering Materials: Rangwala S.R. Charotar Publications. Anand.
10. Specifications for different materials. BIS Publications. New Delhi
11. Relevant I.S. codes. Bureau of Indian standard. New Delhi.

Digital Material
1. http://civ02.vlabs.ac.in/exp10/index.html
2. http://www.vlab.co.in/broad-area-civil-engineering

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Semester - IV

(Professional Core Course)

CE-2301   L-T-P-S-C
Theory of Reinforced Concrete Structure   3-1-0-1-5

Objective: *This course will impart the fundamental concepts of the design of reinforced concrete structure using ULM and LSM. The course covers the various clauses of IS: 456-2000 and its significance in the RCC design. The course is designed to understand the importance of ULM in the analysis and design of beams. Moreover it also aims to cover the concepts of LSM in the analysis and design of beams, slabs, columns and footings.*

Course Outcome: *Students must be able to understand the various clauses specified in IS: 456-2000 for designing structural members with the safety and economy. They must understand the application and effectiveness of the LSM to the considerable extent along with the application of ULM in the limited extent.*

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
1	1	1	0	0	1	1	1	0	1	0	1	1	0

Course Content

Module 01: Ultimate Load Method

Brief introduction to fundamentals of ultimate strength theory: curved stress distribution, compressive stress block, simplified rectangular stress block as per

Whitney's approach, ultimate moment of resistance of singly reinforced section and doubly reinforced sections.

Module 02: Limit State Method

Introduction to limit state method of design as per IS 456 (latest edition): concepts of probability and reliability, characteristic loads, characteristic strength, partial safety factors for loads and materials, introduction to various limit states.

Module 03: Limit State of Collapse – Flexure

Limit state of collapse in flexure, shear and Limit state of serviceability in deflection and cracking, design of singly and doubly reinforced rectangular and T sections for flexure, design of members in shear and bond, design of beam subjected to bending and torsion.

Module 04: Design of Slabs

Design of one way and two way slabs

Module 05: Limit State of Collapse – Compression

Limit state of collapse compression for short and slender column. Members subjected to combined axial and uni-axial as well as biaxial bending. Development of interactive curves and their use in column design.

Module 06: Design of Foundations:

Isolated square and rectangular footings subjected to axial load and moments. Design of combined rectangular pad footings, slab beam type footing and strap footing.

Text/Reference Books

1. Design of Reinforced Concrete Structures: Dayaratnam, P; Oxford and IBH.
2. Limit State Design – Reinforced Concrete: Jain A. K, Nemchand and Bros., Roorkee
3. Limit State Design – Reinforced Concrete: Shah and Karve, Structure Publications, Pune.
4. Ultimate Strength Design for Structural Concrete: Arthur, P. D. and Ramakrishnan, V., Wheeler and Co. Pvt. Ltd.
5. Limit State Theory of Reinforced Concrete Design: Huges, B. P.,Pitman.
6. Reinforced Concrete: Warner, R. F., Rangan, B. C.and Hall, A. S.,Pitman.
7. Reinforced Concrete: H.J. Shah, Charotar Publishers, Anand.

8. Fundamentals of Reinforced Concrete: Sinha and Roy, S. Chand and Co. Ltd.
9. Illustrated Reinforced Concrete Design: Dr. V. L. Shah and Dr. S. R. Karve, Structure Publications, Pune.
10. Reinforced Concrete Design: Wang, C. K., Salmon, C. G., and Pincheira, J.A, John Wiley(2007), 7th Edition.
11. Reinforced Concrete Fundamentals: *Ferguson, P. M., Breen, J. E., and Jirsa, J. O.,* John Wiley andSons (1988) 5th Edition.
12. RCC Design (WSM and LSM): *Punmia, B. C.,Jain, A. K., and Jain, Arun, K.,* Laxmi Publications.
13. Limit State Design of Reinforced Concrete (as per IS: 456-2000): *Punmia, B. C., Jain K., and Jain, Arun, K.,* Laxmi Publications.
14. Design and RCC structural Elements (RCC Vol-I): *Bhavikatti, S. S.,*New Age International Publications.

Digital Material

1. Design of Reinforeced Concrete Structures. Prof. N. Dhang. NPTEL (https://nptel.ac.in/courses/105105105/)
2. Design of RC Structures. Weekly Assignments NPTEL (https://nptel.ac.in/downloads/105105105/)

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Semester - IV

(Professional Core Course)

CE-3303   L-T-P-S-C
Geotechnical Engineering   3-0-0-0-3

Objective: *The course is designed to study the types of soil, relationships involving the weight, volume, index properties, soil classification based on different systems, determination of permeability of soils, study the concept of total stress, neutral stress & effective stress in soil, deformation concept through compaction process, basic mechanism of consolidation, importance of slope failure and shear strength of soil, soil exploration, and assessing the subsoil conditions.*

Course Outcome: *Students must be able to understand the soil types, index and engineering properties and relationship between various parameters, classify the soil with a view towards assessing the suitability of a given soil for use, determine permeability of soil, compaction process, basic mechanism of soil consolidation, compute stresses in soil, significance of shear strength of soil, differentiate different modes of slope failure, soil exploration and subsoil conditions, ,*

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
1	1	1	1	1	1	1	1	1	0	1	1	1	1

Course Content

Module 01: Introduction

Types of soils, their formation and deposition, Definitions: soil mechanics, soil engineering, rock mechanics, geotechnical engineering. Scope of soil engineering. Comparison and difference between soil and rock. Basic Definitions and Relationships-Soil as three-phase system in terms of weight, volume, voids ratio, and porosity. Definitions: moisture content, unit weights, degree of saturation, voids ratio, porosity, specific gravity, mass specific gravity, etc. Relationship between volume weight, voids ratio- moisture content, unit weight- percent air voids, saturation moisture= content, moisture content- specific gravity etc. Determination of various parameters such as: Moisture content by oven dry method, pycnometer, sand bath method, torsional balance method, nuclear method, alcohol method and sensors. Specific gravity by density bottle method, pycnometer method, measuring flask method. Unit weight by water displacement method, submerged weight method, core-cutter method, sand-replacement method.

Module 02: Plasticity Characteristics of Soil

Introduction to definitions of: plasticity of soil, consistency limits-liquid limit, plastic limit, shrinkage limit, plasticity, liquidity and consistency indices, flow & toughness indices, definitions of activity and sensitivity. Determination of: liquid limit, plastic limit, and shrinkage limit. Use of consistency limits. Classification of Soils-Introduction of soil classification: particle size classification, textural classification, unified soil classification system, Indian standard soil classification system. Identification: field identification of soils, general characteristics of soil in different groups.

Module 03: Permeability of Soil

Darcy's law, validity of Darcy's law. Determination of coefficient of permeability: Laboratory method: constant-head method, falling-head method. Field method: pumping- in test, pumping- out test. Permeability aspects: permeability of stratified soils, factors affecting permeability of soil. Seepage Analysis- Introduction, stream and potential functions, characteristics of flow nets, graphical method to plot flow nets.

Module 04: Effective Stress Principle

Introduction, effective stress principle, nature of effective stress, effect of water table. Fluctuations of effective stress, effective stress in soils saturated by capillary action, seepage pressure, quick sand condition.

Module 05: Compaction of Soil

Introduction, theory of compaction, laboratory determination of optimum moisture content and maximum dry density. Compaction in field, compaction specifications and field control.

Module 06: Consolidation of Soil

Introduction, comparison between compaction and consolidation, initial, primary & secondary consolidation, spring analogy for primary consolidation, interpretation of consolidation test results, Terzaghi's theory of consolidation, final settlement of soil deposits, computation of consolidation settlement and secondary consolidation.

Module 06: Shear Strength

Mohr circle and its characteristics, principal planes, relation between major and minor principal stresses, Mohr-Coulomb theory, types of shear tests: direct shear test, merits of direct shear test, triaxial compression tests, test behaviour of UU, CU and CD tests, pore pressure measurement, computation of effective shear strength parameters. unconfined compression test, vane shear test.

Module 06: Stability of Slopes

Introduction, types of slopes and their failure mechanisms, factor of safety, analysis of finite and infinite slopes, wedge failure Swedish circle method, friction circle method, stability numbers and charts.

Module 06: Soil Exploration

Introduction, methods of site exploration and soil investigation, methods of boring, soil samplers, sampling procedures, trail pits, borings, penetrometer tests, analysis of borehole logs, geophysical and advance soil exploration methods.

Text/Reference Books

1. Soil Engineering in Theory and Practice; Alam Singh, CBS Publishers Distributors New Delhi.
2. Soil Mechanics and Foundation Engineering: V. N. S. Murthy; Saitech Publications.
3. Soil Mechanics and Foundation Engineering: K. R. Arora; Standard Publishers and Distributors New Delhi.
4. Geotechnical Engineering. Ramaiah C.V. New Age International.
5. Relevant Indian Standard Specifications Codes. BIS Publications New Delhi.
6. Theoretical Soil Mechanics. Terzaghi K. John Wiley and Sons.

Digital Material

1. Concept in Civil Engineering NPTEL. (https://nptel.ac.in/courses/105106142/)
2. https://nptel.ac.in/courses/112103019/41

Detailed Syllabus for B. Tech. Degree Programme
in
Civil Engineering

Semester - III

(Professional Core Course)

CE-3303   L-T-P-S-C

Geotechnical Engineering Lab   0-0-1-0-1

Laboratory Outcome: *Students must be able to conduct various laboratory experiments on soil and able to collect, analyze, interpret and present the data.*

Description: *The purpose of the laboratory is to facilitate high-level research and development work within the field of geotechnics and soil mechanics with emphasis on soils laboratory testing, field testing and monitoring.*

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
1	0	0	0	1	0	1	1	1	1	0	1	1	0

List of Experiments/Drawings (Any Ten)

S. No.	Title of the Experiment	Module
1.	Field identification of fine grained soils	01
2.	Specific gravity of soil grains by density bottle method or pycnometer method.	01
3.	Determination of natural moisture content using oven drying method.	01
4.	Grain size distribution by sieve analysis	02
5.	Grain size distribution by hydrometer analysis	02

6.	Determination of liquid & plastic limit	02
7.	Determination of shrinkage limit	02
8.	Field density using core cutter method.	05
9.	Field density using sand replacement method	05
10.	Permeability using constant head method	03
11.	Permeability using falling head method	03
12.	Compaction test, IS light compaction test/ Standard Proctor test	05
13.	Compaction test, IS heavy compaction test/ Modified Proctor test	05
14.	Relative density test	05
15.	Determination of pre-consolidated pressure coefficient of consolidation from one dimensional consolidation test.	07
16.	Determination of shear parameters from unconsolidated undrained tri-axial compression test	07
17.	Determination of shear parameters from direct shear test.	08
18.	Determination of CBR value from CBR test	08
19.	Determination of shear strength of soft clays from vane shear test	08

Text/Reference Books

1. Soil Engineering in Theory and Practice; Alam Singh, CBS Publishers Distributors New Delhi.
2. Soil Mechanics and Foundation Engineering: V. N. S. Murthy; Saitech Publications.
3. Soil Mechanics and Foundation Engineering: K. R. Arora; Standard Publishers and Distributors New Delhi.
4. Geotechnical Engineering. Ramaiah C.V. New Age International.
5. Relevant Indian Standard Specifications Codes. BIS Publications New Delhi.
6. Theoretical Soil Mechanics. Terzaghi K. John Wiley and Sons

Digital Material

1. Soil Mechanics Lab. Virtual Labs. (http://smfe-iiith.vlabs.ac.in/Introduction.html)
2. Civil Engineering Lab. NITTTR-NCTEL. (http://www.nitttrchd.ac.in/sitenew1/nctel/civil.php)

Detailed Syllabus for B. Tech. Degree Programme

in
Civil Engineering

Semester – V

(Professional Core Course)

CE-2304   L-T-S-P-C
Applied Hydraulics   3-0-0-0-3

Objective: *The course is designed to introduce the concept of dynamics of fluid flow and dimensional analysis, study hydraulic machines like centrifugal pumps, reciprocating pumps and turbines. Also, to impart the dynamic behavior of the fluid flow analyzed by the Newton's second law of motion, understand the uniform and non-uniform flow through open channels and to study design of open channel and understand concept of surface profile with hydraulic jump.*

Course Outcome: *Students must be able to apply the concepts of fluid dynamics to solve pipe bend and sprinkler problems, analyze dimensional problems and explain model laws. Students must be able to explain the working and functions of Francis, Kaplan and Pelton wheel turbines and basic concepts of open channel hydraulics and measure discharge through open channels.*

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
1	1	1	1	0	0	0	0	1	0	1	1	1	0

Course Content

Module 01: Dynamics of Fluid Flow

Momentum principle (applications: pipe bends), moment of momentum equation (applications: sprinkler).

Module 02: Dimensional Analysis

Dimensional homogeneity, Buckingham's π theorem, Rayleigh's method, dimensionless numbers and their significance, Model (or similarity) laws, application of model laws: Reynold's model law, Froude's model law, scale effect in models.

Module 03: Impact of Jets

Introduction, force exerted on stationary flat plate held normal to jet, held inclined to jet, hinged plates, curved plate.

Module 04: Hydraulic Turbines

General layout of hydro-electric plant, heads, efficiencies of turbine, classification, working of Pelton Wheel Turbine, Reaction Turbine, Francis Turbine, Kaplan Turbine, and draft tube theory.

Module 05: Centrifugal pumps

Work done, heads, efficiencies, Minimum speed: series parallel operation, Multistage pumps, specific speed, model testing, priming, characteristic curves, cavitations. Brief introduction to reciprocating pump.

Module 06: Flow through open channels

Uniform Flow: Flow through open channel: Definition, types of channels, Types of flows in channels, Prismatic, non-prismatic channels, Uniform flow: steady flow and unsteady flow, laminar and turbulent flow, subcritical flow, supercritical flow, Chezy's formula, Manning's formula, hydraulically efficient channel cross-section (most economical section). Non-Uniform Flow: Specific energy and specific energy curve, Specific force, Hydraulic jump and standing wave. Gradually varied flow, equation for gradually varied flow, back water curve and afflux, Introduction to surface profiles.

Text/Reference Books

1. Hydraulics and Fluid mechanics: Dr. P.N. Modi and Dr. S.M. Seth, Standard Book House, Delhi.
2. Theory and Application of Fluid Mechanics: K. Subramanya, Tata McGraw hill publishing company, New Delhi.
3. Fluid Mechanics: A.K Jain, Khanna Publishers.
4. Fluid Mechanics and Hydraulics: S.K. Ukarande, Ane's Books Pvt. Ltd. (Revised Edition 2012), ISBN 97893 8116 2538
5. Fluid Mechanics and Fluid Pressure Engineering: D.S. Kumar, F.K. Kataria and sons 6. Fluid

6. Mechanics: R.K. Bansal, Laxmi Publications (P) Ltd.
7. Flow in Open Channels: K. Subramanya; Tata Mc-Graw Hill Publishing House Pvt. Ltd.
8. Irrigation and Water Power Engineering: B. C. Purnnia.; Standard Publishers, New Delhi.

Digital Material

1. Concept of Civil Engineering-NPTEL https://nptel.ac.in/courses/105107059/

Detailed Syllabus for B. Tech. Degree Programme
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Semester - V

(Professional Core Course)

CE-2305   L-T-S-P-C
Applied Hydraulics   0-0-0-1-1

Laboratory Outcome: *At the end of the course, the student will be able to design the working proportions of hydraulic machines, channel and develop the understanding of the flow phenomena.*

Description: *The knowledge of this subject is essential to understand facts, concepts and design parameters of dynamics of fluid flow, application of momentum equation in impact of jets. Further it helps to understand the design aspects, components, function, and uses of centrifugal pump and turbines*

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
1	1	1	0	0	0	0	1	1	0	0	1	1	0

List of Experiments (Any Six)

S. No.	Title of the Experiment	Module
1	Impact of jet on flat plate/inclined plate/curved plate.	03
2	Performance of Pelton wheel- full gate opening.	04
3	Performance of Centrifugal pumps.	05
4	Performance of Kaplan turbine.	04

5	Performance of Francis turbine.	04
6	Determination of Chezy's roughness factor.	06
7	Study of gradually varied flow	06
8	Study of hydraulic jump and its characteristics	06
9	Calibration of Venturi-flume/Standing wave flume	06

Text/Reference Books

1. Soil Mechanics and Foundation Engineering. Arora K. R. Standard Publishers and Distributors, New Delhi.
2. Geotechnical Engineering. Ramaiah CV. New Age International.
3. Relevant Indian Standard Specifications Codes. BIS Publications. New Delhi.

Digital Material

1. Fluid Mechanics Virtual Lab http://fm-nitk.vlabs.ac.in/

Detailed Syllabus for B. Tech. Degree Programme
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Semester - V

(Professional Core Course)

CE-2306   L-T-P-S-C
Transportation Engineering   3-0-0-1-4

Objective: *The objective of this course is to give insight of the development in the field of highway engineering, different road development policies, enable the students to understand the phase of engineering which deals with the planning and geometrics design of streets, highways and with traffic operations thereon w.r.t. safe and convenient transportation of people and goods, understand the properties of the different materials, properties along with its significance, classification and behaviour of different types of pavements.*

Course Outcome: *After successful completion of this course, the students should be able to Describe the development in the fields of highway engineering and familiarized with road developments plans of India for the implementation of the highway project; Understand and apply the phase of engineering which deals with the planning and geometrics design of streets and highways demonstrating of safe and convenient traffic operations, know the required traffic studies, parameters and control devices; Explain the properties of the different materials to be used in the construction of highways, understand the classification of different types of pavements and compute the pavement design.*

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
1	1	1	1	0	1	0	1	1	0	0	1	1	1

Course Content

Module 01 Highway development and planning

Road development in India, Classification of roads, Jaykaar Committee recommendation, Master plan, Saturation system, twenty year Road development plans.

Module 02 Geometric design

Geometric design of highways-: Introduction; highway cross section elements; sight distance, design of horizontal alignment; design of vertical alignment; problems.

Module 03: Traffic engineering & control

Traffic Characteristics, traffic engineering studies, traffic flow and capacity, traffic regulation and control; road intersections; parking facilities; highway lighting; problems

Module 04: Pavement materials

Materials used in Highway Construction- Soils, Stone aggregates, bituminous binders, bituminous paving mixes; desirable properties, requirements for different types of pavements.

Module 05: Design of pavements

Introduction; flexible pavements, factors affecting design and performance; stresses in flexible pavements; design of flexible pavements as per IRC; rigid pavements-components and functions; factors affecting design and performance of CC pavements; stresses in rigid pavements; design of concrete pavements as per IRC; problems

Text/Reference Books
1. Highway Engineering. Khanna S.K. Justo C.E.G. & Veeraraghavan A. Nem Chand and Bros. Roorkee.
2. Principles and Practice of Highway Engineering. Kadiyali L.R. Khanna Publishers Delhi.
3. A Textbook of Highway and Traffic Engineering. Saxena & Chandra S. CBS Publishers and Distributors. 2014.
4. Textbook of Highway Engineering. Sriniwasakumar R. University Press Hyderabad Reprinted. 2013.
5. Transportation Engineering (Vol.-I) Highway Engineering. Venkatramaiah C. University Press Hyderabad. 2016.
6. Principles of Transportation and Highway Engineering. Rao G.V. Tata McGraw Hill Publishing House Pvt. Ltd. New Delhi.
7. Principles, Practice and Design of Highway Engineering (Including Airport Engineering). Sharma S.K. S. Chand and Company Pvt. Ltd. New Delhi.

8. Principles of Transportation Engineering. Chakraborty Partha & Das A. Prentice Hall India Learning Pvt. Ltd. New Delhi. 2013.

Digital Material
1. Concept of Civil Engineering NPTEL. (https://nptel.ac.in/courses/105101087/)

Detailed Syllabus for B. Tech. Degree Programme
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Civil Engineering

Semester - V

(Professional Core Course)

CE-2307   L-T-P-S-C
Transportation Engineering Lab   0-0-1-0-1

Laboratory Outcome: *Students must be able to conduct laboratory experiments to collect, analyze, interpret and present the data.*

Description: *The purpose of the laboratory is to facilitate high-level research and development work within the field of pavement engineering with emphasis on aggregate, bitumen, soils laboratory testing and monitoring.*

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
1	1	0	0	0	0	0	1	1	0	0	1	1	0

List of Experiments (Any eight to be performed)

S. No.	Title of the Experiment	Module
1.	Traffic volume count by manual method	03
2.	Impact test on aggregates	04
3.	Abrasion test on aggregates	04
4.	Crushing test on aggregates	04
5.	Shape test on aggregates	04
6.	Soundness test	04
7.	Penetration test on bitumen	04
8.	Ductility test on bitumen	04

9.	Softening point test on bitumen	04
10.	Viscosity test on bitumen	04
11.	Flash point and fire point test on bitumen	04
12.	Marshall stability test on the bituminous mix	04
13.	CBR test on subgrade soil material (Laboratory or Field)	04

Text/Reference Books
1. Highway Engineering. Khanna, S.K., Justo, C.E.G. & Veeraraghavan A. Nem Chand and Bros. Roorkee.
2. Principles, Practice and Design of Highway Engineering (Including Airport Engineering). Sharma S.K. S. Chand and Company Pvt. Ltd. New Delhi.
3. Principles of Transportation Engineering. Chakraborty. Partha. & Das A. Prentice Hall India Learning Pvt. Ltd. New Delhi. 2013.

Digital Material
1. https://nptel.ac.in/courses/105101087/

Detailed Syllabus for B. Tech. Degree Programme
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Civil Engineering

Semester - V

(Professional Core Course)

CE-3308   L-T-P-S-C
Design & Drawing of steel structures   3-0-0-1-4
Pre-requisite   Strength of Materials

Objective: *To learn IS 800-2007 code of practice for the design of compression, tension & flexural members using various cross-sections; to study the behaviour & design of compression & tension members using simple & built-up sections.*

Course Outcome: *On completion of this course, the students will be able to: Explain the Limit State Design philosophy as applied to steel structures, Predict the behaviour and design members subjected to axial compression, tension and their connection, Predict the behaviour and design members subjected to bending, shear and their connection Calculate loading for a truss and design the complete truss, Demonstrate ability to follow IS codes, design tables and aids in analysis and design steel structure,. Analyze and design the commercial steel structures and prepare drawing with complete detailing.*

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
1	0	1	0	1	1	1	1	1	1	1	1	1	1

Course Content

Module 01: Introduction

Types of steel structures, Properties of Structural Steel, Indian Standard Specifications and Sections, Design Requirements & Design Process, Advantages and limitations of WSM, Introduction to Limit State Design, partial safety factors for load and resistance, design load combinations, section classification such as plastic, compact, semi-compact and slender.

Module 02: Design of tension members

Introduction, types of tension members, net area calculation. Design strength due to yielding, rupture and block shear. Design of tension members with welded and bolted end connection using single angle section & double angle section.

Module 03: Design of compression members and column bases

Introduction, types of compression members, classification of cross sections, types of buckling, effective length of column and slenderness ratio, buckling curves, design of compression members as struts using single angle sections & double angle section. Design of axially loaded column using rolled steel sections, design of built up column, laced and battened columns. Design of slab bases & gusseted base.

Module 04: Design of beams and welded plate girder

Design strength in bending, effective length, Lateral torsion buckling behavior of unrestrained beams, design of single rolled section with or without flange plates, design strength of laterally supported beams, low and high shear, design strength of laterally unsupported beams, web buckling, web crippling, shear lag effect and deflection. Design of angle section purlin. Design of welded plate girder: proportioning of web and flanges, flange plate curtailment, stiffeners and connections

Module 05: Design of connections

Design of bolted and welded beam to beam and beam to column connections. Framed, stiffened and unstiffened seat, bracket connections.

Module 06: Design of truss

Design of determinate truss. Calculation of dead load, live load and wind load acting on truss. Load combinations and calculation of internal forces. Design and detailing of members. Support detailing.

Text/Reference Books

1. Design of Steel Structure by N. Subramanian, Oxford University Press, New Delhi.

2. Limit state design of steel structures by S. K. Duggal, McGraw Hill Education(India) Pvt. Limited, New Delhi.

3. Design of steel structure by Limit State Method as per IS: 800- 2007 by Bhavikatti S. S., I.K. International Publishing House, New Delhi

4. Design of Steel Structures by K. S. Sai Ram, Pearson Education, New Delhi.

Digital Material

Design of Steel Structure, Prof. Damodar Maity, IIT Guwahati. NPTEL (https://nptel.ac.in/courses/105105162/)

Detailed Syllabus for B. Tech. Degree Programme
in
Civil Engineering

Semester – V

(Professional Core Course)

CE-3309   L-T-P-S-C
Design & Drawing of steel structures   0-0-1-0-1
Pre-requisite   Strength of Materials

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
1	1	1	0	0	1	0	1	1	0	0	0	1	0

Term Work:

The Term work shall consist of following:

1. Design Report including detail drawings on any of the two projects as listed below:
   a) Design of truss (internal forces to be calculated by analytical method/graphical method/using any software)
   b) Flooring system including beam, column, column base and connections.
   c) Welded plate girder.

The drawing should be drawn in pencil only on minimum of A-1(imperial) size drawing sheets.

2. Neatly drawn minimum 15 sketches showing structural detailing based on entire syllabus (in sketchbook).

3. Neatly written assignments covering the syllabus. (At least four problems on each modules and contents thereof)

One site visit report (The report should contain structural details with sketches).viz. Industrial structure, Railway Structures, Workshops etc.

Detailed Syllabus for B. Tech. Degree Programme

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Civil Engineering

Semester - V

(Professional Core Course)

CE-2310	L-T-P-S-C
Environmental Engineering	3-0-0-0-3
Pre-requisite	Environmental Studies

Objective: *The course is designed to prepare students who can accomplish planning, design and construction of water systems and related infrastructural facilities, provide the necessary knowledge on quality of water, concepts in the field of water supply and treatment, impart necessary skill for the design and operation of water treatment plants and to introduce new developments in the field of water treatment and to develop rational approaches towards sustainable wastewater management via pollution prevention.*

Course Outcome: *Students must be able to understand the water supply system, its components and water demand by various consumers, analyze the quality of water and will be able to conduct the quality control test on samples, different processes in the water treatment facility, the students shall able to ensure the safe handling and treatment of wastewater and sewage, design the different units of treatment for water treatment plants, they shall be able to formulate approaches to treat waste water in most effective manner, Lastly they able to handle problems of air and noise pollution and solutions to environmental problems in our society.*

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
1	1	1	1	0	0	1	0	1	0	1	1	1	0

Course Content

Module 01: Water Supply and Distribution of Water

Water resources, Water supply systems, distribution systems of water, types of intake structure, water demand.

Module 02: Quality of Water

Wholesomeness and palatability, physical, chemical, Biological standards, Treatment of water, drinking water standards, environmental chemistry, Eutrophication, Primary, Secondary and Tertiary treatment of water. Typical water treatment flow diagram.

Module 03: Aeration Sedimentation Coagulation flocculation and Filtration

Aeration, Types of Aeration systems, Theory and factors affecting efficiency of sedimentation, design of sedimentation tank and tube settler Coagulation and flocculation: Mechanisms, common coagulations, rapid mixing and flocculating devices, Jar test, coagulant aids – PAC. Filtration: Classification, slow and rapid sand filters, dual media filters, under drainage system, mode of action, cleaning, limitations, operational difficulties, performance, basic design consideration, head loss in filters and numerical on head loss, pressure filters: construction and operation. Water Softening: Lime soda and base exchange methods, Principle reactions, design considerations, sludge disposal. Disinfection: Chlorination, chemistry of chlorination, kinetics of disinfection, chlorine demand, free and combined chlorine, break point chlorination, super chlorination, de-chlorination, chlorine residual, uses of iodine, ozone, ultra violet rays and chlorine dioxide as disinfectants, well water disinfection. Advanced and Miscellaneous Treatments: Reverse Osmosis, Activated carbon, Membrane filtration, Removal of Iron and Manganese, taste, odour and colour, principles and methods, de-fluoridation.

Module 04: Primary Treatment of sewage

Need for Analysis, Characteristics of sewage: Composition, Biochemical characteristics, aerobic decomposition, anaerobic decomposition, Sampling of sewage, Analysis of sewage. Treatment processes: Objective, methods of treatment, flow sheets showing Preliminary, Primary, Secondary and Tertiary treatment. Screens, Grit chamber, Primary and secondary clarifier. Design of primary treatment units.

Module 05: Secondary treatment methods

Principles, Trickling filter, Activated sludge process, recirculation, hydraulic design of trickling filter and activated sludge process, Sludge volume index, Operational problems in trickling filter and activated sludge process, Aerated lagoons, Rotating Biological contractors, Stabilization Ponds, UASB . Design of secondary treatment units. Sludge treatment and disposal: Sludge Digestion: Principles of anaerobic digestion, quantity and characterization of sludge, design of sludge digestion tanks, disposal of digested sludge, drying beds. Sewage disposal: Discharge of Raw and treated sewage on land and water, standards for disposal. Self-purification of natural water bodies: Oxygen economy, Numerical on BOD, Sewage farming. Disposal of treated effluent.

Module 06: Air Pollution & Noise

Air-Composition and properties of air, Quantification of air pollutants, Monitoring of air pollutants, Air pollution- Occupational hazards, Urban air pollution-automobile pollution, Air quality standards, Control measures for Air pollution, construction and limitations. Noise: Basic concept, measurement and various control methods. Thermal pollution.

Text/Reference Books

1. Water Supply and Sanitary Engineering. S.K. Hussain, Oxford & IBH Publication New Delhi.
2. 2. Manual on Water Supply and Treatment. Ministry of Urban Development New Delhi.
3. Plumbing Engineering Theory and Practice. Patil S.M. Seema Publication Mumbai.
4. Water Supply and Sewage. Steel E.W. McGraw Hill New York.
5. Water Supply and Sewage: McGhee T.J. McGraw Hill New York.
6. CPHEEO Manual on Water Supply and Treatment.
7. Water Supply Engineering. Modi P.N. Rajsons Publication.
8. Water Supply Engineering. Garg S. K. Khanna Publication.

9. Environmental Engineering (Vol. II) Sewage Disposal and Air Pollution Engineering. Garg S. K. Khanna Publication.
10. Introduction to Environmental Engineering. Vesilind, PWS Publishing company.
11. Water supply and pollution control. Clark J.W. Veisman W. & Hammer M.J. International textbook company.
12. Relevant Indian standard specifications.
13. Environmental Pollution. Gilbert Masters.
14. Basic Environmental Engineering. Nathanson J.A. Prentice Hall of India.
15. Environmental Engineering. Sincero & Sincero.
16. Air pollution. Rao M.N. Tata Mc Graw Hill. New Delhi.

Digital Material

Concept of Civil Engineering NPTEL. https://nptel.ac.in/courses/105106119/

Detailed Syllabus for B. Tech. Degree Programme

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Civil Engineering

Semester - V

(Professional Core Course)

CE-2311   L-T-P-S-C
Environmental Engineering Lab   0-0-1-0-1
Pre-requisite   Environmental Studies

Laboratory Outcome: *Students must be able to conduct laboratory experiments to collect, analyze, interpret and present the data.*

Description: *The purpose of the laboratory is to facilitate high-level research and development work within the field of environmental engineering with emphasis on water and wastewater laboratory testing.*

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
1	1	1	0	0	0	1	1	1	0	0	1	1	0

List of Experiments (Any eight to be performed)

S. No.	Title of the Experiment	Module
1.	Determination of pH of water.	02
2.	Determination of Alkalinity of water	02

3.	Determination of Hardness of water.	02
4.	Determination of Turbidity of water.	02
5.	Determination of Optimum dose of coagulant by using Jar Test Apparatus	03
6.	Determination of Dissolved Oxygen of Water	03
7.	Determination of Residual chlorine in water	02
8.	Determination of Dissolved oxygen	04
9.	Determination of Biological Oxygen Demand of sewage sample	05
10.	Determination of Chemical Oxygen Demand of sewage sample.	05

Text/Reference Books

1. Soil Mechanics and Foundation Engineering. Arora K. R. Standard Publishers.
2. Manual on Water Supply and Treatment. Ministry of Urban Development New Delhi.
3. CPHEEO Manual on Water Supply and Treatment.
4. Water supply and pollution control Clark J.W. Veisman W. Hammer M.J. International textbook company.

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Semester - VI

(Professional Core Course)

CE-3312   L-T-P-S-C
Water Resource Engineering   3-1-0-0-4

Objective: *The course is designed to study the hydrological cycle, rainfall measurement, various water losses, hydrograph, unit hydrograph their applications and runoff. Students will also learn the necessity & importance of irrigation, factors affecting frequency & efficiency of irrigation, different parameters and their impact on the hydraulic structures such as canal and dams.*

Course Outcome: *On successful completion of the course, the students will: be able to understand hydrological cycle, measure rainfall and runoff. They will be able to understand the irrigation process and water distribution systems and evaluate the impact of different parameters on the hydraulic structures such as canal and dams.*

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
1	1	1	1	0	1	1	1	0	1	0	1	1	1

Course Content

Module 01: Introduction

Hydrologic cycle, water-budget equation, history of hydrology, world water balance, applications in engineering, sources of data.

Module 02: Precipitation

Forms of precipitation, characteristics of precipitation in India, measurement of precipitation, rain gauge network, mean precipitation over an area, depth-area duration relationships, maximum intensity/depth-duration-frequency relationship, Probable Maximum Precipitation (PMP), rainfall data in India

Module 03: Abstractions from precipitation

Evaporation process, evaporimeters, analytical methods of evaporation estimation, reservoir evaporation and methods for its reduction, evapotranspiration, measurement of evapotranspiration, evapotranspiration equations, potential evapotranspiration over India, actual evapotranspiration, interception, depression storage, infiltration, infiltration capacity, measurement of infiltration, modelling infiltration capacity, classification of infiltration capacities, infiltration indices

Module 04: Runoff

Runoff volume, SCS-CN method of estimating runoff volume, flow-duration curve, flow-mass curve, hydrograph, factors affecting runoff hydrograph, components of hydrograph, base flow separation, effective rainfall, unit hydrograph surface water resources of India, environmental flows

Module 05: Ground water and well hydrology

Forms of subsurface water, saturated formation, aquifer properties, geologic formations of aquifers, well hydraulics: steady state flow in wells, equilibrium equations for confined and unconfined aquifers, aquifer tests.

Module 06: Water withdrawals and uses

Water for energy production, water for agriculture, water for hydroelectric generation; flood control. Analysis of surface water supply, Water requirement of crops-Crops and crop seasons in India, cropping pattern, duty and delta; Quality of irrigation water; Soil-water relationships, root zone soil water, infiltration, consumptive use, irrigation requirement, frequency of irrigation; Methods of applying water to the fields: surface, sub surface, sprinkler and trickle / drip irrigation.

Module 06: Distribution systems

Canal systems, alignment of canals, canal losses, estimation of design discharge. Design of channels- rigid boundary channels, alluvial channels, Kennedy's and Lacey's theory of regime channels. Canal outlets: non-modular, semi-modular and modular outlets. Water logging: causes, effects and remedial measures. Lining of canals, types of lining. Drainage of irrigated lands: necessity, methods.

Module 06: Dams and spillways

Embankment dams: Classification, design considerations, estimation and control of seepage, slope protection. Gravity dams: forces on gravity dams, causes of failure, stress analysis, elementary and practical profile. Arch and buttress dams. Spillways: components of spillways, types of gates for spillway crests; Reservoirs- Types, capacity of reservoirs, yield of reservoir, reservoir regulation, sedimentation, economic height of dam, selection of suitable site.

Text/Reference Books
1. Irrigation and Waterpower Engineering. Punmia B.C. Pande B.B. & A.K Jain. Laxmi Publications Pvt, Ltd. New Delhi.
2. Irrigation Water Resources and Waterpower Engineering. Modi P.N. Standard Book House Delhi. ISBN 978-81-87401-29-0.
3. Irrigation Engineering and Hydraulic Structures. Ukarande S.K. Ane Books Pvt. Ltd.
4. Irrigation Engineering and Hydraulics Structures. Garg S.K. Khanna Publishers Delhi.
5. Design of Irrigation Structures. Sharma S.K. S. Chand and Co.
6. Theory and Design of Irrigation Structures. Varshney R.S. & Gupta R.C. Nem Chand.
7. Engineering for Dams Vol. I to III. Justin C. & Hinds. John Wiley.
8. Design of Small Dams. USBR.
9. Hydro Power Structures. Varshney R.S. Nem Chand and Bros.
10. Concrete Dam. Varshney R.S. Oxford and IBH Publishing Co.
11. Engineering Hydrology. Subramanya K. Tata McGraw Hill Publishing Co. Ltd. New Delhi.
12. Hydrology. Raghunath H. M. New Age International Publishers New Delhi.
13. Engineering Hydrology Principles and practice. Ponce V. M. Prentice Hall.

Digital Material
1. Water Resource Engineering, Prof. Rajesh Srivastava IIT Kanpur and Dr. Pranab K Mohapatra IIT Kanpur. NPTEL (https://nptel.ac.in/courses/105104103/)
2. Watershed Management, Dr. T.I. Eldho, IIT Bombay NPTEL (https://nptel.ac.in/courses/105101010/)

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Semester – VII

(Engineering Science Course)

CE-2313   L-T-P-S-C
Software Applications in Civil Engineering   0-0-1-0-1

Objective: *This course will help the students learn all kinds of software packages available in various fields of civil engineering.*

Course Outcome: *The students will be able to: Use the software in various disciplines of Civil Engineering, apply the software in to provide solutions to field problems.*

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
1	1	1	0	0	1	1	1	0	1	0	1	1	0

Course Content

Module 01: General

Importance and need of software for modelling, analysis and design in Civil Engineering field, Advantages and limitations of software, causes for errors, validation of software results. Failures due to errors in modelling, data entry and interpretation of software results.

Module 02: Software application in various disciplines of Civil Engineering

Drafting and drawing: AutoCAD, Civil 3D, Auto plotter, Design and detailing of same using AutoCAD Beams (simply supported, continuous etc), Slabs (one way, two way), Columns, Portal frame, Truss.

Building Information Modelling: Navisworks, Trimble, AECOsim Building designer , Sketchup

Numerical Analysis and Mathematical operations: MATLAB, Scilab,

Structural Analysis and Design: STAAD Pro, ETABS, SAP 2000, SAFE, MIDAS.

Finite Element Analysis: ANSYS, ABAQUS, NISA

Project Management: Primavera, MS Project

Geotechnical Engineering: Geo studio, PLAXIS

Quantity Surveying: QS red, CCS Candy

Environmental Engineering: Storm CAD, EPANET, Sewer CAD

Remote Sensing and Geographical Information System: QGIS, GRAM++, Arc GIS

Transportation Engineering: MX Road, HDM, Road estimator

Hydraulics and Water Resources Engineering: Water Gems, Water CAD, Flow Master, Culvert Master, Nero solution, Discipulus, HEC-RAS, Arc SWAT, Hydrology: HEC, HMS.

MS Excel: Conduct concrete mix design for M40 grade concrete. or any exercise of Civil Engineering domain.

Text/Reference Books

1.   Software manuals.
2.   Refereed Journal papers on Software applications.
3.   MATLAB programming for numerical computation. Kaisare N. IIT Madras.

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Semester - VI

(Departmental Core Subject)

CE-4100   L-T-P-S-C
Minor Project   0-0-0-3-3

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	1	1	1	1	1	1	1	1	0	1	1	1

The Project shall be based on thrust areas in Civil Engineering (Construction Engineering and Management; Structural Engineering, Geotechnical Engineering including Geology, Transportation Engineering, Hydraulics Engineering, Environmental Engineering, Remote Sensing, etc.) or interface problem of any of the diversified fields of the Civil Engineering Branch.

For this purpose, the students shall form a group of minimum two students and maximum four students. Further, each faculty shall be permitted to guide maximum four groups.

Guidelines for Minor Project:

- Student should carry out the preliminary literature survey and subsequently, identify the problem in broad terms for the project and finalize/ settle it in consultation with Guide/ Supervisor.

- Pursuant to this, the student shall refer multiple literatures pertaining to the theme of the problem and understand the problem and define the problem in the precise terms.

- Student should attempt solution to the problem by analytical/simulation/experimental methods. The solution shall be validated with proper justification. The students shall compile the report in standard format.
- The work to be pursued as a part of the project shall be divided broadly in two parts, namely- Minor Project and Major Project.
- The topic of the project should be such that it is a value addition for the existing knowledge in the field and has some worthwhile outcomes.

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Semester – VII

(Professional Core Course)

CE-3401   L-T-P-S-C
Quantity Survey Estimation and Valuation   3-1-0-0-4

Objective: *The course is designed to read, understand and interpret plans, sections, detailed drawings and specifications for a construction project. Moreover, it also aims to cover the various methods of detailed and approximate estimates. This course will impart the fundamental concepts of the relevant IS: 1200- 1964 codes and relevant Indian Standard specifications, taking out quantities from the given requirements of the work, and drafting specifications. The course covers the process of tendering and its various stages, various types of contracts, its suitability and validity as per the Indian Contract Act of 1872 and draft various clauses and conditions of a contract.*

Course Outcome: *Students must be able to Read, understand and interpret plans, sections, detailed drawings and specifications for a construction project. Student will learn to Prepare approximate and detailed estimates based on the quantity survey of the available general and detailed drawings. Also, the student will have knowledge about the current market rates for labor and material required for construction, perform rate analysis and compare with DSR.*

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
1	0	1	0	1	1	1	1	1	1	1	1	1	1

Course Content

Module 01: Estimates

Various types, their relative importance, factors to be considered. Approximate estimates: importance, purpose, different methods. Methods of preparation of estimates for projects such as: Building R.C.C., Load bearing, Road, Cross drainage work, Factory shed including steel truss.

Module 02: Material survey

Approximate estimates of requirement of various materials for building works, percentage breakup of the cost, cost sensitive index, market survey of basic materials.

Module 03: Specifications

Types, requirements and importance, detailing of specifications for various items.

Module 04: Rate analysis

Purpose, importance and necessity of the same, factors affecting, task work.

Module 05: Tender

Preparation of tender documents, importance of inviting tenders, contract types, relative merits, prequalification. general and special conditions, termination of contracts.

Module 06: Valuation

Different terms used the role of a valuer, purpose, and necessity of the same. Capitalized Value, Year's purchase, sinking fund, depreciation, types of values, Purpose of valuation. Different methods of valuation for open plots, open plots with existing residential and commercial structures lease hold properties.

Text/Reference Books

1. Estimating, Costing Specifications and Valuation: Chakraborty, M., Kolkata.
2. Building and Engineering Contracts: Patil, B. S., University Press, Hyderabad.
3. Estimating and Costing: Datta, B. N., UBS Publications
4. Relevant Indian Standard Specifications, BIS Publications
5. World Bank approved contract documents

Digital Material

1. Construction Planning and Management Unit 7-8. Prof. A.K.Singh. NPTEL (https://nptel.ac.in/syllabus/105103093/)

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Semester - VII

(Professional Core Course)

CE-2402   L-T-P-S-C
Construction Engineering & Management   2-1-0-0-3

Objective: *To understand the basic principles and functions of construction management. To learn scheduling techniques such as CPM and PERT. To gain the knowledge of time-cost optimization and effective utilization of resources on construction sites. To understand allocating the resources and project monitoring. To know about basics of contract management.*

Course Outcome: *On successful completion of the course the students will be able to; understand and apply the knowledge of management functions like planning, scheduling, executing and controlling to construction projects. Demonstrate their capability for preparing the project networks to work out best possible time for completing the project. Understand the time- cost relationship and basics of contracts management. Inculcate the managerial skills.*

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
1	0	1	0	1	1	1	1	1	1	1	1	1	1

Course Content

Module 01: Basics of Construction

Unique features of construction, construction projects- types and features, phases of a project, agencies involved and their methods of execution.

Module 02: Construction project planning

Stages of project planning: pre-tender planning, preconstruction planning, detailed construction planning, role of client and contractor, level of detail. Process of development of plans and schedules, work break-down structure, activity lists, assessment of work content, concept of productivities, estimating durations, sequence of activities, activity utility data; Techniques of planning- Bar charts, Gantt Charts. Networks: basic terminology, types of precedence relationships, preparation of CPM networks: activity on link and activity on node representation, computation of float values, critical and semi critical paths, calendaring networks. PERT- Assumptions underlying PERT analysis, determining three time estimates, analysis, slack computations, calculation of probability of completion.

Module 03: Construction Methods basics

Types of foundations and construction methods; Basics of Formwork and Staging; Common building construction methods (conventional walls and slabs; conventional framed structure with blockwork walls; Modular construction methods for repetitive works; Precast concrete construction methods; Basics of Slip forming for tall structures; Basic construction methods for steel structures; Basics of construction methods for Bridges.

Module 04: Construction Equipment basics

Conventional construction methods Vs Mechanized methods and advantages of latter; Equipment for Earthmoving, Dewatering; Concrete mixing, transporting & placing; Cranes, Hoists and other equipment for lifting; Equipment for transportation of materials. Equipment Productivities.

Module 05: Planning and organizing construction site and resources

Site: site layout including enabling structures, developing site organization, Documentation at site; Manpower: planning, organizing, staffing, motivation; Materials: concepts of planning, procurement and inventory control; Equipment: basic concepts of planning and organizing; Funds: cash flow, sources of funds; Histograms and S-Curves. Earned Value; Resource Scheduling- Bar chart, line of balance technique, resource constraints and conflicts; resource aggregation, allocation, smoothening and leveling. Common Good Practices in Construction.

Module 06: Project Monitoring & Control

Supervision, record keeping, periodic progress reports, periodical progress meetings. Updating of plans: purpose, frequency and methods of updating. Common causes of time and cost overruns and corrective measures. Basics of Modern Project management systems such as Lean Construction; Use of Building Information Modelling (BIM) in project management; Quality control: concept of quality, quality of constructed structure, use of manuals and checklists for quality control, role of inspection, basics of statistical quality control. Safety, Health and Environment on project sites: accidents; their causes, effects and preventive measures, costs of accidents, occupational health problems in construction, organizing for safety and health.

Module 07: Contracts Management basics

Importance of contracts; Types of Contracts, parties to a contract; Common contract clauses (Notice to proceed, rights and duties of various parties, notices to be given, Contract Duration and Price. Performance parameters; Delays, penalties and liquidated damages; Force Majeure, Suspension and Termination. Changes & variations, Dispute Resolution methods.

Module 08: Construction Costs: Make-up of construction costs

Classification of costs, time-cost trade-off in construction projects, compression and decompression.

Text/Reference Books
1. Building Construction. Varghese P.C. Prentice Hall India. Delhi.
2. National Building Code, Bureau of Indian Standards, New Delhi.
3. Construction Technology. Chudley R. ELBS Publishers.
4. Construction Planning, Methods and Equipment. Peurifoy R.L. McGraw Hill.
5. Construction Methods and Management. Nunnally S.W. Prentice Hall.
6. Construction Project management, Theory & Practice. Jha K.N. Pearson Education India.
7. Project Planning with PERT and CPM. Punmia B.C. & Khandelwal K.K. Laxmi Publications. New Delhi.

Digital Material
1. Civil Engineering Lab. NITTTR-NCTEL. (http://www.nitttrchd.ac.in/sitenew1/nctel/civil.php)
2. Virtual Labs.(http://smfe-iiith.vlabs.ac.in/Introduction.html)

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Semester - VII

(Departmental Core Subject)

CE-4200   L-T-P-S-C
Major Project   0-0-0-6-6

After completion of the work at the end of Semester VII, the student shall compile the report in a standard format and written in the systematic manner and chapter wise. The student shall adhere to the following scheme of chaptalization while compiling the final report in general. The Guide/ Supervisor shall ensure the student has written the Dissertation Report in appropriate language (grammatically correct).

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
1	1	1	1	1	1	1	1	1	1	0	1	1	1

Course Content

Module 01: Introduction

The student shall give the introduction to the theme of the subject chosen as a Project/ Dissertation, give further current state of art related to the theme (i.e., brief review of literature), broad problem definition and scope of the work. The student shall also state at the end of this chapter the scheme of chaptalization included in his/ her Dissertation

Module 02: Theoretical Aspects/ Review of Literature

The student is expected to highlight the various theoretical aspects pertaining to the topic chosen, literature (updated) available related to the various aspects of the topic chosen citing the research work carried out by the earlier researchers and summarize

the findings of the literature. The student may state the precise the problem definition. If felt necessary, these two aspects, i.e., theoretical aspects and review of literature can be compiled as separate chapters.

Module 03: Formulation/ Methodology/ Experimental Work

In this chapter, the student is expected to explain the methodology for pursuing their work. In case of analytical work, students may give the formulation along with validation for assessment of accuracy of the numerical procedure being used/ proposed by them. In respect of experimental work, the students may outline the experimental set up/ procedure. In case of the work in which either approach is involved, the students may appropriately provide the methodology to cover either approach. This chapter may be supported by the Data Collection if the work involves the Collection of the Data and its subsequent processing.

Module 04: Analysis/ Results and Discussion

The students are expected to present the results emerging from the analytical/ theoretical/ experimental study/ studies being pursued by them. The results shall be discussed properly. The results may be compared with the results published by the earlier researchers if the work being pursued by the students warrants the same. The students may indicate the broad conclusions/ inferences at the end

Module 05: Summary and Conclusions

Based on the results discussed in the previous chapter, the students shall give in the systematic manner the conclusions/ inferences emerged from the study and summarize it properly. The students shall indicate the scope of the future work which can be extended by any other students in the future. The students may point out the limitation/s left out in the work pursued by them while carrying out the work contained in the Dissertation.

Module 06: References

The students shall at the end give the list of the references in the appropriate manner. This part should not be treated as a Chapter. For referencing style, student may refer any standard journal of national and international repute.

Module 07: Publication/s

The student shall give the list of the technical/ research papers published/ accepted for publication in the referred journal/ conference proceedings. This part should not be treated as a Chapter.

Project Stage- II should be assessed based on following points:

1. Quality of Literature survey and Novelty in the problem
2. Clarity of Problem definition and Feasibility of problem solution
3. Relevance to the specialization or current Research / Industrial trends Clarity of objective and scope
4. Methodology for carrying out the work defined as a Problem Statement (Formulation in respect of the analytical studies/ Experimental Work / Combination thereof depending upon the nature of the work involved)
5. Quality of work attempted
6. Presentation of the results along with the validation of results or part thereof.
7. Quality of Written Report and Oral Presentation
8. Publication of the technical/ research paper by the student in a conference of National/ International repute. Publication of paper in a referred/ peer reviewed journal is highly preferred.

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Semester - VII

(Departmental Core Subject)

CE-3300   L-T-P-S-C
Summer Internship   ------3-3

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	1	1	1	1	1	1	1	1	0	1	1	1

Summer Internships offer students personal & real world spirits & exposes to an actual working life, an experiential foundation to their career choices & the chance to build valuable business networks. Under this programme each student undergoes training in an Industry for a minimum period of six weeks during the summer vacation after VI Semester. Through the internship students are exposed with the various processes involved at any typical industrial unit such as, operating procedure, construction processes, management procedures etc.; have the opportunity to relate with the knowledge they acquired in the classroom. Students execute a small project based on any of the above-mentioned aspects under the supervision of competent personnel in the industry; a faculty member of the university. After completion of the Internship, students are required to prepare a report, based on the activities performed during the internship, as per the prescribed format/ guidelines. The report should be certified by the Supervisors; presented in the form of a seminar in the VII Semester. Evaluation of the Summer Internship will be done as per the approved procedure.

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Semester - VII

(Departmental Core Subject)

CE-4300   L-T-P-S-C
Thesis/Industrial Training   - - 0-12-12

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	1	1	1	1	1	1	1	1	1	1	1	1

Course Content

Module 01: Introduction

The student shall give the introduction to the theme of the subject chosen as a Thesis/ Industrial training project, give further current state of art related to the theme (i.e., brief review of literature), broad problem definition and scope of the work. The student shall also state at the end of this chapter the scheme of chaptalization included in his/ her Dissertation

Module 02: Theoretical Aspects/ Review of Literature

The student is expected to highlight the various theoretical aspects pertaining to the topic chosen, literature (updated) available related to the various aspects of the topic chosen citing the research work carried out by the earlier researchers and summarize the findings of the literature. The student may state the precise the problem definition. If felt necessary, these two aspects, i.e., theoretical aspects and review of literature can be compiled as separate chapters.

Module 03: Formulation/ Methodology/ Experimental Work

In this chapter, the student is expected to explain the methodology for pursuing their work. In case of analytical work, students may give the formulation along with validation for assessment of accuracy of the numerical procedure being used/ proposed by them. In respect of experimental work, the students may outline the experimental set up/ procedure. In case of the work in which either approach is involved, the students may appropriately provide the methodology to cover either approach. This chapter may be supported by the Data Collection if the work involves the Collection of the Data and its subsequent processing.

Module 04: Analysis/ Results and Discussion

The students are expected to present the results emerging from the analytical/ theoretical/ experimental study/ studies being pursued by them. The results shall be discussed properly. The results may be compared with the results published by the earlier researchers if the work being pursued by the students warrants the same. The students may indicate the broad conclusions/ inferences at the end

Module 05: Summary and Conclusions

Based on the results discussed in the previous chapter, the students shall give in the systematic manner the conclusions/ inferences emerged from the study and summarize it properly. The students shall indicate the scope of the future work which can be extended by any other students in the future. The students may point out the limitation/s left out in the work pursued by them while carrying out the work contained in the Dissertation.

Module 06: References

The students shall at the end give the list of the references in the appropriate manner. This part should not be treated as a Chapter. For referencing style, student may refer any standard journal of national and international repute.

Module 07: Publication/s

The student shall give the list of the technical/ research papers published/ accepted for publication in the referred journal/ conference proceedings. This part should not be treated as a Chapter.

Project Stage- II should be assessed based on following points:

1. Quality of Literature survey and Novelty in the problem
2. Clarity of Problem definition and Feasibility of problem solution

3. Relevance to the specialization or current Research / Industrial trends Clarity of objective and scope
4. Methodology for carrying out the work defined as a Problem Statement (Formulation in respect of the analytical studies/ Experimental Work / Combination thereof depending upon the nature of the work involved)
5. Quality of work attempted
6. Presentation of the results along with the validation of results or part thereof.
7. Quality of Written Report and Oral Presentation
8. Publication of the technical/ research paper by the student in a conference of National/ International repute. Publication of paper in a referred/ peer reviewed journal is highly preferred.

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Semester - IV

(Department Level Optional Course-I)

CE-1021   L-T-P-S-C
Civil Engineering- Societal & Global Impact   3-0-0-0-3

Objective: *This course is designed to provide a better understanding of the impact which Civil Engineering has on the Society at large and on the global arena. Civil Engineering projects have an impact on the Infrastructure, Energy consumption and generation, Sustainability of the Environment, Aesthetics of the environment, Employment creation, Contribution to the GDP, and on a more perceptible level, the Quality of Life. It is important for the civil engineers to realise the impact which this field has and take appropriate precautions to ensure that the impact is not adverse but beneficial.*

Course Outcome: *On successful completion of the course the students will be able to understand; the impact which Civil Engineering projects have on the Society at large and on the global arena and using resources efficiently and effectively, extent of Infrastructure, its requirements for energy and how they are met: past, present and future, the Sustainability of the Environment, including its Aesthetics, the potentials of Civil Engineering for Employment creation and its Contribution to the GDP, the Built Environment and factors impacting the Quality of Life, and apply professional and responsible judgement and take a leadership role.*

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
1	1	1	0	0	1	1	1	0	1	0	1	1	0

Course Content

Module 01: Introduction to Course and Overview

Understanding the past to look into the future: Preindustrial revolution days, Agricultural revolution, first and second industrial revolutions, IT revolution; Recent major Civil Engineering breakthroughs and innovations; Present day world and future projections, Ecosystems in Society and in Nature; the steady erosion in Sustainability; Global warming, its impact and possible causes; Evaluating future requirements for various resources; GIS and applications for monitoring systems; Human Development Index and Ecological Footprint of India Vs other countries and analysis.

Module 02: Understanding the importance of Civil Engineering in shaping and impacting the world

The ancient and modern Marvels and Wonders in the field of Civil Engineering; Future Vision for Civil Engineering.

Module 03: Infrastructure

Habitats, Megacities, Smart Cities, futuristic visions; Transportation (Roads, Railways & Metros, Airports, Seaports, River ways, Sea canals, Tunnels (below ground, under water); Futuristic systems (ex, Hyper Loop)); Energy generation (Hydro, Solar (Photovoltaic, Solar Chimney), Wind, Wave, Tidal, Geothermal, Thermal energy); Water provisioning; Telecommunication needs (towers, above-ground and underground cabling); Awareness of various Codes & Standards governing Infrastructure development; Innovations and methodologies for ensuring Sustainability.

Module 04: Environment-Traditional & futuristic methods

Solid waste management, Water purification, Wastewater treatment & Recycling, Hazardous waste treatment; Flood control (Dams, Canals, River interlinking), Multi-purpose water projects, Atmospheric pollution; Global warming phenomena and Pollution Mitigation measures, Stationarity and non-stationarity; Environmental Metrics & Monitoring; Other Sustainability measures; Innovations and methodologies for ensuring Sustainability.

Module 05: Built environment‑Facilities management, Climate control

Energy efficient built environments and LEED ratings, Recycling, Temperature/ Sound control in built environment, Security systems; Intelligent/ Smart Buildings; Aesthetics of built environment, Role of Urban Arts Commissions; Conservation, Repairs & Rehabilitation of Structures & Heritage structures; Innovations and methodologies for ensuring Sustainability.

Module 06: Civil Engineering Projects

Environmental Impact Analysis procedures; Waste (materials, manpower, equipment) avoidance/ Efficiency increase; Advanced construction techniques for better sustainability; Techniques for reduction of Green House Gas emissions in various aspects of Civil Engineering Projects; New Project Management paradigms & Systems (Ex. Lean Construction), contribution of Civil Engineering to GDP, Contribution to employment (projects, facilities management), Quality of products, Health & Safety aspects for stakeholders; Innovations and methodologies for ensuring Sustainability during Project development.

Text/Reference Books

1. Žiga Turk (2014), Global Challenges and the Role of Civil Engineering, Chapter 3 in: Fischinger M. (eds) Performance-Based Seismic Engineering: Vision for an Earthquake Resilient Society. Geotechnical, Geological and Earthquake Engineering, Vol. 32. Springer, Dordrecht.
2. Brito, Ciampi, Vasconcelos, Amarol, Barros (2013) Engineering impacting Social, Economical and Working Environment, 120th ASEE Annual Conference and Exposition
3. NAE Grand Challenges for Engineering (2006), Engineering for the Developing World, The Bridge, Vol 34, No.2, Summer 2004.
4. Allen M. (2008) Cleansing the city. Ohio University Press. Athens Ohio.
5. Ashley R., Stovin V., Moore S., Hurley L., Lewis L., Saul A. (2010). London Tideway Tunnels Programme – Thames Tunnel Project Needs Report – Potential source control andSUDS applications: Land use and retrofit options
6. http://www.thamestunnelconsultation.co.uk/consultation-documents.aspx
7. Ashley R M., Nowell R., Gersonius B., Walker L. (2011). Surface Water Management andUrban Green Infrastructure. Review of Current Knowledge. Foundation for Water Research FR/R0014
8. Barry M. (2003) Corporate social responsibility – unworkable paradox or sustainable paradigm? Proc ICE Engineering Sustainability 156. Sept Issue ES3 paper 13550. p 129-130
9. Blackmore J M., Plant R A J. (2008). Risk and resilience to enhance sustainability with application to urban water systems. J. Water Resources Planning and Management. ASCE. Vol. 134, No. 3, May.

10. Bogle D. (2010) UK's engineering Council guidance on sustainability. Proc ICE Engineering Sustainability 163. June Issue ES2 p61-63

11. Brown R R., Ashley R M., Farrelly M. (2011). Political and Professional Agency Entrapment: An Agenda for Urban Water Research. Water Resources Management. Vol. 23, No.4. European Water Resources Association (EWRA) ISSN 0920-4741.

12. Brugnach M., Dewulf A., Pahl-Wostl C., Taillieu T. (2008) Toward a relational concept of uncertainty: about knowing too little, knowing too differently and accepting not to know. Ecology and Society 13 (2): 30

13. Butler D., Davies J. (2011). Urban Drainage. Spon. 3rd Ed.

14. Cavill S., Sohail M. (2003) Accountability in the provision of urban services. Proc. ICE. Municipal Engineer 156. Issue ME4 paper 13445, p235-244.

15. Centre for Water Sensitive Cities (2012) Blueprint for a water sensitive city. Monash University.

16. Charles J A. (2009) Robert Rawlinson and the UK public health revolution. Proc ICE Eng History and Heritage. 162 Nov. Issue EH4. p 199-206

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Semester - IV

(Department Level Optional Course-I)

CE-1022   L-T-P-S-C
Sustainability Concepts in Civil Engineering   3-0-0-0-3

Objective: *This course will enable students to learn about the principles, indicators and general concept of sustainability, understand local, regional and global impacts of unsustainable designs, products and processes, apply the sustainability concepts in engineering, understand built environment framework and implement sustainability in building designs.*

Course Outcome: *On successful completion of the course the students will be able to; learn the sustainability concepts; understand the role and responsibility of engineers in sustainable development, understand and apply sustainability concepts in construction practices, designs, product developments and processes across various engineering disciplines, apply green engineering concepts.*

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
1	1	1	0	0	1	1	1	0	1	0	1	1	0

Course Content

Module 01: Introduction

Sustainability - Introduction, Need and concept of sustainability, Social-environmental and economic sustainability concepts. Sustainable development, Nexus between Technology and Sustainable development, Challenges for Sustainable Development. Multilateral environmental agreements and Protocols - Clean Development Mechanism (CDM), Environmental legislations in India - Water Act, Air Act.

Module 02: Global Environmental Issue

Resource degradation, Climate change, Regional and Local Environmental Issues. Carbon credits and carbon trading, carbon footprint, Carbon sequestration – Carbon capture and storage (CCS). Environmental management standards, ISO 14000 series, Life Cycle Analysis (LCA) - Scope and Goal, Bio-mimicking.

Module 03: Sustainable Design

Basic concepts of sustainable habitat, green buildings, green materials for building construction, material selection for sustainable design, green building certification- GRIHA & IGBC Certification for buildings, Energy efficient building design- Passive solar design technique, Thermal storage, Cooling strategies, high performance insulation. Sustainable cities, Sustainable transport.

Module 04: Clean Technology and Energy

Energy sources: Basic Concepts-Conventional and non-conventional, solar energy, Fuel cells, Wind energy, Small hydro plants, bio-fuels, Energy derived from oceans, Geothermal energy. Rainwater harvesting.

Module 05: Green Engineering

Green Engineering concepts, Sustainable Urbanization, industrialization and poverty reduction; Social and technological change, Industrial Processes: Material selection, Pollution Prevention, Industrial Ecology, Industrial symbiosis.

Text/Reference Books
1. Sustainability Engineering: Concepts, Design and Case Studies Allen D.T. & S Honnard D.R. Prentice Hall.
2. Engineering Applications in Sustainable Design and Development. Bradley A.S. Adebayo A.O. & Maria P. Cengage Learning.
3. Basic Concepts in Environmental Management. Mackenthun K.M. Lewis Publication.
4. ECBC Code 2007, Bureau of Energy Efficiency, New Delhi Bureau of Energy Efficiency Publications. Rating System, TERI Publications - GRIHA Rating System.
5. Systems Analysis for Sustainable Engineering: Theory and Applications. Ni bin Chang. McGraw-Hill Professional.

6.   Renewable Energy Resources. Twidell J.W. & Weir A. D. English Language Book Society (ELBS).

7.   Climate Change and Sustainable Development: Law, Policy and Practice. Malcolm Dowden.

8.   Sustainable Design: The Science of Sustainability and Green Engineering. Daniel A.V. & Brasier C. Wiley-Blackwell.

9.   Sustainable Engineering Practice: An Introduction, Committee on Sustainability, American Society of Civil Engineers.

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Semester - V

(Department Level Optional Course-II)

CE-1031   L-T-P-S-C
Supplementary Cementitious Materials   3-0-0-0-3

Objective: *This course will enable students to learn about the different types of supplementary cementitious materials, understand their impact on the fresh and hardened concrete, and apply concepts in production of concrete.*

Course Outcome: *On successful completion of the course the students will be able to; learn about supplementary cementitious materials, understand the impact on fresh and hardened concrete and apply concepts in production of concrete.*

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	1	1	1	1	1	1	0	1	0	1	1	0

Course Content

Module 01: Portland Cement

Different Grades, manufacturing process, physical and chemical properties, hydration process.

Module 02: Fly Ash

Fly ash as cementitious material, effect of fly ash on fresh and hardened concrete, concrete mixture consideration with fly ash.

Module 03: Slag Cement

Classification of blast furnace slag, slag as cementitious material, effect of slag cement on fresh and hardened concrete.

Module 04: Silica fume

Production, silica fume as cementitious material, effect of slag cement on fresh and hardened concrete.

Module 05: Pozzolans

Classification of pozzolans, pozzolans as cementitious material, effect of different types of pozzolans on fresh and hardened concrete.

Text/Reference Books

1. Admixtures for Concrete, Turan Y. Erdogan, 1997, Middle East Technical University Press.
2. Properties of Concrete. Neville A. M. Wiley & Sons.
3. Concrete Technology: Theory and Practice: Shetty M.S., S. Chand.

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Semester - V

(Department Level Optional Course-II)

CE-1032   L-T-P-S-C
Green Building & Technologies   3-0-0-0-3

Objective: *This course will enable students to learn about the green building, benefits of water and energy conservation, importance of building's indoor environment and occupant wellbeing and implement green building rating systems.*

Course Outcome: *On successful completion of the course the students will be able to understand; typical features of green building, benefits of water and energy conservation, importance of building's indoor environment and occupant wellbeing and apply green building rating systems.*

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
1	0	1	0	1	1	1	1	1	1	1	1	1	1

Course Content

Module 01: Introduction

Green Buildings: Definition of green buildings and sustainable development, typical features of green buildings, benefits of green buildings towards sustainable development. Green building rating systems – GRIHA, IGBC and LEED, overview of the criteria as per these rating systems.

Module 02: Site selection and planning

Criteria for site selection, preservation of landscape, soil erosion control, minimizing urban heat island effect, maximize comfort by proper orientation of building facades, day lighting, ventilation, etc. Water conservation and efficiency: Rainwater harvesting methods for roof & non-roof, reducing landscape water demand by proper irrigation systems, water efficient plumbing systems, water metering, wastewater treatment, recycle and reuse systems.

Module 03: Energy Efficiency

Environmental impact of building constructions, Concepts of embodied energy, operational energy and life cycle energy. Methods to reduce operational energy: Energy efficient building envelopes, efficient lighting technologies, energy efficient appliances for heating and air-conditioning systems in buildings, zero ozone depleting potential (ODP) materials, wind and solar energy harvesting, energy metering and monitoring, concept of net zero buildings.

Module 04: Building materials

Methods to reduce embodied energy in building materials: (a) Use of local building materials (b) Use of natural and renewable materials like bamboo, timber, rammed earth, stabilized mud blocks, (c) use of materials with recycled content such as blended cements, pozzolana cements, fly ash bricks, vitrified tiles, materials from agro and industrial waste. (d) reuse of waste and salvaged materials Waste Management: Handling of construction waste materials, separation of household waste, on-site and off-site organic waste management.

Module 05: Indoor Environmental Quality for Occupant Comfort and Wellbeing

Daylighting, air ventilation, exhaust systems, low VOC paints, materials & adhesives, building acoustics. Codes related to green buildings: NBC, ECBC, ASHRAE, UPC etc.

Text/Reference Books
1. IGBC Green Homes Rating System, Version 2.0., Abridged reference guide, 2013, Indian Green Building Council Publishers.
2. GRIHA version 2015, GRIHA rating system, Green Rating for Integrated Habitat Assessment.
3. Alternative building materials and technologies by K.S. Jagadish & Reddy Venkatarama B.V. & Rao N.K.S.
4. Non-Conventional Energy Resources. Rai G. D. Khanna Publishers.
5. Sustainable Building Design Manual, Vol.1 and 2, TERI, New Delhi.
6. Green Building Fundamentals. Montoya M. Pearson. USA.
7. Sustainable Construction – Green Building Design and Delivery. Kibert C.J. John Wiley & Sons. New York.

8. Sustainable Construction and Design. Leffers R. Prentice Hall, USA.

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Semester - VI

(Department Level Optional Course - III)

CE-3033   L-T-S-P-C
Pavement Design   3-0-0-0-3
Pre-requisite   Transportation Engineering

Objective: *The course is designed to develop skills in the students so that they can design the road pavements of rigid and flexible type.*

Course Outcome: *Students must be able to explain types of pavements, functions of components of pavement and factors affecting design of pavement. Student will be able to identify different components of pavement and their functions and design flexible pavement.*

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
1	1	1	1	1	1	0	1	0	0	1	1	1	0

Course Content

Module 01: Introduction

Types of pavements – Factors affecting design of pavements – wheel loads –ESWL Concept- tyre pressure – contact pressure, Material characteristics – Environmental and other factors. Stresses in flexible pavement – Stresses in rigid pavements

Module 02: Pavement design

Pavement design: CBR Method of Flexible Pavement Design- IRC method of flexible pavement design. - AASHO Method of Flexible Pavement design. IRC method of Rigid pavement design – Importance of Joints in Rigid Pavements- Types of Joints – Use of Tie Bars and Dowell Bars.

Module 03: Highway Materials

Highway Materials – Soil, Aggregate and Bitumen- Tests on aggregates – Aggregate Properties and their Importance- Tests on Bitumen – Bituminous Concrete- Requirements of Design Mix- Marshall's Method of Bituminous Mix design.

Module 04: Highway maintenance

Need for Highway Maintenance- Pavement Failures- Failures in Flexible Pavements- Types and Causes-Rigid Pavement Failures- Types and causes- Pavement Evaluation- Benkleman Beam method- Strengthening of Existing Pavements- Overlays.

Text/Reference Books

1. Highway Engineering: Khanna, S.K., Justo, C. E. G. and Veeraraghavan A; NemChand and Bros., Roorkee (Revised 10th Edition)
2. Principles and Practice of Highway Engineering: Kadiyali, L. R.; Khanna Publishers, Delhi.
3. Text Book of Highway Engineering: Sriniwasakumar, R.; University Press, Hyderabad (First Published in 2011; Reprinted in 2013)
4. Principles of Transportation and Highway Engineering, Rao, G.V.; Tata McGraw Hill Publishing House Pvt. Ltd., New Delhi.
5. Principles, Practice and Design of Highway Engineering (Including Airport Engineering): Sharma, S.K.; S. Chand and Company Pvt. Ltd., New Delhi.
6. Principles of Transportation Engineering: Chakraborty, Partha and Das, Animesh; Prentice Hall India Learning Pvt. Ltd., New Delhi (Eighth Printing: January 2013).
7. MORTH - Specifications for Road & Bridge Works. Ministry of Road Transport and Highways, Government of India.

Digital Material

1. https://www.civil.iitb.ac.in/tvm/nptel/401_lnTse/web/web.html.
2. https://nptel.ac.in/courses/105/104/105104098/

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Semester - IV

(Department Level Optional Course- III)

CE-3034   L-T-P-S-C
Bridge Engineering   3-0-0-0-3

Objective: *Selection of suitable type of bridge according to the site condition. IRC loadings, load distribution and railway loading. Design of bridge superstructure and substructures. Different types of bridge foundations. Erection of bridge super structure.*

Course Outcome: *Select the suitable type of bridge according to the site condition. Understand IRC loads, distribution of these loads among longitudinal beams of a bridge. Design of balanced cantilever concrete bridge, prestressed concrete bridge, lattice girder Railway Bridge, RC Arch bridges and box bridges. Design different types of foundations, piers and abutments, their methods of construction. Understand various types of bearings and their suitability, erection of bridge superstructure.*

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
1	1	1	0	0	1	1	1	0	1	0	1	1	0

Course Content

Module 01: Introduction

Types of Bridges, Selection of suitable type of bridge, aesthetics, economic span.

Module 02: Design Loads and their Distribution

IRC loads, analysis of deck slab and IRC loads, Load distribution among longitudinal beams of a bridge, railway loading.

Module 03: Design of Superstructure

Design of balanced cantilever concrete bridge, design of prestressed concrete bridge, design of lattice girder railway bridge, introduction to design of RC Arch bridges and box bridges.

Module 04: Design of Substructure

Different types of foundations, their choice and methods of construction, design of well foundation, design of piers and abutments, various types of bearings and their suitability.

Module 05: Construction Methods

Erection of bridge superstructure, cantilever construction.

Text/Reference Books

1. Design of Bridge Superstructures: T.R. Jagdeesh andM.A. Jayaram, Prentice Hall India Private Ltd., New Delhi.
2. Essentials of Bridge Engineering: Victor D.J, Oxford and IDH.
3. Concrete Bridge Practice: Raina V. K., Tata Mc Graw Hill.
4. Bridge Engineering: Ponnuswamy S., Tata Mc Graw Hill.

Design of Bridges: Raju N. K., Oxford and IDH.

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Semester - IV

(Departmental Core Subject)

CE-3035   L-T-P-S-C
Repair and Rehabilitation of Structures   3-0-0-0-3
Prerequisite   Reinforced Concrete Structures

Objective: *The course seeks to recognize the mechanisms of degradation of concrete structures, provide the students with the knowledge of available techniques and their application for strengthening or upgrading existing structural systems. It also provides how to conduct field monitoring and non-destructive evaluation of concrete structures.*

Course Outcomes: *After the completion of the course, the student should be able to: understand the properties of fresh and hardened concrete; Know the strategies of maintenance and repair; understand the retrofitting strategies and techniques.*

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
1	1	1	0	0	1	1	1	0	1	0	1	1	0

Course Content

Module 01: Introduction

Deterioration of structures with aging; Need for rehabilitation. Effects due to climate, temperature, chemicals , wear and erosion , design and construction errors , corrosion mechanism , Effects of cover thickness and cracking, Method of corrosion production., corrosion inhibitors , corrosion resistant steels , coatings , cathodic production Distress

in concrete /steel structures Types of damages; Sources or causes for damages; effects of damages; Case studies.

Module 02: Structural Health Monitoring

An overview of Structural Health Monitoring, Structural Health Monitoring and Smart Materials, Structural Health Monitoring versus Non-Destructive Testing, A broad overview of smart materials, Overview of Application potential of SHM.

Module 03: Maintenance and Repair Strategies

Special concrete and mortar, Concrete chemicals , special elements for accelerator, strength gain, expansive cement , polymer concrete , sulphur infiltrated concrete , ferro cement, fibre reinforced concrete. Shotcreting; Grouting; Epoxy-cement mortar injection; Crack ceiling.

Text/Reference Books

1. Diagnosis and treatment of structures in distress Raikar R.N. R&D Centre of Structural Designers & Consultants Pvt.Ltd. Mumbai, 1994.
2. Earthquake resistant design of structures Agarwal P. Shrikhande M. Prentice-Hall of India, 2006.
3. Handbook on Repair and Rehabilitation of RCC buildings, Published by CPWD, Delhi, 2002.

Digital Material

Repair & Rehabilitation of Structures Lecture Compilation.
https://www.youtube.com/watch?v=i11zIIOeqfU

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Semester - IV

(Department Level Optional Course- IV)

CE-3041   L-T-P-S-C
Pre-stressed Concrete & Industrial Structures   3-0-0-0-3
Prerequisite   Reinforced Concrete Structures

Objective: *The course is designed to bring the students to such a level so as to enable them to take the appropriate decision in respect of choice of prestressed section over R. C. C. as a civil engineer. Moreover, it also aims to make the student to be aware of such a highly mechanized technology in civil engineering construction.*

Course Outcome: *On successful completion of the course, the students shall be able: to understand the concept of pre-stressing, behavior of the pre-stressed structures vis- à-vis that of the RCC structure, to take the decision with respect to the choice of pre-stressed section over RCC, to understand the application of these techniques in civil engineering construction, especially in mass housing, railway sleepers, transmission of poles, bridges, etc., to analyze the various pre-stressed components of the structures and design the same.*

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	1	0	0	1	1	1	0	1	0	1	1	0

Course Content

Module 01: Introduction to Prestressed Concrete

Basic concept and general principles, materials used and their properties, methods, techniques and systems of prestressing.

Module 02: Analysis of Prestressed concrete sections

Loading stages and computation of section properties, critical section under working load for pre tensioned and post tensioned members, stress method, load balancing method and internal resisting couple method, kern points, choice and efficiency of sections, cable profiles.

Module 03: Loss of Prestress

Loss of stresses doe to elastic deformation of concrete, creep in concrete, creep in steel, shrinkage in concrete, relaxation in steel, anchorage slip and friction.

Module 04: Deflections of Prestressed Concrete Members

Short time and long time deflection, deflection of uncracked sections, Uni-linear and bi-linear methods for cracked sections.

Module 05: Design of Prestressed Concrete Sections for Flexure in Working Stress and Limit State Method

General philosophy of design, permissible stresses in concrete and steel, suitability of section, safe cable zone, design of simply supported pretension and post tension slabs and beams using limit state method

Module 06: Design for shear

Calculation of principle tension under working load, permissible principle tension, shear strength calculation under limit state of collapse for both sections cracked and uncracked in flexure.

Module 07: End zone stresses in prestressed concrete members

Pretension transfer bond, transmission length, end block of post- tensioned members.

Module 08: Application of prestressing to continuous members

Introduction to application of prestressing to continuous beams and slabs, linear transformation and concordancy of cables.

Text/Reference Books

1. Prestressed Concrete: N. Krishna Raju, McGraw Hill, New York.
2. Prestressed Concrete: N. Rajgopalan, Narosa Publishing House.
3. Fundamentals of Prestressed Concrete: Sinha, N.C.and S.K. Roy, S.C. Chand and Company.
4. Prestressed Concrete Structures: Dayaratnam, P., Oxford andIBH
5. Design of Prestressed Concrete Structures: T.Y.Lin andN.H. Burns, John Willey, New York.
6. Design of Prestressed Concrete: Nilson Arthur, McGraw Hill Book Company.
7. Prestressed Concrete Vol—I: IY.Guyon, Contractors Record, London.
8. Prestressed Concrete: S. Ramamurtham, Dhanpat RaiandSon's
9. Relevant latest IS codes.

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Semester - VII

(Department Level Optional Course-IV)

CE-2042   L-T-P-S-C
Urban Transportation Planning   3-0-0-0-3

Objective: *The aim of this course is to Impart the knowledge of urban transportation system, know about the process & concepts of transportation planning & to study about trip generation & trip distribution by various methods and to make it economical justification of projects.*

Course Outcome: *On the completion of this course students will be able to describe the information for planning and operation of urban transport, understanding the issues and challenges in the Transportation Sector and summarize the process of trip generation; learn and understand demand distribution models (gravity models), interpret travel demand forecasting problems, attraction regression models; understand transportation project planning and economic evaluation of transportation projects.*

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
1	1	1	1	0	0	0	1	1	1	0	1	1	0

Course Content

Module 01 Urban Transportation System Planning

Introduction, Objectives, Historical Development of Transport, Transportation in the Cities, modes of transport, ranking of modes, Transport Planning Process, Travel demand, transportation problems and identification, solution.

Module 02 Trip Generation

Introduction, Zonal Models, Category Analysis, trip attraction, trip production, Household, Institutional household, Trip Generation Analysis.

Module 03 Trip Distribution

Introduction, Presentation of Trip-Distribution Data, PA and OD matrix, PA Matrix to OD Matrix, Basis of Trip Distribution, Gravity Model of Trip Distribution, Calibration of Gravity Model. Regression analysis, case studies, Model split, route assignment.

Module 04: Road Planning and Economics

User Benefits and Vehicle operation Cost, economic evaluation, Cost & Benefits of project, project cost, economic analysis, techniques of economic Analysis, case studies, sources of revenue, travel time saving, monetary evaluation of travel time saving, road pricing.

Text/Reference Books
1. Highway Engineering. Khanna S.K. Justo C.E.G. & Veeraraghavan A. Nem Chand and Bros. Roorkee.
2. Principles and Practice of Highway Engineering. Kadiyali L.R. Khanna Publishers Delhi.
3. Principles of Transportation Engineering. Chakraborty Partha & Das A. Prentice Hall India Learning Pvt. Ltd. New Delhi. 2013.
4. An Introduction to Transportation Planning (The Living Environment). Bruton M. J. UCL Press. London. UK. 2000.
5. Transportation Planning Handbook. Edwards J. D. 2nd Ed. Institution of Transportation Engineers.1999.
6. Principles of Urban Transportation System Planning. Hutchinson. B.G. McGraw Hill. 1974.
7. Urban Transportation Planning: A Decision Oriented Approach. Mayer M. & Miller E. McGraw Hill. 2000.

Digital Material
1. https://nptel.ac.in/courses/105/107/105107067/

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Semester - VII

(Department Level Optional Course-IV)

CE-3043   L-T-P-S-C
Solid Waste Management   3-0-0-0-3

Objective: *The course is designed to understand the implications of the production, resource management and environmental impact of solid waste management, to understand the components of solid waste management infrastructure systems to minimize the above effects, to be aware of the significance of recycling, reuse and reclamation of solid wastes, to be familiar with relationships between inappropriate waste management practices and impacts on water, soil and sediment quality, to fully appreciate the current practices available and implement the systems available in solid waste management.*

Course Outcome: *On completion of this course, the students shall be able to understand the various methods of disposal of solid waste. They shall have the better understanding of the nature and characteristics of solid waste and regulatory requirements regarding solid waste management and further they shall have an ability to plan waste minimization. Besides, they shall be prepared to contribute practical solutions to environmental problems in our society.*

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	1	1	0	0	1	0	1	1	0	1	1	1	0

Course Content

Module 01 Introducing Municipal Solid Waste Management Overview

problems and issues of solid waste management - Need for solid waste management-Functional elements such as waste generation, storage, collection, transfer and transport, processing, recovery and disposal in the management of solid waste.

Module 02 Generation and Characteristics of Waste

Sources, Types, composition, quantity, sampling and characteristics of waste, factors affecting generation of solid wastes.

Module 03 Waste Collection, Storage and Transport

Collection and storage of municipal solid waste; Methods of collection - House to House collection - Type of vehicles-Manpower requirement- collection routes; on site storage methods-materials used for containers- Reduction of solid waste at source-on site segregation of solid waste- Recycling and Reuse Need for transfer and transport; transfer station- selection of location, operation and maintenance; transportation Methods- manual, Mechanical methods with or without compaction, economy in transportation of waste optimization of transportation routes.

Module 04: Waste Processing Techniques

Processing techniques-biological and chemical conversion technologies – composting and its methods, vermicomposting, mechanical composting, In vessel composting, incineration, pyrolysis, gasification.

Module 05: Disposal of Solid Waste

Segregation, reduction at source, recovery and recycle; dumping of solid waste-sanitary waste- sanitary landfills-site selection-design and operation of sanitary landfill-secure landfills-landfill bioreactors-leachate and landfill gas management-landfill closure and environmental monitoring-landfill remediation; Municipal solid waste in Indian conditions, legal aspects of solid waste disposal.

Module 06: Industrial Solid Waste

Waste products during manufacturing and packing, operation of pollution control facilities, generation, minimization at source, recycling, disposal

Module 07: Hazardous Waste

Definition, sources, hazardous characteristics, management, Treatment and disposal, mutagenesis, carcinogenesis, Toxicity testing.

Module 08: Biomedical Waste

Definition, sources, classification, collection, segregation, treatment and disposal.

Module 09: Electronic Waste

Waste characteristics, generation, collection, transport and disposal.

Text/Reference Books

1. Integrated Solid Waste Management. Techobanglous. Thisen. & Vigil. McGraw Hill International.
2. Hazardous Waste Management. Lagrega. Buckingham. & Evans. McGraw Hill International.
3. Solid Waste Management in Developing Countries. Bhide A. D. Nagpur publications.
4. Environmental Pollution Control Engineering. Rao. C. S. Wiley Eastern. Manual of solid waste of management. CPHEEO.
5. E-Waste Implications Regulations and Management in India and Current Global Best Practices. Rakesh Johri. The Energy and Resources Institute.
6. Biomedical Waste Management in India. Kishore J. & Ingle G. K. Century Publications.

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Semester - VII

(Department Level Optional Course-V)

CE-3044   L-T-P-S-C
Contracts Management   3-0-0-0-3

Objective: *The course is designed to learn the different types of contracts, common contract clauses, various acts governing contracts, contract management, and dispute resolution.*

Course Outcome: *On completion of this course, the students shall be able to understand the various types of contracts and acts governing contracts. The students will also be able to evaluate the contract documents.*

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
0	0	1	0	0	1	0	1	1	1	1	1	0	1

Course Content
Module 01 Introduction

Importance of Contracts, Overview of Contract Management, Overview of Activities in Contract Management; Planning and People- Resource Management.

Module 02 Types of Contracts

Parties to a Contract; Contract Formation, Formulation of Contract, Contract Start-Up, Managing Relationships; Common contract clauses (Notice to proceed, rights and duties of various parties, notices to be given, Contract Duration and Price.)

Module 03 Performance parameters

Delays, penalties and liquidated damages; Force Majeure, Suspension and Termination. Changes & variations, Notices under contracts; Conventional and Alternative Dispute Resolution methods. Various Acts governing Contracts; Contract Administration and Payments- Contract Administration, Payments.

Module 04: Contract Management

Contract Management in NCB Works, Contract Management in ICB Works Contracts, Contract of Supply of Goods- Design, Supply and Installation Contracts, Contract Management in Consultancy,; Managing Risks and Change- Managing Risks, Managing Change; Contract Closure and Review- Ending a Contract, Post-Implementation Review.

Module 05: Legal Aspects in Contract Management

Contract Management Legal View, Dispute Resolution, Integrity in Contract Management; Managing Performance- Introduction, Monitoring and Measurement.

Text/Reference Books
1. Building and Engineering Contracts. Patil B.S. University Press Hyderabad.
2. Construction Contracts Law and Management. Hughes W. Champion R. Murdoch J. Routledge.
3. Introduction to Construction Contracts Management. Greenhalgh B. Routledge.

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Semester - VII

(Department Level Optional Course-V)

CE-2045   L-T-P-S-C
Ground Improvement Techniques   3-0-0-0-3

Objective: *The course is designed to learn the different ground improvement techniques.*

Course Outcome: *On completion of this course, the students shall be able to understand and analyze different ground improvement techniques.*

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
1	1	1	1	0	0	1	0	0	1	0	1	1	0

Course Content

Module 01 Introduction

Soil compaction: laboratory methods, field methods, ground modification by vibro-replacement, preloading and prefabricated drains.

Module 02 Soil Stabilization

Using additives, sand drains, stone columns, lime columns.

Module 03 Grouting

Types of grouts, methods of grouting.

Module 04: Soil Reinforcement

Using strips, geogrids, geotextiles, geomembranes, geonets, geotubes.

Module 05: Dewatering

Dewatering methods, Soil nailing; Underpinning; Tunnelling.

Text/Reference Books
1. Soil Mechanics. Lambe T.W. & Whitman R.V. John Wiley & Sons.
2. Engineering Principles of Ground Modification. Hausmann M. R. McGraw Hill.
3. Principles and Practice of Ground Improvement. Han J. Wiley.
4. Ground Improvement Techniques. Raj P.P. Laxmi Publications.

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Semester - VII

(Department Level Optional Course-V)

CE-3046   L-T-P-S-C
Design of Foundations & Retaining Structures   3-0-0-0-3
Prerequisite   Reinforced Concrete Structures

Objective: *To equip the students to understand the analysis & design of various foundation systems required for various infrastructure projects.*

Course Outcomes: *On completion of the course students will be able to: identify a suitable foundation system for a structure; evaluate the importance of raft foundation and principles of design for buildings and tower structures; analyze and design pile foundations.*

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
1	1	1	1	0	0	1	0	0	1	0	1	1	0

Course Content

Module 01: Bearing Capacity

Bearing capacity on slopes, settlement analysis of foundation on sand & clay. Advanced bearing capacity theories.

Module 02: Shallow Foundation

Design of isolated footing & steel grillage, combined footing of rectangular, trapezoidal cantilever types, Mat or raft foundation of dry & saturated soil floating foundations.

Module 03: Deep Foundation

Settlement of piles; vertical & lateral loads in pile foundation, negative skin friction & uplift capacity of pile, design of pile caps, design of well foundation & caissons of different types, design of bridge pairs resting on piles & machine foundation.

Module 04: Retaining structures

Design of retaining walls- Gravity, cantilever & counterfort type. Design of sheet piles & cofferdams, braced excavations.

Text/Reference Books

1. Design of Foundation Systems: Principles & Practices. Kurien N.P. Narosa. New Delhi. 1992.
2. Foundation Analysis & Design. Bowles J.E. Mc-Graw Hill Book & Company.
3. Principles of Foundation Engineering. Das B.M. Thomson Brooks/Cole.

Digital Material

1. Advanced Topics on Advanced Foundation Design. https://nptel.ac.in/courses/105/108/105108069/

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Semester - VI

(University Level Optional Course -II)

CE-3047   L-T-P-S-C

Disaster Management and Mitigation Measures   3-0-0-0-3

Objective: *This course is designed to understand physics and various types of disaster occurring around the world, to identify extent and damaging capacity of a disaster, to study and understand the means of losses and methods to overcome /minimize it.*

Course Outcome: *Students will be able to: get to know natural as well as manmade disaster and their extent and possible effects on the economy, plan of national importance structures based upon the previous history, get to know the simple do's and don'ts in such extreme events and act accordingly.*

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
1	0	0	1	0	1	1	1	1	0	1	1	1	0

Course Content

Module 01: Introduction

Definition of Disaster, hazard, global and Indian scenario, general perspective, importance of study in human life, Direct and indirect effects of disasters, long term effects of disasters. Introduction to global warming and climate change.

Module 02: Natural Disaster and Manmade disasters

Natural Disaster: Meaning and nature of natural disaster, Flood, Flash flood, drought, cloud burst, Earthquake, Landslides, Avalanches, Volcanic eruptions, Mudflow, Cyclone, Storm, Storm Surge, climate change, global warming, sea level rise, ozone depletion.

Manmade Disasters: Chemical, Industrial, Nuclear and Fire Hazards. Role of growing

population and subsequent industrialization, urbanization and changing lifestyle of human beings in frequent occurrences of manmade disasters.

Module 03: Disaster Management, Policy and Administration

Disaster management: meaning, concept, importance, objective of disaster management policy, disaster risks in India, Paradigm shift in disaster management. Policy and administration: Importance and principles of disaster management policies, command and co-ordination of in disaster management, rescue operations-how to start with and how to proceed in due course of time, study of flowchart showing the entire process.

Module 04: Institutional Framework for Disaster Management in India

Importance of public awareness, Preparation and execution of emergency management programme. Scope and responsibilities of National Institute of Disaster Management (NIDM) and National disaster management authority (NDMA) in India. Methods and measures to avoid disasters, Management of casualties, set up of emergency facilities, importance of effective communication amongst different agencies in such situations. Use of Internet and softwares for effective disaster management. Applications of GIS, Remote sensing and GPS in this regard.

Module 05: Financing Relief Measures

Ways to raise finance for relief expenditure, role of government agencies and NGO's in this process, Legal aspects related to finance raising as well as overall management of disasters. Various NGO's and the works they have carried out in the past on the

occurrence of various disasters, Ways to approach these teams. International relief aid agencies and their role in extreme events.

Module 06: Preventive and Mitigation Measures

Pre-disaster, during disaster and post-disaster measures in some events in general Structural mapping: Risk mapping, assessment and analysis, sea walls and embankments, Bio shield, shelters, early warning and communication Non Structural Mitigation: Community based disaster preparedness, risk transfer and risk financing, capacity development and training, awareness and education, contingency plans. Do's and don'ts in case of disasters and effective implementation of relief aids.

Text/Reference Books

1. Disaster Management. Gupta H.K. Universities Press Publications.
2. Disaster Management. An Appraisal of Institutional Mechanisms in India. Dagur O.S. Centre for land warfare studies New Delhi. 2011.
3. Introduction to International Disaster Management. Copolla D. & Heinemann B. Elsevier Publications.
4. Disaster Management Handbook. Pinkowski J. CRC Press Taylor and Francis group.
5. Disaster management & rehabilitation. Dasgupta R. Mittal Publications New Delhi.
6. Natural Hazards and Disaster Management, Vulnerability and Mitigation. Singh R B. Rawat Publications.
7. Concepts and Techniques of GIS. Lo C.P. Albert. K.W. & Yonng. Prentice Hall (India) Publications.

Digital Material

1. Natural Hazard Prof. Javed Malik IIT Kanpur, NPTEL (https://nptel.ac.in/courses/105104183/)

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Semester - VI

(University Level Optional Course – II)

CS-3003   L-T-P-S-C
Management Information System   3-0-0-0-3

Pre-requisite   Nil

Objective: *The objectives of this course are to discuss the roles played by information technology in today's business and define various technology architectures on which information systems are built, define and analyze typical functional information systems and identify how they meet the needs of the firm to deliver efficiency and competitive advantage, identify the basic steps in systems development.*

Course Outcome*: At the end of the course student will be able to explain how information systems Transform Business, identify the impact information systems have on an organization, describe IT infrastructure and its components and its current trends, understand the principal tools and technologies for accessing information from databases to improve business performance and decision making, identify the types of systems used for enterprise-wide knowledge management and how they provide value for businesses.*

Course Content

Module 01: Introduction

Introduction to Information Systems (IS): Computer Based Information Systems, Impact of IT on organizations, Importance of IS to Society. Organizational Strategy, Competitive Advantages and IS

Module 02: KMS and BI

Data and Knowledge Management: Database Approach, Big Data, Data warehouse and Data Marts, Knowledge Management; Business intelligence (BI): Managers and Decision Making, BI for Data analysis and Presenting Results

Module 03: Ethical issues and privacy

Ethical issues and Privacy: Information Security. Threat to IS, and Security Controls

Module 04: Social Computing

Social Computing (SC): Web 2.0 and 3.0, SC in business-shopping, Marketing, Operational and Analytic CRM, commerce. E-business and E-commerce – B2B B2C.

Module 05: Mobile Computing

Mobile Computer Networks, Wired and Wireless Technology, Pervasive computing, Cloud computing model.

Module 06: Information Systems

Information System within Organization: Transaction Processing Systems, Functional Area Information System, ERP and ERP support of Business Process. Acquiring Information Systems and Applications: Various System development life cycle models.

Text/Reference Books
1. Management Information Systems. Rainer K. & Prince B. Wiley.
2. Management Information Systems: Managing the Digital Firm. Laudon K. C. & Laudon J. P. 10th Ed. Prentice Hall, 2007.
3. Managing Information Systems: Strategy and Organization. Boddy D. & Boonstra A. Prentice Hall, 2008.

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Semester - VI

(University Level Optional Course – II)

CS-3004   L-T-P-S-C
Cyber Security & Laws   3-0-0-0-3

Pre-requisite   Nil

Objective: *The objectives of this course are to understand and identify different types cybercrime and cyber law, recognized Indian IT Act 2008 and its latest amendments, learn various types of security standards compliances.*

Course Outcome*: At the end of the course student will be able to understand the concept of cybercrime and its effect on outside world, interpret and apply IT law in various legal issues, distinguish different aspects of cyber law, apply Information Security Standards compliance during software design and development.*

Course Content

Module 01: Introduction to Cybercrime

Cybercrime definition and origins of the world, Cybercrime and information security, Classifications of cybercrime, Cybercrime and the Indian ITA 2000, A global Perspective on cybercrimes.

Module 02: Cyber offenses & Cybercrime

How criminal plan the attacks, Social Engg, Cyber stalking, Cyber café and Cybercrimes, Botnets, Attack vector, Cloud computing, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures

for Handling Mobile, Devices-Related Security Issues, Organizational Security Policies and Measures in Mobile Computing Era, Laptops

Module 03: Tools and Methods Used in Cyberline

Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Over Flow, Attacks on Wireless Networks, Phishing, Identity Theft (ID Theft)

Module 04: The Concept of Cyberspace

E-Commerce, The Contract Aspects in Cyber Law, The Security Aspect of Cyber Law, The Intellectual Property Aspect in Cyber Law, The Evidence Aspect in Cyber Law, The Criminal Aspect in Cyber Law, Global Trends in Cyber Law, Legal Framework for Electronic Data Interchange Law Relating to Electronic Banking, The Need for an Indian Cyber Law

Module 05: Indian IT Act

Cyber Crime and Criminal Justice: Penalties, Adjudication and Appeals Under the IT Act,2000, IT Act. 2008 and its Amendments

Module 06: Information Security Standard compliances

SOX, GLBA, HIPAA, ISO, FISMA, NERC, PCI.

Text/Reference Books
1. Cyber Security. Godbole N. & Belapure S. Wiley India.
2. The Indian Cyber Law. Vishwanathan S. T. Bharat Law House, New Delhi.
3. The Information technology Act, 2000. Professional Book Publishers.
4. Cyber Law & Cyber Crimes. Mali P. Snow White Publications.
5. Information Systems Security. Godbole N. Wiley India.
6. Cyber Security & Global Information Assurance. Knapp K. J. Information Science Publishing.
7. Cryptography and Network Security. Stallings W. Pearson Publication.
8. Websites for more information is available on: The Information Technology ACT, 2008 - TIFR: https://www.tifrh.res.in
9. Website for more information, A Compliance Primer for IT professional :
10. https://www.sans.org/reading-room/whitepapers/compliance/compliance-primer-professionals-33538

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Semester - VI

(University Level Optional Course – II)

EE-2294   L-T-P-S-C

Energy Audit & Management   3-0-0-0-3

Objective: *To understand the importance energy security for sustainable development and the fundamentals of energy conservation, to introduce performance evaluation criteria of various electrical and thermal installations to facilitate the energy management.*

Course Outcome*: At the end of the course student will be able to identify and describe present state of energy security and its importance, the basic principles and methodologies adopted in energy audit of a utility. Also, describe the energy performance evaluation of some common electrical installations and identify the energy saving opportunities.*

Course Content

Module 01: Energy Scenario

Present Energy Scenario, Energy Pricing, Energy Sector Reforms, Energy Security, Energy Conservation and its Importance, Energy Conservation Act-2001 and its Features. Basics of Energy and its various forms, Material and Energy balance.

Module 02: Energy Audit Principles

Definition, Energy audit- need, Types of energy audit, Energy management (audit) approach-understanding energy costs, Bench marking, Energy performance, Matching energy use to requirement, maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution. Elements of monitoring& targeting; Energy audit Instruments; Data and information-analysis. Financial analysis techniques: Simple payback period, NPV, Return on investment (ROI), Internal rate of return (IRR).

Module 03: Energy Management and Energy Conservation in Electrical System

Electricity billing, Electrical load management and maximum demand Control; Power factor improvement, Energy efficient equipment and appliances, star ratings.

Module 04: Energy Management and Energy Conservation in Thermal Systems

Review of different thermal loads; Energy conservation opportunities in: Steam distribution system, Assessment of steam distribution losses, Steam leakages, Steam trapping, Condensate, and flash steam recovery system. General fuel economy measures in Boilers and furnaces, Waste heat recovery, use of insulation- types and application. HVAC system: Coefficient of performance, Capacity, factors affecting Refrigeration and Air Conditioning system performance and savings opportunities.

Module 05: Energy Performance Assessment

On site Performance evaluation techniques, Case studies based on: Motors and variable speed drive, pumps, HVAC system calculations; Lighting System: Installed Load Efficacy Ratio (ILER) method, Financial Analysis.

Module 06: Energy conservation in Buildings

Energy Conservation Building Codes (ECBC): Green Building, LEED rating, Application of Non-Conventional and Renewable Energy Sources.

Text/Reference Books

1. Handbook of Electrical Installation Practice, Geofry Stokes, Blackwell Science
2. Designing with light: Lighting Handbook, By Anil Valia, Lighting System

3. Energy Management Handbook, By W.C. Turner, John Wiley and Sons
4. Handbook on Energy Audits and Management, edited by A. K. Tyagi, Tata Energy Research Institute.
5. Energy Management Principles, C.B.Smith, Pergamon Press
6. Energy Conservation Guidebook, Dale R. Patrick, S. Fardo, Ray E. Richardson, Fairmont Press
7. Handbook of Energy Audits, Albert Thumann, W. J. Younger, T. Niehus, CRC Press

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Semester - VI

(University Level Optional Course – II)

EE-2295   L-T-P-S-C

Distributed Generation & Microgrid   3-0-0-0-3

Objective: *To impart knowledge about distributed generation technologies, their interconnection in grid, to understand relevance of power electronics in DG, to understand concept of microgrid.*

Course Outcome*:   At the end of the course student will be able to understand the conventional power generation, analyze the concept of distributed generation and installation and design the grid integration system with conventional and non-conventional energy sources. Also, demonstrate the power quality issues and control operation of micro grid.*

Course Content

Module 01: Introduction

Conventional power generation: advantages and disadvantages, Energy crises, Non - conventional energy (NCE) resources: review of Solar PV, Wind Energy systems, Fuel Cells, micro-turbines, biomass, and tidal sources.

Module 02: Distributed Generations

Concept of distributed generations, topologies, selection of sources, regulatory standards/ framework, Standards for interconnecting Distributed resources to electric power systems: IEEE 1547. DG installation classes, security issues in DG implementations. Energy storage elements: Batteries, ultra-capacitors, flywheels. Captive power plants.

Module 03: Basics of Microgrid

Concept and definition of microgrid, microgrid drivers and benefits, review of sources of microgrids, typical structure and configuration of a microgrid, AC and DC microgrids, Power Electronics interfaces in DC and AC microgrids.

Module 04: Control and Operation of Microgrid

Modes of operation and control of microgrid: grid connected and islanded mode, Active and reactive power control, protection issues, anti-islanding schemes: passive, active and communication-based techniques, microgrid communication infrastructure, Power quality issues in microgrids, regulatory standards, Microgrid economics, Introduction to smart microgrids.

Module 05: Impact of Grid Integration

Requirements for grid interconnection, limits on operational parameters, voltage, frequency, THD, response to grid abnormal operating conditions, islanding issues. Impact of grid integration with NCE sources on existing power system: reliability, stability, and power quality issues.

Text/Reference Books

1. Amirnaser Yezdani, and Reza Iravani, "Voltage Source Converters in Power Systems: Modeling, Control and Applications", IEEE John Wiley Publications, 2009.
2. DorinNeacsu, "Power Switching Converters: Medium and High Power", CRC Press, Taylor & Francis, 2006.
3. Chetan Singh Solanki, "Solar Photo Voltaics", , PHI learning Pvt. Ltd., New Delhi, 2009
4. J.F. Manwell, J.G "Wind Energy Explained, Theory Design and Applications,". McGowan Wiley publication, 2nd Edition, 2009.
5. D. D. Hall and R. P. Grover, "Biomass Regenerable Energy", , John Wiley, New York, 1987.
6. John Twidell and Tony Weir, "Renewable Energy Resources", Taylor and Francis Publications, Second Edition, 2006.

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Semester - VI

(University Level Optional Course - II)

EC-2291   L-T-P-S-C

Building IoT Applications   2-0-1-0-3

Objective: *The aim of this course will enable students to assess the genesis and impact of IoT applications, architecture in real world, Illustrate deployment options, compare different IoT application protocols, Understand the sensor interface and role of IoT in industry.*

Course Outcome: *Students will be able to Interpret the impact and challenges posed by IoT networks leading to new architectural models. Compare and contrast the deployment of smart objects and the technologies to connect them to network. Appraise the role of IoT protocols for efficient network communication. Illustrate different sensor technologies for sensing real world entities and identify the applications of IoT in Industry.*

Course Content

Module 01: Introduction to Internet of Things (IoT)

What is IoT, Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT

Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack.

Module 02: Smart Objects

The "Things" in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies.

Module 03: IoT Network

IP as the IoT Network Layer, The Business Case for IP, The need for Optimization, Optimizing IP for IoT, Profiles and Compliances, Application Protocols for IoT, The Transport Layer, IoT Application Transport Methods.

Module 04: IoT Devices

IoT Physical Devices and Endpoints - RaspberryPi: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi with Python, Wireless Temperature Monitoring System Using Pi, DS18B20 Temperature Sensor, Connecting Raspberry Pi via SSH, Accessing Temperature from DS18B20 sensors, Remote access to RaspberryPi.

List of Experiments

S. No.	Title of the Experiment	Module
11.	Getting started with Raspberry Pi, Install Raspian on your SD card.	1
12.	Linux basic commands.	1
13.	Coding simple programs in Python.	1
14.	How to use Python-based IDE (integrated development environments) for the Raspberry Pi and how to trace and debug Python code on the device	2
15.	How to have your Raspberry Pi interact with online services through the use of public APIs and SDKs	2
16.	Understanding the connectivity of Raspberry-Pi with IR sensor. Write an application to detect obstacle and notify user using LEDs.	2
17.	Design APP Using MIT App Inventor and Connect to Temperature Sensor	3

Text/Reference Books

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, 1stEdition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978-9386873743).
2. Srinivasa K G, Internet of Things, CENGAGE Leaning India, 2017.

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Semester - VI

(University Level Optional Course – II)

ME-3233   L-T-P-S-C
Solar Energy and Application   3-0-0-0-3

Prerequisite   Nil

Objective: *This course is designed to understand the importance of solar energy and its direct and indirect utilization for the thermal and electrical energy needs.*

Course Outcome: *Students will be able to*

1. Explain the solar geometry and importance of solar energy.

2. Calculate and analyse flat plate and concentrating collector.

3. Discuss the concept of solar thermal and photovoltaic power generation.

4. Illustrate the Indirect methods of solar energy utilization.

PO1	PO2	PO3	PO6	PO7	PO12	PSO2
1	1	**1**	1	1	1	1

Course Content

Module 1: Solar Radiation and Solar geometry

The energy crisis-causes and options, renewable and non-renewable forms of energy and their characteristics, solar energy option availability and land area requirements. Solar radiation outside the earth atmosphere and at the earth's surface, instruments for measuring solar radiation, solar radiation geometry, basic earth-sun angles, flux on tilted surfaces.

Module 2: Flat plate and Concentrating Collectors

Liquid flat-plate collectors design and performance parameters, solar air heaters, concentrating collectors, solar ponds and energy storage, solar cooling, drying and desalination, solar air and water heating.

Module 3: Solar thermal power generation

Solar thermal power generation: low, medium and high temperature cycles, Concentration and temperatures, parabolic geometries, paraboloid geometries(dish), heliostats, central receiver.

Module 4: Solar photovoltaic power generation

Solar photovoltaic power generation: mono crystalline, poly crystalline and amorphous cells, Fabrication and performance of SPV modules.

Module 5: Indirect methods of solar energy utilization

Biomass, wind, wave and ocean thermal energy conversion technologies. Economic considerations.

Text/Reference Books

1. Sukhatme, "Solar Energy: principles of thermal collection and storage", 3rd Ed.Tata McGraw-Hill, 2008.
2. Garg & Prakash, "Solar Energy fundamentals and applications" 1st Ed. (Revised), TataMcGraw-Hill, 2013.
3. G.N. Tiwari , "Solar Energy: Fundamentals, Design, Modeling and Applications". 1st Ed. (revised), Narosa Publications, 2013.
4. G.D. Rai, "Non-conventional energy sources" Khanna Publishers.
5. Boyle, "Renewable Energy:Power for a Sustainable Future", 3rd Edition, Oxford University Press.
6. C. S. Solanki, "Solar Photovoltaics: Fundamentals, Technologies and Applications", 2ndEdition, PHI Learning.

Digital Material
https://www.youtube.com/watch?v=E4S02rc9AvM
https://www.youtube.com/watch?v=Fuyq6WrM1EA

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Semester - VI

(University Level Optional Course – II)

MA-3004   L-T-P-C
Modern Algebra   3–0–0–3

Pre-requisite   Nil

Course Objectives: *To Build a Strong Foundation in Mathematics and Develop Abstract Thinking Skills. To apply the properties of group in engineering problems when situations satisfy the group axioms.*

Course Outcomes:

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

CO1: *To understand and apply the properties of group in engineering problems when situations satisfy the group axioms.*

CO2: *To understand the properties of Ring and integral domain to build strong foundation and better understanding of linear algebra.*

CO3: *To understand the properties of vector Space and linear transformation and apply in computer science including graphics, image processing, cryptography, machine learning, computer vision, optimization, graph algorithms*

CO4: *To understand the numerical linear algebra to solve linear system of equations and apply in computer science including quantum computation, computational biology, information retrieval and web search.*

PO1	PO2	PO12
1	1	1

Course Content:

Module 01: Group Theory

Group, Abelian Group, Finite & Infinite Group, Order of a Group, Quasi Group/Groupoid, Loop, Semi Group, Monoid, Some Properties of Groups, Order of an Element of a Group.

Cyclic Groups: Generator of a Group, Cyclic Group

Permutation Groups: Transformation, Permutation, Cyclic Permutation, Symmetric Group of permutations, Disjoint Cycles, Inverse of a product of Cyclic Permutations, Powers of a Cyclic Permutation, Transposition, Even and Odd Permutations.

Complex of a Group, Induced Composition, Subgroup, Proper Subgroup, Improper Subgroup, Union and Intersection of Subgroups, Criterion for a Complex to be a Subgroup,

Coset, Index of a subgroup in a Group, Lagrange's theorem, Theorems (without proof)

Normal Subgroup, Proper and Improper Normal Subgroups, Simple Group, Normalizer and Centralizer, Centre of Group, Factor/Quotient Groups,

Isomorphism of a Group: Definitions of Homomorphism, Monomorphism, Epimorphism, Endomorphism Isomorphism, Automorphism, Kernel of a Homomorphism, Cayley Theorem (without proof)

Module 02: Ring, Field & Integral Domain

Rings: Ring, Ring with Unity, Commutative Ring, Ring with Zero Divisors, Ring without zero divisors, Integral Domain, Field, Division Ring / Skew Field, Characteristic of a Ring, Integral Domain and Field

Subrings, Subdomain, Subfield: (Definitions only) Induced Composition, Subring, Subdomain, Subfield, Prime Field,

Ideals: (Definitions only) Right and Left Ideal, Proper and Improper Ideals, Unit and Zero Ideals, Simple Ring, Principal Ideal, Principal Ideal Ring, Principal Ideal Domain, Prime Ideal, Maximal Ideal

Isomorphism of a Ring: (Definitions only) Ring Homomorphism into, Ring Homomorphism onto, Ring Isomorphism and it's Properties, Kernel of Ring Homomorphism.

Polynomial Rings: (Definitions only) Polynomial over a Ring, Sum and Product of Polynomials, Imbedding of R into R[x], Principal Ideal Domain,

Module 03: Vector Space

Vector spaces: Definition of Real Vector Space and it's Properties, Subspace, Examples and Theorems on Subspace, Algebra of Subspaces, Linear Combination, Linear Span, Linear Sum of Subspaces, Linearly Dependent and Linearly Independent Vectors, Theorems and Problems on LD & LI.

Quotient Space and Direct Sum: Quotient Space and Direct Sum of Subspaces.

Basis: Definition of Basis, Statements of the following theorems Existence of Basis, Invariance of number of elements in Basis, Extension Theorem.

Dimension: Dimension of Vector Space and Subspace, Quotient Space and Direct Sum.

Module 04: Linear Transformation

Linear transformations: Linear Transformations, Linear Operator, Zero Transformation, Identity Operator, Properties of LT, Range and Null Space (Kernel) LT, Rank and Nullity of LT, Sylvester's Law of Nullity (Statement only), Problems related to Range and Null space.

Finite Dimensional Inner Product Spaces: Definition of Inner Product Spaces with Examples, Norm or Length, Unit Vector, Schwarz's Inequality, Normed Vector Space, Distance, Orthogonality, Orthogonal Set, Orthonormal Set, Existence of ONS, Orthonormal Set, Orthonormal Basis, Graham Schmidt Orthogonalization Process, Orthogonal Complement.

Module 05: Numerical Linear Algebra

Triangular form, Conditioning of linear system, Cholesky, Dolittle, Crauts Triangularisation Methods, Iteartive methods (Jacobi,Gaussseidel) methods for solving linear systems.Computation of Eigen values and Eigen vectors (Jacobi, Givens, Householder, QR methods).

Text/Reference Books

1. Higher Engineering Mathematics. Ramana B.V. 1st Ed. Tata McGraw-Hill Education.
2. Higher Engineering Mathematics. Dass H. K. 3rd Ed. S Chand & Co Ltd. 2014.
3. Higher Engineering Mathematics. Grewal B.S. 42nd Ed. Khanna Publishers. 2012.
4. Advanced Engineering Mathematics. Kreyszig E. 10th Ed. Wiley Eastern. 2012.
5. Matrix and Linear Algebra, Dutta K. B., Prentice Hall of India
6. Linear Algebra, Charles W., Springer Verlag
7. Advance Course in Modern Algebra, *Goyal* J.K., *Gupta* K.P., Pragati Prakashan, Meerut
8. Finite Dimensional Vector Spaces, Halmos P. R.,Springer Verlag.
9. Applied Linear Algebra, Peter J., Olver and Shakivban C., Prentice Hall.
10. Elementary linear algebra with applications (8th Edition), H. Anton,

John Wiley (1995).

11 Linear algebra and its applications (4th Edition), G. Strang, Thomson (2006).

Digital Material

1. Power Point Slides covering the course lectures, Course content, video demonstration, problem sets etc. shall be uploaded on the Moodle site developed by the course teacher
2. The Recordings of all the held classes will also be preserved in the MS Teams for students.

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Semester - VI

(University Level Optional Course – II)

ME-3234   L-T-P-S-C
Project Management   3-0-0-0-3

Prerequisite   Nil

Objective: *The aim of this course is to develop the understanding, as well as practical skills, within the field of project management. The traditional lines between permanent and temporary organizational forms are nowadays blurring, which requires new perspectives on management, collaboration and organization. The course provides students with an orientation in this developing landscape as well as knowledge and skills to lead organizational development in practice, by reflecting on a project that the students plan, execute and evaluate.*

Course Outcome: *The students will be able to:*

1. Define project and project management as empirical phenomena and a field of research, define, interpret and exemplify the challenges in project management both in regards to the outcomes of projects and of the projects itself (process).

2. Identify and describe the characteristics of projects as a form of organization, describe different models, tools and techniques in project management for broad stakeholder involvement.

3. Discuss the extent to which these are essential to sustain a coalition of diverse stakeholders, assess different approaches to project management and select the relevant approach to answer an identified problem.

PO1	PO2	PO12	PSO2
1	1	1	1

Course Content

Module 01 Project Management Foundation:

Project Management Foundation: Definition of a project, Project Vs Operations, Necessity of project management, Triple constraints, Project life cycles (typical & atypical) Project phases and stage gate process. Role of project manager, Negotiations and resolving conflicts, Project management in various organization structures, PM knowledge areas as per Project Management Institute (PMI)

Module 02 Initiating Projects:

Initiating Projects: How to get a project started, selecting project strategically, Project selection models (Numeric /Scoring Models and Non-numeric models), Project portfolio process, Project sponsor and creating charter; Project proposal. Effective project team, Stages of team development & growth (forming, storming, norming &performing), team dynamics

Module 03: Project Planning and Scheduling:

Project Planning and Scheduling: Work Breakdown structure (WBS) and linear responsibility chart, Interface Co-ordination and concurrent engineering, Project cost estimation and budgeting, Top down and bottoms up budgeting, Networking and Scheduling techniques. PERT, CPM, GANTT chart, Introduction to Project Management Information System (PMIS).

Module 04 Planning Projects:

Planning Projects: Crashing project time, Resource loading and levelling, Goldratt's critical chain, Project Stakeholders and Communication plan Risk Management in projects: Risk management planning, Risk identification and risk register, Qualitative and quantitative risk assessment, Probability and impact matrix. Risk response strategies for positive and negative risks

Module 05: Executing Projects:

Executing Projects: Planning monitoring and controlling cycle, Information needs and reporting, engaging with all stakeholders of the projects, Team management, communication and project Meetings

Monitoring and Controlling Projects: Earned Value Management techniques for measuring value of work completed; Using milestones for measurement; change requests and scope creep, Project audit

Project Contracting: Project procurement management, contracting and outsourcing.

Module 06: Project Leadership and Ethics:

Project Leadership and Ethics: Introduction to project leadership, ethics in projects, Multicultural and virtual projects.

Closing the project: Customer acceptance; Reasons of project termination, Various types of project terminations (Extinction, Addition, Integration, Starvation), Process of project termination, completing a final report; doing a lessons learned analysis; acknowledging successes and failures; Project management templates and other resources; Managing without authority; Areas of further study.

Text/Reference Books

1. Jack Meredith & Samuel Mantel. Project Management: A managerial approach, 7th Edition, Wiley India
2. A Guide to the Project Management Body of Knowledge (PMBOK® Guide), 5th Ed, Project Management Institute PA, USA.
3. Gido Clements Project Management,, Cengage Learning.
4. Gopalan. Project Management, Wiley India
5. Dennis Lock. Project Management,, 9th Edition, Gower Publishing England

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Semester - VI

(Open Elective - II)

PH-3201   L - T – P-S - C
Nanotechnology   3 - 0 - 0 – 0- 3

Objective: *The objective of this course is to discuss why & how changes occur in the properties of bulk materials when their size approaches a billionth of a meter & to understand the basics of nanostructures, nanotubes, nano-electronic devices, nanobiotechnology, nanomachines etc.*

Course Outcome: *Upon successful completion of this course, the student will be able to:*

CO-1: Understand the properties of bulk materials and nanostructures.

CO-2:Understand the nanotubes, nano-electronic devices, nanobiotechnology, nanomachines

CO-3: Apply the nanotechnology in development of nanostructure such as carbon nanotubes, Sensors & drug delivery vehicles, nanoclays etc.

PO1	PO2	PO12
1	1	1

Course Content

Basics of low dimensional (0D, 1D, 2D) structures, Quantum dots wires & wells, Nanoparicles-free & dispersed, Nanocrystalline & nanostructured films, Self-organized structures; Nanostructures for optical & electronic applications, Quantum dot diodes, lasers & detectors, Single electron devices & logic applications, Optical computing & Information processing; Carbon based nanostructures, Electrical, mechanical & chemical properties of carbon nanotubes, Sensors & drug delivery vehicles, Data processing; Bulk nanostructured material & Photonic crystals; Nanostructures for Magnetic applications, Giant & Colossal Magnetoresistance. Nanostructured ferromagnetism, Random Access Memories; Nanostructures for catalysis & hydrogen storage, Nanoclays, colloids & hydrogen storage nano materials. Organic & Biological nanostructures. Nanomachines & supra molecular devices.

Text/Reference Books

1. Introduction to Nanotechnology. Charles P. Poole Jr. & Frank J. Owens. 1st Ed. Wiley-India Edition. 2007.
2. Nanotechnology: Principles and Practices. Sulbha K. Kulkarni. 3rd Ed. Springer. 2014.
3. Introduction to nanoelectronics. Mitin V. V., Kochelap V. A. & Stroscio M. A. 1st Ed. Cambridge University Press. 2007.
4. Nanoelectronics and Nanosystems. Goser K., Glosekotter P. & Dienstuhl J. 2nd Ed. Springer. 2009.

Detailed Syllabus for B.Tech. Degree Programme

in

CE/ME/MIE

Semester - VI

(Open Elective - II)

PH-3202   L - T – P-S - C
Nanomaterials   3 - 0 – 0-0 - 3

Objective: *The objective of this course is to introduce the various techniques used for the production of nanomaterials, their characterization & applications in mechanical & civil engineering.*

Course Outcome: *Upon successful completion of this course, the student will be able to:*

CO-1: Understand the various techniques used for the production of nanomaterials

CO-2: Understand the characterization & applications of nanomaterials in mechanical & civil engineering.

CO-3: Apply the nanomaterials in development of Mechanical, Electronics engineering industries, automobiles, aerospace, defense & medical applications.

PO1	PO2	PO12
1	1	1

Course Content

Introduction to Nanomaterials: Amorphous, crystalline, microcrystalline, quasi-crystalline & nano-crystalline materials. Historical development of nanomaterials – Issues in fabrication & haracterization of nanomaterials.

Synthesis of Nanomaterials: Methods of production of Nanoparticles, Sol-gel synthesis, Inert gas condensation, High energy Ball milling, Plasma synthesis, Electro deposition & other techniques. Synthesis of Carbon Nanotubes – Solid carbon source based production techniques, Gaseous carbon source based production techniques - Growth mechanisms Nano wires

Characterization of Nanomaterials: Scanning Probe Microscopy (SPM) – Scanning tunneling microscope, Transmission electron microscope, Scanning transmission electron microscope, Atomic force microscope, Scanning force microscopy, electrostatic force microscopy , Dynamic force microscopy, Magnetic force microscopy, Scanning thermal microscopy, Peizo force microscopy, scanning capacitance microscopy, Nano indentation.

Applications of Nanomaterials: Applications in Mechanical, Electronics engineering industries–Use of nanomaterials in automobiles, aerospace, defense & medical applications –Metallic, polymeric, organic & ceramic nanomaterials.

Nanofabrication & Nanomachining: LIGA, Ion beam etching, Molecular manufacturing techniques–Nanomachining techniques –, Top/Bottom up Nano fabrication techniques - Sub micron lithographic technique, conventional film growth technique, Chemical etching, Quantum materials.

Text/Reference Books

1. Nano Materials. Bandyopadhyay A.K. 1st Ed. New Age International Publishers. 2007.
2. Handbook of Nanotechnology. Bharat B. 3rd Ed. Springer. 2010.
3. Nanotechnology. Timp G. 1st Ed. Springer. 1999.
4. Nanomanufacturing Handbook . Busnaina A. 1st Ed. CRC Press. 2006.

Detailed Syllabus for B. Tech. Degree Programme
in
Mechanical Engineering

Semester - VII

(Advanced Professional Core Courses)

ME-3223   L-T-P-S-C
Machine Design – II   4-0-0-1-5

Prerequisite   Nil

Objective: The objective of this course is to acquaint students with functional and strength design principles of important machine elements such as gears, flywheels, Cam and followers, brakes, belts and clutches.This course also deals to familiarise selection of standard elements such as rolling element bearings, belts etc.

Course Outcome: Students will be able to

1. Select appropriate gears and belts for power transmission on the basis of given load and speed

2.Design gears based on the given conditions

3.Select bearings for a given application from the manufacturer's catalogue.

4.Design flywheels, cam and follower mechanisms, clutches and brakes.

PO1	PO2	PO3	PO4	PO12	PSO1
1	1	1	1	1	1

Course Content

Module 01: Design of Gears:

Gears: Design of spur, helical, bevel and worm gears with strength, wear and thermal considerations

Gear Box: Two stage Gear box with fixed ratio consisting of spur, helical and bevel gear pairs: gear box housing layout and housing design

Module 02: Bearings:

Rolling Contact Bearings: Types of bearing and designation, selection of rolling contact bearings based on constant / variable load & speed conditions (includes deep groove ball bearing, cylindrical roller, spherical roller, taper roller, self-aligning bearing and thrust bearing)

Sliding Contact Bearings: Design of hydro dynamically lubricated bearings (self-contained), Introduction to hydro static bearings, Types and selection of Mechanical seals

Module 03: Design of Cams and Followers

Design of Cam and Roller follower mechanisms with spring and shaft

Module 04: Design of Belts drive and Flywheel

Design and selection of Belts: Flat and V-belts with pulley construction, Design and selection of standard roller chains

Design of Flywheel – Introduction, Fluctuation of energy and speed, turning moment diagram, estimating inertia of flywheel for reciprocating prime movers and machines, Weight of the flywheel, flywheel for punches, rim constructions ,stresses in rims and arms, Construction of flywheel

Module 05: Clutches and brakes

Design of Clutches: Introduction, types, Basic theory of plate and cone type clutches, Design of single plate, multi-plate and cone clutches, with spring, lever design and thermal, wear considerations.

Design of Brakes: Design of single shoe brakes.

Text/Reference Books
1. V.B. Banadari. Design of Machine Elements -, Tata McGraw Hill Publication
2. Sharma, Purohil. Design of Machine Elements -. Prentice Hall India Publication
3. Robert L. Norton. Machine Design -An Integrated Approach -, Pearson Education
4. Pandya & Shah. Machine Design , Charotar PublishingMechanical Engineering
5. J.E.Shigley. Design , McGraw Hill
6. R.S. Khurmi. Machine Design , Eurasia Publishing House (pvt.) ltd
7. Recommended Data Books - PSG
8. Reshetov. Machine Design , Mir Publication
9. Black Adams. Machine Design , McGraw Hill
10 Hawrock..Fundamentals of Machine Elements, Jacobson McGraw Hill
11. R.C.Patel, Pandya, Sikh.Machine Design, Vol-I & II C. Jamnadas & Co

Detailed Syllabus for B. Tech. Degree Programme

in
Civil Engineering

Semester - VII

(Advanced Professional Core Courses)

ME-3224   L-T-P-S-C
Machine Design Lab – II   0-0-1-0-1

Prerequisite   Nil

Objective: *To familiarize applications of strength design principles for various according to particular conditions.*

Laboratory Outcome: *The students will be able to*

1. Design gearbox according to particular application.

2. They will also be able to design cam & followers, gears, clutches and according to particular conditions.

PO1	PO2	PO3	PO4	PO9	PO10	PO12	PSO1
1	1	1	1	1	1	1	1

List of Experiments

S. No.	Title of the Experiment	Module
1	Design of Gears and gear box	1
2	Design of cam and followers	4
3	Design of clutches	6
4	Design of brakes	6

Text/Reference Books

1. V.B. Banadari. Design of Machine Elements -, Tata McGraw Hill Publication
2.Sharma, Purohil. Design of Machine Elements -. Prentice Hall India Publication
3.Robert L. Norton. Machine Design -An Integrated Approach -, Pearson Education
4.Pandya & Shah. Machine Design , Charotar PublishingMechanical Engineering

Detailed Syllabus for B. Tech. Degree Programme
in
Civil Engineering

Semester - VII

(Advanced Professional Core Courses)

ME-3225
CAD/CAM/CAE

L-T-P-S-C
3-0-0-0-3

Pre
requisite   Nil

Objective: *All major manufacturing companies and their suppliers use CAD/CAM software to design parts and evaluate them with respect to fit, form and function. This course introduces students to CAD CAM/CAE software in particular. Students will learn theory and practice related to solid modeling, assembly modeling, drafting, parametric modeling, freeform surface modeling, and use of CAD models for some downstream engineering activities such as motion simulation and manufacturing.*

Course Outcome: *Students will be able to…*

1. Design a part or assembly of parts using Computer-Aided Design software.

2. Analyse *parametric modeling and database techniques.*

3. Describe the use of computers in manufacturing.

4. Explain different types of rapid prototyping methods.

PO1	PO2	PO3	PO4	PO5	PO12	PSO1	PSO2
1	1	1	1	1	1	1	1

Course Content

Module 01: Computer Graphics and Techniques for Geometric Modeling

Computer Graphics:

Two dimensional computer graphics, vector generation, the windowing transformation, Three dimensional Computer graphics, viewing transformation, Homogeneous coordinates, Perspective projection, Hidden line removal & hidden surface removal algorithm, light & shade ray tracing.

The parametric representation of geometry, Bezier curves, Cubic Spline curve, B-Spline curve, parametric representation of line, circle, ellipse & parabola. Constructive solid geometry (CSG), Boundary Representation (B-Rep), Wire Frame Modeling, Solid Modeling, Surface Modeling, Parametric Modeling, feature based modeling, Feature recognition, Design by feature.

Module 02: Transformation, Manipulation & Data Storage and Application Programming Interface (API)

Transformation, Manipulation & Data Storage: 2D & 3D Transformations (Translation, Rotation, & Scaling & Magnification), Concatenations, Matrix representation, Problems & object oriented programming on Transformations. Object transformation, mirror transformation, Artificial Intelligence in Design & Manufacturing, Representation of Knowledge, and Knowledge base Engineering.

Application Programming Interface (API)

Concept of customizing applications by writing programs, Fusion Object Model, Creating Scripts and Add-Ins, Document and assembly structure, Attributes, Creating Programs for Assemblies, Joint, B- Rep & Geometry

Module 03: Design to Manufacturing (CAM)

2D Machining Strategies, 3D Machining Strategies, Fixture Component Terminology, Work Coordinate System Terminology, Create setups, Apply 2D operations, Facing, 2D adaptive clearing, 2D contour. Chamfer milling, Bore ,Tool simulation and stock material removal , Produce setup sheets , Product NC code via post processing,

Module 04: Computer Aided Engineering (CAE)

Fundamentals of computer aided engineering, CAE includes mass property calculations, kinematic analysis and animation (movement, visualization, simulation and FEA). Case study based on modeling and analysis of structural, thermal/fluid, and dynamic (vibration analysis) system. Parameter optimization.

Module 05: Computer Integrated Manufacturing & Technology Driven Practices

Introduction, Evolution, Objectives, CIM Hardware and Software, CIM Benefits, Nature and role of the elements of CIM, Identifying CIM needs, Data base requirements of CIM,

Role08 of CAD/CAM in CIM, Obstacles to Computer Integrated Manufacturing, Concept of the future CIM systems, Socio -techno- economic aspects of CIM.

Module 06: Rapid Prototyping and Tooling

Introduction to RP, Technology Description, Overview of RP, Benefits and Application. RP

Processes: Process overviews, STL file Generation, Classes of RP systems: St ereo- lithography Approach (SLA), SLA with photo-polymerization (mathematical modelling of the process), SLA with liquid thermal polymerization, Selective Laser Sintering (SLS), Fused deposition modelling, Laminated object manufacturing, Laser powder form ing. Prototype properties: Material properties, colour, dimensional accuracy, stability, surface finish, machinability, environmental resistance, operational properties. RP Applications: Design, Concept Models, Form & fit checking, Functional testing, CAD data verification, Rapid Tooling, Rapid manufacturing, Science & Medicine, RP processes

for MEMS, Photolithography, Direct Laser Writer, Bulk Lithography for 3D micro fabrication (Modelling of beam propagation and curing in resin system).

Text/Reference Books

1. Groover Mikell P. and Emory W. Zimmers Jr., "CAD/CAM Computer Aided and Manufacturing", Eastern Economy Edition
2. Zeid Ibrahim, Sivasubramanian R., "CAD/CAM: Theory & Practice", Tata McGraw Hill Publications
3. Hearn Donald and M. Pauline Baker, "Computer Graphics", Eastern Economy Edition
4. Chris Mc Mahon, Jimmie Brown, "CAD/CAM Principles, Practice and Manufacturing Management", Pearson Education.
5. Radhakrishan P., Subramanyan S., V. Raju, "CAD/CAM/CIM", New Age International Publishers
6. P.N. Rao, "CAD/CAM Principles and Applications", Tata McGraw Hill Publications
7. William .M. Neumann and Robert F. Sproul, "Principle of Computer Graphics" Mc Graw Hill.
8. Pabla B.S. and M. Adithan, "CNC Machines", New Age International Publishers.

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in
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Semester - VII

(Advanced Professional Core Courses)

ME-3226 L-T-P-S-C
CAD/CAM/CAE Lab 0-0-1-0-1

Pre-
requisite Nil

Objective*: To introduce a new and exciting field of Intelligent CAD/CAM/CAE with particular focus on engineering product design and manufacturing. To develop a holistic view of initial competency in engineering design by modern computational methods. To develop New API for CAD.*

Laboratory Outcome: *Students will be able to...*

1. Demonstrate computer graphics techniques for geometric modelling.

2. Create a part program & apply rapid prototyping and tooling concepts.

PO1	PO2	PO3	PO4	PO5	PO9	PO10	PO12	PSO1	PSO2
1	1	1	1	1	1	1	1	1	1

List of Experiments

S. No.	Title of the Experiment	Module
1.	Programming for transformations,	02
2.	API on Creating As built joints, Slider Joint Motion	02
3.	Get the physical Properties API	02
4.	Get the circle and arc data from the edge	01
5.	Sketch spline through points creation : API	01

6.	Solid modeling using any 3D modeling software	03
7.	Part programming and part fabrication on CNC trainer (Turning / Milling)	02
8.	Geometrical optimization of any mechanical component using computer aided engineering concepts. (Shape optimization)	04
9.	Development of physical 3D mechanical structure using any one of the rapid prototyping processes.	06

Text/Reference Books

1. Groover Mikell P. and Emory W. Zimmers Jr., "CAD/CAM Computer Aided and Manufacturing", Eastern Economy Edition
2. Zeid Ibrahim, Sivasubramanian R., "CAD/CAM: Theory & Practice", Tata McGraw Hill Publications
3. Hearn Donald and M. Pauline Baker, "Computer Graphics", Eastern Economy Edition

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Semester - VII

(Department Level Optional Course – V)

ME-3227   L-T-P-S-C
Production Planning and Control   3 -0-0-0-3

Pre-
requisite   Nil

Objective: To understand the various components and functions of production planning and control such as work study, product planning, process planning, production scheduling, Inventory Control. To know the recent trends like manufacturing requirement Planning (MRP II) and Enterprise Resource Planning (ERP)

Course Outcome: The students are able to….

1. Formulate production planning and control activities such as work study, product planning, production scheduling, Inventory Control.

2. Enhance proficiency in scheduling and sequencing of manufacturing operations Forecast the demand of the product and prepare an aggregate plan Better approach to Line Balancing in various production systems Plan manufacturing requirements manufacturing requirement Planning (MRP II) and Enterprise Resource Planning (ERP).

3. Implement techniques of manufacturing planning and control.

PO1	PO2	PO12	PSO2
1	1	1	1

Course Content

Module 01: Concepts of PPC:

Manufacturing systems- components and types, need for PPC, functions of P PCrelationship of PPC with other functions. Factors influencing PPC in the organization, manufacturing methods- projects & jobbing products, batch, mass / flow production, continuous process production. Organization of PPC- status of PPC department, internal structure, degree of centralization, PPC as an integrated approach Prerequisites of PPC – data pertaining to design, equipment, raw materials, tooling, performance standards, labour and operating systems.

Module 02: Forecasting, Aggregate planning, Capacity planning

Forecasting: Need for forecasting, role of forecasting in PPC, forecasting methods of qualitative type like judgment techniques. Forecasting methods of quantitative types like time series analysis, least square method, moving average method, exponential smoothing method. Forecasting Errors and Forecasting Bias

Aggregate planning: Concept of aggregate planning, decision rules, strategies and Methods

Capacity Planning: Measurement of capacity, Measures of capacity, Factors influencing effective capacity, short range, medium range and long range capacity planning, Rough cut capacity planning.

Module 03: Inventory Control:

Basic concepts of inventory, Types of inventory, purpose of holding stock and influence of demand on inventory, Costs associated with Inventory management.

Inventory Models: Deterministic models - instantaneous stock replenishment model, Production model, planned shortages and price discount model, Probabilistic models- fixed quantity system(Q-system) and Fixed period system (p-system)

Selective Inventory Control techniques - ABC analysis, HML analysis and VED Analysis.

Module 04: Process Planning and Line Balancing

Process planning: Prerequisite information requirement, steps in process planning, process planning in different situations, documents in process planning, machine /process selection & Computer Aided Process Planning. Line Balancing: objectives, constraints, terminology in assembly line, heuristic methods, like Kilbridge-Wester, Largest Candidate rule, Rank positional weight.

Module 05: Production Scheduling and Sequencing

Scheduling: Inputs for scheduling, loading and scheduling devices, factors Influencing scheduling, scheduling techniques, use of Gantt Charts and basic scheduling problems.Project scheduling by using elements of network analysis PERT & CPM, cost analysis & crashing, resource leveling

Sequencing: Product sequencing, dispatching, progress report & expediting and control. Johnson's Rule for optimal sequence of N jobs on 2 machine. Process n jobs on 3 Machines (n/3 problem) and Jackson Algorithm. Processing of 2 Jobs on Machine (2/m) problem.

Module 06: MRP, MRP-II, ERP: Material Requirement planning (MRP) and Manufacturing Resource Planning (MRP-II) -general concepts, types of demands, Inputs to MRP, MRP objectives, outputs of MRP, Estimation of planned order releases. Benefits and Limitations of MRP II Enterprise Resource Planning (ERP): Evolution, features, purpose of modeling an enterprise, information mapping, generic model of ERP, Modules in ERP, Methodology of implementation, critical success factors of ERP, Case studies of success and failure of ERP implementations, ERP packages.

Text/Reference Books
1. Samuel Eilon. Production Planning and Control.
2. L C Jamb. Production Planning and Control.
3. W. Boltan-Longman. Production Planning and Control, Scientific & Technical
4. James. L. Riggs. Production Systems- Planning, Analysis& Control, John Wiley &Sons
5. Thomas E. Vollman, William L.Berry. Manufacturing Planning and Control Systems, -Galgotia
   Publishers
6. AnandBewoor. Manufacturing Process Planning and Systems Engineering, -Dreamtech Press.
7. CharyS.N. Production and Operations Management, - TMH publishing company
8. Jhamb L.C. Modernization & Manufacturing Management- Everest Publishing House.

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Civil Engineering

Semester - VII

(Department Level Optional Course – V)

ME-3228   L-T-P-S-C
Industrial Engineering & Management   3-0-0-0-3

Pre-
requisite   Nil

Objective: *The course is designed to familiarize the students with concept of integration of various resources and the significance of optimizing them in manufacturing and allied Industries and to acquaint them with various productivity enhancement techniques*

Course Outcome: The students are able to….

1. Illustrate the need for optimization of resources and its significance, develop ability in integrating knowledge of design along with other aspects of value addition in the conceptualization and manufacturing stage of various products, demonstrate the concept of value analysis and its relevance.

2. Manage and implement different concepts involved in method study and understanding of work content in different situations,

3. Describe different aspects of work system design and facilities design pertinent to manufacturing industries and illustrate concepts of Agile manufacturing, Lean manufacturing and Flexible manufacturing.

PO1	PO2	PO3	PO12	PSO2
1	1	1	1	1

Course Content

Module 01 Introduction

Introduction to Industrial Engineering History and contribution, Industrial engineering approach, techniques of industrial engineering, objectives of industrial engineering, system approach to industrial engineering, definition and concept of productivity, productivity measurements, factors influencing productivity and productivity improvement techniques

Module 02: Value Engineering and Value Analysis:

Value Engineering and Value Analysis: Distinction between value engineering & value analysis and their Significance. Steps in value engineering & analysis and Check lists.

Module 03: Work study:

Work study: Method study, micro-motion study and principles of motion economy, Work measurement: time study, work sampling, standard data, PMTS; MOST

Module 04: Work system design:

Work system design: Introduction to ergonomics and its scope in relation to work. Outline of discipline of anatomy, physiology and psychology, with respect to ergonomics building blocks such as anthropometry and biomechanics Job evaluation, merit rating, incentive schemes, wage administration and business process reengineering

Module 05: Facility Design:

Facility location factors and evaluation of alternate locations; types of plant layout and their evaluation; computer aided layout design techniques; assembly line balancing; materials handling system. Concepts of Group Technology and cellular manufacturing

Module 06: Agile manufacturing:

Introduction, Developing agile manufacturing, Integration of Product/Process. Development, Application of IT/IS concepts, Agile supply chain management, Design of skill and knowledge and Computer control of Agile manufacturing Flexible manufacturing, Lean Manufacturing, Value Stream Mapping.

Text/Reference Books
1. Introduction to Work study, ILO, Geneva, and Oxford & IBH Pub Co. Pvt. Ltd.
2. Murrell. Ergonomics at Work,
3. James M. Apple. Plant Layout and Material Handling,, John Wiley & Sons

4. Richard L. Francis& John A. White. Facility Layout and Location – An Analytical Approach,, Prentice Hall
5. Samuel Elion. Production Planning and Control,
6. Joseph G. Monks. Production and Operations Management,
7. J M Juran, FM Gryana. Quality planning and analysis, TMH
8. H. Bester Field et al. Total Quality Management, prentice hall
9. HG Menon. TQM in new product manufacturing,; TMH
10. Shankar R. Industrial Engineering and Management.

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Semester - VII

(Department Level Optional Course – VI)

ME-3229   L-T-P-S-C
Mechanical Vibration   3-0-0-0-3

Pre-
requisite   Nil

Objective: *The course is designed to make the students understand the fundamentals of Vibration theory. The course will be able to mathematically model real-world mechanical vibration problems and familiarize them with the practices of monitoring health conditions of the systems*

Course Outcome: The learners will be able to

1. Model the vibration problems encountered in application and examine vibration response, establishing relation between real system and physical model.

2. Investigate vibratory response of mechanical system, evaluate the constraints of vibration isolation system,

3. Mechanize the vibrations to the tolerable level and understand the working principle of vibration measuring instruments.

PO1	PO2	PO9	PO12	PSO1	PSO2
1	1	1	1	1	1

Course Content

Module 01: Basic Concepts of Vibration

Basic Concepts of Vibration: Introduction, classification, terminology, modelling vibration analysis

Free Undamped Single Degree of Freedom Vibration System: Longitudinal, transverse, torsional, vibration system, methods for formulation of differential equations by D'Alembert's Principle, Newton, Energy, Lagrangian and Rayleigh's method.

Module 02: Multi Degree of Freedom System:

Undamped free vibration: Free vibration equation of motion, Influence coefficients (stiffness and flexibility), Reciprocity theorem, Generalized Coordinates, and Coordinate Coupling, Lagrangian equations, Rayleigh and Dunkerley method, two rotor and geared Systems

Eigen Values and Eigen vectors: for translatory and torsional two d.o.f. systems, Matrix method, Holzer's method (translatory and torsional unbranched systems)

Module 03: Free Damped Vibration System

Free Damped Single Degree of Freedom Vibration System: Types of dampers, Viscous damped system- translatory and rotary systems, Coulomb's damping- final rest position of body in coulomb damping, motion with negative damping factor,

Module 04: Forced vibration

Forced Single Degree of Freedom Vibratory System: Analysis of linear and torsional

systems subjected to harmonic force excitation and harmonic motion excitation

Vibration Isolation and Control: Conventional Methods: By mass /Inertia, stiffness, damping   (vibration   isolation   principles) Force Transmissibility, motion transmissibility, typical isolators & mounts. Introduction to Semi-Active and Active Vibration control.

Module 05: Vibration Measuring Instruments and Conditioning Monitoring

Vibration Measuring Instruments: Principle of seismic instruments, vibrometer, accelerometer- undamped, damped

Introduction to Conditioning Monitoring and Fault Diagnosis: Introduction to conditioning monitoring and fault diagnosis, Condition & Vibration Monitoring Techniques Condition / vibration monitoring data collection. Signature analysis.

Module 06: Vibration Measuring Instruments

Non-Linear Vibration : Basics of Non-linear vibration, systems with non-linear elastic properties, free vibrations of system with non-linear elasticity and damping, phase –plane technique, Duffing's equation, Jump phenomenon, Limit Cycle, Perturbation method.

Text/Reference Books

1. Rao S.S.. Mechanical Vibrations, fourth edition, Pearson Education
2. Grover G. K. . Mechanical Vibraitons
3. Graham Kelly S. Fundamentals of Mechanical Vibration, Tata McGraw Hll
4. Srineevasan P. Vibration Analysis, Tata McGraw Hill
5. William W.Seto.Mechanical Vibrations- Schaum's outline series,, McGraw Hill
6. Rao J.S. Gupta J.K. Theory and Practice of Mechanical Vibrations, New Age
7. International Publications
8. Den, Chambil, Hinckle. Mechanical Vibrations
9. Den Hartog J.P. Mechanical Vibrations, McGraw Hill Book Company Inc
10. Meirovitch L. Introduction to Dynamics and Control, Wiley, New York.
11. Meirovitch L. Elements of Vibration Analysis by Leonard Meirovitch, McGrmv-Hill, New York
12. Meirovitch L. Dynamics and Control of Strucdtures, Wiley, New York
13. Antony J. Pettofrezzo, Dover. Matrices and Transformations. New York
14. Benson H. Tongue. Principles of Vibratioz, Oxford University Press
15. Thomson W. Theory of Vibration with Applications, 2nd edition, Pearson Education
16. Vibrations by Balakumar Balachandan, Edward Magrab, Cengagae Learning.

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Semester - VII

(Department Level Optional Course – VI)

ME-3230   L-T-P-S-C
Automobile Engineering   3-0-0-0-3

Pre-
requisite   Nil

Objective: *The course is designed to impart necessary knowledge about important mechanical components/systems of an automobile and recent technological advancement in automotive technology.*

Course Outcome: *Students will be able to*

1. Identify the different parts of the automobile such as body, chassis, engine, transmission system etc.

2. Explain the working of various parts like engine, transmission, clutch, brakes, steering, suspension.

3. Demonstrate the automotive electric system, battery charging, starting system.

4. Discuss various recent technologies in automobiles and develop a strong base for understanding future developments in the automobile industry.

PO1	PO3	PO5	PO6	PO12	PSO1
1	1	1	1	1	1

Course Content

Module 01: Introduction of automobile components and transmission system:

Automobile components: Brief introduction of various parts and systems of automobile, Engine, piston, piston rings, cooling system, body, chassis, supercharging etc.

Clutch: Requirements of Clutches, Types of Clutches; Single Plate, Multi-plate, Wet Clutch, Semi- centrifugal, Centrifugal. Clutch materials. Clutch operating mechanisms; Mechanical, Electric, Hydraulic and Vacuum. Free Pedal Play.

Transmission: Necessity of gear box. Sliding mesh, Constant mesh, and Synchromesh

Gear selector mechanisms. Overdrives and hydrodynamic torque converter, Trouble shooting and remedies.

Propeller Shaft and Axle: Propeller shafts and universal joints: Types and construction, Different types of universal joints. and constant velocity joints. Types of live axles; semi, three quarter and full floating axles. Types of Front Stub Axles; Elliot, Reverse Elliot, Lamoine and Reverse Lamoine

Module 02: Driving and braking system

Final Drive and Differential : Types of Final drive; spiral, bevel, Hypoid and worm drives. Necessity of differential, Working of differential, Conventional and non-slip differential, Trouble shooting and remedies

Steering System : Steering geometry, Steering requirements, Steering linkages and steering gears. Over steer and under steer, Cornering power, Reversibility of steering gears.

Braking System: Requirement of brake, Classification of brakes, Brake Actuation Methods; Mechanical, Hydraulic, Pneumatic, Electro and vacuum brakes. Types of Disc brakes and Drum Brakes, Brake trouble shooting, Introduction to antilock braking system (ABS)

Module 03: Suspension system and wheels – tyres

Suspension system: Objects of suspension, Basic requirements, Sprung and un-sprung mass, Types of Independent and rigid axle suspension. Air suspension and its features. Pitching, rolling and bouncing. Shock absorbers and its types

Wheels and Tyres: Requirements of wheels and tyres. Types of wheels, types of tyres and types of carcass

Module 04: Automotive Electrical System:

Storage System: Lead-Acid Battery; construction, working, ratings, types of charging methods, Alkaline, ZEBRA, Sodium Sulphur and Swing batteries Charging System

Dynamo: Principle of operation, Construction and Working. Regulators, combined current and voltage regulator. Alternator: Principle of operation, Construction, Working. Rectification from AC to DC

Starting system: Requirements, Various torque terms used, Starter motor drives; Bendix, Rubber compression, Compression Spring, Overrunning Clutch.

Starter motor solenoids and switches

Module 05: Body Engineering:

Importance of Body design, Materials for body construction-Styling forms-Coach and bus body style, layouts of passenger cars, Bus and truck bodies.

Chassis types and structure types: Open, Semi integral and integral bus structure

Frames: functions and types of frames, Loads on frames, Load distribution of structure, Location of power plant

Module 06: Recent trends in Automobiles and Intelligent Vehicle Systems :

Cruise Control, Adaptive Cruise Control (ACC), Electronic Stability Program (ESP), Electronic ,Brake Distribution (EBD), Traction Control System (TCS). Integrated Starter Alternator (ISA)

Text/Reference Books
1. Kirpal Singh, "Automobile Engineering", Vol I & II, Standard publishers Distributors ,Delhi
2. Rajput R. K., "Automobile Engineering", Laxmi publication, New Delhi
3. Banga T.R. & Nathu Singh, "The Automobile Engineering" Khanna Publishers
4. Richard Stone, Jeffrey K. Ball, "Automotive Engineering Fundamentals", SAE International.
5. Powlowski J., "Vehicle body engineering" Century
6. Giri N. K., "Automobile Mechanics", 8th Edition, Khanna Publishers
8. Tom Denton, "Automobile Electrical and Electronics", Routledge

Digital Material

1. https://nptel.ac.in/courses/112103262/

2. https://www.youtube.com/watch?v=RsLQREBiC3Y

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Semester - VII

(Department Level Optional Course – VI)

ME-3231   L-T-P-S-C
Computational Fluid Dynamics   3-0-0-0-3

Prerequisite: Fluid Mechanics, Heat Transfer

Objective: *The course is designed to impart knowledge about basic principles of Computational Fluid Dynamics and discretization methods.*

Course Outcome: *Students will be able to*

1. Discuss basics of computational methods in fluid flow applications.

2. Illustrate the principles of grid generation and discretization methods, and apply specific boundary conditions relevant to specific applications.

3. Decide solution parameters relevant to specific applications and analyze the results and draw the appropriate inferences.

4. Demonstrate basic principles of Finite Volume Methods.

PO1	PO2	PO3	PO4	PO5	PO12	PSO1	PSO2
1	1	**1**	1	1	1	1	1

Course Content

Module 01 Introduction of CFD:

Introduction: What is CFD, Scope and Application of CFD, Methods of Predictions like

Experimental and theoretical, Working of Commercial CFD Software, Solution methodology-Preprocessing, Solver, Post processing.

Module 02: Mathematical description of Physical Phenomenon:

Governing Differential Equations, Meaning of Differential equation, The Continuity Equation, A Momentum equation, The Energy Equation, The General Differential Equation, Boundary Conditions, Initial and Boundary Value problems.

Module 03: Grid Generation and Discretization Methods:

Grid Generation and Discretization Methods: Structured and unstructured Grids: O-type, H-type, C-type of Structured Grid Generation, Mesh Adaptation. The Nature of Numerical Methods: The Discritization Concept, The Structure of Discritization Equation.

Basic discretization techniques applied to model equations and systems of equations: finite difference, finite volume and finite element methods. Methods of Deriving the Discretization Equations, Taylor-Series Formulation, Variational Formulation, Method of Weighted Residuals, Control Volume Formulation

Module 04: Heat Conduction, Convection and Diffusion

Heat Conduction, Convection and Diffusion: Steady One-dimensional Conduction, Unsteady One-dimensional Conduction, Two and Three-dimensional Situations, Over relaxation and Under relaxation, Steady One-dimensional and Two Dimensional Convection-Diffusion, Unsteady One-dimensional Convection.

Module 05: Incompressible Fluid Flow

Incompressible Fluid Flow: Governing Equations, Stream Function-Vorticity Method, Determination of Pressure for Viscous Flow, The SIMPLE, SIMPLER Algorithm, Introduction to Turbulence Modeling, Basic Theories of Turbulence, The Time-Averaged Equations for Turbulent Flow.

Module 06: Finite Volume Methods:

Finite Volume Methods: FVM solutions to steady one, two and three dimensional diffusion problems and unsteady one and two dimensional diffusion problems, FVM solutions to convection-diffusion problems - one and two dimensional, steady and unsteady; Advection schemes; Pressure velocity coupling

Text/Reference Books
1. Versteeg H.K., Malalasekera.W., "An introduction to computational fluid dynamics-The finite volume method", Prentice Hall.
2. Anderson J.D. "Computational Fluid Dynamics", McGraw Hill

3. Anderson D.A., Tannehill, I.I., and Pletcher, R.H., "Computational Fluid Mechanics and Heat Transfer", Hemishphere Publishing Corporation, New York, USA, 1984
4. Niyogi P. ,Laha M.K., Chakrabarty S.K., "Introduction to Computational Fluid Dynamics", Pearson Education, India
5. Muralidhar K., & Sundararajan T., "Computational Fluid Flow and Heat Transfer", Narosa Publishing House ,New Delhi
6. Ghoshdasdidar P. S., "Computer Simulation of flow and heat transfer", Tata McGraw-Hill Publishing Company Ltd
7. Taylor C. and Hughes J.B., "Finite Element Programming of the Navier Stock Equation", Pineridge Press Ltd.U.K.

Digital Material

1. https://www.youtube.com/watch?v=kwqoyuZTglQ
2. https://www.youtube.com/watch?v=514Ml2DxaiM

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in
Civil Engineering

Semester - VII

(Department Level Optional Course – VI)

ME-3232   L-T-P-S-C
Refrigeration and Air Conditioning   3-0-0-0-3
Pre-
requisite   Nil

Objective: *The aim of this course is to understand the principles of refrigeration and air conditioning and calculate the cooling load for different applications. This course also deals with selecting the right equipment for a particular application, design and implementation of refrigeration and air conditioning systems using standards.*

Course Outcome: *Students will be able to*

1. Describe fundamental principles of refrigeration and air conditioning and identify various important components of the refrigeration and air conditioning system

2. Demonstrate the use of psychrometry in analyzing refrigeration systems and interpret the usage of refrigerants

3.Design Air Conditioning system using cooling load calculations.

4. Estimate air conditioning system parameters and apply concepts of duct design.

PO1	PO2	PO3	PO4	PO5	PO12	PSO1
1	1	1	1	1	1	1

Course Content

Module 01:

Introduction to Refrigeration: Methods of refrigeration, First and Second Law applied to refrigerating machines, Carnot refrigerator, Carnot heat pump, unit of refrigeration, Co- efficient of Performance, Energy Efficiency Ratio (EER), and BEE star rating Air refrigeration systems: Bell Coleman cycle, applications.

Aircraft air refrigeration systems: Need for aircraft refrigeration, Simple, Bootstrap including evaporative cooling, Reduced ambient, Regenerative air cooling system, Comparison of these systems based on DART rating.

Module 02:

Vapour Compression Refrigeration System: Simple vapour compression cycle, Effect of liquid sub cooling & superheating, effect of evaporator and condenser pressures, methods of subcooling, use of P-h charts, Actual VCR cycle, Use of P-h Charts, Comparison between air-cooled and water cooled condenser based air conditioning systems, Types of condensers, evaporators, expansion devices and Compressors.

Cooling tower: Types of cooling towers, tower approach, tower range, tower efficiency, tower losses, tower maintenance

Refrigerants: Desirable properties of refrigerants, ASHRAE numbering system for refrigerants. Thermodynamic, Chemical and Physical properties, Secondary refrigerants, ODP and GWP, Montreal protocol and India's commitment, Recent substitutes for refrigerants

Module 03:

Other Refrigeration Systems: Vapour Absorption Refrigeration, Importance of VAR system, COP of ideal VAR system, Ammonia-water VAR system, Lithium Bromide – Water VAR system, Single and double effect, Electrolux refrigeration system,

Non-Conventional Refrigeration Systems: Thermoelectric Refrigeration, Thermo-acoustic Refrigeration, Vortex Tube Refrigeration

Module 04:

Psychrometry: Need for air conditioning, Principle of psychromerty, Psychrometric properties, chart and processes, air washers, requirements of comfort air conditioning, summer and Winter Air conditioning

Module 05:

Design of Air Conditioning Systems:

Different Heat sources,- Adiabatic mixing of two air streams, Bypass factor, sensible heat factor, RSHF, GSHF, ERSHF, Room apparatus dew point and coil apparatus dew point, Ventilation and infiltration, Inside and Outside Design condition, Cooling Load estimation, Introduction to Unitary Products viz. Room/Split and Packaged Air Conditioners, Introduction to recent developments viz. Variable Refrigerant Flow systems, VAV control systems, Inverter Units. Human Comfort, Thermal exchange of

body with environment, Effective temperature, Comfort chart, Comfort zone, Indoor Air Quality, Green Buildings

Duct Design Friction chart for circular ducts, Equivalent diameter of a circular duct for rectangular ducts, Static pressure regain and equal pressure drop methods of duct design, Factors considered in air distribution system, Air distribution systems for cooling and heating.

Module 06:

Controls and Applications:

Controls – LP/HP cutoff, Thermostats, Humidistats, Interlocking control, Electronic Controllers Applications Refrigeration & A/C Ice plant – food storage plants – diary and food processing plants, Food preservation ,Freeze Drying, A/c in textile ,printing pharmaceutical industry and Hospitals, Liquefaction of LNG, Liquefaction of gases (cryogenics), Deep sea water air-conditioning.

Text/Reference Book
1. Dossat R.J. Principles of refrigeration , Willey Eastern Publication
2. Stoeker W. F. and Jones J. W . Refrigeration and air-conditioning , TMH
3. Arora C.P.Modern Air-conditioning practice, TMH
4. Prasad M. Refrigeration and air-conditioning- , New Age Int (P) Ltd
5. Ananthanarayana P., Basic Refrigeration and air-conditioning, TMH
6. ASHRAE Handbook of Fundamentals
7. ASHRAE Handbook of Systems
8. ASHRAE Handbook of Equipment
9. ISHRAE Air Conditioning Handbook
10. ISHRAE Refrigeration Handbook

Digital Material
https://www.youtube.com/watch?v=9uCeFhO8H40

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Semester - VII

(Department Level Optional Course – VI)

ME-4202   L-T-P-S-C
Design of Mechanical Systems   3-0-0-0-3

Pre-
requisite   Nil

Objective: The aim of this course is to familiarize with the concept of system and methodology of system. This course also impart necessary knowledge of design of various systems such as snatch block, belt conveyors, engine system, pumps and machine tool gearbox.

Course Outcome: The students will be able to

1. Implement the concept of system design.

2. Design material handling systems such as hoisting mechanism of EOT crane,

3. Design belt conveyor systems, design engine components such as cylinder, piston, connecting rod and crankshaft.

4. Design pumps for the given applications and prepare layout of machine tool gear box and select number of teeth on each gear.

PO1	PO2	PO3	PO4	PO5	PO12	PSO1
1	1	1	1	1	1	1

Course Content

Module 01 Introduction

Methodology & Morphology of design, Optimum design, system concepts in design.

Module 02: Design of Hoisting mechanism

Design of Hoisting mechanism: Design of Snatch Block Assembly including Rope Selection, Sheave, Hook, Bearing for hook, cross piece, Axle for sheave and shackle plate, Design of rope drum, selection motor with transmission system.

Module 03: Design of belt Conveyors

Design of belt Conveyors- Power requirement, selection of belt, design of tension take up unit, idler pulley

Module 04: Engine Design (Petrol and Diesel):

Engine Design (Petrol and Diesel): Design of cylinder, Piston with pin and rings, connecting rod & crankshaft with bearings

Module 05: Design of Pump:

Design of main components of the gear pump. Motor selection, Gear design, Shaft design and bearing selection,Casing and bolt. Design, Suction and delivery pipe Design of main components of Centrifugal Pump: Motor selection, Suction and Delivery pipe, Design of Impeller, Impeller shaft, Design of Volute Casing.

Module 06: Design of Gear Box:

Design of gear boxes for machine tool applications(Maximum three stages and twelve speeds), Requirements of gear box, determination of variable speed range, graphical representation of speeds, structure diagram, ray diagram, selection of optimum ray diagram, estimation of numbers of teeth on gears, deviation diagram, layout of gear box.

Text/Reference Books
1. S.N.Trikha. Machine Design Exercises, Khanna Publications, Delhi
2. Shigley J E and Mischke C R. Mechanical Engineering Design, McGraw Hill
3. M FSpotts. Mechanical design analysis, Prentice Hall Inc
4. Bhandari VB. Design of Machine Elements,, TMH
5. Black PH and O Eugene Adams. Machine Design, McGraw Hill
6. Design Data by P.S.G. College of Technology, Coimbatore.
7. I S: 2825 Code for unfired pressure vessels
8. Mechanical Design Synthesis with Optimisation Applications byJohnson R C, Von Nostrand-Reynold Pub
9. Dieter G E. Engineering Design by, McGraw Hill Inc
10. S K Basu and D K Pal. Design of machine tools, Oxford and IBH Pub. Co.
11. NKMehta. Machine tool design, TMH
12. SP Patil,Mechanical System Design, JAICO students Ed., JAICO Publishing House
13. G K Sahu. Pumps: Theory, Design and Applications, New Age International
14. Khandare S.S & Kale A.V. Design Data Book- Design of engine parts.

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Semester – VII

(University Level open elective - III)

BM-2203   L-T-P-S-C

Strategic Management   3-0-0-0-3

Pre-requisite-   Basic understanding of Marketing, Finance

Objective: *Learner should know about the role of strategic thinking in changing business environments and to understand the process of strategy formulation, implementation & evaluation.*

Learning Outcomes: Leaner will be able to

1. Understand the importance of Strategic management for an organisation

2. Analyse various tools of Strategic formation and issues in business strategy implementation

3. Learn concept of Strategic Evaluation & control

Course Content

Module 01: Introduction:

Introduction to strategic management, schools of strategic formulation and implementation & evaluation. Globalization, addressing a VUCA environment with a bottom – up approach (Volatile, Uncertain Complex and Ambiguous time)

Module 02: Strategy Analysis and formation

PESTEL & SWOT as tools for strategic formulation, BCG matrix /GE matrix, 7S McKinsey models as tools for strategic formulation, VRIO analysis, Ansoff matrix,

grand strategy as tools for strategic formulation, Porter's Generic strategies and value chain, Red – Blue - Purple Ocean strategy

Module 03: Competencies

Internal Competences & Resources Core, Distinctive, Strategic & Threshold Competence,   Competence v/s Capability, Resource Analysis, Value Chain, Analysis, Strategic Outsourcing Core competence and   synergy,   Distinctive competencies.

Module 04: Competing in Global Markets and Strategic Control

Competing in Global Markets: Differences in Cultural, Demographic and Markets, Multi Country and Global competition concepts, Strategy options, competing in Emerging Markets., Mergers and Acquisitions, Strategic alliance & Joint Ventures, Vertical Integration, Offensive, Defensive, and Strategies, Strategic Evaluation & control

Text/Reference Books

1. Pierce & Robinson, "Strategic Management: Formulation, Implementation &Control", 9th Ed, Tata McGraw – Hill, N. Delhi
2. David Fred R, "Strategic Management: Concepts & Cases", 10th Ed, Pearson – Prentice Hall, N. DelhiThomson, Strickland, Gamble & Jain, "Crafting & Executing Strategy", 14th Ed, Tata McGraw – Hill, N.Delhi
3. 4. Hit, Ireland, Hoskisson & Manikutty, "Strategic Management: A South – Asian Perspective", 9th Ed, Cengage Learning, Delhi
4. Pierce & Robinson, "Strategic Management: Formulation, Implementation & Control", 9th Ed, Tata McGraw – Hill, N. Delhi
5. David Fred R, "Strategic Management: Concepts & Cases", 10th Ed, Pearson – Prentice Hall, N. Delhi.
6. Cherunilam Francis, "Strategic Management: A Book on Business Policy & Corporate Planning", Himalaya Publishing House, Mumbai, 2008.
7. Johnson & Scholes, "Explaining Corporate Strategy", 6th Ed, Pearson Education, Delhi

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Semester - VII

(University level open elective-III)

BMF-2101   L-T-P-S-C
Basics of Financial Services   3-0-0-0-3

Pre-requisite   Basic understanding of finance and core concept of
accounting

Objective: *The main aim of the course is to provide core concepts of business finance in managing a business. Further, the subject aimed to provide a conceptual framework of the finance function, tools, types, instruments of the financial system in the realm of the Indian Financial Market.*

Learning Outcome: *The learner will be able to*

1. learn about Financial services and their types.

2. Development banking and its services.

3. Services of Insurance and Mutual fund.

Course Content

Module 01: Financial System

An overview of Financial System, Financial Markets, Structure of Financial Market (Organised and Unorganized Market), Components of Financial System, Major Financial Intermediaries, Financial Products, Function of Financial System, Regulatory Framework of Indian Financial System (Overview of SEBI and RBI-Role and Importance as regulators). Annual Reports of Banking Companies, Profit and loss statement and Balance sheet and their Interpretations.

Module 02: Commercial Banks, RBI and Development Banks

Concept of Commercial Banks- Functions, Investment Policy of Commercial Banks, Liquidity in Banks, Asset Structure of Commercial Banks, Non-Performing Assets, Interest Rate reforms, Capital Adequacy Norms. Reserve Bank of India-Organisation

Module 03: Insurance

Concept, Basic Characteristics of Insurance, Insurance Company Operations, Principles of Insurance, Reinsurance, Purpose and Need of Insurance, Different Kinds of Life Insurance Products, Basic Idea About Fire and Marine Insurance and Bancassurance.

Module 04: Mutual Funds

Concept of Mutual Funds, Growth of Mutual Funds in India, Features and Importance of Mutual Fund. Mutual Fund Schemes, Money Market Mutual Funds, Private Sector Mutual Funds, Evaluation of the Performance of Mutual Funds, Functioning of Mutual Funds In India.

Text/Reference Books
1. Khan M.Y., Indian Financial System, Tata McGrew Hill Publishing Company
2. Varshney P.N. & Mittal MN, Financial System, Sultan Chand & Co
3. Bhole L. M: Financial Markets and Institutions; Tata McGraw-Hill Publishing Company, New Delhi.
4. Chandra Prasanna: Financial Management: Theory and Practice; Tata McGraw Hill, New Delhi.
5. Gupta Suraj B: Monetary Economics; S. Chand and Co., New Delhi.

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Semester – VII

(University level open elective-III)

BM-2201   L-T-P-S-C
Business Planning & Entrepreneurial Management   3-0-0-0-3
Pre-requisite   Nil

Objective: *The main aim of the course is to make students familiarize with Entrepreneurship which is one of the major focus areas of the discipline of Management. This course prepares students to take the responsibility of the full line of management function of a company with special reference to the SME sector.*

Learning Outcomes: *Learner will be able to*

1. Know the foundation of Entrepreneurship Development.

2. Understand the concept of Entrepreneurship, types & classification of Entrepreneurs.

3. Develop entrepreneurs' skills in the present scenario.

4. Acquaint with Entrepreneur Project Development, Business Plan and Venture development

Course Content

Module 01: Foundations of Entrepreneurship Development

Foundations of Entrepreneurship Development: Concept and Need of Entrepreneurship Development Definition of Entrepreneur, Entrepreneurship, Importance and significance of growth of entrepreneurial activities Characteristics and qualities of entrepreneur; Theories of Entrepreneurship: Innovation Theory by Schumpeter & Imitating Theory of High Achievement by McClelland, X-Efficiency Theory by Leibenstein, Theory of Profit by Knight: Theory of Social change by Everett Hagen; External Influences on Entrepreneurship Development: Socio-Cultural,

Political, Economic, Personal. Role of Entrepreneurial culture in Entrepreneurship Development.

Module 02: Types & Classification of Entrepreneurs

Intrapreneur –Concept and Development of Intrapreneurship: Women Entrepreneur – concept, development and problems faced by Women Entrepreneurs, Development of Women Entrepreneurs with reference to Self Help Group; Social entrepreneurship– concept, development of social entrepreneurship in India. Importance and Social responsibility of NGO's. Entrepreneurial development Program (EDP)– concept, factor influencing EDP. Option available to Entrepreneurs.

Module 03: Entrepreneur Project Development & Business Plan

Innovation, Invention, Creativity, Business Idea, Opportunities through change, Idea generation– Sources-Development of product /idea, Environmental scanning and SWOT analysis, Creating Entrepreneurial Venture-Entrepreneurship Development Cycle, Business Planning Process-The business plan as an Entrepreneurial tool, scope and value of Business plan, Elements of Business Plan, Objectives, Market and Feasibility Analysis, Marketing, Finance, Organization & Management.

Module 04: Venture Development

Steps involved in starting of Venture; Institutional support to an entrepreneur; Venture funding, requirements of Capital (Fixed and working) Sources of finance, problem of Venture set-up and prospects; Marketing: Methods, Channel of Marketing, Marketing Institutions and Assistance; New trends in entrepreneurship.

Text/Reference Books
1. Deepa, Prerna, Beeny, Business Planning & Entrepreneurial Management, Sheth Publishers Private Limited, Mumbai.
2. Robert J. Calvin, Entrepreneurial Management: Creating Successful Business Plans, Raising, Createspace Independent Publication.
3. Vasant Desai, Dynamics of Entrepreneurial Development. PHI.
4. CL Bansal, Entrepreneurship & Small Business Management, Haranand Publication.
5. Sami Uddin, Entrepreneurial Development in India, Mittal Publication, Delhi

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Semester - VII

(University Level Optional Course – III)

BT-2352   L-T-P-S-C
Green Technology   3-0-0-0-3

Pre-requisite   Basics of Chemistry and
Biology

Objectives: *This course is designed to emphasize on green systems and the environment, energy technology and efficiency, and sustainability and society. Also, this course seek opportunities for alternative sourcing, conservation, efficiency and re-purposing through an understanding of product life cycles from origins to recycling or inevitable disposal, to design products, processes etc.*

Course Outcome: *After completing this course students will be able to:*

1. *Understand the principles of green chemistry and engineering.*
2. *Design processes and products those are safe and hazard free, learn to modify chemical processes making hazardous products and make them green safe and economically acceptable by using biotechnology.*

PO1	PO6	PO7	PO9
1	1	1	1

Course Content

Module 01: Fundamentals of Green Chemistry and Technology

Principles of Green Chemistry and technology, green chemistry metrics (atom economy, atom efficiency, E-factor, and other green chemistry metrics).

Module 02: Catalysis

Introduction to catalysis, Catalytic cycle, TON, TOF, bio-catalysis

Module 3: Industrial Safety and Hazard analysis

Introduction to ISO standards, hazard identification, life cycle analysis, and safety aspects related to transport, handling and storage of hazardous chemicals. green technologies for addressing the problems of Water, Energy, Health, Agriculture and Biodiversity- WEHAB (eco-restoration/ phyto-remediation, ecological sanitation, renewable energy technologies, industrial ecology, agro ecology and other appropriate green technologies, global warming; greenhouse gas emissions, impacts, mitigation and adaptation.

Module 04: Green processes

Microwave assisted reactions, ultra-sonication assisted reactions, ionic liquids as solvent, water as a reaction medium, solvent free reactions, supercritical solvents, safe product and process design, case studies.

Module 05: Advances in separation process

Adsorption, Distillation, filtration, membrane separation, precipitation, crystallization

Module 05: Green Biotechnology

Green concepts in biotechnology, organic synthesis using supported microbes and enzymes in biopharmaceuticals/ bio refineries, bioreactor designs, downstream processing.

Module 05: Green Nanotechnology

Nanomaterials for water treatment, nanotechnology for renewable energy, nanotechnology for environmental remediation and waste Management, nanotechnology products as potential substitutes for harmful chemicals, environmental concerns with nanotechnology.

Text/Reference Books

1. Lancaster M. Green Chemistry – An introductory text. Royal Society of Chemistry. 2012.
2. Soares C.G. (Eds). Safety and Reliability of Industrial Products, Systems and Structures. CRC Press. 2010.
3. Afonso C.A.M. & Crespo J.G. (Ed)- Green separation processes- Wiley Press. 2005.

4. Soetaert W. & Wandamme R.J. Industrial biotechnology- sustainable growth and economic success. Wiley VCH. 2010.

Wilson B.R. & Jones W.J. Energy, Ecology and the Environment. Academic Press Inc. 2005.

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Semester - VII

(University Level Optional Course- III)

CE-3048   L-T-P-S-C
Environmental Management   3-0-0-0-3

Objective: *This course will students to understand and identify environmental issues relevant to India and global concerns; learn concepts of ecology and familiarize environment related legislations.*

Course Outcome: On successful completion of the course, the learners shall understand: the concept of environmental management; ecosystem and interdependence, food chain etc.; the interpretation of environment related legislations.

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
1	1	1	1	1	1	1	0	1	0	1	1	1	1

Course Content
Module 01: Introduction

Introduction and Definition of Environment: Significance of Environment Management for contemporary managers, Career opportunities. Environmental issues relevant to India, Sustainable Development, The Energy scenario

Module 02: Global Environmental concerns

Global Warming, Acid Rain, Ozone Depletion, Hazardous Wastes, Endangered life-species, Loss of Biodiversity, Industrial/Man-made disasters, Atomic/Biomedical hazards, etc.

Module 03: Concepts of Ecology

Ecosystems and interdependence between living organisms, habitats, limiting factors, carrying capacity, food chain, etc.

Module 04: Scope of Environment Management

Role & functions of Government as a planning and regulating agency. Environment Quality Management and Corporate Environmental Responsibility

Module 05: Total Quality Environmental Management

ISO-14000, EMS certification.

Module 06: General overview

Major legislations like Environment Protection Act, Air (P & CP) Act, Water (P & CP) Act, Wildlife Protection Act, Forest Act, Factories Act, etc.

Text/Reference Books

1. Environmental Management: Principles and Practice. Barrow C.J., Routledge Publishers London.1999.
2. A Handbook of Environmental Management. Edited by Lovett J.C. & Ockwell D.G. Edward Elgar Publishing
3. Environmental Management. Ramachandra T.V. & Kulkarni V. TERI Press.
4. Indian Standard Environmental Management Systems — Requirements With Guidance For Use. Bureau of Indian Standards. 2005.
5. Environmental Management: An Indian Perspective. Chary S.N. & Vyasulu V. Maclillan India. 2000.
6. Introduction to Environmental Management. Mary K Theodore and Louise Theodore. CRC Press.
7. Environment and Ecology. Majid Hussain. 3rd Ed. Access Publishing. 2015.

Digital Material

1. https://nptel.ac.in/courses/120108004/