COEP Technological University Pune

(A Unitary Public University of Govt. of Maharashtra)

School of Civil Engineering and Planning

Curriculum Structure with Evaluation Scheme
First and Second Year B. Tech. in

Civil Engineering

(F.Y. Structure Effective from: A.Y. 2023-24)

(S.Y. Structure Effective from: A.Y. 2024-25)

Curriculum of F.Y. and S.Y. B. Tech. in Civil Engineering

Program Educational Objectives (PEOs)

After the completion of the program

I. Student will be employable in the diversified sectors of the industry, government organizations, public sector and research organizations.

II. Student will pursue higher education in electrical engineering or other fields of their interests, at institutes of repute and high ranking.

III. Student will demonstrate effective communication, life long learning ability, integrity, team work, leadership qualities, concern to environment and commitment to safety, health, legal and cultural issues in the fields they choose to pursue.

Program Outcomes (POs):

Engineering Graduate will be able to:

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

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

PO3: Design/Development Solution: Design solution for complex engineering problems and design system component or process that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, social and environmental conditions.

PO4: Conduct Investigation of Complex Problem: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusion.

PO5: Method, Tool Usage: Create, select and apply appropriately technique, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with understanding the limitation.

PO6: The Engineer and Society: Apply reasoning informed by the contextual knowledge to access societal health, safety, legal and cultural and consequent responsibility relevant to the professional engineering practice.

PO7: Environment and Sustainability: Understand the impact of the professional engineering solution in societal and environmental context, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principle and commitment to professional ethics and responsibilities and norms of the engineering practices.

PO9: Individual and Team Work: Function effectively as an individual, and as themember or leader in diverse team and multidisciplinary setting.

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

PO11: Project management and Finance: Demonstrate knowledge & understanding of the engineering and management principles and apply these to ones work, as the member and teleader in a team to manage projects and in multidisciplinary environment.

PO12: Life Long Learning: Recognize the need for, and have the preparation and abilityto engage in independent and lifelong learning in broadest context of technological change.

Program Specific Outcome for Undergraduate (PSOs):

PSO1: Survey, map, plan and mark layouts for buildings and other structures.

PSO2: Specify, analyze, design, test and assess different structures with quality and safety aspect.

PSO3: Plan, analyze, and design water resources systems with effectiveness and sustainable environmental considerations.

List of Abbreviations

Abbreviation	Title
BS	Basic Science Course
ESC	Engineering Science Course
PCC	Programme Core Course (PCC)
PEC	Programme Elective Course (PEC)
OE/SE	Open/School Elective (OE/SE) other than particular program
MD M	Multidisciplinary Minor (MD M)
VSEC	Vocational and Skill Enhancement Course (VSEC)
HSMC	Humanities Social Science and Management
IKS	Indian Knowledge System (IKS)
VEC	Value Education Course (VEC)
RM	Research Methodology (RM)
--	Internship
--	Project
CEA	Community Engagement Activity (CEA)/Field Project
CCA	Co-curricular & Extracurricular Activities (CCA)

F.Y. B. Tech.
Civil Engineering

[Level 4.5, UG Certificate] Semester -I

Sr. No.	Course Type	Course Code	Course Name	L	T	P	S	Cr	Evaluation Scheme (Weightages in %)				
									Theory			Laboratory	
									MSE	TA	ESE	ISE	ESE
01	BSC	*<tbd>*	Matrix Algebra and Calculus	3	0	0	1	3	30	10	60	--	--
02	BSC	*<tbd>*	Engineering Chemistry	2	0	2	1	3	30	20	50	CIE: 100	
03	BSC	*<tbd>*	Biology for Engineers	2	0	0	1	2	30	20	50	--	--
04	ESC	*<tbd>*	Essentials of Civil Engineering	3	0	0	1	3	30	20	50	--	--
05	ESC	*<tbd>*	Sensors & Actuators in Civil Engineering	2	0	2	1	3	30	20	50	CIE: 100	
06	ESC	*<tbd>*	Engineering Drawing and Graphics	1	0	4	1	3	CIE: 100			CIE: 100	
07	AEC	*<tbd>*	Communication and Presentation skills	0	0	2	1	1	--	--	--	CIE: 100	
08	VSEC	*<tbd>*	Fab lab I	0	0	2	0	1	--	--	--	CIE: 100	
09	CCA	*<tbd>*	Liberal Learning course – I	0	0	2	2	1	--	--	--	CIE: 100	
			Total	**13**	**00**	**14**	**09**	**20**					

[Level 4.5, UG Certificate] Semester -II

Sr. No.	Course Type	Course Code	Course Name	L	T	P	S	Cr	Evaluation Scheme (Weightages in %)				
									Theory			Laboratory	
									MSE	TA	ESE	ISE	ESE
01	BSC	*<tbd>*	Vector Calculus and Differential Equations	3	0	0	1	3	30	10	60	--	--
02	BSC	*<tbd>*	Engineering Physics	2	0	2	1	3	30	20	50	CIE: 100	
03	ESC	*<tbd>*	Geomatic Engineering	3	0	2	1	4	30	20	50	CIE: 100	
04	ESC	*<tbd>*	Engineering Mechanics	3	0	2	1	4	30	20	50	CIE: 100	
06	VSEC	*<tbd>*	Computer Programming	1	0	2	2	2	CIE: 100			CIE: 100	
07	AEC	*<tbd>*	Language	0	0	2	0	1	--	--	--	CIE: 100	
08	CCA	*<tbd>*	Liberal Learning course – II	0	0	2	2	1	--	--	--	CIE: 100	
09	IKS	*<tbd>*	Indian Knowledge System	2	0	0	1	2	CIE: 100			--	--
			Total	**14**	**00**	**12**	**09**	**20**					

Legends: **L**-Lecture, **T**-Tutorial, **P**-Practical, **S**-Self Study, **Cr**-Credits
ISE-In-Semester-Evaluation, **ESE**-End-Semester-Evaluation, **MSE**-Mid-Semester-Evaluation, **TA**-Teachers' Assessment, **CIE**-Continuous-Internal-Evaluation

- Exit option to qualify for Certification, common at the School Level:
  - Plumbing Services (4 Credits)
  - Sustainable Construction Practices (4 Credits)
  - *Note: Exiting students need to take one SEC from his/her discipline and the other of his/her choice.*

S. Y. B. Tech. Civil Engineering

[Level 5, UG Diploma] Semester -III

Sr. No.	Course Type	Course Code	Course Name	L	T	P	S	Cr	Evaluation Scheme (Weightages in %)				
									Theory			Laboratory	
									MSE	TA	ESE	ISE	ESE
01	PCC	*<tbd>*	Fluid Mechanics	3	0	2	1	4	30	20	50	50	50
02	PCC	*<tbd>*	Strength of Materials	3	0	2	1	4	30	20	50	50	50
03	PCC	*<tbd>*	Building Construction and Design	3	0	2	1	4	30	20	50	50	50
04	OE	*<tbd>*	Open Elective – I (International Standards)	2	0	0	1	2	30	20	50	--	--
05	HSMC	*<tbd>*	Indian language	2	0	0	1	2	CIE: 100			--	--
06	VEC	*<tbd>*	Environmental Studies	1	0	0	2	1	CIE: 100			--	--
07	CEA	*<tbd>*	Community Engagement Activity (CEA)/Field Project	0	0	4	0	2	--	--	--	CIE: 100	
08	HSMC	*<tbd>*	Entrepreneurship	2	0	0	1	2	30	20	50	--	--
			Total	**16**	**00**	**10**	**08**	**21**					

[Level 5, UG Diploma] Semester -IV

Sr. No.	Course Type	Course Code	Course Name	L	T	P	S	Cr	Evaluation Scheme (Weightages in %)				
									Theory			Laboratory	
									MSE	TA	ESE	ISE	ESE
01	PCC	*<tbd>*	Geotechnical Foundation Engineering	3	0	2	1	4	30	20	50	50	50
02	PCC	*<tbd>*	Concrete Technology	3	0	2	1	4	30	20	50	50	50
03	PCC	*<tbd>*	Structural Mechanics	3	0	0	1	3	30	20	50	--	--
04	VEC-2	*<tbd>*	Constitution of India	1	0	0	1	1	CIE: 100			--	--
05	OE	*<tbd>*	Open Elective – II (Sustainable Finance)	2	0	0	1	2	30	20	50	--	--
06	HSMC	*<tbd>*	Design Thinking	1	0	2	1	2	30	20	50	CIE: 100	
07	VSEC	*<tbd>*	Plumbing Practices	2	0	0	2	2	CIE: 100				
08	MD M	*<tbd>*	Multidisciplinary Minor – I (Construction Materials and Building Design	3	0	0	1	3	30	20	50	--	--
			Total	**18**	**00**	**06**	**09**	**21**					

Legends: **L**-Lecture, **T**-Tutorial, **P**-Practical, **S**-Self Study, **Cr**-Credits
ISE-In-Semester-Evaluation, **ESE**-End-Semester-Evaluation, **MSE**-Mid-Semester-Evaluation, **TA**-Teachers' Assessment, **CIE**-Continuous-Internal-Evaluation

Exit option to qualify for UG Diploma:

- Sustainable Construction Practices (3 Credits)
- Construction Management (3 Credits)

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School of Civil Engineering and Planning

Curriculum Structure & Detailed Syllabus

F.Y. B. Tech.
Civil Engineering

(Effective from: A.Y. 2023-24)

F.Y. B. Tech. in
Civil Engineering

List of Abbreviations

Abbreviation	Title	No of Courses	Credits	% of Credits
BS	Basic Science Course	05	14	35
ESC	Engineering Science Course	05	17	42.5
PCC	Programme Core Course (PCC)	--	--	--
PEC	Programme Elective Course (PEC)	--	--	--
OE/SE	Open/School Elective (OE/SE) other than particular program	--	--	--
MD M	Multidisciplinary Minor (MD M)	--	--	--
VSEC	Vocational and Skill Enhancement Course (VSEC)	02	03	7.5
HSMC	Humanities Social Science and Management	01	02	5
IKS	Indian Knowledge System (IKS)	01	02	5
VEC	Value Education Course (VEC)	--	--	--
RM	Research Methodology (RM)	--	--	--
--	Internship	--	--	--
--	Project	--	--	--
CEA	Community Engagement Activity (CEA)/Field Project	--	--	--
CCA	Co-curricular & Extracurricular Activities (CCA)	02	02	5
	Total	**16**	**40**	**100**

Semester I

BS-01 Matrix Algebra and Calculus (MAC)	
Teaching Scheme	**Examination Scheme**
Lectures: 3 Hrs/ week	**Mid Sem Exam -** 30 marks
	Teacher's Assessment - 10 marks
	End Sem. Exam. - 60 marks

Course Outcomes: At the end of the course, the students are able to:
CO 1: Define matrices, linear equations, and determinants, recall basic matrix algebra, limits, continuity and derivatives of functions of single variable, indefinite and definite integrals and their properties.
CO 2: Solve a system of linear equations using matrices, verify MVTs, find Critical points and Monotonicity of functions of single variable, evaluate Beta, Gamma integrals
CO 3: Calculate eigen values, eigen vectors, rank of a matrix, find extreme values of functions, sketch curves, evaluate double and triple integrals.
CO 4: Apply concepts of calculus to find length of curves, areas, and volumes, including real life problems.
CO 5: Apply concepts of Matrix Algebra and Calculus to various problems including real life problems.

Unit 1	**Matrix Algebra** **[6Hrs]**
	Properties of Matrices and Determinants; Solutions of Systems of linear equations using Gauss Elimination method; Rank of a matrix; Eigen Values and Eigen Vectors; Applications S: Properties of Matrices and Determinants
Unit 2	**Differential Calculus** **[11 Hrs]**
	Functions of single variable; Limits: Standard limits and methods of evaluation, L-Hospital's Rule, Continuity and Differentiability; Extreme Values of Functions, The Mean Value Theorems, Monotonic Functions and The First Derivative Test, Concavity and Curve Sketching, Applied Optimization Problems. Functions of Several Variables, Partial Derivatives, The Chain Rule, Extreme Values and Saddle Points. S: Functions of single variable; Limits: Standard limits and methods of evaluation, L-Hospital's Rule; Continuity and Differentiability
Unit 3	**Integral Calculus** **[11 Hrs]**
	Beta function and Gamma Function; Double Integrals in cartesian and polar coordinates, Triple integrals in cartesian, cylindrical and spherical coordinates, Change of order of integration, Applications of single, double and triple integration in finding length of a curve, area under a curve, volume of solids. S: Beta function and Gamma Function, length of a curve, area under a curve.

Text Books:

1. Advanced Engineering Mathematics (10th edition) by Erwin Kreyszig, Wiley Eastern Ltd.
2. Thomas's Calculus (12th edition) by Maurice D. Weir, Joel Hass, Frank R. Giordano, Pearson Education.

Reference Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
2. Elementary Linear Algebra (Sixth Edition) by R. Larson and D. Falvo, Houghton Mifflin Harcourt Publishing company, Boston, New York.

Note:

- To measure CO1, questions may be of the type- define, identify, state, match, list, name etc.
- To measure CO2, questions may be of the type- explain, describe, illustrate, evaluate, give examples, compute etc.
- To measure CO3, questions will be based on applications of core concepts.
- To measure CO4, questions may be of the type- true/false with justification, theoretical fill in the blanks, theoretical problems, prove implications or corollaries of theorems, etc.
- To measure CO5, some questions may be based on self-study topics and comprehension of unseen passages.

BS-02 Engineering Chemistry	
Teaching Scheme	**Examination Scheme**
Lectures: 3 Hrs/ week	**Mid Sem Exam -** 30 marks
Practical : 2 hrs/week	**Teacher's Assessment** - 20 marks
Self study : 1 hrs/week	**End Sem. Exam.** - 50 marks

Course Outcomes: At the end of the course, the students are able to:
CO 1: Impart an understanding of Engineering chemistry's fundamental concepts, analytical methods and technological features.
CO 2: Develop the capacity to analyze engineering problems based on the knowledge of chemistry
CO 3: Develop problem-solving ability
CO 4: Keep students abreast of the newest advancements and uses of contemporary materials

Unit 1	**Analytical Techniques for Engineers** **[7Hrs]**
	• Role of materials in engineering fields. • Quality control and assurance in engineering contexts. • Qualitative and quantitative analysis • Emerging trends and applications of analytical techniques for engineering. • Instrumental methods of analysis: spectroscopy (UV and IR), chromatography (GLC and HPLC), Microscopy: SEM, Thermo-gravimetry: TGA
Unit 2	**Corrosion and material protection** **[6 Hrs]**
	• Introduction to corrosion and its impact on engineering materials • Mechanism, Types/forms of corrosion, Factors that enhance corrosion and choice of parameters to mitigate corrosion. • Corrosion prevention techniques, advanced surface coatings and corrosion inhibitors • Case studies and real-world applications in corrosion prevention
Unit 3	**Electrochemical energy systems** **[8 Hrs]**
	• High energy electrochemical energy systems: Lithium-ion batteries principle, construction, working, advantages and applications, Na-ion Battery, fiber battery • New emerging Fuel cells-working principles, advantages, applications • Solar cells, Types Importance of silicon single crystal, polycrystalline and amorphous silicon solar cells- working principles, characteristics and applications • Green hydrogen technology
Unit 4	**Nanomaterials for electronics** **[7 Hrs]**
	Nanomaterials, classification, Nanoscale phenomena and quantum effects • Top-down and bottom –up approach, Synthesis methods: ball milling, RF sputtering, pulsed laser deposition, thin film deposition • Applications of nanomaterials in electronics • Fundamentals of Sensors and materials used in sensors, Synthesis of a sensor. • Fundamentals of Super capacitor and materials used in super capacitor, Synthesis of a super capacitor

List of Recommended books:

1. Willard Dean, Merrittee, "Instrumental Methods of Chemical Analysis",Tata McGraw Hill Limited.
2. Gurdeep R. Chatwal,"Instrumental Methods of Chemical Analysis",Himalaya Publishing House.
3. Jain and Jain "A textbook of Engineering Chemistry", Dhanpatrai Publication.
4. S. S. Dara , "A textbook of Engineering Chemistry", S. Chand Publication 2010 ed.
5. Shashi Chawla, "A textbook of Engineering Chemistry", Dhanpatrai Publication.
6. Prof. Jianmin Ma, "Battery Technologies: Materials and Components", Wiley
7. Charles P. Poole, Frank J. Owens "Introduction to Nanotechnology"
8. Shripad Revankar, Pradeep Majumdar , "Fuel Cells"
9. Fuel Cell Fundamentals-Ryan O'Hayre, Suk-Won Cha
10. SuddhasatwaBasu, "Recent Trends in Fuel Cell Science and Technology"

@ 13-15 lectures per credit per course

Self-study - Green Chemistry (12 principles and industrial case study)

Engineering Chemistry Laboratory	
Teaching Scheme **Practical :** 2 hrs/week	**Examination Scheme** **CIE** - 100 marks

Course Outcomes: At the end of the course, the students are able to:
CO 1: Apply theoretical knowledge for practical use and solve engineering problems.
CO 2: Design and carry out scientific experiments, accurately record and analyze the results of experiments

	List of Experiments
	1. Preparation and standardization of analytical reagents 2. pH-metric analysis of a sample solution 3. Analysis of inorganic solution by spectroscopic method (Calorimetry) 4. Corrosion testing of electronic integrated circuits 5. Finding the Calorific value of fuel by Bomb calorimeter (GCV, LCV) 6. Flash point-fire point and cloud point-pour point of fuel/lubricant 7. Synthesis of nanomaterials by green route (co-precipitation method) 8. Synthesis of nanomaterial by Ball-milling technique 9. Synthesis of thin films by Spin-coating 10. Characterization of material obtained by Ball-milling technique
	Course Educational Objectives: **CEO1:**To impart an understanding of Engineering chemistry's concepts, analytical methods and technological features. **CEO2:**To acknowledge Laboratory Safety rules.

BS-03 Biology for Engineers	
Teaching Scheme	**Examination Scheme**
Lectures: 2 Hrs/ week	**Mid Sem Exam -** 30 marks
Self study : 1 hrs/week	**Teacher's Assessment** - 20 marks
	End Sem. Exam. - 50 marks

Course Outcomes: At the end of the course, the students are able to:
CO 1: Understand the overlapping areas between biology and engineering
CO 2: Observe the principles of biological organization with lessons of increasing efficiency of engineered technologies
CO 3: Analyze the analogies between biological and engineering processes
CO 4: Explore the basic biological principles as guiding elements for engineering structures and processes
CO 5: Appreciate the technological optimization of living systems

Unit 1	**Crosstalk between Biology and Engineering**	**[4Hrs]**
	a) Biologically inspired technologies: Case studies of designs in nature and inspired technologies, Biomemetics: Nature inspired material and mechanisms, Self-cleaning surfaces; Self-healing Bioconcrete, Biomining, Algorithms in nature, b) Contribution of engineering in biological domain: Contribution of Microscope, Imaging techniques, Bio-medical Instruments, Mechanisms (Ergonomics)	
Unit 2	**Organization of Living Machines**	**[8 Hrs]**
	Biomolecules and manufacturing of Biopolymers: • Carbohydrates (structure-based function and engineering applications) • Lipids (structure-based function and engineering applications) • Proteins (structure-based function and engineering applications) • Nucleic Acids (structure-based function and engineering applications) Organization of life forms: Cell to organism Bioenergetics- Energy dynamics in biological system- principles of energy conservation and optimization	
Unit 3	**Analogy of biological organ/system and engineering Device/Mechanism**	**[6 Hrs]**
	Organ & system: Brain & CPU, Eye & Camera, Kidney & Filtration system, Lungs & purification system, Heart & Pumping system Process: Photosynthesis & solar cells, Xylem & plumbing, Thermoregulation in human body & heat transfer in machine, Defense mechanism in organism, signaling processing in biology and electronics	
Unit 4	**Concepts in Bioengineering**	**[6 Hrs]**
	Biomechanics: Mechanical properties of tissues, Prosthesis and rehabilitation Bioprinting: 3D printing of biological tissues and organ engineering and transplanting Biomaterials: Types, properties and applications Tissue Engineering: Principle, Components, Methods of Scafold synthesis, properties and applications	

Unit 5	Application areas of Bioengineering [6 Hrs]
	Databases & Biocomputing: Acquisition, storage, processing and transmission of biological data and its applications like PCR Bioinstrumentation: Diagnostic and Therapeutic devices Bioimaging: Principle, types and examples Biosensors: Principle, types and examples Computational biology and application of Artificial Intelligence in bio-medical field

Suggested learning resources:

1. Lodish H, Berk A, Zipursky SL, et al. (2000)" Molecular Cell Biology" W. H. Freeman
2. Lehninger, A. L., Nelson, D. L., & Cox, M. M. (2000),"Lehninger principles of biochemistry" New York: Worth Publishers
3. Lewin B. (2000) "Genes VII" Oxford University Press
4. Rao CNR, et.al. , "Chemistry of Nanomaterials: Synthesis, Properties and Applications'
5. Eggins BR. (1006) , "Biosensors: An Introduction", John Wiley & Sons Publishers
6. Palsson B.O. and Bhatia S.N. (2009) "Tissue Engineering" Pearson

ES-01 Essentials of Civil Engineering

Teaching Scheme	Examination Scheme
Lectures: 3 Hrs/ week	**Mid Sem Exam -** 30 marks
Self Study: 1 hrs/week	**Teacher's Assessment** - 20 marks
	End Sem. Exam. - 50 marks

Course Outcomes: At the end of the course, the students are able to:
CO 1: Demonstrate different terminologies related to Civil Engineering.
CO 2: Select suitable structural component or structure, services in a particular situation.
CO 3: Apply the various concepts of environmental engineering in practice.
CO 4: Assess suitability of material or type of foundation in a particular situation.
CO 5: Choose provision of dam, weir, barrage or water conservation structures.

Unit 1	**Introduction to Civil Engineering and Civil Engineering Materials [6Hrs]**
	Introduction, Branches, Scope and Role of Civil Engineering, List of materials, Type, Properties, Uses of materials: Cement, Aggregate, Brick, Steel, Concrete, Stone, Soil, Mortar, Timber, Plastic, Fly ash, Steel slag, Bitumen, Pipe, Wire, Cable.
Unit 2	**Building Planning and Transportation [7 Hrs]**
	Principles of planning, orientation of buildings, introduction to 'Byelaws' regarding building line, height of building, open space requirements, F.S.I., Setbacks, ventilation, sanitation. Role of transportation in national development, Types of roads: Introductions to NH, SH, MDR, ODR, VR, and Expressway. Cross section of road, Transportation system-BRTS, Metro. Railway: Introduction, Gauges, Cross section.
Unit 3	**Building Construction and Building Services [7 Hrs]**
	Type of building, Component of building and its functions, types of load acting on building, types of brick bonds, typical building layout, Symbol used for water supply, plumbing, and sanitation. Types of building services like plumbing and sanitation, electricity, building finishes.
Unit 4	**Foundation for Structures [6 Hrs]**
	Introduction to foundation, Types of foundation and their suitability, Soil type as foundation strata, Concept of bearing capacity, ultimate, safe and presumptive bearing capacity, Shallow foundation and Deep foundations, Modes of failure.
Unit 5	**Water Management [7 Hrs]**
	Elementary Hydrology, Sources of Water, Watershed Development, Water conservation, Basic Introduction of Hydraulic Structures: dam, weirs and barrages, Irrigation methods.
Unit 6	**Environmental Engineering [7 Hrs]**
	Sources and effects of air pollutants on environmental, Air Pollution control devices. Noise Pollution Sources, Noise characteristics, measurement of noise, Effects of noise, Control of noise. Sources of water and wastewater, water supply and drainage system, characteristics of water and wastewater and process flowchart of water and wastewater

	treatment, Sustainable solid waste management. Introduction to environmental impact assessment.

Text Books:

1. Arora S. P. and Bindra S.P., "Building Construction", Dhanpat Rai and Sons, Delhi.
2. Duggal S.K., "Surveying", Volume I, Tata Mc Graw Hill Publishing Company Limited New Delhi, Edition 2013
3. Rajvir Singh, "Watershed Planning and Management", Yash Pulishing House, Jaipur, India 3rd Edition 2016
4. Punmiya B.C., A.K.Jain and Ashok kumar Jain, "Soil Mechanics and Foundations", Laxmi Publications Pvt Ltd, New Delhi
5. Shah, Kale and Patki, "Building Design and Drawing", Tata Mc Graw Hill, New Delhi
6. K.A.Patil and I.K.Pateriya, "Basic Civil Engineering", Shree Laxmi Prakashan, Aurangabad.
7. Garg S.K. "Water Resources Engineering, Volume I", Khanna Publishers, New Delhi
8. Garg S.K. "Water Resources Engineering, Volume II", Khanna Publishers, New Delhi
9. Punmiya B.C., Ashok kumar Jain and A.K. Jain, "Water Supply Engineering", Laxmi Publications Pvt Ltd, New Delhi
10. Punmiya B.C., Ashok kumar Jain and A.K. Jain, "Waste Water Engineering and Air Pollution", Laxmi Publications Pvt Ltd, New Delhi

Reference Books:

3. E.M. Tideman," Watershed Management: Guidelines for Indian Conditions", Omega Scientific Publishers.
4. Sushil Kumar, "Building Construction", Standard Publishers Distributors, Nai Sarak Delhi.

HSMC-01A Communication and Professional Skills	
Teaching Scheme **Practical:** 2 Hrs/ week **Self Study:** 1 hrs/week	**Examination Scheme** **CIE -** 100 marks

Course Outcomes: At the end of the course, the students are able to:
CO 1: Recall and use basic language skills-listening, speaking, reading and writing and attempt tasks using grammar and vocabulary efficiently
CO 2: Understand the concepts/ principles of communication skills and structure conversations effectively
CO 3: Develop the knack to make their point of view clear to the audience and portray their communicative competence efficiently in front of a large audience on a variety of relevant situations
CO 4: Analyze, apply and present themselves competently in all formal spheres

Unit 1	**Introduction to English for Engineers [2Hrs]**
	Varieties and Registers of English, English for Specific Purposes (ESP): Business English
Unit 2	**Foundation of Communicative and Linguistic Ability Development [4Hrs]**
	Types of Communication, Process of Communication, Barriers and ways to overcome them, Common Challenges: Phonological, Syntactic, Semantic and Pragmatic Errors
Unit 3	**Advanced Speaking Skills [4 hrs]**
	Nuances of Speaking Skills/ Public Speaking, Group Communication, Presentation Skills: The 4 P's of Presentation, Do's and Don'ts, Techniques for Effective Delivery
Unit 4	**Business Writing Development [4Hrs]**
	Techniques of Writing: Note-making, Drafting, Editing, Paraphrasing and Proof-reading, Business Letters, Emails and Brief Reports

HSMC-01B Practical Activity and Exposure Oriented T & L Methodology	
Teaching Scheme **Practical:** 2 Hrs/ week **Self Study:** 1 hrs/week	**Examination Scheme** **CIE -** 100 marks

Unit 1	**Foundation of Language Learning Skills**	**[2Hrs]**
	Receptive Skills: Listening and Reading; Productive Skills: Speaking and Writing; Grammaticality and Appropriateness; Vocabulary Development	
Unit 2	**Listening Skills**	**[4Hrs]**
	Stages of Listening (pre, while and post), Strategies to Develop Active Listening Skills, Problematic Sounds for Indian Users	
Unit 3	**Speaking Skills**	**[4 hrs]**
	Oral Communication, Sounds in English, Pronunciation, Stress, Intonation and Pauses, Formal and Informal Expressions, Situational Conversations, Group Discussion	
Unit 4	**Reading and Writing Skills**	**[4Hrs]**
	Reading Techniques: Scanning and Skimming, Active Reading; Common Problems in Reading; Stages of Writing (pre, while and post), 7 Cs of Effective Communication; Letter/ Email writing- drafting, editing, summarizing	

CCA-01 Liberal Learning course - I	
Teaching Scheme **Practical:** 2 Hrs/ week **Self Study:** 2 hrs/week	**Examination Scheme** **CIE -** 100 marks

Course Outcomes: At the end of the course, the students are able to:
CO 1: TBI
CO 2:
CO 3:
CO 4:

	Humanities & Social Sciences
	Agriculture, Defence, History, Holistic Health, Geography, Political Science, Interior Design etc.

Semester - II

BS-04 Vector Calculus and Differential Equations (VCDE)	
Teaching Scheme	**Examination Scheme**
Lectures: 3 Hrs/ week	**Mid Sem Exam -** 30 marks
Self Study: 1 hrs/week	**Teacher's Assessment** - 10 marks
	End Sem. Exam. - 60 marks

Course Outcomes: At the end of the course, the students are able to:
CO 1: Understand basic concepts of vector calculus, ODE and PDE
CO 2: list types of ordinary differential equations and partial differential equations, find Laplace Transforms of simple functions.
CO 3: Solve different ODEs and PDEs, find divergence and curl of vector fields.
CO 4: Apply concepts of Fourier Series to solve PDEs, evaluate line and surface integrals.
CO 5: Apply concepts of vector calculus, ODE and PDE to solve real life application problems.

Unit 1	**Vector Calculus** **[9Hrs]**
	Vectors in 2-Space, 3-Space, Dot and Cross Product of Vectors, Derivatives of Vector Valued Functions, Gradient of a Scalar Field and Directional Derivatives, Divergence and Curl of a Vector Field, Line, Surface and Volume Integrals and their interrelations to find work done, flux and divergence. S: Vectors in 2-Space, 3-Space, Dot, and Cross Product of Vectors
Unit 2	**Ordinary Differential Equations** **[9 Hrs]**
	First order Ordinary Differential Equations - Variable Separable, Homogeneous, Linear; Higher order linear equations with constant coefficients; Euler-Cauchy equations, non-homogeneous higher order linear differential equations with constant coefficients (method of undetermined coefficients and method of variation of parameters); Laplace Transform of simple functions, Inverse Laplace Transform, Properties and Theorems of Laplace Transforms; Applications to Initial and Boundary value problems. S: first order variable separable, homogeneous, Linear differential equations
Unit 3	**Partial Differential Equations** **[10 Hrs]**
	Fourier Series; Method of Separation of Variables; Solutions of one-dimensional diffusion equation, first and second order one-dimensional wave equation. S: Modeling of one-dimensional diffusion equation

Text Books:

1. Advanced Engineering Mathematics (10th edition) by Erwin Kreyszig, Wiley eastern Ltd.

Reference Books:

1. Thomas' Calculus (14th edition) by Maurice D. Weir, Joel Hass, Frank R. Giordano, Pearson Education.
2. Calculus for Scientists and Engineers by K.D Joshi, CRC Press.
3. A course in Calculus and Real Analysis (1st edition) by Sudhir Ghorpade and Balmohan Limaye, Springer-Verlag, New York.
4. Applied Mathematics Vol.1 (Reprint July 2014) by P.N. Wartikar and J.N. Wartikar, Pune Vidhyarthi Griha Prakashan Pune.

Note:

- To measure CO1, questions may be of the type- define, identify, state, match, list, name etc.

- To measure CO2, questions may be of the type- explain, describe, illustrate, evaluate, give examples, compute etc.

- To measure CO3, questions will be based on applications of core concepts.

- To measure CO4, questions may be of the type- true/false with justification, theoretical fill in the blanks, theoretical problems, prove implications or corollaries of theorems, etc.

- To measure CO5, some questions may be based on self-study topics and comprehension of unseen passages.

BS-05 Engineering Physics

Teaching Scheme	Examination Scheme
Lectures: 3 Hrs/ week	**Mid Sem Exam -** 30 marks
Practical: 2 Hrs/week	**Teacher's Assessment** - 20 marks
Self Study : 1 hrs/week	**End Sem. Exam.** - 50 marks
	Lab - Continuous-Internal-Evaluation **-** 100 marks

Course Outcomes: At the end of the course, the students are able to:
CO 1: Apply the concepts of Quantum mechanics to one dimensional motion of electrons
CO 2: Classify solids on the basis of Band theory and to calculate carrier concentrations
CO 3: Evaluate the electrical conductivity and identify the type of semiconductor
CO 4: Implement the fundamentals of LASER for different applications

Unit 1	**Quantum Mechanics**	**[8Hrs]**
	Matter waves, Properties of matter waves, Physical significance of wave function. Schrödinger's time dependent and time independent equations, Operators, Eigen values and Eigen functions, Expectation values, Applications of Schrödinger's equation; Motion of a free particle, Electron in an infinite deep potential well (rigid box), Electron in a finite deep potential well (non-rigid box)	
Unit 2	**Solid State Physics**	**[7 Hrs]**
	lattice parameters, Miller indices, inter planer distance of lattice plane, density of crystals (linear, planar and volume), So¨mmerfield's free electron theory, Density of states (3D), Fermi-Dirac probability function, Nearly free electron theory (E-k curve), classification of solids on the basis of band theory	
Unit 3	**Semiconductor Physics**	**[8 Hrs]**
	Electron and hole concentrations in semiconductors, intrinsic density, intrinsic and Extrinsic conductivity, Position of Fermi level in intrinsic and extrinsic semiconductors, Law of mass action, Temperature variation of carrier concentration in extrinsic semiconductors, Electrical conduction in extrinsic semiconductor, Hall Effect	
Unit 4	**Laser Physics**	**[7 Hrs]**
	Introduction to laser, Spontaneous and stimulated emission of radiations, Thermal equilibrium, Condition for Light amplification, Population inversion, Pumping (Three level and four level pumping), Optical resonator, Laser beam characteristics, Ruby laser, Nd-YAG Laser, He-Ne Laser, Semiconductor Laser, Engineering applications of Laser (Fiber optics, Laser material interaction)	

BS-05 Engineering Physics Laboratory	
Teaching Scheme	**Examination Scheme**
Practical: 2 Hrs/week	**Lab -** Continuous-Internal-Evaluation **-** 100 marks

Course Outcomes: At the end of the course, the students are able to:
CO 1:
CO 2:
CO 3:
CO 4:

Unit 1	
Unit 2	
Unit 3	
Unit 4	

ES-04 Geomatic Engineering

Teaching Scheme	Examination Scheme
Lectures: 3 Hrs/ week	**Mid Sem Exam -** 30 marks
Practical: 2 Hrs/week	**Teacher's Assessment** - 20 marks
	End Sem. Exam. - 50 marks
	Lab - Continuous-Internal-Evaluation **-** 100 marks

Course Outcomes: At the end of the course, the students are able to:
CO 1: Apprehend the fundamental concepts and applications of various map types, coordinate systems, and datums.
CO 2: Apply land surveying principles, including the use of levels and total stations, to collect accurate field data.
CO 3: Analyze the operation and advanced functionalities of total station technology to support surveying and engineering tasks.
CO 4: Create engineering drawings using AutoCAD software, demonstrating a comprehensive understanding of the program's components and commands.

Unit 1	**[6Hrs]**
	Maps- Importance of maps to engineering projects, Types of maps, Scales and uses, Plotting accuracy, Map sheet numbering, Coordinate systems- Cartesian and geographical, map projections, map datum – MSL, Geoid, spheroid, WGS-84.
Unit 2	**[7 Hrs]**
	Land Surveying- Various Levels, Levelling methods, Introduction to total station and Tachometer.
Unit 3	**[7 Hrs]**
	Total station settings, parts of total station, uses of total station, Total station set up on station, different adjustment in total station
Unit 4	**[6 Hrs]**
	Height measurement by Total station, Distance, and angle measurement by Total station
Unit 5	**[7 Hrs]**
	Area measurement by Total station, Resection and offset setting by Total station
Unit 6	**[7 Hrs]**
	Introduction to AUTO-CAD, Basic components of AUTO-CAD, Drawings using AUTO-CAD

Text Books:

1. Kanetkar T.P. and Kulkarni S.V. "Surveying and Levelling – Part1", Pune Vidyarthi Griha Prakashan, Pune.
2. Kanetkar T.P. and Kulkarni S.V. "Surveying and Levelling – Part2", Pune Vidyarthi Griha Prakashan, Pune.

Reference Books:

1. Duggal S. K. "Surveying Volume I", Tata McGraw-Hill Publishing Company Limited. Duggal S. K. "Surveying Volume II", Tata McGraw-Hill Publishing Company Limited. Bannister A, Raymond S & Baker R. "Surveying", Pearson Education Ltd.
2. Subramanium R., "Surveying & Levelling", Oxford University Press. 52
3. Clark David, "Plane and Geodetic Surveying for Engineers Volume–I", CBS, 6/E.
4. Clark David, " Plane and Geodetic Surveying for Engineers Volume –II", CBS, 6/E Clendinning J. "Principles of Surveying", Blackie
5. Punmia B. C. "Surveying-I", Laxmi Publications (P) Ltd. New Delhi
6. Punmia B. C., Jain A, Jain A., "Surveying-II", Laxmi Publications (P) Ltd. New Delhi

ES-05 Engineering Mechanics

Teaching Scheme	**Examination Scheme**
Lectures: 3 Hrs/ week	**Mid Sem Exam -** 30 marks
Practical: 2 Hrs/week	**Teacher's Assessment** - 20 marks
	End Sem. Exam. - 50 marks
	Lab - Continuous-Internal-Evaluation **-** 100 marks

Course Outcomes: At the end of the course, the students are able to:
CO 1: Apply Mechanics principles to find resultant and equilibrium of general force systems.
CO 2: Evaluate forces in statically determinate trusses and cables using equations of static equilibrium.
CO 3: Determine reactions and internal forces of beams using principles of statics.
CO 4: Apply laws of dry friction for engineering problems.
CO 5: Solve engineering problems on motion of a particle.

Unit 1	**Concurrent Force system**	**[6 Hrs]**
	Forces, Free-Body Diagrams, Resultant and Equilibrium of Two-dimensional and Three-dimensional concurrent force System (2D and 3D).	
Unit 2	**General Force system**	**[6 Hrs]**
	Moment vector, Couples, Equivalent Force systems, Resultant and Equilibrium of Two-dimensional (2D) general force System.	
Unit 3	**Structures in Equilibrium**	**[8 Hrs]**
	Beams, Trusses, Cables, Dry Friction for inclined planes, Belt friction.	
Unit 4	**Internal Forces in Determinate Beams**	**[8 Hrs]**
	Shear and Bending Moment in a Beam, Shear and Bending-Moment Diagrams, Relations among Load, Shear, and Bending Moment.	
Unit 5	**Motion of a Point**	**[7 Hrs]**
	Position, Velocity and Acceleration, Straight Line motion, Curvilinear Motion, Cartesian coordinates, normal & tangential coordinates and polar coordinates. Relative motion.	
Unit 6	**Forces, Mass and Acceleration**	**[7 Hrs]**
	Newton's second law, Work-Energy Principle, Impulse-Momentum Principle, Direct central impact.	

Text Books:

1. Hibbeler R. C., "Engineering Mechanics - Statics", 14th Edition, Prentice Hall Hibbeler R. C., "Engineering Mechanics - Dynamics" , 14th Edition, Prentice Hall
2. Beer F. P., Johnston E. R. et al., "Vector Mechanics for Engineers: Statics Dynamics", 12th Edition, McGraw-Hill Publication

Reference Books:

1. Meriam J. L., Kraige L. G., "Engineering Mechanics - Statics", John Wiley and Sons, 8th Edition
2. Meriam J. L., Kraige L. G., "Engineering Mechanics - Dynamics", John Wiley and Sons, 8th Edition A.
3. Bedford and W. Fowler, "Engineering Mechanics - Statics and Dynamics", Pearson Publications

CCA-02 Liberal Learning course - II	
Teaching Scheme **Practical:** 2 Hrs/ week **Self Study:** 2 hrs/week	**Examination Scheme** **CIE -** 100 marks

Course Outcomes: At the end of the course, the students are able to:
CO 1: TBI
CO 2:
CO 3:
CO 4:

	Performing Arts
	Music (Vocal), Music (Instrumental), Dance, Photography, Painting, Theatre & Film Appreciation, Clay Art & Pottery etc.

HSMC-02 Indian Knowledge System	
Teaching Scheme **Practical:** 2 Hrs/ week **Self Study:** 1 hrs/week	**Examination Scheme** **CIE -** 100 marks

Course Outcomes: At the end of the course, the students are able to:
CO 1: TBI
CO 2:
CO 3:
CO 4:

Unit 1	**[4Hrs]**
	Basics of Ancient Indian Knowledge and diverse fields from health (Yoga), Agriculture, performing arts etc.
Unit 2	**[8Hrs]**
	Ancient Indian Knowledge in various Science streams like physics, chemistry, biology, forestry, mathematics etc.
Unit 3	**[8 Hrs]**
	Ancient Indian Knowledge in Civil Engineering, Metallurgy, Mechanical Sciences, Textile Technology etc
Unit 4	**[8 Hrs]**
	Ancient Indian Knowledge in Electrical, Electronics, Computational Studies, Instrumentation etc.

Reference Books:

1. TBI

Exit Option

To qualify for Certification, Common at the School Level

Note: Exiting students need to take one SEC from his/her discipline and the other of his/her choice

COEP Technological University Pune

(A Unitary Public University of Govt. of Maharashtra)

School of Civil Engineering and Planning

Curriculum Structure and Detailed Syllabus

S.Y. B. Tech.
Civil Engineering

(Effective from: A.Y. 2024-25)

S. Y. B. Tech. Civil Engineering

[Level 5, UG Diploma] Regular Students, Semester -III

Sr. No.	Course Type	Course Code	Course Name	L	T	P	S	Cr	Evaluation Scheme (Weightages in %)				
									Theory			Laboratory	
									MSE	TA	ESE	ISE	ESE
01	PCC	*<tbd>*	Fluid Mechanics	3	0	2	1	4	30	20	50	50	50
02	PCC	*<tbd>*	Strength of Materials	3	0	2	1	4	30	20	50	50	50
03	PCC	*<tbd>*	Building Construction and Design	3	0	2	1	4	30	20	50	50	50
04	OE	*<tbd>*	Open Elective – I (International Standards)	2	0	0	1	2	30	20	50	--	--
05	HSMC	*<tbd>*	Indian language	2	0	0	1	2	CIE: 100			--	--
06	VEC	*<tbd>*	Environmental Studies	1	0	0	2	1	CIE: 100			--	--
07	CEA	*<tbd>*	Community Engagement Activity (CEA)/Field Project	0	0	4	0	2	--	--	--	CIE: 100	
08	HSMC	*<tbd>*	Entrepreneurship	2	0	0	1	2	30	20	50	--	--
			Total	**16**	**00**	**10**	**08**	**21**					

[Level 5, UG Diploma] Regular Students, Semester -IV

Sr. No.	Course Type	Course Code	Course Name	L	T	P	S	Cr	Evaluation Scheme (Weightages in %)				
									Theory			Laboratory	
									MSE	TA	ESE	ISE	ESE
01	PCC	*<tbd>*	Geotechnical Foundation Engineering	3	0	2	1	4	30	20	50	50	50
02	PCC	*<tbd>*	Concrete Technology	3	0	2	1	4	30	20	50	50	50
03	PCC	*<tbd>*	Structural Mechanics	3	0	0	1	3	30	20	50	--	--
04	VEC-2	*<tbd>*	Constitution of India	1	0	0	1	1	CIE: 100			--	--
05	OE	*<tbd>*	Open Elective – II (Sustainable Finance)	2	0	0	1	2	30	20	50	--	--
06	HSMC	*<tbd>*	Design Thinking	1	0	2	1	2	30	20	50	CIE: 100	
07	VSEC	*<tbd>*	Plumbing Practices	2	0	0	2	2	CIE: 100				
08	MD M	*<tbd>*	Multidisciplinary Minor – I (Construction Materials and Building Design	3	0	0	1	3	30	20	50	--	--
			Total	**18**	**00**	**06**	**09**	**21**					

Legends: **L**-Lecture, **T**-Tutorial, **P**-Practical, **S**-Self Study, **Cr**-Credits
ISE-In-Semester-Evaluation, **ESE**-End-Semester-Evaluation, **MSE**-Mid-Semester-Evaluation, **TA**-Teachers' Assessment, **CIE**-Continuous-Internal-Evaluation

Exit option to qualify for UG Diploma:

- Sustainable Construction Practices (3 Credits)
- Construction Management (3 Credits)

S. Y. B. Tech. Civil Engineering

[Level 5, UG Diploma] Lateral Entry Students- Semester -III

Sr. No.	Course Type	Course Code	Course Name	L	T	P	S	Cr	Evaluation Scheme (Weightages in %)				
									Theory			Laboratory	
									MSE	TA	ESE	ISE	ESE
01	PCC	*<tbd>*	Fluid Mechanics	3	0	2	1	4	30	20	50	50	50
02	PCC	*<tbd>*	Strength of Materials	3	0	2	1	4	30	20	50	50	50
03	PCC	*<tbd>*	Building Construction and Design	3	0	2	1	4	30	20	50	50	50
04	BS-06	<tbd>	Mathematics	3	0	0	1	3	30	10	60	---	---
04	OE	*<tbd>*	Open Elective – I (International Standards)	2	0	0	1	2	30	20	50	--	--
05	HSMC	*<tbd>*	Indian language	2	0	0	1	2	CIE: 100			--	--
06	VEC	*<tbd>*	Environmental Studies	1	0	0	2	1	CIE: 100			--	--
07	CEA	*<tbd>*	Community Engagement Activity (CEA)/Field Project	0	0	4	0	2	--	--	--	CIE: 100	
08	HSMC	*<tbd>*	Entrepreneurship	2	0	0	1	2	30	20	50	--	--
			Total	**19**	**00**	**10**	**09**	**24**					

[Level 5, UG Diploma] Lateral Entry Students- Semester -IV

Sr. No.	Course Type	Course Code	Course Name	L	T	P	S	Cr	Evaluation Scheme (Weightages in %)				
									Theory			Laboratory	
									MSE	TA	ESE	ISE	ESE
01	PCC	*<tbd>*	Geotechnical Foundation Engineering	3	0	2	1	4	30	20	50	50	50
02	PCC	*<tbd>*	Concrete Technology	3	0	2	1	4	30	20	50	50	50
03	PCC	*<tbd>*	Structural Mechanics	3	0	0	1	3	30	20	50	--	--
04	VEC-2	*<tbd>*	Constitution of India	1	0	0	1	1	CIE: 100			--	--
05	OE	*<tbd>*	Open Elective – II (Sustainable Finance)	2	0	0	1	2	30	20	50	--	--
06	HSMC	*<tbd>*	Design Thinking	1	0	2	1	2	30	20	50	CIE: 100	
07	VSEC	*<tbd>*	Plumbing Practices	2	0	0	2	2	CIE: 100				
08	MD M	*<tbd>*	Multidisciplinary Minor – I (Construction Materials and Building Design	3	0	0	1	3	30	20	50	--	--
09	HSMC	<tbd>	Communication Skills	1	0	2	0	2	CIE:100			CIE:100	
			Total	**19**	**00**	**08**	**09**	**23**					

Legends: **L**-Lecture, **T**-Tutorial, **P**-Practical, **S**-Self Study, **Cr**-Credits
ISE-In-Semester-Evaluation, **ESE**-End-Semester-Evaluation, **MSE**-Mid-Semester-Evaluation, **TA**-Teachers' Assessment, **CIE**-Continuous-Internal-Evaluation

Exit option to qualify for UG Diploma:

- Sustainable Construction Practices (3 Credits)
- Construction Management (3 Credits)

Semester III

PCC-01 Fluid Mechanics	
Teaching Scheme	**Examination Scheme**
Lectures: 3 Hrs/ week	**Mid Sem Exam -** 30 marks
Practical: 2 Hrs/week	**Teacher's Assessment** - 20 marks
	End Sem. Exam. - 50 marks
	Lab – Mid Sem/End Sem - 50 marks each

Course Outcomes: At the end of the course, the students are able to:
CO 1: Demonstrate different terminologies in fluid mechanics fundamentals, including concepts of mass and momentum conservation.
CO 2: Compute different parameters related to fluid static, fluid kinetics and fluid dynamics.
CO 3: Compute different parameters related to laminar flow, turbulent flow, boundary layer theory and flow through pipes
CO 4: Compute discharge through pipes, notches and weir
CO 5: Compute different parameters related to open channel flow and hydraulic machinery

Unit 1	**Properties of Fluid and Dimensional Analysis and Model studies: [6 Hrs]**
	Properties of Fluid: Physical properties of fluids: density, specific weight, specific volume, relative density, Newton's Law of Viscosity, Dynamic and kinematic viscosity, Classification of fluids, Rheological diagram, Newtonian and Non-Newtonian fluids, ideal and real fluids, compressibility, cohesion, adhesion, surface tension, capillarity, vapour pressure. **Dimensional Analysis and Model studies:** Dimensions of physical quantities, Dimensional homogeneity, Dimensional analysis using Buckingham's Pai theorem, important dimensionless parameters and their significance. Geometric; Kinematic and Dynamic similitude; Model laws, Type of models, Applications of dimensional analysis and studies to fluid flow problems.
Unit 2	**Fluid Statics and Buoyancy and Floatation [6 Hrs]**
	Fluid Statics: The basic equation of hydrostatics, concept of pressure head, Measurement of pressure datum (absolute, gauge), Application of the basic equation of hydrostatics. Piezometers, Simple and differential manometers, inclined manometers, Introduction to pressure transducers. Total pressure, Center of pressure for plane and curved surfaces, Pressure Diagrams, Practical applications (gate, dams, lock gates). **Buoyancy and Floatation:** Principle of floatation and Buoyancy, Equilibrium of floating bodies, Stability of Floating bodies, metacentre, metacentric height and its determination (experimental and analytical), Stability of submerged bodies. Relative Equilibrium of liquids: Fluid masses subjected to uniform linear acceleration and rotational.

Unit 3	**Fluid Kinematics, Dynamics, Flow over Notches and Weirs [8 Hrs]**
	Fluid Kinematics: Methods for describing the motion of fluid; Velocity and acceleration of fluids, Type of flow: Steady and unsteady, uniform and nonuniform, Laminar and Turbulent, one, two and three dimensional flows in Cartesian co-ordinate, Equation for one dimensional flow along a streamline, Rotational and irrotational motions, Circulation and vorticity, Derivation of Cauchy's Riemann equation, Velocity potential, stream function and flow net, Method of drawing flow net, use and limitation of flow net **Fluid Dynamics:** Forces acting on fluid mass in motion, Euler's equation of motion along a streamline and its integration, Assumptions of Bernoulli's equation, Kinetic energy correction factor, Hydraulic Grade line and total energy line, Linear momentum equation and momentum correction factor, angular momentum, Application of continuity, Bernoulli and momentum equations. Flow through orifices and mouthpieces under free and submerged condition, venturi meter, orifice meter, Nozzle meter, rotameter and pitot tube. **Flow over Notches and Weirs:** Classification of notches and weirs, Discharges over a sharp crested rectangular notch, velocity approach, end contractions, discharges over a triangular notch, trapezoidal notch, Cippoletti notch, Ventilation of weir, time required to empty a tank.
Unit 4	**Laminar Flow and Boundary Layer Theory [7 Hrs]**
	Laminar Flow: Reynolds Experiment, Laminar flow through a circular pipe, Flow between tow fixed parallel plates, Stoke's law, Methods of measurement of viscosity, Flow through porous media, Darcy's law, Transition from laminar to turbulent flow. **Boundary Layer Theory:** Development of boundary layer on a flat plate, Nominal, displacement, momentum and Energy thicknesses. Laminar, turbulent and transitional boundary layer, Application of momentum equation for boundary layer development, Local and mean drag coefficient, Hydro dynamically smooth and rough boundaries, Boundary layer separation and its control.
Unit 5	**Flow through pipes and Turbulent Flow [7 Hrs]**
	Flow through pipes: Energy losses in pipe flow (major and minor losses), Flow through pipes such as simple, compound, parallel, branched pipes and siphons, Dupit's equation, Hydraulic transmission of power through pipes, introduction to three reservoir problem and pipe network. **Turbulent Flow:** Characteristics of turbulent flow, instantaneous velocity, temporal velocity, scale of turbulence and intensity of turbulence, semi-empirical theories to estimates shear stress in turbulent flows using Boussinesq's theory, Prandtl's mixing length theory, velocity distribution in turbulent flow, Prandtl's velocity distribution equation, Karman Prandtl velocity distribution equations for smooth and rough boundaries, Equation for mean velocity for pipes, Darcy flow; Nikuradse's experiments on artificially roughened pipe, Friction factor for commercial pipes. Moody's diagram, explicit equation for friction factor
Unit 6	**Fundamentals of Open Channel Flow and Introduction of Hydraulic Machinery [6 Hrs]**
	Fundamentals of Open Channel Flow: Difference between pipe flow and open channel flow. Types of open channel flow. Uniform and Nonuniform flow. Concept of specific energy and specific force. Sub-critical, critical and super-critical flow, type of channel transition, Continuity Equation and Momentum Equation for open channel flow.

	Introduction to Hydraulic Machinery: Concept of impact of jet. Jet impinging on a stationary plate, jet impinging on a moving plate (straight and inclined). Jet striking the plates mounted on a circular wheel. Types of Turbines (Pelton Wheel and Reaction Turbine). Types of Pumps.

Text Books:

1. Modi, P. N. and S. N. Seth " Hydraulics and Fluid Mechanics", Standard book house, New Delhi, ISBN: 978-81-89401-26-9.
2. Bernard Massey and John Ward Smith, " Mechanics of Fluids", Taylor and Francis, 8 Edition (2006) London and New York.
3. Douglas J. F. Gaisorek J. M. , Swaffield J. A., "Fluid Mechanics" Addison-Weisley Harlow 1999.
4. Shames I. H., " Mehcanics of Fluids", Mc Graw-Hill, New York 1992.

Reference Books:

1. R. J. Garde and Mirajgaonkar, " Fluid Mechanics Through Problems", New Age International.
2. Streeter V.L. Wylie E. Benjamin, "Fluid Mechanics ", Mc Graw Hil, London, 1998.

PCC-02 Strength of Materials	
Teaching Scheme	**Examination Scheme**
Lectures: 3 Hrs/ week	**Mid Sem Exam -** 30 marks
Practical: 2 Hrs/week	**Teacher's Assessment** - 20 marks
	End Sem. Exam. - 50 marks
	Lab – Mid Sem/End Sem - 50 marks each

Course Outcomes: At the end of the course, the students are able to:
CO 1: Analyse structural members subjected to axial loads and temperature variations
CO 2: Analyse shafts subjected to combined loading
CO 3: Analyse beams subjected to combined loading
CO 4: Determine the stress distribution inside deformable body
CO 5: Compute the buckling loads for columns

Unit 1	**Simple stresses and strains**	**[5 Hrs]**
	Stress and strain (linear, lateral, shear and volumetric), Generalized Hooke's law. Elastic constants and their relationship for isotropic materials. Axial force diagram, stresses, strains and deformation in determinate and indeterminate homogeneous and composite bars under concentrated loads, self-weight and temperature changes.	
Unit 2	**Shear Force and Bending Moment Diagrams, Stresses in Beams due to Bending**	**[5 Hrs]**
	Shear force and bending moment diagrams for determinate beams: Concept and definition of shear force and Bending Moment. Beams under various kinds of loading **Stresses in beams due to bending:** Theory of pure bending, Flexure formula. Bending stress distribution diagram, Moment of resistance and section modulus.	
Unit 3	**Stresses in beams due to Shear and Torsion of Circular shaft**	**[8 Hrs]**
	Stresses in beams due to Shear: Shear stress distribution diagram for common symmetrical sections (with at least one axis of symmetry), maximum and average shear stress, Flitched beams. **Torsion of Circular Shaft:** Stresses, strains and deformation in determinate and indeterminate shafts of hollow and solids sections of homogenous and composite materials subjected to torsion	
Unit 4	**Principal planes and stresses**	**[5 Hrs]**
	Normal and shear stresses on any oblique plane and concept of principal planes and principal stresses by analytical and graphical methods (Mohr's circle of stress 2-D). Combined Effects of axial force, bending moment, shear force and Torsional moment. Theories of failure: Maximum normal stress, Maximum shear stress and Maximum strain energy theory.	
Unit 5	**Axially loaded columns and direct and bending stresses**	**[7 Hrs]**
	Axially loaded columns: Critical load and buckling, Euler's formulae for column with hinged ends, equivalent length for various end conditions. Rankine's formula	

	Direct and Bending Stresses: Eccentrically loaded short columns including biaxial cases, retaining walls, dams, chimneys. Core of section for standard symmetrical sections
Unit 6	**Slope and Deflection of Determinate Beams [6 Hrs]**
	a) Double integration method (McCauley's Method). b) Moment Area Method c) Conjugate Beam Method

Text Books:

1. Beer and Johnston, "Mechanics of Material", Tata Mc Graw Hill publication.
2. F. L. Singer and Pytel, "Strength of Material", Harper and Row publication

Reference Books:

1. Gere and Timoshenko, "Mechanics of Materials", CBS publishers.
2. J.B. Popov, "Introduction to Mechanics of Solids", Prentice Hall publication
3. James M.Gere, "Mechanics of Materials", Brooks/Cole Thomson Learning,(Fifth edition)
4. Andrew Pytel and Jaan Kiusalaas, "Mechanics of Materials", Thomson Learning, 511, Forest Lodge Road, Pacific Grove, US

PCC-03 Building Construction and Design	
Teaching Scheme	**Examination Scheme**
Lectures: 3 Hrs/ week	**Mid Sem Exam -** 30 marks
Practical: 2 Hrs/week	**Teacher's Assessment** - 20 marks
	End Sem. Exam. - 50 marks
	Lab – Mid Sem/End Sem - 50 marks each

Course Outcomes: At the end of the course, the students are able to:
CO 1: Demonstrate and use the principles and concepts related to building construction techniques and materials.
CO 2: Select materials and apply appropriate construction methods in a given scenario.
CO 3: Plan and design building as per rules, regulations, and acoustical factors
CO 4: Assess the functional and aesthetic requirements of different building types and propose improvements.
CO 5: Develop integrated, innovative building designs that incorporate sustainable and energy-efficient strategies.

Unit 1	**Introduction to building construction: Superstructure and Substructure [9 Hrs]**
	Footings and foundation: Bearing capacity of soil and rock, necessity and concept of site investigation, Foundation types – shallow and deep and their suitability, setting out and layout of foundation plan, Damp proof course, basement construction, plinth filling and soling, under pinning. **Masonry Construction:** Stones and stone masonry. Stones – Requirements of good building stones, IS specification and tests on stones; Stone masonry – principal terms, Detailing of constructions – procedure for UCR and CR masonry, Mortar preparation, types of mortar, Pointing – Purpose and types. Brick and block masonry: Characteristics of good building bricks, IS specifications and test; Classification of bricks¬ silica, refractory, fire etc; Brick work – terms, types of bonds – English, Flemish, Stretcher, Header; Construction procedure, supervision, Openings in walls, mortar preparation; Block masonry – Hollow, solid, cavity wall construction; Scaffolding – types.
Unit 2	**Building materials [8 Hrs]**
	Materials of doors and windows: types, glazing, method of fixing doors and windows, fixtures and fastenings. **Flooring materials tests and IS specifications:** Ground and upper floors; Flooring-functional requirements of flooring material, varieties of floor finishes and their suitability, construction details for concrete, tiles and stone flooring.
Unit 3	**Roofing materials and Protective coatings [8 Hrs]**
	Roofing materials: GI, AC, fibre sheets, Mangalore tiles; Roof construction – types and their suitability, method of construction, types of trusses, types of shell structures, space and frame structures. **Protective coatings:** Plastering types and application, mortar; Painting and varnishing, types and application; Whitewashing, distempering, oil paints; Wall cladding – materials, methods of fixing, wall papering and glazing work.

Unit 4	**Principles of Building planning and Development Control Rule [9 Hrs]**
	Principle of planning of Buildings, Principles of Architectural design – form, function, utility, aesthetics. Integrated approach in Built Environment, Building Rules and Byelaws. Necessity of laws, plot sizes, road width, open spaces, floor area ratio (F.A.R.), marginal distances, building line control line, height regulation, room sizes, types of area calculations – built-up area, floor area, carpet area, Rules for ventilation, lighting, drainage, sanitation and parking of vehicles ; Landscape elements and elements of interior decoration.
Unit 5	**Building Types, Layout, and Acoustics [8 Hrs]**
	Noise and Acoustics: Effect of noise, comfort standards, noise control, sound insulation. Acoustics – reverberation, Sabine's formula, acoustical defects, conditions of good acoustics, sound absorbents, and acoustics for various types of buildings. **Building Types and layout details:** Planning of residential buildings – Load bearing / Framed Structure – (a) Bungalows (b) Row houses, (c) Ownership flats, (d) Apartments. Layout details , Elevation , sectional details.
Unit 6	**Planning of public buildings [8 Hrs]**
	Functional requirements of public buildings. Following types of public buildings may be considered for planning. Educational Buildings, Hostel building with Rector's and servants' quarters, Lodge/Hotel building, Primary Health center with Hospital-staff quarters, factory building-Administrative block and factory, Bus Stand, Library building, Shopping complex, Health club, Marriage hall, auditorium, multiplex, sports complex, restaurant, vegetable market, post office, bank and any other.

Text Books:

1. Shah M.G., Kale C.M. and Patki S.Y., "Building drawing an Integrated approach to Built environment", Tata McGraw Hill (Fifth edition).
2. Mentt, "Building Design and Constructions", Tata McGraw Hill (Second edition)
3. Punmia B C. "Building Construction"

Reference Books:

1. Schild E, Casselmann H.F., Dahmen G., Pohlenz R. "Environmental Physics in
2. Construction", Granada Publishing, London.
3. National Building Code of India 2005, Bureau of Indian Standard, New Delhi
4. Jain V.K. "Fire safety in Buildings" new Age International Publisher
5. Barrid, "Building Construction" Tata McGraw Hill, New Delhi
6. Ghosh, "Materials of Construction" Tata McGraw Hill
7. CBRI, Roorkee, "Building Construction manual `.
8. TTTI Chandigrah, "Civil Engineering Materials", Tata McGraw Publication
9. Callender," Times Savers Standards of Architectural Design Data", Tata McGraw Hill.
10. Unified Development Control and Promotion Regulation (UDCPR), 2020

Bs-06 Matrices, Differential Calculus and Probability (MDCP)	
Teaching Scheme	**Examination Scheme**
Lectures: 3 Hrs/ week	**Mid Sem Exam -** 30 marks
Self Study: 1 Hrs/week	**Teacher's Assessment** - 10 marks
	End Sem. Exam. - 60 marks

Course Outcomes: At the end of the course, the students are able to:
CO 1: Define matrices, linear equations, and determinants, recall basics of probability theory, probability distribution, gradient, divergence and curl, Laplace Transform, ODE and PDE.
CO 2: Identify types of ordinary differential equations and partial differential equations, state the formulae for Fourier coefficients, basic concepts of probability, probability distributions, Laplace Transform.
CO 3: Solve ODEs and PDEs, find Fourier series expansions, analyze, and calculate eigen values, eigen vectors, evaluate probability of compound events, find probabilities using standard distributions, solve ODE using Laplace Transform.
CO 4: Prove theorems, solve theoretical problems.
CO 5: Apply concepts of ODE and PDE, Matrix algebra, Calculus and Probability to various problems including real life problems.

Unit 1	**Matrix Algebra**	**[6Hrs]**
	Properties of Matrices and Determinants, Solutions of Systems of linear equations using Gauss Elimination method, Eigen Values and Eigen Vectors. S: Properties of Matrices and Determinants	
Unit 2	**Vector Differential Calculus**	**[6 Hrs]**
	Functions of several variables (Domain and Range), Partial Derivatives, The Chain Rule, Vector differentiation, gradient, divergence, and curl. S: Review of Vector Algebra	
Unit 3	**Ordinary Differential Equations**	**[12 Hrs]**
	First order Ordinary Differential Equations - Variable Separable, Homogeneous, Linear; Higher order linear equations with constant coefficients, non-homogeneous higher order linear differential equations with constant coefficients: method of variation of parameters; Applications to Initial value problems: Simple Electrical Circuits. Definition of Laplace Transform, Laplace Transform of standard functions, basic properties to solve ODE: linearity and LT of derivatives. S: First order Ordinary Differential Equations - Variable Separable, Homogeneous ODEs	
Unit 4	**Partial Differential Equations**	**[8 Hrs]**
	Fourier Series; Partial differential equations. Initial and Boundary value problems by separation of variables method, boundary value problems: Vibration of string: one dimensional wave equation. S: Types of PDEs	

Unit 5	Probability [7 Hrs]
	Mean, median, mode, standard deviation, combinatorial probability, compound, and conditional probability. Probability distributions, Binomial distribution, Poisson distribution, Normal distribution. S: Compound and conditional probability.

Text Books:

1. Advanced Engineering Mathematics (10th edition) by Erwin Kreyszig, Wiley Eastern Ltd.
2. Thomas's Calculus (12th edition) by Maurice D. Weir, Joel Hass, Frank R. Giordano, Pearson Education.

Reference Books:

3. Calculus for Scientists and Engineers by K.D Joshi, CRC Press.
4. A course in Calculus and Real Analysis (1st edition) by Sudhir Ghorpade and Balmohan Limaye, Springer-Verlag, New York.
5. Applied Mathematics Vol.1 (Reprint July 2014) by P.N. Wartikar and J.N. Wartikar, Pune Vidhyarthi Griha Prakashan Pune.

Note :

- To measure CO1, questions may be of the type- define, identify, state, match, list, name etc.
- To measure CO2, questions may be of the type- explain, describe, illustrate, evaluate, give examples, compute etc.
- To measure CO3, questions will be based on applications of core concepts.
- To measure CO4, questions may be of the type- true/false with justification, theoretical fill in the blanks, theoretical problems, prove implications or corollaries of theorems, etc.
- To measure CO5, some questions may be based on self-study topics and also comprehension of unseen passages.

Semester IV

PCC-04 Geotechnical Foundation Engineering	
Teaching Scheme	**Examination Scheme**
Lectures: 3 Hrs/ week	**Mid Sem Exam -** 30 marks
Practical: 2 Hrs/week	**Teacher's Assessment** - 20 marks
	End Sem. Exam. - 50 marks
	Lab – Mid Sem/End Sem - 50 marks each

Course Outcomes: At the end of the course, the students are able to:
CO 1: Demonstrate the characteristics and classification of soil types, and the principles of the three-phase soil system.
CO 2: Apply testing methods to determine soil characteristics
CO 3: Analyze soil stresses and bearing capacity
CO 4: Evaluate slope stability and earth pressure theories
CO 5: Create integrated foundation design solutions for complex geotechnical challenges.

Unit 1	**Properties of Soil**	**[7 Hrs]**
	Introduction to Soil Mechanics, major soil deposits of India such as marine deposits, black cotton soils, lateritic soils, alluvial deposits and desert soils. Three phase soil system, weight volume relationships, index properties of soil - methods of determination and its significance, I.S. classification of soil. Soil structure: single grained and honey combed, flocculated and dispersed.	
Unit 2	**Permeability and Seepage**	**[7 Hrs]**
	Darcy's law, Factors affecting permeability, Determination of permeability by constant head and falling head method as per IS - 2720, field test as per IS – 5529 (part I) - pumping in test and pumping out test. Permeability of layered soils, Seepage forces, General flow equation. Flow net and its application.	
Unit 3	**Compaction**	**[7 Hrs]**
	Soil compaction phenomenon, Factors affecting compaction. Dry density and moisture content relationship. Zero air voids line, Effect of compaction on soil structure. Standard Proctor test and Modified Proctor test as per IS – 2720. Field compaction equipment and methods for cohesive and non-cohesive soils.	
Unit 4	**Shear Strength of Soil**	**[7 Hrs]**
	Mohr's circle, Mohr-coulomb failure criteria, Effective stress concept. Peak and residual shear strength. Factors affecting shear strength. Laboratory measurement of shear strength by direct, unconfined and triaxial tests under different drainage conditions. Vane shear test.	

Unit 5	[7 Hrs]
	a) Stress Distribution in Soils: Boussinesq theory- point load, pressure distribution due to line load, strip load, pressure bulb, Westergaard's theory, contact pressure, approximate stress distribution method. **b) Bearing Capacity of Foundation:** Types of foundations, Terzaghi's and Meyerhoff bearing capacity analysis, effect of various BC factor on bearing capacity, Shear failure and Settlement criteria, Pile foundation. Use of field test (SPT and Plate Load) data for bearing capacity determination.
Unit 6	**[7 Hrs]**
	a) Lateral Earth Pressure: Earth pressure on vertical wall, effect of wall movement on earth pressure, earth pressure at rest, Rankine's theory, lateral earth pressure due to submerged backfill, backfill with uniform surcharge, backfill with sloping surface, Coulomb's theory. **b) Stability of Slopes:** Slope classification, slope failure, modes of failure. Infinite slope in cohesive and cohesion less soil, slope stability analysis using Swedish Slip Circle Method.
	Note- More emphasis would be given on basic fundamentals in the course work. Tutorial 1-Based on basic index properties of soil. Tutorial 2- Permeability of soil Tutorial 3-Permeability of layered soil and seepage forces Tutorial 4- Compaction Tutorial 5- Shear strength of soil Tutorial 6- Stress distribution of soil Tutorial 7- Bearing capacity determination of shallow foundation. Tutorial 8- Problems based on earth pressure determination for various condition. Tutorial 9- Slope stability. **Textbooks:** • Gopal Ranjan and A S Rao, "Basic and Applied Soil Mechanics", G. K. Publications pvt. Ltd • V. N. S. Murthy, "Soil Mechanics and Foundation Engineering", B.S.Publications (3rd Edition) • B. C. Punmia, "Soil Mechanics and Foundation Engineering", Laxmi Publishing Co., New Delhi. • Dr. B. J. Kasmalkar,"Geotechnical Engineering", Pune Vidyarthi Griha Prakashan, 1986

Reference Books:

- Joseph E Bowles, "Engineering Properties of Soils and Their Measurements", McGraw Hill Publications (2001)
- Lambe and Whitman, "Soil Mechanics", S. Chand publications(SI Version),(1969).
- Donald P Coduto, Man-chu Ronald Yeung and William A. Kitch "Geotechnical Engineering Principle and practice", McMillan Press (PHI) (2010)
- P Purushothma Raj, "Geotechnical Engineering", McGraw Hill Publication 4th Edition (2008)
- Compendium of Indian standards on soil engineering part 1 (1980)

PCC-05 Concrete Technology	
Teaching Scheme	**Examination Scheme**
Lectures: 3 Hrs/ week	**Mid Sem Exam -** 30 marks
Practical: 2 Hrs/week	**Teacher's Assessment** - 20 marks
	End Sem. Exam. - 50 marks
	Lab – Mid Sem/End Sem - 50 marks each

Course Outcomes: At the end of the course, the students are able to:
CO 1: Apply checks for quality of ingredients.
CO 2: Determine quantities of ingredients for different concrete grades
CO 3: Design mix proportions of different ingredients.
CO 4: Determine the properties of fresh concrete.
CO 5: Evaluate the properties of hardened concrete.

Unit 1	**Ingredients of Concrete**	**[6 Hrs]**
	Cement: -Manufacture of Portland cement, Chemical composition, Hydration of cement, Classification and types of cement, Tests on cement. **Aggregate:** -Classification, Mechanical and Physical properties, Deleterious Materials, Soundness, Alkali aggregate reaction, Grading of Aggregates, Tests on aggregate, Artificial and Recycled aggregate. **Water:** -Mixing Water, Curing water, Tests on water.	
Unit 2	**Fresh Concrete**	**[6 Hrs]**
	Workability: Factors affecting workability, measurement of workability, cohesion and segregation, bleeding, Mixing, Transporting, Placing, and Compaction of concrete Curing, Methods of curing, Influence of temperature, Maturity rule, Steam curing.	
Unit 3	**Hardened concrete**	**[7 Hrs]**
	Strength of concrete – General, Factors affecting strength, Micro cracking and stress strain relation, other strength properties, Relation between tensile and compression strengths, impact strength, Resistance to abrasion. Elasticity, Creep, and Shrinkage Non-Destructive Testing Rebound hammer, Ultra Sonic Pulse Velocity, Impact echo test.	
Unit 4	**Concrete Mix Design**	**[7 Hrs]**
	Factors to be considered, Statistical quality control, Methods of Mix Design IS(10262), and DOE, High strength concrete, Acceptance criteria for concrete as per IS specifications.	
Unit 5	**Admixtures in concrete**	**[7 Hrs]**
	Functions, Classification, Types, Mineral and Chemical. a) Chemical Admixtures: Plasticizers, Super plasticizers, Retarders, Air entraining agents, IS Specifications (9103), Compatibility of Admixtures, Marsh Cone test. b) Mineral Admixtures: Fly ash, Silica Fume, GGBS, Rice husk ash.	
Unit 6	**Special Concretes and Durability of concrete**	**[7 Hrs]**

	a) Special Concretes: Light weight concrete, Polymer concrete, Fibre reinforced concrete, High performance concrete, Pumped concrete, Ready mixed concrete, Roller compacted concrete, Ferrocement. b) Durability of concrete: Significance, Permeability and Durability, Chemical Attack, Sulphate attack, Attack by Seawater, Acid attack, Chloride attack, Carbonation of concrete and its determination
	Textbooks: • M. L. Gambhir, "Concrete Technology", Tata McGraw Hill Publications, • M. S. Shetty, "Concrete Technology", S. Chand Publications **Reference Books:** • A. M. Neville, J. J. Brooks, "Concrete Technology" Pearson Education India • A. M. Neville, "Properties of Concrete", Pearson Education India. • R.S. Varshney, "Concrete Technology", Oxford and IBH. • P. Kumar Mehta, "Microstructure and properties of concrete", Prentice Hall.SP-26

PCC-06 Structural Mechanics	
Teaching Scheme	**Examination Scheme**
Lectures: 3 Hrs/ week	**Mid Sem Exam -** 30 marks
	Teacher's Assessment - 20 marks
	End Sem. Exam. - 50 marks

Course Outcomes: At the end of the course, the students are able to:
CO 1: Develop mathematical model for given structural engineering problem
CO 2: Identify appropriate method for structural analysis
CO 3: Analyse indeterminate beams
CO 4: Analyse indeterminate truss structures
CO 5: Estimate the forces in the structures due to moving loads

Course Content

Unit 1	**[4 Hrs]**
	a) Basic concepts of structural analysis – Types and Classification of structures based on structural forms. Skeletal Structures, Surface Structures, 3D Structures. b) Concept of indeterminacy and degrees of freedom – Static and Kinematic degree of Indeterminacy.
Unit 2	**[7 Hrs]**
	a) Concept of strain energy, strain energy due to axial, due to shear, bending moment and torsional moment b) Energy Methods in Structural analysis Unit Load Method, Castigliano's theorems, Deflection of determinate structures – beams, and rectangular portals
Unit 3	**[7 Hrs]**
	a) Analysis of indeterminate structures by application of Castigliano's Theorem, Beams and Rectangular portal frames b) Analysis of Indeterminate Beams by Compatibility Methods c) Maxwell's theorem of reciprocal displacements and Betti's law.
Unit 4	**[7Hrs]**
	a) Deflections of Determinate Trusses by Castigliano's Theorem and virtual work principle. b) Analysis of Redundant Trusses by Castigliano's Theorem and virtual work principle. Lack of fit and temperature changes in members, sinking of supports
Unit 5	**[6 Hrs]**
	Analysis of continuous beams (with indeterminacy up to 3 degrees) including sinking and rotational yielding at supports by a) Slope deflection method b) Moment distribution method
Unit 6	**[9 Hrs]**
	a) Influence lines Basic Concept of Influence lines. Application of Muller Breslau's principle. b) Rolling loads Use of Influence line diagram for determination of SF and BM in beams due to UDL, series of concentrated loads and conditions for maximum SF and maximum BM

	values. Condition for maximum BM under a chosen load, determination of absolute maximum SF and BM. Absolute maximum B M diagram, Concept of Equivalent UDL. c) Influence line diagram for the truss reactions and member forces for Plane Determinate trusses
	Textbooks: • Junnarkar, S. B. and Shah, H. J., "Mechanics of Structures Vol. II", Charotar Publishing house • Reddy, C. S., "Basic Structural Analysis", Tata McGraw Hill Publishing Company Limited. • C. K. Wang, "Intermediate structural analysis", McGraw Hill Book Comp. **Reference Books:** • Gupta, S. P. and Pandit, G. S., "Theory of Structures, Vol. I", Tata McGraw Hill Publishing Company Limited. • Timoshenko, S. P. and Young, D. H., "Theory of Structures", McGraw Hill Publication, 2/e • R.C. Hibbeler, "Structural Analysis", Pearson Education Asia Publication, 6/e • Utku, S., Norris, C. H. and Wilbur, J. B., "Elementary Structural Analysis", McGraw Hill Publication, 4/e • T.G.H. Megson, "Structural and Stress Analysis", Butterworth Heinemann Publication

HSMC-03 Design Thinking

Teaching Scheme	Examination Scheme
Lectures: 1 Hrs/ week	**Mid Sem Exam -** 30 marks
Practical: 2 Hrs/week	**Teacher's Assessment** - 20 marks
	End Sem. Exam. - 50 marks
	Lab - Continuous-Internal-Evaluation **-** 100 marks

Course Outcomes: At the end of the course, the students is able to:
CO 1: Demonstrate the critical theories of design, systems thinking, and design methodologies.
CO 2: Produce great designs, be a more effective engineer, and communicate with high emotional and intellectual impact.
CO 3: Demonstrate the diverse methods employed in design thinking and establish a workable design thinking framework to use in their practices.
CO 4: Conceive, organize, lead and implement projects in interdisciplinary domain and address social concerns with innovative approaches

Unit 1	**Design process**	**[6 Hrs]**
	Traditional design, Design thinking, Existing sample design projects, Study on designs around us, Compositions/structure of a design, Innovative design: Breaking of patterns, Reframe existing design problems, Principles of creativity Empathy: Customer Needs, Insight-leaving from the lives of others/standing on the shoes of others, Observation	
Unit 2	**Design team**	**[6 Hrs]**
	Team formation, Conceptualization: Visual thinking, Drawing/sketching, New concept thinking, Patents and Intellectual Property, Concept Generation Methodologies, Concept Selection, Concept Testing, Opportunity identification Prototyping: Principles of prototyping, Prototyping technologies, Prototype using simple things, Wooden model, Clay model, 3D printing; Experimenting/testing.	
Unit 3	**Sustainable product design**	**[6 Hrs]**
	Ergonomics, Semantics, Entrepreneurship/business ideas, Product Data Specification, Establishing target specifications, Setting the final specifications. Design projects for teams.	

Text Books:

1. Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation, HarperCollins Publishers Ltd.
2. Idris Mootee, Design Thinking for Strategic Innovation,2013, John Wiley & Sons Inc

Reference Books:

1. Brenda Laurel Design Research methods and perspectives MIT press 2003.
2. Terwiesch, C. & Ulrich, K.T., 2009. Innovation Tournaments: creating and identifying Exceptional Opportunities, Harvard Business Press.
3. Ulrich &Eppinger, Product Design and Development, 3rd Edition, McGraw Hill, 2004

4. Stuart Pugh, Total Design: Integrated Methods for Successful Product Engineering, Bjarki Hallgrimsson, Prototyping and model making for product design, 2012, Laurence King Publishing Ltd
5. Kevin Henry, Drawing for Product designers, 2012, Laurence King Publishing Ltd

VSEC-03 Plumbing Practices	
Teaching Scheme	**Examination Scheme**
Lectures: 2 Hrs/ week	**Theory -** Continuous-Internal-Evaluation **-** 100 marks

Course Outcomes: At the end of the course, the students are able to:
CO 1: Explain stakeholder roles and relevant codes/standards for plumbing systems.
CO 2: Determine appropriate plumbing fixtures, materials, and system configurations.
CO 3: Examine coordination requirements between architectural, structural, and plumbing elements.
CO 4: Assess the feasibility and performance of alternate water systems and pumping solutions.
CO 5: Develop comprehensive plumbing design solutions and effective construction management strategies.

Unit 1	**[6 Hrs]**
	Introduction to plumbing engineering: Definition- plumbing engineering, plumber, role of architect, structural consultant, plumbing consultant, plumbing contractor, plumber. Alternate source of water, water quality norms as per CPCB, IS standards, acceptable limits, impurities of water and their impacts on various applications. **Introduction to codes and standards:** Introduction to NBC, UIPCI. Approvals, AHJ, local municipal laws relating to plumbing, generals regulations. Testing and labelling, alternate material, workmanship and minimum standards, space required for various sanitary facilities, plumbing shaft, water tanks and pump rooms. Architectural and Structural coordination, structural parameters such as sunken toilets, location of columns and beam, importance of ledge walls.
Unit 2	**[6 Hrs]**
	Plumbing Terminology: Definitions for most words can be found in a dictionary, but there are technical or trade terms which take on a special meaning when used in relation to plumbing. **Plumbing Fixtures and Fixture Fittings:** types of various plumbing fixtures and fittings, water conserving fixtures, rating system for water efficient products (WEP) water closets, bidets, urinals, flushing devices, lavatories, bath/shower, kitchen sinks, water coolers, drinking fountain, clothes washer, mop sink, overflows, strainers, prohibited fixtures, installation standards, strainers, floor drains, floor slopes, location of valves
Unit 3	**[8 Hrs]**
	Water Supply: Type of water supply pipes fittings and joints, GI, SS, Copper, HDPE, MDPE, PVC, cPVC, uPVC, Pex, Multilayer, composite pipe, PEX, jointing methods, tools etc, type of valves (isolation valves, PRV, NRV, ARV, purge valves etc), backflow prevention, air gap, cross connection, installation and disinfections, protection of pipe, color codes and arrow marking. Introduction to WSFU, minimum and maximum velocity, pressure, temperature in water supply pipe, sizing calculations. **Solar Hot Water:** Introduction to solar water systems. System components, panels, hot water tanks, electrical backup, safety measures, auto controls, hot water supply and return systems, various insulating materials, control valves, introduction to other methods of hot water generation. hot water temperature, and table of minimum plumbing facilities.

Unit 4	**[6 Hrs]**
	Traps and Interceptors: Trapes**-** purpose, function and requirement, trap arms, developed length, trap seals, venting to traps, trap primers, prohibited traps, building traps, clarifiers, grease interceptors, sizing, FOG disposal, oil and sand interceptors, Trap Malfunction. **Indirect Waste:** Air-gap, food establishments, sink traps, dish washers, drinking fountains, waste receptors, sterile equipment, appliances, condensers, chemical wastes, point of discharge, venting. Introduction to pipe sizing. **Vents:** Vent requirement, concept of venting, materials, vent connections, trap seal protection, flood rim level, termination, vent stacks, water curtain and hydraulic jump, horizontal and vertical wet venting, combination waste and vent system, cleanouts, venting of interceptors. Introduction to vent sizing, sizing of combination vents etc.
Unit 5	**[8 Hrs]**
	Sanitary Drainage: Types of drainage system i.e. one pipe system, two pipe system, single stack and double stack system, pipe materials and jointing methods, special joints, fixture connections (drainage), hydraulic jump, change in direction of flow, T and Y fittings, cleanouts, pipe grading, fixtures below invert level, suds relief, testing, building sewers, testing, sumps and pumps, public sewers, sewage disposal. Introduce DFU, sizing of horizontal and vertical pipes. **Storm Drainage:** Storm drain required, prohibited connections, subsoil drains, sub-drains, gutters/channels/scuppers, window areaway drains, roof drains, strainers, leaders, conductors and connections, siphonic drains, underground drains, materials, traps required, prohibited installations, testing. Introduction to sizing of channels, rainwater down takes, underground drains. Introduction to rainwater harvesting. **Gray-water Systems:** Definition of gray water, specifications and drawings, total gray water discharge, soil absorption, holding tanks, valves and piping. Reclaimed water systems, definition of reclaimed water, pipe identification, installation, signs, valves, cross connection, inspection and testing, approved uses.
Unit 6	**[6 Hrs]**
	Pumps and HPS: Types of pumps for water supply, heat exchangers, wastewater dewatering and sewage. Pressure boosting and hydro-pneumatic systems shall be elaborated along with the accessories and controls. **Construction Management:** Organization charts, inter-organization relations, coordination of other agencies, role of Engineer-in-charge, safety and security, working at heights and confined spaces, accidents reporting. Inventory, material ordering and stacking, testing, record keeping, measurements, and billing. Time and cost analysis, specifications writing, resources planning, takeoff quantities (BOQ), and cost estimates of few plumbing items. Break down activities, activity sequence and activity period for few selected cases.
	Textbooks: • Deolalikar S.G. " Plumbing Design and Practice", Tata McGraw Hill Publishing company Ltd., New Delhi, ISBN, 933922132X, 9789339221324. • Plumbing Engineering Design Handbook 2010, American Society of Plumbing Engineers (ASPE) • Panchdhari A. C. 2017, Water Supply and Sanitary Installation (Within Building), Design, Construction and Maintenance, New Age International publishers. **References:** • National Building Code (NBC) 2017, Bureau of Indian Standards (BIS)

	• Uniform Illustrated Plumbing Code- India (UIPCI 2022), International Association of Plumbing and Mechanical Officials (IAPMO) • Plumbing, Sanitation and Domestic Engineering" Volume – 1to 4 by G. S. Williams, Mc Graw Hill.

MD M-01 Construction Materials and Building Design	
Teaching Scheme	**Examination Scheme**
Lectures: 3 Hrs/ week	**Mid Sem Exam -** 30 marks
	Teacher's Assessment - 20 marks
	End Sem. Exam. - 50 marks

Course Outcomes: At the end of the course, the students are able to:
CO 1: Identify different building materials and their uses in construction sector
CO 2: Demonstrate properties of different construction material
CO 3: Apply various principles of building planning and building design
CO 4: Select proper material in a particular condition

Unit 1	**Building materials**	**[6 Hrs]**
	a) Stones: Stones Requirements of good building stones, IS specification and tests on stones; stone masonry b) Brick and block masonry: Characteristics of good building bricks, IS specifications and test; Classification of bricks	
Unit 2	**Materials for Doors and windows**	**[6 Hrs]**
	Functional requirements, materials of doors and windows, glazing, method of fixing doors and windows, fixtures and fastenings. Timber Types and properties, seasoning, testing; Glass – Types and properties	
Unit 3	**Flooring and Roof material**	**[7 Hrs]**
	a) Flooring materials, tests and IS specifications: Ground and upper floors; Flooring functional requirements of flooring material, varieties of floor finishes and their suitability. b) Roofing materials: GI, AC, fibre sheets, Mangalore tiles; Roof construction – types and their suitability.	
Unit 4	**Miscellaneous materials**	**[6 Hrs]**
	Properties, types and uses of following materials, Lime, Ferrous metals, Polymers, Plastics types Mastic, Gypsum, Ferro Crete, Clay Tiles and glazed ware, Plaster of Paris. Artificial stone; Aluminum and alloys– Properties.	
Unit 5	**Building planning**	**[8 Hrs]**
	Principle of Building planning, Integrated approach in Built Environment, Building Rules and Byelaws, Necessity of laws, plot sizes, road width, open spaces, floor area ratio (F.A.R.), marginal distances, building line control line, height regulation, Built-up area, floor area, carpet area, Landscape elements and elements of interior decoration.	
Unit 6	**Building Design**	**[7 Hrs]**
	Introduction, Types of load, thermal insulation of roofs and walls. Ventilation: Necessity of ventilation, stack effect, wind effect, Mechanical ventilation, objectives, selection of ventilation system, ventilation rate Lighting**:** Principles, Day lighting, design of windows, sky component, E.R.C, Orientation, artificial illumination, supplementary illumination	

	Textbooks: • Shah M.G., Kale C.M. and Patki S.Y., "Building drawing an Integrated approach to Built environment", Tata McGraw Hill (Fifth edition). • Mentt, "Building Design and Constructions", Tata McGraw Hill (Second edition) **Reference Books:** • National Building Code of India 2016, Bureau of Indian Standard, New Delhi • Ghosh,"Materials of Construction" Tata McGraw Hill • M. S. Mamlouk and J. P. Zaniewski, Materials for Civil and Construction Engineers, 3rd Ed., Prentice Hall, USA, 2010. • P. C. Varghese, Building Materials, PHI Learning Pvt. Ltd., India, 2005. • TTTI Chandigarh, "Civil Engineering Materials", Tata McGraw Publication