Scheme of Instruction, Evaluation

and

Syllabi of

B.E. CIVIL ENGINEERING

With effect from Academic Year 2022-23

Estd. 1917

DEPARTMENT OF CIVIL ENGINEERING

UNIVERSITY COLLEGE OF ENGINEERING

(Autonomous)

Osmania University

Hyderabad – 500 007, TS, INDIA

Estd. 1929

INSTITUTION

About the Institution not more than (10 lines)

Vision

The Vision of the institute is to generate and disseminate knowledge through harmonious blending of science, engineering and technology. To serve the society by developing a modern technology in students' heightened intellectual, cultural, ethical and humane sensitivities, fostering a scientific temper and promoting professional and technological expertise.

Mission

- To achieve excellence in Teaching and Research
- To generate , disseminate and preserve knowledge
- To enable empowerment through knowledge and information
- Advancement of knowledge in Engineering, Science and Technology
- Promote learning in free thinking and innovative environment
- Cultivate skills, attitudes to promote knowledge creation
- Rendering socially relevant technical services to the community
- To impart new skills of technology development
- To inculcate entrepreneurial talents and technology appreciation programmes
- Technology transfer and incubation

DEPARTMENT

The Department of Civil Engineering was established in the year 1929 and was the first Department to commence the undergraduate programme at University college of Engineering, Osmania University. Over the years, the Department grew from strength to strength in terms of its academic achievements and infrastructure development. Currently, the Department offers BE in Civil Engineering; ME in Structural Engineering, Geotechnical Engineering, Water Resources Engineering and Transportation Engineering specializations and PhD programs. The Department also has the distinction of enrolling large number of foreign students both at UG and PG level. The Department provides research and consultancy services to various organizations. Several faculty members have received prestigious awards including the Best Teacher awards of the State Government and the Best Publication awards reflecting their teaching abilities and the research contribution. Many of the faculty members are listed in several national and international biographical directories. The faculty has published over 1500 papers in various international and national journals and conferences besides text books and professional books.

Vision

To be as a leading academic department on pace with global standards and contribute to the development of economic, technically viable and useful to societal problems and challenges of civil engineering profession and also contribute to the regional and country's developmental activities.

Mission

- To produce highly competent and capable professionals to face the challenges and provide viable solutions to Civil Engineering problems
- Integration of their knowledge and skills to excel in the profession through continuous learning and contribute to the well being of the society.
- To enhance the technical knowledge, research aptitude to serve the society in highly competent manner.

Programme Educational Objectives (PEO):

PEO1: Impart basic knowledge in the field of Civil Engineering.
PEO2: Develop skills to analyze and provide viable solutions to various Civil Engineering problems.
PEO3: Enhance communication skills and encourage team work.
PEO4: Prepare Civil Engineering professionals with zeal for research, life-long learning, and work for sustainable development of society with ethics.

PROGRAM OUTCOMES (POs)

POs	Engineering Graduates 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 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 team work:** 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	**Lifelong learning:** Recognize the need for, and have the preparation and ability to engage in Independent and lifelong learning in the broadest context of technological change.

	PROGRAM SPECIFIC OUTCOMES (PSOs)
PSO1	**Analytical Skill :** Ability to plan, execute, manage and rehabilitate Civil Engineering systems and processes
PSO2	**Entrepreneurial Skill :** Ability to become independent practitioners, consultant and entrepreneurs in the field of Civil Engineering

MAPPING OF PEO'S WITH PO'S

S.No.	PEO Statement	M1	M2	M3
PEO 1	Impart basic knowledge in the field of Civil Engineering	3	2	2
PEO 2	Develop skills to analyse and provide viable solutions to various Civil Engineering problems.	3	3	2
PEO 3	Enhance communication skills and encourage team work.	2	2	1
PEO 4	Prepare Civil Engineering professionals with zeal for research, life-long learning, and work for sustainable development of society with ethics.	3	3	3

Rubrics

1 : Weakly mapped

2 : Moderately mapped

3 : Strongly mapped

PEO	Justification and rationale of the mapping
PEO 1	Mainly focuses on imparting basic knowledge in Civil Engineering to produce highly competent and capable professionals. Accordingly, the correlations are assigned.
PEO 2	Emphasis is on training to inculcate analytical skills to design various Civil Engineering problems. Hence, the correlations are allotted.
PEO 3	Focuses on personality development, character building and to work with peers. Therefore, the correlations are justified.
PEO 4	Equip with required skills to effectively tackle the real life problems of Civil Engineering in sustainable manner. Therefore, M1 to M3 are in good agreement.

SCHEME OF INSTRUCTION AND EVALUATION
B.E. (CIVIL ENGINEERING) w.e.f. 2025-26

VII – Semester

S. No.	Course Code	Course Title	Scheme of Instruction			Contact hr/week	Scheme of Evaluation		Credits
			L	T	P		CIE	SEE	
1	PC 701 CE	Estimation Costing and Specifications	3	0	-	3	40	60	3
2	PC 702 CE	SEDD-II (Steel)	3	-	-	3	40	60	3
3	HS 701 MB	Managerial Economics and Accountancy	3	0	-	3	40	60	3
4	PE –IV	Professional Elective – IV	3	-	-	3	40	60	3
5	ES 701 CE	Disaster Risk Management	3	0	-	3	40	60	3
6	OE-II	Open Elective-II (basket provided at the end)	3	0	-	3	40	60	3
		PRACTICALS							
7	PC 751 CE	Computer Applications in Civil Engineering Lab	-	-	2	2	25	50	1
8	PW 761 CE	Project Work-I	-	-	6	6	50	-	3
9	PW 762 CE	Summer Internship	-	-	-	-	50	-	2
			18	**-**	**08**	**26**	365	410	**24**

Professional Elective – IV

SNo	Code	Course Title	Scheme of Instruction			Contact Hrs/Wk	Scheme of Evaluation			Credits
			L	T	P		Hrs	CIE	SEE	
1	PE 701 CE	Bridge Engineering	3	0	-	3	3	40	60	3
2	PE 702 CE	Elements of Earth Quake Resistant Design of Buildings	3	0	-	3	3	40	60	3
3	PE 703 CE	Watershed Management	3	0	-	3	3	40	60	3
4	PE 704 CE	Urban Transportation Planning	3	0	-	3	3	40	60	3
5	PE 705 CE	Geosynthetic Applications	3	0	-	3	3	40	60	3
5	PE 706 CE	Legal Issues in Construction Management	3	0	-	3	3	40	60	3

OPEN ELECTIVE-I (BE VI Semester)

SNo	Code	Course Title	Scheme of Instruction			Contact Hrs/Wk	Scheme of Evaluation			Credits
			L	T	P		Hrs	CIE	SEE	
			3	**0**	**-**	**3**	**3**	**40**	**60**	**3**

LIST OF OPEN ELECTIVES I BE VI Semester

1) OE 601 BM Engineering Applications in Medicine
2) OE 602 BM Human Assistive Technologies
3) OE601 CE Disaster Management
4) OE 602 CE Road Safety Engineering
5) OE 601 EC Verilog HDL
6) OE 602 EC Principles of Electronic Communication Systems
7) OE 601 ME 3D Printing Technology
8) OE 602 ME Finite Element Method
9) OE 601 EE Applications of Electrical Energy
10) OE 602 EE Electrical Safety Management
11) OE 601 CS Python Programming
12) OE 602 CS Cyber security

OPEN ELECTIVE –II BE VII Semester

1) OE 701 BM Basic Biomedical Equipment
2) OE 702 BM Artificial intelligence in Health Care
3) OE701CE Green Building Technology
4) OE702 CE Plumbing Technology
5) OE 701CS Cloud Computing
6) OE 702CS Data Base Management Systems
7) OE 701 EC Embedded Systems Design
8) OE 702 EC Basics of Internet of Things
9) OE 701EE Optimization Techniques
10) OE 702EE Non- Conventional Energy Sources
11) OE 701 ME Nano Technology
12) OE 711ME Start up Entrepreneurship

SCHEME OF INSTRUCTION AND EVALUATION
B.E. (CIVIL ENGINEERING) w.e.f. 2025-26

VIII – Semester

S.No	Code	Course Title	Scheme of Instruction			Contact Hrs/ Wk	Scheme of Evaluation			Credits
			L	T	P		Hrs	CIE	SEE	
Theory										
1	MC801CE	Environmental Science (MC-I)	3	-	-	3	3	40	60	-
2	MC80XXX	Mandatory Course-II	3	-	-	3	3	40	60	-
3		Mandatory Course-III	3	-	-	3	3	40	60	-
Practicals										
4	PW 861 CE	Project Work -II	-	-	12	12	-	50	100	6
		Total	**9**	-	**12**	**21**	**9**	**170**	**280**	**6**

Mandatory Course

S.No.	Code	Course Title
1	MC802HS	Intellectual Property Rights
2	MC803HS	English for Technical Paper Writing
3	MC804HS	Constitution of India
4	MC805HS	Essence of Indian Traditional Knowledge
5	MC806HS	Stress Management by Yoga
6	MC807HS	Sports

Credit Summary

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	20.5	25.5	21	21	20	25	24	06	163

COURSE TYPE DISTRBUTION OF CREDITS

S.No.	Course Type	I	II	III	IV	V	VI	VII	VIII	TOTAL
1	Humanities and Social Sciences (HS)	4						3		7
2	Basic Sciences (BS)	8.5	8.5	3						23
3	Engineering Sciences (ES)	9	14					6		29
4	Program Cores (PC)		3	18	17	17	16	4		75
5	Program Electives (PE)				3	3	3	3		12
6	Open Electives (OE)						3	3		6
7	Project / Seminar						3	5	6	14
8	Mandatory Courses (MC)									0
	TOTAL									**163**

VII SEMESTER

PC 701 CE	Estimation Costing and Specification					
Pre-requisites	CACED, BMCD and CT		**L**	**T**	**P**	**C**
			3	-	-	3
Evaluation	**SEE**	60Marks	**CIE**		40Marks	

Course Objectives:	
The course is taught with the objectives of enabling the student to:	
1.	Understand the basic principles and specifications for estimations.
2.	Know the basic procedures for Tenders and Tender documents.
3.	Understand the detailed estimation of buildings, roads and Irrigation structures.
4.	Understand the usage of software in preparation of Estimations

Course Outcomes:	
On completion of this course, the student will be able to:	
CO-1	Will be able to prepare detailed specifications for Civil Engineering works.
CO-2	Ability to prepare tender documents and schedules for Civil Engineering related works
CO-3	Able to prepare estimates by long wall and shortfall methods for structures
CO-4	Will be able to prepare estimates for culverts and bridges
CO-5	Get familiar with bar bending schedules and use of software for estimation

Articulation matrix of Course outcomes with PO's:

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

Correlation rating: Low/ Medium/High:1/2/3 respectively

Unit I

Basic principles and specifications:

General and detailed specification of works types of estimates various types of contracts turnkey projects. Essentials of contracts and conditions of contracts Schedule of rates standard data rate analysis bill of quantities.

Unit II

Tenders and documentation:

Preparation of tenders, tender documentation, tender notice work order, Earnest money deposit security money deposit comparative statements additional conditions mentioned by tender. Measurement book and muster role advances in tender procedures, National bidding /international bidding shopping, BOT, BOOT and PPP project role of it in tenders and construction industry

Unit III

Estimation of buildings and roads:

Traditional residential buildings advanced buildings (earth work footings columns beams and slabs etc…) by long wall and short wall method and centre line method. Estimation of road works using levels (Cross section and longitudinal sections).

Unit IV

Estimation of irrigation structure:

Pipe culvert, slab culvert and Simple bridge Irrigation canal including earth work (cutting and banking), Retaining walls, overhead water tank and aqueduct.

Unit V

Bar bending schedules:

Estimation of reinforcement quantity, preparation of estimates using computer software viz. B-EST software V 5.0, MS office, MS Excel.

Suggested Reading:

1.	Dutta, B.N. (2016). Estimating and Costing in Civil Engineering: Theory and Practice. UBS Publishers Distributers Pvt. Ltd., New Delhi.
2.	Chakraborthi, M. (2002). Estimating, Costing and Specifications in Civil Engineering. M/S. Laxmi Publications, New Delhi.
3.	Jagjit Singh. (1996). Estimating and Costing in Civil Engineering. Galgotia Publications, New Delhi
4.	Wai-Fah Chen Lian Duan, Bridge Engineering Handbook, CRC Press, USA,2000.
5.	R. M. Barker, and J. A. Puckett, Design of Highway Bridges, John Wiley & Sons, New York,1997.
6.	P. P. Xanthakos, Theory and Design of Bridges, John Wiley & Sons, New York, 1994.

PC 702 CE	Structural Engineering Design and Drawing –II (Steel)					
Pre-requisites			**L**	**T**	**P**	**C**
			3	-	-	3
Evaluation	**SEE**	60Marks	**CIE**		40Marks	

Course Objectives:	
The course is taught with the objectives of enabling the student to:	
1.	To understand the design principles of bolted and welded plate girders and their components under static loads.
2.	To impart knowledge on the design of crane girders and gantry girders with codal provisions.
3.	To develop understanding of the design and function of structural bearings used in bridges.
4.	To provide detailed insight into design and drawing of railway plate girder and truss bridges as per Ministry of Railways guidelines.
	To introduce the general design principles of chimneys and transmission towers subjected to environmental loads.

Course Outcomes:	
On completion of this course, the student will be able to:	
CO-1	Analyze and design bolted and welded plate girders, including flange curtailment, stiffeners, and splices
CO-2	Design crane girders and gantry girders in compliance with relevant IS codes
CO-3	Identify types of bearings and perform detailed design for bridge applications
CO-4	Design and prepare detailed drawings for railway plate girder and truss bridges based on Railway Board rules
CO-5	Design and prepare detailed drawings for railway plate girder and truss bridges based on Railway Board rules

Articulation matrix of Course outcomes with PO's:

COs \ POs	PO1 (Engineering Knowledge)	PO2 (Problem Analysis)	PO3 (Design/Development)	PO4 (Investigation)	PO5 (Modern Tools)	PO6–PO12 (Others)
CO1	3	3	3	2	2	–
CO2	3	3	3	2	2	–
CO3	3	2	3	2	2	–
CO4	3	3	3	3	2	–
CO5	2	2	2	1	2	–

Correlation rating: Low/ Medium/High:1/2/3 respectively

UNIT-I

Plate Girders: Design of bolted and welded plate girders for static loads, including flange curtailment, connections, intermediate and bearing stiffeners, web and flange splice

UNIT-II

Crane and Gantry Girders: Basic principles, codal provision and detailed design

UNIT-III

.**Bearings**: Types and materials, detailed design of bearings for bridges

UNIT-IV

Bridges: Deck and trough type bridges, economical spans, bridges rules, Ministry of railways, (Railway board), detailed design and drawing of plate girders and truss bridges

UNIT-V

Chimneys and Towers: General design principles of chimneys and transmission towers

References:

1. Subramanya N. (2008). "Design of Steel Structures." Oxford University Press.
2. Dayaratnam, P. (2003). "Design of steel Structures." S. Chand &Company Ltd.
3. Krishna Raju, N.(1998). " Design of Bridges." Oxford and IBH Publishers, New Delhi.

HS 701 MB	Managerial Economics and Accountancy					
Pre-requisites			**L**	**T**	**P**	**C**
			3	-	-	3
Evaluation	**SEE**	60Marks	**CIE**		40Marks	

Course Objectives:	
The course is taught with the objectives of enabling the student to:	
1.	To learn important concepts of Managerial Economics and apply them to evaluate business decisions
2.	To understand various parameters that determine the consumer's behavior
3.	To evaluate all the factors that affect production
4.	To understand the concepts of capital budgeting and payback period
5	To study the concepts of various book-keeping methods

Course Outcomes:	
On completion of this course, the student will be able to:	
CO-1	Apply the fundamental concepts of managerial economics to evaluate business decisions
CO-2	Understand types of demand and factors related to it
CO-3	Identify different types of markets and determine price-output under perfect competition
CO-4	Determine working capital requirement and payback period
CO-5	Analyze and interpret financial statements through ratios

UNIT–I

Meaning and Nature of Managerial Economics: Managerial Economics and its usefulness to Engineers, Fundamental Concepts of Managerial Economics-Scarcity, Marginalism, Equi-marginalism, Opportunity costs, Discounting, Time perspective, Risk and Uncertainty, Profits, Case study method.

UNIT–II

Consumer Behavior: Law of Demand, Determinants, Types of Demand; Elasticity of Demand (Price, Income and Cross-Elasticity); Demand Forecasting, Law of Supply and Concept of Equilibrium. (Theory questions and small numerical problem can be asked).

UNIT–III

Theory of Production and Markets: Production Function, Law of Variable Protection, ISO quants, Economics of Scale, Cost of Production (Types and their measurements), Concept of Opportunity cost, Concept of Revenue, Cost-Output relationship, Break-Even Analysis, Price-Output determination under perfect Competition and Monopoly (Theory and problems can be asked).

UNIT-IV

Capital Management: Significance, determination and estimation of fixed and working capital requirements, sources of capital, Introduction to capital budgeting, methods of payback and discounted cash flow methods with problems. (Theory questions and numerical problems on estimating working capital requirements and evaluation of capital budgeting opportunities can be asked)

UNIT – V

Book-keeping: Principles and significance of double entry book keeping, Journal, Subsidiary books, Ledger accounts, Trial Balance, concept and preparation of Final Accounts with sample adjustments, Analysis and interpretation of Financial statements through Ratios.
(Theory questions and numerical problems on preparation of final accounts, cash book, pretty cash book, bank reconciliations statement, calculation of some ratios).

Suggested Reading:

1. Mehta P.L., Managerial Economics-Analysis, Problems and Cases, Sulthan Chand & Sons Educational Publishers, 2011
2. Maheswari S.N., Introduction to Accountancy, Vikas Publishing House, 2005
3. Pandey I.M., Financial Management, Vikas Publishing House, 2009

Professional Elective-IV

PE 701CE	BRIDGE ENGINEERING					
Pre-requisites			**L**	**T**	**P**	**C**
			3	-	-	3
Evaluation	**SEE**	60 Marks	**CIE**		40 Marks	

Course Objectives:	
The course is taught with the objectives of enabling the student to:	
1.	Learn various materials and loading standards for bridge designs
2.	Gain the knowledge of the current technologies in concrete slab bridges.
3.	Study concepts and importance of composite bridge designs
4.	Know the basic design concepts of different sub structure designs in bridges
5.	To understand the basic design concepts of long span bridges and various construction techniques in bridges.

Course Outcomes	
On completion of this course, the student will be able to:	
1.	To be able to understand different high strength materials and IRC loads in bridge designs.
2.	To be competent to design the bridges with latest technologies and approaches with various RC slab sections of with few methods.
3.	Design basic components of composite bridges with IRC loading standards.
4.	Ability to understand and design different substructure designs in bridges.
5.	Able to design long span bridges and current construction technologies in bridges.

Articulation matrix of Course outcomes with PO"s:

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

Correlation rating: Low/ Medium/ High:1/2 /3 respectively

UNIT-I

Introduction - Introduction to bridge Engineering: Types of bridges, materials of construction, codes of practice, loading standards such as IRC codes, recent developments RC bridges and culverts, historical bridges, planning and layout of bridges, hydraulic design, geological and geotechnical considerations, Developments in road and urban infrastructure.

UNIT-II

Concrete Bridges - Materials requirements, precast systems and materials used for precast and cast in-situ bridges. Bridge deck and approach slabs, design of bridge deck systems, slab-beam systems design philosophies. Design of slabs by using effective width method.

UNIT-III

Composite Bridges - Importance of composite bridges, orthotropic decks, box girders, composite structures, concrete bridges, analysis and design of composite sections.

UNIT-IV

Sub-structures–Introduction to substructures**,** design of Piers, columns and towers, analysis and design, shallow and deep foundations, caissons, abutments and retaining walls.

Bridge components-Introduction, Expansion joints, design of joints, types and functions of bearings, design of elastomers.

UNIT-V

Long Span Bridges - Introduction, design specifications, Design principles of continuous box girders, curved and skew bridges, basic concepts of cable stayed and suspension bridges, seismic resistant design, seismic isolation and damping devices.

Construction Techniques - Introduction to Pre-cast Techniques, Cast in-situ, prefabricated, incremental launching, free cantilever construction, inspection, maintenance and rehabilitation, current design and construction practices, innovative materials, construction techniques and methodologies.

Suggested Reading:

1.	Krishna Raju, N.(2009). "Structural Design and Drawing (thirdEdition)." Universities Press
2.	Punmia, B.C., Jain, A. KandJain, A.K. (2006)."RCC designs (Reinforced concrete structures). Laxmi publications (10thedition).
3.	Phatak,(1990). "Bridge Engineering." Satya Prakashan Publishers.
4.	Johnson D.Victor. (2006). "Essentials of Bridge Engineering." Oxford &IBH Publishers, Pvt. Ltd., New Delhi.
5.	Design of Bridge Structures by T.R. Jagadeesh and M.A. Jayaram, prentice Hall of India New Delhi 2004,
6.	Essentials of Bridge Engineering by D. Johnson wictor 5th Edition, Oxford & IBN publishing. co. pvt. Ltd New Delhi 2005
7.	IS:456:2000,Code of Practice for Plane and Reinforced Cement Concrete.
8.	SP16,SP 34-&IS3370Part I to Part IV.

PE 702 CE	ELEMENTS OF EARTHQUAKE RESISTANT DESIGN OF BUILDINGS					
Pre-requisites		**L**	**T**	**P**	**C**	
		3	-	-	3	
Evaluation	**SEE**	60 Marks	**CIE**		40 Marks	

Course Objectives:	
The course is taught with the objectives of enabling the student to:	
1.	To provide a coherent development to the students for the courses in sector of earthquake engineering
2.	To present the foundations of many basic engineering concepts related earthquake Engineering
3.	To give an experience in the implementation of engineering concepts which are applied in field of earthquake engineering
4.	To involve the application of scientific and technological principles of planning, analysis and design of buildings according to earthquake design philosophy

Course Outcomes :	
On completion of this course , the student will be able to :	
CO-1	Enable to solve the problems of structural dynamics.
CO-2	Will be able to Understand the causes and effect of Seismology.
CO-3	To perform seismic analysis & design of RC structure using IS codes.
CO-4	Assess various irregularities in buildings
CO-5	Apply the provisions of IS:13920

Articulation matrix of Course outcomes with *PO"s:*

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

Correlation rating: Low/ Medium/ High:1/2 /3 respectively

UNIT-I

Introduction to Dynamic Static Load v/s Dynamic Load, Types of Dynamic forces, Single, two and multi- degree of freedom systems . long and short period structure ,Concepts of damped and un-damped vibration

UNIT-II

Basics of Seismology Earth and its interior, Plate Tectonics, Convection Currents, Causes of Earth quake, Inter Plate Earthquake (Convergent Boundaries, Divergent Boundaries and Transform Boundaries), Intra Plate Earthquake (Faults and Types of Faults), Seismic Waves, Basic Terminology..

UNIT-III

Earthquake Resistant Design: Reviews of latest I.S : 1893 (Part 1) provisions for buildings - General principles and design criteria – Assumptions –Design lateral force – Design imposed loads for Earthquake force calculation –Seismic weight – Analysis by Equivalent Static Method and Dynamic Method (Response Spectrum Method) – Storey drift limitation.

UNIT-IV

Building Configurations: Introduction – Regular and Irregular Buildings. Plan Irregularities – Torsion Irregularity – Re-entrant corners - Floor slabs having excessive cut-outs or openings- Out of plane offsets in Vertical Elements – Non-parallel Lateral Force system. Vertical Irregularities – Stiffness Irregularity (soft storey) – Mass Irregularity – Vertical Geometric Irregularity – In-plane discontinuity in Vertical Elements resisting lateral force – strength Irregularity (weak storey) – Floating or stub columns – Irregular Modes of Oscillation in two Principle Plan Directions.

UNIT-V

Ductile Design And Detailing: Review of Latest IS: 13920 provisions General specifications – Beams – Columns – Shear walls. Special confining reinforcement.

Suggested Reading:

1. Earthquake Resistant Design of Structures By Pankaj Agarwal & Manish Shrikhande, PHI Publications
2. Manish Shrikhande & Pankaj Agrawal; Earthquake Resistant Design of Structures, PHI Publication, New Delhi
3. S. K. Duggal; Earthquake Resistance Design of Structures; Oxford University Press, New Delhi
4. A.K. Chopra; Dynamics of Structures, Pearson, New Delhi
5. Clough & Penzin; Dynamics of Structures
6. Park & Pauly; Behavior of R.C Structures
7. IS: 1893 (Part-I) 2002, Criteria for Earthquake Resistant Design General Provision to Building
8. IS: 13920 (1993), Code of Practice for Ductile Detailing of RC Structures
9. IS: 4326 (1993), Code of Practice for Earthquake Resistant Design and Construction of Buildings .
10. IS: 13827 (1993), Improving Earthquake Resistance of Earthen Buildings
11. IS: 13828 (1993), Guide lines for Improving Earthquake Resistance of low Strength Masonry Buildings
12. IITK-bmtpc, Earthquake Tips "Learning Earthquake Design and Construction" by C.V.R.Murthy, Building Material and Technology Promotion Council
13. IITK – GSDMA EQ 26 – V- 3.0 Design Example of a Six Storey Building.

Web Materials:

1. **http://www.cdeep.iitk.ac.in/nptel**
2. **http://www.nptel.iitm.ac.in**

PE 703 CE	WATERSHED MANAGEMENT					
Pre-requisites	Water Resources Engineering Subjects		**L**	**T**	**P**	**C**
			3	-	-	3
Evaluation	**SEE**	60 Marks	**CIE**		40 Marks	

Course Objectives:	
1.	Introduce the concept of watershed management practices globally
2.	Acquaint with various features and issues of watershed management
3.	Create awareness about current status and importance of watershed management

Course Outcomes:	
On completion of this course, the student will be able to:	
CO-1	Understanding the fundamentals of watershed management practices.
CO-2	Ability to apply watershed principles and asses the physiographic, geomorphologic and climatic characteristics of a watershed
CO-3	Ability to solve soil erosion issues and applying the erosion control measures techniques for watershed management
CO-4	Adopting appropriate techniques suitable for rainwater harvesting of urban and rural watershed.
CO-5	Ability to solve problems related to environmental, socio-economical, water governance for sustainable watershed management

Articulation matrix of Course outcomes with PO's:

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

Correlation rating: Low/ Medium/ High:1/2 /3 respectively

UNIT-I

Introduction and basic concept of watershed: Concept of watershed management, objectives of watershed management, need for watershed development in India, multidisciplinary approach for watershed management, Status of water resources in India.

UNIT-II

Characteristics of Watershed: components of watershed management, delineation of watershed physiographic characteristics - Size, shape, physiographic, slope, drainage, land use, vegetation, geology and soils, hydrology and hydrogeology, Climatic characteristics-rainfall, intensity and duration of rainfall, temperature, humidity, wind velocity, evaporation and transpiration, socio-economic characteristics, basic data on watersheds.

UNIT-III

Processes of Erosion: Types of erosion, factors affecting erosion, effects of erosion on land fertility and land capability, estimation of soil loss due to erosion, Universal soil loss equation, (USLE), Modified universal soil loss equation (MUSLE), Revised universal soil loss equation.

Measures to Control Erosion: Contour techniques, ploughing, furrowing, trenching, bunding, terracing, gully control, rock fill dams, brushwood dam, Gabion.

UNIT-IV

Water Harvesting: Rainwater harvesting, catchment harvesting, harvesting structures, soil moisture conservation, check dams, artificial recharge, farm ponds and percolation tanks.

Land Management: Land use and land capability classification, management of forest, agricultural, grassland and wild land, reclamation of saline and alkaline soils.

UNIT-V

Ecosystem Management: Role of Ecosystem, crop husbandry, soil enrichment, inter mixed and strip cropping, cropping pattern, sustainable agriculture, bio-mass management, dry land agriculture, silvi pasture, horticulture, social forestry and afforestation.

Applications: Planning of watershed management activities, people‘s participation, preparation of action plan, administrative requirements. Social aspects of watershed management, community participation, private sector participation, industrial issues, socio-economy, integrated development, water legislation and implementations, case studies, applications of geospatial techniques in watershed management systems.

Suggested Reading:

1. M.M. Das and M.D. Saikia, Watershed Management, PHI Learning Pvt, Ltd, India 2013.
2. R. Awurbs and WP James, Water Resources Engineering, Prentice Hall Publishers
3. V.V. Dhruva Narayana, Soil and Water Sonservation Research in India. Indian Council of Agricultural Research, New Delhi, 2002.
4. D.K. Majumdar, Irrigation and Water Management, Principle and Practice, Prentice Hall of India, New Delhi, 2000.
5. R.P.C. Morgan, Soil Erosion and Conservation, Longman Group Limited, UK, 1995.
6. C.T. Haan, H.P. Johnson, D.L. Brakensiek, Hydrologic Modeling of Small Watersheds, ASAE, Michigan, 1982.

PE 704 CE	Urban Transportation planning					
Pre-requisites	Transportation Engineering		**L**	**T**	**P**	**C**
			3	-	-	3
Evaluation	**SEE**	60Marks	**CIE**		40Marks	

Course Objectives:	
The course is taught with the objectives of enabling the student to:	
1.	To discuss various urban transportation planning process and its components
2.	To understand data collection processes and travel surveys
3.	To review different travel demand forecasting models
4.	To examine integrated land use transport models

Course Outcomes:	
On completion of this course, the student will be able to:	
CO-1	Able to apply various planning methodologies
CO-2	To identify the appropriate data collection methods
CO-3	Able to perform travel demand forecasting
CO-4	Perform trip distribution and model split analysis
CO-5	Perform trip assignment and prepare master plan

Articulation matrix of Course outcomes with PO's:

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

Correlation rating: Low/ Medium/High:1/2/3 respectively.

UNIT-I

Components of Urban Transportation: urban transportation components, urban transportation issues and challenges, demand and supply, measure of effectiveness, measure of collectiveness, planning and management, models, planning methodologies.

UNIT -II

Travel Surveys and Data Collection: concept of surveys, design of survey format, organization of surveys and analysis, study area definition, zoning system, types and sources of data, Collection of data, road side interview method, home interview survey, in-vehicle surveys, sampling, types, various techniques, expansion factors, logical checks, use of secondary sources of data, planning variables, vehicles ownership, projection of data and statistical techniques.

UNIT-III

Travel Demand Forecasting; short and long term planning process, different kinds of variables, travel attributes, traffic analysis zones, trip generation, category analysis and regression analysis, formulation of trip generation models.

UNIT-IV

*Trip Distribution Models***:** concept of trip distribution, Growth factor models, synthetic pattern models, various growth factor models and its conceptual procedures with merits and demerits. **G**ravity model, calibration of gravity model, importance of deterrence function and other models of synthetic pattern models.

UNIT-V

Model Split Analysis and Traffic Assignment: Factors affecting mode choice, aggregate models and disaggregate models, trip interchange, Toronto transit model, service ratio model, probabilistic models, discriminate analysis and sensitivity analysis. Nodes, links, transport. network, coding, rout characteristics, network skims, various methods, judgment, towpath method, diversion curves, network, assignment, all or nothing assignment, capacity restraint techniques, multi-path assignment technique. Introduction to land use transportation models.

Suggested Reading:

1. Hutchinson, E.G., Principles of Urban Transport Systems Planning, McGraw Hill, New York, 1974.
2. Ortuzar,J. and Williamson,E.G.,ModellingTransport,Wiley,Chinchestor,1994.
3. Oppenheim,N.,UrbanTravelDemandModeling:FromIndividualChoicestoGeneral Equilibrium, Wiley, New York, 1995.
4. Taniguchi,E.,Thompson,R.G,Yamada,T.andVanDuin,R.,CityLogistics-Network Modelling and Intelligent Transport Systems, Elsevier, Pergamon, Oxford, 2001.
5. Bruton, M.I, Introduction to Transportation Planning, Hutchinson,. London, 1985.
6. Dickey,J.W, Metropolitan Transportation lanning, TataMcGraw Hill, NewDelhi, 1975.

PE705CE	GEOSYNTHETIC APPLICATIONS					
Pre-requisites	Soil Mechanics & Foundation Engineering		**L**	**T**	**P**	**C**
			3	-	-	3
Evaluation	**SEE**	60Marks	**CIE**		40Marks	

Course Objectives:	
The course is taught with the objectives of enabling the student to:	
1.	Understand the classification of geosynthetics and the functions served by each of them.
2.	Study the geotechnical engineering applications of the geosynthetics
3.	Learn the applications of geosynthetics in transportation engineering
4	Evaluate the applications of geosynthetics in Water Resources Engineering
5	Know the other applications of the Geofoam and other products

Course Outcomes:	
On completion of this course, the student will be able to:	
CO-1	classify of Geosynthetic products and acquire knowledge about functions of the geosynthetics
CO-2	Gain competence in application of Geosynthetics in improvement of bearing capacity of shallow foundations. Stability of slopes and consolidation acceleration
CO-3	Acquire comprehensive understanding about application of geosynthetics in subgrade improvement, drainage and erosion control applications
CO-4	Gain knowledge about necessity and use of geosynthetics in seepage control in Dams, canal lining etc.
CO-5	Analyse the applications of Geosynthetics in Geo-environmental and other areas of Civil Engineering

CO-PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
PC504CE.1	3	2	2									2	2	2
PC504CE.2	2	2		1	1				3	3				
PC504CE.3	2	2		1	1	1								2
PC504CE.4	3			1	1	1			2	2	2		2	2
PC504CE.5	2	3			2	1	1	1			1	2	3	2

Correlation rating: Low/ Medium/High:1/2/3 respectively.

UNIT – I

An overview of Geosythetics : Introduction – Classification & basic description of Geosythetics – manufacturing process – Over view of 1D Geosynthetic products viz., Polymeric Fibre - 2D geosynthetic products viz., Geotextiles, Geogrids, Geonets, Geomembranes, Geocomposites and 3D Geosynthetic products viz., Geocell, Gabions

Functions – Separation, Reinforcement, Drainage, Filtration and moisture barrier function

Design methods – Design by cost & availability – Design by specification – Design by function.

UNIT – II

Geotechnical Engineering Applications:

Foundations : Improvement in Bearing capacity – Reduction in Settlement – Confinement – Stability of Foundation trenches – Basal mattress function

Retaining walls : Reinforced Soil Walls (RSW) – Components and their functions – Types of facia - Types of reinforcement – Factors influencing the Reinforcement mechanism – Stability Analysis-construction procedure – Essentials of Design of RSW.

Ground Improvement – Consolidation Acceleration using Pre-fabricated Vertical Drains (PVDs)

UNIT – III

Transportation Engineering Applications:

Highways : Improvement of Sub-grade / Base and Sub-base courses / Wearing course – Layer separator applications – Drainage applications

Slope Protection & Embankment Erosion Control applications

Railways : Improvement of permanent way

Airways : Improvement of Runway and drive ways.

UNIT – IV

Water Resources Engineering Applications

Reservoirs : Seepage control applications (Bed and Body of the Dams)

Canals : Lining of Canals

Erosion Control Applications – Geo tubes for shore protection applications

UNIT – V

Other Applications

Geo-environmental Applications : Land Fills : Lining / Capping applications

Geosynthetic Clay Liners / Geo foam applications

Case Histories and recent advancements.

Suggested Reading:

1. Koener, R.M. (2012), "*Designing with Geosynthetics, Vol.1 & 2,* Xlibriss Corporation LLC.
2. Rao, G.V. and Raju, G.V.S.S. (1995). " *Engineering with Geosynthetics*", Tata McGraw Hills.
3. Purushothama Raj, P. (2014). "*Ground Improvement Techniques*". Lami Publishers (P), Ltd. New Delhi
4. Hausman, M. R. (1990). " *Engineering Principles of Ground Modification*" McGraw-Hills
5. Moseley, M.P. (1993), "*Ground Improvemen*." Champman and Hall.
6. Fang, H.Y. (1991). "*Foundation Engineering Hand Book*", Second Edition, CBS Publications, New Delhi.

PE706CE	Legal Issues in Construction Management					
Pre-requisites	Soil Mechanics & Foundation Engineering		**L**	**T**	**P**	**C**
			3	-	-	3
Evaluation	**SEE**	60Marks	**CIE**		40Marks	

Course Objectives:	
The course is taught with the objectives of enabling the student to:	
1.	study the various types of construction contracts and their legal aspects and provisions
2.	study the tenders, arbitration, legal requirements, labor and human rights regulations Course Outcomes
3.	Know different types of contracts in construction, arbitration and legal aspects and its provision

Course Outcomes:	
On completion of this course, the student will be able to:	
CO-1	Students shall able to know basics on construction related Contracts
CO-2	Student shall be able to carry out the tendering process
CO-3	Overview of Construction Management , Administration and Present Status of Construction Industry
CO-4	Student shall be aware labour law related legislations
CO-5	Student shall be able to know Dispute resolution mechanism

Unit -1

Introduction to Construction Law - Need for legal issues in Construction–The Indian Contract Act, 1872 - Definition of a Contract and its essentials, Formation of a valid Contract - Offer and Acceptance, Consideration, Capacity to Contract, Free consent, Legality of object, Discharge of a Contract by performance, Impossibility and Frustration, Breach, Damages for breach of a contract, Quasi contracts. Special Contracts Contract of Indemnity and Guarantee, Contract of Bailment and Pledge, Contract of Agency— I T Law and its Influence on Construction Contracts

UNIT-2

Construction Tendering Process: Introduction to Construction Process, Need for tendering, process of Tendering in Construction, Importance of Specifications and Estimates in Construction, Concept of completion of the Contract, Sub-Contracts and requirements, Tendering Models and Strategies, Re Tendering , Prequalification of Bidders, Documents forming a BID and Contract, Agreements and Bonds in Tendering Process – E- Procurement

UNIT-3

Construction Administration: Duties and Responsibilities – Project Manager, Owner, Engineers and Contractors, Important Site Documents, Process of Building Permissions, Provision for Scheduling delays and accelerations, Environmental Provisions for Construction Contracts.

UNIT-4:

Employment legislations - Industrial Dispute Act, Factories Act, Payment of Wages Act, Workmen's Compensation Act. Important Provisions of Employees' State Insurance Act, Payment of Gratuity Act, Employees Provident Fund Act, Worker Compensation and Insurance laws.

UNIT-5:

Disputes and Liabilities in Construction: Major sources of disputes in construction, Reasons for Delays – Types, Claims and solutions Construction Liabilities and Litigations, Disputes in Land Development. Dispute Resolution in Construction and Judicial Process and ADRs, Arbitration and Conciliation Act 1996,Arbitration Agreement, Importance of ADR Methods in Construction, Arbitration Process, Arbitration Clause in Contracts

Suggested Readings:

1) Civil Engineering Contracts and Estimates - B. S. Patil – Universities Press- 2006 Edition, reprinted in 2009.
2) The Indian Contract Act (9 of 1872), 1872- Bare Act- 2018 edition, Asia Law Book Publishers Hyderabad..
3) The Arbitration and Conciliation Act,(1996), 1996 (26 of 1996)- 2006 Edition, Professional Book Publisher.
4) Law of contract Part I and Part II, Dr. R.K. Bangia- 2017 Edition, Allahabad Law Agency.
5) Arbitration, Conciliation and Alternative Dispute Resolution Systems- Dr. S.R. Myneni2004 Edition, reprinted in 2005- Asia Law House Publishers.
6) The Workmen's Compensation Act, 1923 (8 of 1923) Bare Act- 2005- Professional Book Publishers.
7) Standard General Conditions for Domestic Contracts- 2001 Edition- Published by Ministry Of Statistics and Program Implementation, Government of India.
8) FIDIC Document (1999). 9) Dispute Resolution Board foundation manual-www.drbf.org
9) Dispute Resolution Board foundation manual-www.drbf.org.

ES701CE	Disaster Risk Management					
Pre-requisites	No pre-requisite		**L**	**T**	**P**	**C**
			3	-	-	3
Evaluation	**SEE**	60Marks	**CIE**		40Marks	

Course Objectives:	
The course is taught with the objectives of enabling the student to:	
1.	Understand disasters, their causes, classification, and the Disaster-Development Nexus.
2.	Explore natural and man-made hazards, their consequences, and emerging disaster trends.
3.	Learn the Disaster Management Cycle, including risk assessment, mitigation, and recovery.
4.	Analyze India's disaster management policies, institutional mechanisms, and key stakeholders.
5.	Apply scientific and engineering approaches for disaster risk reduction and resilient infrastructure.

Course Outcomes:	
On completion of this course, the student will be able to:	
CO-1	Explain disaster-related terminologies, conduct basic hazard assessments, and outline strategies for resilience planning
CO-2	Evaluate the causes and consequences of natural and man-made hazards, and recommend appropriate mitigation strategies
CO-3	Interpret key disaster management policies, institutional frameworks, and international agreements relevant to disaster risk reduction
CO-4	Apply engineering principles to develop and assess technological solutions for disaster mitigation, including the use of GIS and resilient infrastructure design
CO-5	Design integrated disaster risk reduction (DRR) plans using scientific tools, sustainable practices, and climate-responsive approaches

Articulation matrix of Course outcomes with PO's:

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

Correlation rating: Low/ Medium/High:1/2/3respectively.

UNIT I: UNDERSTANDING DISASTERS

Fundamental Concepts: Definitions and terminologies in Disaster Risk Management (Hazard, Risk, Vulnerability, Resilience, Capacity Building). **Socio-Economic Dimensions**: Differential impacts of disasters based on gender, age, disability, social status, and location. **Disasters and Development Nexus**: (i) How development projects (dams, embankments, land-use changes) contribute to disaster risks, and (ii) Case studies of disaster-induced development failures (e.g., Uttarakhand floods, Chennai urban flooding). **Global and Regional Disaster Trends**: Frequency, intensity, and losses due to various disasters.

UNIT II: CLASSIFICATION OF HAZARDS AND NEW TRENDS

Types of Hazards: Classification, Causes, Consequences and Controls of (i) Geophysical Hazards-Earthquakes, Landslides, Tsunami; (ii) Weather related Hazards- Meteorological (Cyclones, Storm-surge and Lighting), Hydrological (Floods, Droughts, Avalanches) and Climatological (Wildfire, Cold & Heat Waves); (iii) Biological Hazards-Epidemic & Pandemics with emphasis on COVID-19; (iv) Technological Hazards; (v) Man-made Hazards-Structural Failure, Fire, Transportation accidents, Terrorism and Wars. **Emerging Disasters and Trends:** Urban Areas, Climate Change. Regional and Global Trends-loss of life & Property in various hazards

UNIT III: DISASTER MANAGEMENT CYCLE AND OPERATIONAL FRAMEWORK

Disaster Management Cycle: (i) *Pre-Disaster* – Frameworks and Tools for Hazard and Risk Assessment: Types of hazard assessment, Risk matrix and risk prioritization, Exposure and vulnerability analysis techniques, HAZUS, CAPRA, UNDRR Risk Models, Prevention and Mitigation of Disasters:Hazard Mitigation Strategies- Structural vs. Non-Structural Mitigation; Land-use planning and zoning laws; Building codes and compliance, Relocation and retreat strategies; Early Warning System; Preparedness, Capacity Development; Awareness; (ii) *During Disaster* – Evacuation – Disaster Communication – Search and Rescue– Emergency Operation Centre – Incident Command System – Relief and Rehabilitation (iii) *Post-disaster* – Damage and Needs Assessment, Restoration of Critical Infrastructure – Early Recovery – Reconstruction and Redevelopment.

Evolution of Disaster Management Frameworks: International Decade for Natural Disaster Reduction; Yokohama Strategy; Hyogo Framework for Action; Sendai Framework; Paris Agreement, SDGs and Disasters.

UNIT IV: DISASTER RISK MANAGEMENT PRACTICES IN INDIA

Disaster Profile of India: Mega Disasters of India (Bhopal gas tragedy, Indian Ocean tsunami, Uttarakhand floods) and Lessons Learnt in context of civil engineering.

Traditional and Indigenous Disaster Management Practices: Role of local knowledge and low-cost, community-driven solutions; Sustainable and climate-resilient infrastructure.

Disaster Governance in India: Disaster Management Act 2005 – Institutional and Financial Mechanism. National Policy on Disaster Management. National Guidelines and Plans on Disaster Management.

Role of Stakeholders: Government agencies, NGOs, international organizations (UNDRR, IFRC, World Bank), private sector, Community-Based Disaster Risk Reduction (CBDRR).

UNIT V: PROSPECTIVES OF SCIENCE AND TECHNOLOGY IN DISASTER RISK REDUCTION

Geo-informatics in Disaster Management: Remote Sensing (RS), Geographic Information Systems

(GIS), Global Positioning Systems (GPS), and their applications in hazard mapping and response.

Disaster Communication Systems: Role of AI, drones, and satellite-based early warning systems.

Crowdsourced disaster data and mobile-based alerts.

Disaster-Resilient Infrastructure and Construction: Seismic performance evaluation of RCC buildings, retrofitting of vulnerable structures, BIS codes for disaster-resistant construction. Role of green and blue infrastructure in urban flood management (e.g., permeable pavements, rain gardens, wetland restoration).

Climate-Responsive Disaster Risk Reduction: Integration of climate science with disaster risk management. Nature-based solutions.

India's Technological Capacity for Disaster Management: Institutions and innovations (e.g., ISRO's role in disaster monitoring; research on resilient infrastructure).

SuggestedReading:

1.	Disaster Management and Preparedness – *William L. Waugh & Ronald John Hy*.
2.	Introduction to International Disaster Management – *Damon P. Coppola.* A comprehensive book that covers global disaster management frameworks, policies, and case studies.
3.	Disaster Management Handbook – *Jack Pinkowski*
4.	Manual on natural disaster management in India, M C Gupta, NIDM, New Delhi
5.	An overview on natural & man-made disasters and their reduction, R K Bhandani, CSIR, New Delhi
6.	Disaster Management Act 2005, Publisher by Govt. of India
7.	Publications of National Disaster Management Authority (NDMA) on Various Templates and Guidelines for Disaster Management

Open Elective-II

OE701 BM	**BASIC MEDICAL EQUIPMENT**					
Pre-requisites			**L**	**T**	**P**	**C**
			3	-	-	3
Evaluation	**SEE**	60Marks	**CIE**		40Marks	

Course Objectives:	
The course is taught with the objectives of enabling the student to:	
1	To make the students understand the need for several Biomedical equipment.
2	To make the students understand the operating principles of a wide range of Biomedical Equipment
3	To familiarize students with the design and functional aspects of medical imaging systems and therapeutic devices.
4	To develop the ability to assess the appropriate biomedical equipment needed for specific clinical and therapeutic applications.
5	To enable students to understand the operating principles and clinical use of therapeutic devices like pacemakers, dialysis machines, and lithotripters.

Course Outcomes:	
On completion of this course, the student will be able to:	
CO-1	Learn about various physiological parameters, monitoring and recording.
CO-2	Assess the need and operating principle of equipment used in physiotherapy
CO-3	Interpret the working principle and operating procedure and applications of Medical Imaging equipment.
CO-4	Perceive the governing principles and functions of critical care equipments.
CO-5	Learn about the various Therapeutic Equipment used for different applications

Articulation matrix of Course outcomes with PO's:

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

Correlation rating: Low/ Medium/High:1/2/3 respectively

UNIT–I
Medical Monitoring and recording: Patient monitoring: System concepts, bedside monitoring systems, central monitors, heart rate and pulse rate measurement. Temperature measurement Blood pressure measurement: Direct and indirect methods. Respiration rate measurement: Impedance pneumograph, Apnoea detectors. Ambulatory monitoring: Arrhythmia monitor

UNIT–II
Physiotherapy and Electrotherapy Equipment: Diathermy machines: Short wave diathermy, Microwave diathermy and ultrasonic diathermy Electro diagnostic/Therapeutic apparatus: Nerve muscle stimulator, Functional electrical stimulator.

UNIT–III
Medical Imaging Equipment: X-Ray machines: Properties and production of X-Rays, X-ray machine, Image Intensifier. X-ray computed tomography: basic principle and construction of the components. Ultrasonic Imaging: Physics of ultrasonic waves, medical ultrasound, and basic pulse echo apparatus. Magnetic Resonance Imaging: Principle, Image reconstruction techniques, Basic NMR components, Biological effects, Merits.

UNIT-IV
Critical Care Equipment: Ventilators: Mechanics of respiration, artificial ventilators, Positive pressure ventilator, Types and classification of ventilators. Drug delivery system: Infusion pumps, basic components, implantable infusion system, closed-loop control in infusion pump. Cardiac Defibrillators: Need for defibrillators, DC defibrillator, Implantable defibrillators, Defibrillator analyzer.

UNIT – V
Therapeutic Equipment: Cardiac pacemakers: Need for cardiac pacemakers, External and implantable pacemakers, types. Dialysis Machine: Function of the kidney, artificial kidney, Dialyzers, Membranes, Hemodialysis machine. Lithotripters: The stone disease problem, Modern Lithotripter systems, extra corporeal shockwave therapy.

SUGGESTED READING:

1	R.S. Khandpur, Hand book of Biomedical Instrumentation, Tata McGraw-Hill, Second Edition, 2014.
2	John G.Webster, Medical Instrumentation Application and design, Wiley India Edition, 2009.
3	**Leslie Cromwell,***Biomedical Instrumentation and Measurements, 2nd Edition, Prentice Hall of India,*

OE 702 BM	ARTIFICIAL INTELLIGENCE IN HEALTH CARE					
Pre-requisites		**L**	**T**	**P**	**C**	
		3	**-**	**-**	**3**	
Evaluation	**SEE**	60 Marks	**CIE**		40 Marks	

Course Objectives:	
The course is taught with the objectives of enabling the student to:	
1	To introduce students to the fundamentals of Artificial Intelligence (AI) with a focus on healthcare applications.
2	To explore AI techniques in clinical diagnostics and decision-making.
3	To understand the role of AI in medical imaging, disease prediction, patient monitoring, and personalized medicine.
4	To examine ethical, legal, and regulatory considerations in the deployment of AI in healthcare.
5	To enable students to design and evaluate AI-based healthcare solutions for improving patient outcomes and operational efficiency

Course Outcomes:	
On completion of this course, the student will be able to :	
CO-1	Understand and explain the fundamental AI concepts and techniques relevant to healthcare.
CO-2	Apply machine learning and deep learning methods to analyze medical data and assist in clinical decision-making.
CO-3	Analyze AI-based diagnostic tools used in medical imaging and disease prediction.
CO-4	Evaluate the implementation challenges and ethical implications of AI in healthcare systems.
CO-5	Design AI-driven healthcare applications and propose data-driven solutions to real-world health problems.

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

Correlation rating: Low / Medium / High: 1 / 2 / 3 respectively

UNIT–I
Introduction to Artificial Intelligence: Definition. AI Applications, AI representation. Properties of internal Representation, General problem solving, production system, control strategies: forward and backward chaining. Uninformed and informed search techniques. A* and AO* Algorithm

UNIT–II
Machine Learning and Deep Learning for Healthcare: Supervised, unsupervised, and reinforcement learning. Classification and regression techniques in clinical datasets. Neural networks, CNNs, RNNs and their applications. Case studies: Diabetes prediction, cancer classification, readmission prediction. Model evaluation: accuracy, precision, recall, ROC curves

UNIT–III
AI in Medical Imaging and Diagnostics: Image processing fundamentals and feature extraction. AI in radiology: X-rays, CT, MRI, Ultrasound. Computer-aided diagnosis systems. Deep learning for medical image segmentation and classification. Real-world tools: Google Deep Mind, IBM Watson Health.

UNIT-IV
Natural Language Processing in Healthcare: Basics of NLP and its significance in healthcare**.** Clinical text mining and named entity recognition (NER) Chatbots and virtual health assistants. AI in Electronic Health Record (EHR) processing. Case study: Predictive analysis from clinical notes.

UNIT – V
Ethical, Legal, and Future Perspectives. Ethical concerns: bias, transparency, and ability. Data privacy and security in AI systems. Regulatory aspects: FDA, HIPAA, CDSCO. Human-AI collaboration in clinical settings. Future directions: AI in genomics, telemedicine, and wearable technologies.

SUGGESTED READING:

1	Eugene, Charniak, Drew Mcdermott: Introduction to artificial intelligence.
2	Elaine Rich and Kerin Knight, Nair B., "Artificial Intelligence (SIE)", Mc Graw Hill- 2008.
3	Mathias Goyen, *Artificial Intelligence in Healthcare: Past, Present and Future*, Elsevier, 2021.
4	Eric Topol, *Deep Medicine: How Artificial Intelligence Can Make Healthcare Human Again*, Basic Books, 2019
5	Parashar Shah, *AI in Healthcare: A Practical Guide*, BPB Publications, 2021.

OE701CE	Green Building Technology					
Pre-requisites			**L**	**T**	**P**	**C**
			3	-	-	3
Evaluation	**SEE**	60Marks	**CIE**		40 Marks	

Course Objectives:	
The course is taught with the objectives of enabling the student to:	
1.	Exposure to the green building technologies and their significance.
2.	Understand the judicial use of energy and its management.
3.	Educate about the Sun-earth relationship and its effect on climate.
4.	Enhance awareness of end-use energy requirements in the society.
5.	Develop suitable technologies for energy management.

Course Outcomes:	
On completion of this course, the student will be able to:	
CO-1	Understand concept of Energy in Buildings, factors on energy usage and Management.
CO-2	Environmental, Air conditioning and Auditory requirement indoors
CO-3	Climate, radiation, wind in connection with Energy
CO-4	End use energy requirements in buildings, concepts of heat gain and thermal performance
CO-5	Energy audit, energy management.

Articulation matrix of Course outcomes with PO's:

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

Correlation rating: Low/ Medium/High:1/2/3 respectively

UNIT-I

Overview of the significance of energy use and energy processes in building: Indoor activities and environmental control - Internal and external factors on energy use and the attributes of the factors - Characteristics of energy use and its management - Macro aspect of energy use in dwellings and its implications.

UNIT-II

Indoor environmental requirement and management: Thermal comfort - Ventilation and air quality – Air-conditioning requirement - Visual perception - Illumination requirement – Auditory requirement.

UNIT-III

Climate, solar radiation and their influences: Sun-earth relationship and the energy balance on the earth's surface - Climate, wind, solar radiation, and temperature - Sun shading and solar radiation on surfaces - Energy impact on the shape and orientation of buildings.

UNIT-IV

End-use, energy utilization and requirements: Lighting and day lighting - End-use energy requirements - Status of energy use in buildings Estimation of energy use in a building - Heat gain and thermal performance of building envelope - Steady and non-steady heat transfer through the glazed window and the wall - Standards for thermal performance of building envelope-Evaluation of the overall thermal transfer

UNIT-V

Energy management options: Energy audit and energy targeting - Technological options for energy management.

Suggested Readings:

1. MichaelBauer,PeterMösleandMichaelSchwarz,*"GreenBuilding–Guidebookfor Sustainable Architecture"*, Springer, Heidelberg, Germany, 2010.
2. Norbert Lechner*, "Heating, Cooling, Lighting-Sustainable Design Methods for Architects",* Wiley, New York, 2015.
3. MikeMontoya*, "GreenBuildingFundamentals*‖,Pearson,USA,2010.
4. CharlesJ.Kibert*, "SustainableConstruction-GreenBuildingDesignandDelivery*‖,John Wiley & Sons, New York, 2008.
5. ReginaLeffers*, "SustainableConstructionandDesign*‖,Pearson/PrenticeHall,USA 2009
6. James Kachadorian*, "The Passive Solar House: Using Solar Design to Heat and Cool Your Home",* Chelsea Green Publishing Co., USA, 1997.

OE702CE	Plumbing Technology					
Pre-requisites			**L**	**T**	**P**	**C**
			3	-	-	3
Evaluation	**SEE**	60Marks	**CIE**		40Marks	

Course Objectives:	
The course is taught with the objectives of enabling the student to:	
1.	Understand plumbing components for various systems such as water supply, waste water, high rise buildings
2.	Study various plumbing fixtures materials, tools and equipment
3.	Study the codes and standards in the building industry for plumbing

Course Outcomes:	
On completion of this course, the student will be able to:	
CO-1	Understand and identify the various plumbing related systems, component and types,
CO-2	Ability to understand various plumbing terminology for water supply
CO-3	Ability to understand various plumbing fixtures materials, tools and equipment.
CO-4	Understand about different pumping systems available.
CO-5	Comprehend the importance of codes, the key responsibilities of a plumbing sector and plumber

Articulation matrix of Course outcomes with PO's:

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

Correlation rating: Low/ Medium/High:1/2/3 respectively

Unit – I:

Building Plumbing - Introduction to Plumbing Systems, components of plumbing systems, and basic physics as related to plumbing. Various types of home plumbing systems for water supply and waste water disposal, high rise building plumbing, Pressure reducing valves, Break pressure tanks, Storage tanks, Building drainage for high rise buildings, various kinds of fixtures and fittings used.

Unit – II:

Plumbing Terminology: Definitions, use/purpose of Plumbing Fixtures - accessible, readily accessible, aerated fittings, AHJ, bathroom group, carrier, flood level rim, floor sink, flushometer valve, flush tanks, lavatories, macerating toilet, plumbing appliances, plumber.

Traps: indirect waste, vent, blow off, developed length, dirty arm, FOG, indirect waste, receptors, slip joints, trap, and vent.

Water supply: angle valve, anti-scald valve, backflow, bypass, check valve, cross connection, ferrule, gate valve, gray water, joints

Unit– III:

Plumbing Fixtures and Fittings: Definitions of plumbing fixtures, fittings, appliances and appurtenances; maximum flow rates, water closets, bidets, urinals, flushing devices, washbasins, bath/shower, toilets for differently abled, kitchen sinks, water coolers, drinking

fountain,clotheswasher,dishwasher,mopsink,overflows,strainers,prohibitedfixtures,floor drains, floor slopes, location of valves, hot water temperature controls, installation standard dimensions in plan and elevation.

Unit – IV:

Pumping Systems : Terminology, pump heads, types of Pumps, applications, pump selection, pump characteristics, pumps and motors, pump efficiency, motor efficiency, Hydro Pneumatic Systems(HPS), Zoning, Storm Water and Drainage Pumps, introduction to starters and control panels.

Unit – V:

Codes and Standards: Scope, purpose; codes and standards in the building industry, UIPC-I, NBC and other codes, Local Municipal Laws, approvals, general regulations, standards, water supply, protection of pipes and structures, waterproofing

Introduction to the Sector and the Job Role:

Overview of the Plumbing Sector- Importance and scope of plumbing in construction and maintenance, career opportunities in plumbing.

Understanding the Job Role of a Plumber – Duties and responsibilities of a plumber, Skills and attributes required for a plumber.

Safety Measures and Regulations –Importance of safety in plumbing, Basic safety regulations and practices.

Tools and Equipment – Introduction to basic plumbing tools and equipment, Proper use and handling of plumbing tools.

Reference books and codes:

- Uniform Illustrated Plumbing Code-India (UIPC- I) published by IPA and IAPMO (India)
- National Building Code (NBC) of India
- IS17650 Part1 and Part2 for Water Efficient Plumbing Products
- Water Efficient Products-India (WEP-I) published by IPA and IAPMO (India)
- Water Efficiency and Sanitation Standard (WE. Stand) published by IPA and IAPMO (India)
- Water Pollution, Berry, CBS Publishers.
- 'A Guide to Good Plumbing Practices', a book published by IPA.
- Elements of Water Pollution Control Engineering, O.P.Gupta, Khanna Book Publishing, New Delhi
- Plumbing Engineering.Theory,DesignandPractice,S.M.Patil,1999
- Water supply and sewerage system– G. Birdie

Learning Website:

1. www.nptel.co.in
2. https://ndrfandcd.gov.in/Cms/NATIONA0LBUILDINGCODE.aspx

OE701CS	Cloud Computing					
Pre-requisites			**L**	**T**	**P**	**C**
			3	-	-	3
Evaluation	**SEE**	60Marks	**CIE**		40Marks	

Course Objectives :	
1	To introduce basic concepts cloud computing and enabling technologies
2	To learn about Auto-Scaling, capacity planning and load balancing in cloud
3	To introduce security, privacy and compliance issues in clouds
4	To introduce cloud management standards and programming models

Course Outcomes :	
On completion of this course, the student will be able to :	
CO-1	Understand the basic approaches and Core ideas of Cloud Computing.
CO-2	Understand the Challenges and approaches in the management of the Cloud environments.
CO-3	Familiarize with advanced paradigms and solutions necessary for building and managing modern Cloud environments.
CO-4	Envision use of Cloud environment in Enterprise.

UNIT– I
Introduction, Benefits and challenges, Cloud computing services, Resource Virtualization, Resource pooling sharing and provisioning.

UNIT – II
Scaling in the Cloud, Capacity Planning, Load Balancing, File System and Storage,

UNIT – III
Multi-tenant Software, Data in Cloud, Database Technology, Content Delivery Network, Security Reference Model, Security Issues, Privacy and Compliance Issues

UNIT – IV
Portability and Interoperability Issues, Cloud Management and a Programming Model Case Study, Popular Cloud Services

UNIT –V
Enterprise architecture and SOA, Enterprise Software , Enterprise Custom Applications, Workflow and Business Processes, Enterprise Analytics and Search, Enterprise Cloud Computing Ecosystem.

Suggested Reading:

1	Cloud Computing - Sandeep Bhowmik, Cambridge University Press, 2017.
2	Enterprise Cloud Computing - Technology, Architecture, Applications by Gautam Shroff, Cambridge University Press, 2016.
3	Kai Hwang, Geoffrey C.Fox, Jack J.Dongarra, ―Distributed and Cloud Computing From Parallel Processing to the Internet of Things‖, Elsevier, 2012.
4.	https://aws.amazon.com/about-aws/
5.	https://cloud.google.com/why-google-cloud?hl=en
6.	https://azure.microsoft.com/en-gb/

OE702CS	Data Base Management Systems					
Pre-requisites			**L**	**T**	**P**	**C**
			3	-	-	3
Evaluation	**SEE**	60Marks	**CIE**		40Marks	

Course Objectives:	
The course is taught with the objectives of enabling the student to:	
1.	To introduce three schema architecture and DBMS functional components.
2.	To understand the principles of ER modeling and design.
3.	To learn query languages of RDBMS.
4	To familiarize theory of serializablity and implementation of concurrency control and recovery.
5	To study different file organization and indexing techniques.

Course Outcomes:	
On completion of this course, the student will be able to:	
CO-1	Understand the mathematical foundations on which RDBMS are built.
CO-2	Model a set of requirements using the Entity Relationship Model (ER), transform into a relational model, and refine the relational model using theory of Normalization
CO-3	Develop Database application using SQL and Advanced SQL
CO-4	Understand the working of concurrency control and recovery mechanisms in RDBMS.
CO-5	Use the knowledge of indexing and hashing to improve database application performance

Unit 1: Introduction to DBMS:

- **Introduction:** Database System Applications, Purpose of Database Systems, View of Data, Database Languages, Database Design, Database Engine, Database and Application Architecture, Data Base Users and Administrators.
- **Introduction to the Relational Model:** Structure of Relational Databases, Database Schema, Keys, Schema Diagram, Relational Query Languages, The Relational Algebra

Unit 2: Data Models and Database Design:

- **Entity-Relationship (ER) Model**: The Entity-Relational Model, Complex Attributes, Mapping Cardinalities, Primary key, Removing Redundant Attribute in Entity Set, Reducing E-R diagrams to Relational Schemas, Extended E-R features, Entity-Relationship Design Issues, Alternative Notations for Modelling Data.
- **Relational Model**: Features of Good Relational Designs, Decomposition Using Functional Dependencies, Normal Forms, Functional-Dependency Theory, algorithms for Decomposition using Functional Dependencies, Decomposition Using multivalued Dependencies, Atomic Domains and First Normal Form, Database-Design process, Modelling Temporal Data

Unit 3: SQL and Querying:

- **SQL Basics**: Data definition, data manipulation, and data control languages. functions in sql (single row and multirow& conversion functions), Creating Tables, keys, integrity constraints (column level and table level)
- **Advanced SQL**: Joins, subqueries, aggregate functions, and views. Synonyms
- **Stored Procedures and Triggers**: Concepts and usage.

Unit 4: Transaction Management and Concurrency Control:

- **Transaction Concepts**: Transaction Concept, transaction states, A simple transaction Model, Implementation of Atomicity and Durability, Implementation of Isolation, Serializability (view Serializability, conflict serializability)
- **Concurrency Control**: Locking mechanisms, Lock-based protocol, Timestamp-Based Protocol, Validation Based Protocol, Multiple Granularity, deadlock handling.
- **Recovery Techniques**: Failure Classification, Storage Structure, Recovery and Atomicity, Recovery Algorithm, Buffer Management, Failure with Loss of Non-Volatile Storage, High Availability Using Remote Backup Systems, ARIES, Early Lock Release and Logical Undo Operations, Recovery in Main-memory Databases.

Unit 5: Indexing and Hashing:

Database-System Architectures: Centralized Database Systems, Server System Architectures, Parallel Systems, Distributed Systems, Transaction Processing in Parallel and Distributed Systems, Cloud-Based Services.

Introduction to Big Data: Big Data Storage Systems, The MapReduce Paradigm, Beyond MapReduce, Algebraic Operations, Streaming Data, Graph Databases

Reference Books:

1) Database System Concepts Seventh Edition Abraham Sliberschantz, Henry f. Korth,S. Sudarshan, 7th Edition, 2024.
2) Rama krishnan, Gehrke, "*Database Management Systems"*, McGraw-Hill International Edition, 3rd Edition, 2003.
3) Elma sri, Nava the, Somayajulu, "*Fundamentals of Database Systems"*Pearson Education, 4th Edition, 2004.

OE 701EC	EMBEDDED SYSTEMS DESIGN					
Pre-requisites	Computer Organization, Micro Processors		**L**	**T**	**P**	**C**
			3	**-**	**-**	**3**
Evaluation	**SEE**	60 Marks	**CIE**		40 Marks	

Course Objectives:	
1	To understand the processor selection criteria for Embedded System Design.
2	To provide a clear understanding of role of firmware, operating systems in correlation with hardware systems.
3	To gain the knowledge of tool chain for embedded systems.
4	To understand the importance of RTOS in building real time systems
5	To gain knowledge on internal working procedure of RTOS

Course Outcomes:	
On completion of this course, the student will be able to :	
1	Understand the working of a simple embedded system and embedded system applications
2	Design an Embedded System firmware
3	Use Embedded Software Development Tools for Designing Embedded System appplications
4	Understand RTOS and its use in Embedded environment
5	Understand RTOS concepts like Task Communication and Task Synchronization.

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

Correlation rating: Low / Medium / High: 1 / 2 / 3 respectively.

UNIT–I

Introduction to Embedded Systems:

Embedded systems Vs General computing systems, History of Embedded systems, classification, Characteristics and quality attributes of Embedded Systems Challenges in Embedded System Design, Application and Domain specific Embedded Systems.

UNIT–II

Embedded firmware and Design and Development:

Embedded Firmware Design Approaches and Development languages and Programming in Embedded C.

UNIT–III
Embedded Software Development Tools: Host and Target Machines, Cross Compilers, Cross Assemblers, Tool Chains, Linkers/Locators for Embedded Software, Address Resolution, Locator Maps. Getting Embedded Software Into Target System: PROM programmer, ROM emulator, In Circuit- Emulators, Monitors, Testing on Your Host Machine - Instruction Set Simulators, Logic Analyzers

UNIT-IV
Introduction to Real Time Operating Systems: **Tasks and task states, tasks and Data, Semaphores and shared data. Operating system services: Message queues, mailboxes and pipes, timer functions, events, memory management, Interrupt routines in an RTOS environment**

UNIT – V
TASK COMMUNICATION: **Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, How to Choose an RTOS.**

Suggested Reading:

1	Shibu, K.V., Introduction to Embedded Systems, 1st Ed., TMH, 2009
2	Raj Kamal, Embedded Systems – Architecture, Programming and Design, 2nd Edition, TMH, 2008
3	An Embedded Software Primer - David E. Simon, Pearson Education.
4	Jean.J.Labrosse, MicroC/OS-II, Taylor & Francis, 2002

OE702EC	BASICS OF INTERNET OF THINGS					
(OPEN ELECTIVE)						
Pre-requisites			**L**	**T**	**P**	**C**
			3	-	-	3
Evaluation	**SEE**	60 Marks	**CIE**		40 Marks	

Course Objectives :	
The course is taught with the objectives of enabling the student to:	
1	To understand the concepts of the Internet of Things and be able to build IoT applications
2	To learn the programming and use of Arduino and Raspberry Pi boards Design And detail the deep beams.
3	To study about various IoT case studies and industrial applications.

Course Outcomes:	
On completion of this course, the student will be able to:	
CO-1	Known basic protocols in sensor networks.
CO-2	To Know the Architecture and Protocols of IoT.
CO-3	Python programming and interfacing for Raspberry Pi.
CO-4	Interfacing sensors and actuators with different IoT architectures.
CO-5	Compare IOT Applications in Industrial &real world

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

UNIT–I

Introduction to the Internet of Things, Characteristics of IoT, Physical design of IoT, Functional blocks of IoT, Sensing, Actuation, Basics of Networking, Communication Protocols.

UNIT– II

IoT Architecture: Physical and Logical design of IoT, IoT frameworks, IoT Protocols – MQTT, COAP, 6LOWPAN.

UNIT - III
Introduction to Python programming, Introduction to Raspberry Pi, Interfacing Raspberry Pi with basic peripherals, Implementation of IoT with Raspberry Pi.

UNIT– IV
IoT applications in home, Infrastructures, Buildings, Security, Industries, Home appliances, other IoT electronic equipments.

UNIT–V
Prototyping and Programming for IoT: Sensors, Actuators, Micro Controllers, SoC, Choosing a platform, prototyping hardware platforms- Arduino, Raspberry Pi, Prototype in Physical design- Laser Cutting, 3D-Printing, CNC milling, techniques for writing Embedded code

Suggested Reading:

1	Raj Kamal, "Internet of Things – Architecture and Design Principles", McGraw Hill Education Pvt. Ltd., 2017
2	"Makesensors":Terokarvinen,kemo,karvinenandvilleyvaltokari,1stedition, maker media, 2014.
3	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
4	Internet of Things – A hands-on approach, Arshdeep Bahga, Vijay Madisetti, Universities Press, 2015
5	Rao, M. (2018). Internet of Things with Raspbery Pi 3: Leverage the power of Raspberry Pi 3 and JavaScript to build exciting IoT projects. Packt Publishing Ltd
6	Internet of Things and Data Analytics, Hwaiyu Geng, P.E, Wiley Publications, 2017

Course Code	Course Title						Course Type
OE701EE	OPTIMIZATION TECHNIQUES						Elective
Prerequisite	Contact hours per week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	3	-	-	3	40	60	3

Course Objectives:	
The course is taught with the objectives of enabling the student to:	
1	To understand the need and basic concepts of operations research and classify the optimization problems.
2	To study about the linear programming and non-linear programming concepts and their applications.
3	To understand various constrained and un-constrained optimization techniques and their applications.
4	To understand the concepts and implementation of Genetic Algorithms to get the optimum solutions.
5	To study the concepts of Metaheuristics Optimization techniques.

Course Outcomes:	
On completion of this course, the student will be able to:	
CO-1	Analyze any problem of optimization in an engineering system and able to formulate a mathematical model to the problem and solving it by the techniques that are presented.
CO-2	Solve problems of L.P. by graphical and Simplex methods.
CO-3	Apply various constrained and un-constrained optimization techniques for the specific problems.
CO-4	Implement the Genetic Algorithms to solve the for optimum solution.
CO-5	Understand the concepts to use the Metaheuristics Optimization techniques.

Articulation matrix of Course Outcomes with POs:

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

Correlation rating: Low / Medium / High: 1 / 2 / 3 respectively.

UNIT–I
Introduction: Definitions, Characteristics, Objective function, Classification of optimization problems, Engineering applications and limitations. Single-Variable Optimization, Multivariable Optimization with No Constraints, Multivariable Optimization with Equality Constraints and Multivariable Optimization with Inequality Constraints: Kuhn–Tucker Condition.

UNIT–II
Linear Programming: Definitions and Formulation of the LPP, Construction of L.P. Models, Slack and surplus variables, Standard form, Canonical form and matrix form of LP Problems. Artificial Variables, solution by the Big-M method, Duality principle, Dual problems and numerical problems.

UNIT–III
Random Search Methods Concepts: Direct Search Methods - Univariate Method, Gradient of a Function, Indirect Search Methods - Gradient of a Function, Steepest Descent (Cauchy) Method, Newton's Method.

UNIT-IV
Binary Genetic Algorithm: Genetic Algorithms Natural Selection on a Computer, Components of a Binary Genetic Algorithm. Selecting the Variables and the Cost Function. Variable Encoding and Decoding, The Population, Natural Selection, Selection, Mating. Mutations, the Next Generation and Convergence, Components of a Continuous Genetic Algorithm.

UNIT – V
Metaheuristics Optimization: Concepts of Simulated Annealing, Theoretical approaches, Advantages and disadvantages, applications, Ant Colony Algorithms - Introduction, Collective behavior of social insects, Formalization and properties of ant colony optimization.

Suggested Reading:

1	Rao, S.S. (2009). "Engineering Optimization: Theory and Practice." John Wiley & Sons, Inc.
2	Taha, H.A. (2008). "Operations Research, Pearson Education India." New Delhi, India.
3	Randy L. Haupt and Sue Ellen Haupt, "Practical genetic algorithms" second edition, a John Wiley & sons, inc., publication -2004.
4	Sharma J.K. (2013). "Operation Research: Theory and Applications." Fifth Edition, Macmillan Publishers, New Delhi, India.
5	J. Dreo A. Petrowski, P. Siarry E. Taillard. "Metaheuristics for Hard Optimization" Springer.

Course Code	Course Title						Course Type
OE702EE	NON-CONVENTIONAL ENERGY SOURCES						Elective
Prerequisite	Contact hours per week			Duration of SEE (Hours)	Scheme of Evaluation		Credits
	L	T	P		CIE	SEE	
	3	-	-	3	40	60	3

Course Objectives:	
The course is taught with the objectives of enabling the student to:	
1	To understand the different types of energy sources.
2	To understand the need of non-conventional energy sources and their principles.
3	To understand the limitations of non-conventional energy sources.
4	To outline division aspects and utilization of renewable energy sources for diriment application.
5	To analyze the environmental aspects of renewable energy resources.

Course Outcomes:	
On completion of this course, the student will be able to :	
CO-1	Know the different energy resources and need of renewable energy resources.
CO-2	Understand the concepts of working of fuel cell systems along with their applications.
CO-3	Describe the use of solar energy and the various components and measuring devices used in the energy production and their applications.
CO-4	Appreciate the need of Wind Energy and their classification and various components used in energy generation and working of different electrical wind energy system.
CO-5	Understand the concept of OTEC technology, Biomass energy resources and different types of biogas Plants used in India.

Articulation matrix of Course Outcomes with POs:

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

Correlation rating: Low / Medium / High: 1 / 2 / 3 respectively.

UNIT–I

Review of Conventional and Non-Conventional energy sources, Need for non-conventional energy sources Types of Non-conventional energy sources, Fuel Cells, Principle of operation with special reference to H2O2 Cell, Classification and Block diagram of fuel cell systems, Ion exchange membrane cell, Molten carbonate cells, Solid oxide electrolyte cells, Regenerative system, Regenerative Fuel Cell, Advantages and disadvantages of Fuel Cells, Polarization, Conversion efficiency and Applications of Fuel Cells.

UNIT–II
Solar energy, Solar radiation and its measurements, Solar Energy collectors, Solar Energy storage systems, Solar Pond, Application of Solar Pond, Applications of solar energy.

UNIT–III
Wind energy, Principles of wind energy conversion systems, Nature of wind, Power in the Wind, Basic components of WECS, Classification of WECS, Site selection considerations, Advantages and disadvantages of WECS, Wind energy collectors, Wind electric generating and control systems, Applications of Wind energy, Environmental aspects.

UNIT–IV
Energy from the Oceans, Ocean Thermal Electric Conversion (OTEC) methods, Principles of tidal power generation, Advantages and limitations of tidal power generation, Ocean waves, Wave energy conversion devices, Advantages and disadvantages of wave energy, Geo- thermal Energy, Types of Geo-thermal Energy Systems, Applications of Geo-thermal Energy.

UNIT–V
Energy from Biomass, Biomass conversion technologies / processes, Photosynthesis, Photosynthetic efficiency, Biogas generation, Selection of site for Biogas plant, Classification of Biogas plants, Details of commonly used Biogas plants in India, Advantages and disadvantages of Biogas generation, Thermal gasification of biomass, Biomass gasifies.

Suggested Reading:

1	Rai G.D, Non-Conventional Sources of Energy, Khandala Publishers, New Delhi, 1999.
2	M.M.El-Wakil, Power Plant Technology. McGraw Hill, 1984.

OE701ME	Nano Technology					
Pre-requisites			**L**	**T**	**P**	**C**
			3	-	-	3
Evaluation	**SEE**	60 Marks	**CIE**		40 Marks	

Course Objectives:	
The course is taught with the objectives of enabling the student to:	
1.	To familiarize Nano materials and technology
2.	To understand Nano structures, fabrication and special Nano materials

UNIT-I

Introduction: Nanoscale, Properties at Nanoscale, advantages and disadvantages, importance of Nano Technology, Bottom-up and Top-down approaches, challenges in Nano Technology.

UNIT-II

Materials of Nano Technology: Introduction-Si-based materials, Ge-based materials, Smart materials, metals, Ferroelectric materials, Polymer materials, GaAs & InP (III-V) group materials, Nano tribology and Materials, Principles and analytical techniques of XRD, SEM, TEM and STM/AFM.

UNIT-III

Nano Structures: Zero dimensional Nano structure (Nano Particles)- Synthesis procedure, characterization techniques, properties and applications of Nano Particles One dimensional Nano structures (Nano Wires, Nano Tubes)- Various Synthesis procedure, characterization procedure and principles involved, properties and applications of Nano Wires, Types of Nano Tubes, Synthesis procedure, characterization properties and applications of Nano Tubes.

UNIT-IV

Nano Fabrication: Introduction, Basic fabrication techniques (Lithography, thin film deposition, and doping) MEMS fabrication techniques, Nano fabrication techniques (E-beam Nano-imprint fabrication, Epitaxy and strain engineering, Scanned probe techniques).

UNIT-V

Special Nano Materials: Nano Composites: Introduction, Synthesis procedures, various systems (metal-polymer, metal- ceramics and polymer-Ceramics), Characterization procedures, applications. Nano Biomaterials: Introduction, Biocompatibility, anti-bacterial activity, principles involved, applications.

Suggested Reading:

1. A.K.Bandyopadyay, Nano Materials, New Age Publications, 2007.
2. T. Pradeep, Nano: The Essentials: Understanding Nanoscience and Nanotechnolgy, Tata
   McGraw-Hill, 2008.
3. Carl. C. Koch, Nano Materials Synthesis, Properties and Applications, Jaico Publishing House,2008.
4. Willia Illsey Atkinson, NanoTechnology, Jaico Publishing House, 2009.

OE702ME	Startup Entrepreneurship					
Pre-requisites			**L**	**T**	**P**	**C**
			3	-	-	3
Evaluation	**SEE**	60 Marks	**CIE**		40 Marks	

Course Objectives:	
The course is taught with the objectives of enabling the student to:	
1.	To motivate students to take up entrepreneurship in future
2.	To learn nuances of starting an enterprise & project management
3.	To understand the behavioural aspects of entrepreneurs and time management

Course Outcomes:	
On completion of this course, the student will be able to:	
CO-1	Understand the behavioural aspects of entrepreneurs and time management
CO-2	Creative thinking and transform ideas into reality
CO-3	Importance of innovation in new business opportunities
CO-4	Create a complete business plan and workout the budget plan.
CO-5	Write a project proposal with budget statement

UNIT I

Creativity & Discovery: Definition of Creativity, self test creativity, discovery and delivery skills, The imagination threshold, Building creativity ladder, Collection of wild ideas, Bench marking the ideas, Innovative to borrow or adopt, choosing the best of many ideas, management of tradeoff between discovery and delivery, Sharpening observation skills, reinventing self, Inspire and aspire through success stories

UNIT II

From Idea to Startup : Introduction to think ahead backward, Validation of ideas using cost and strategy, visualizing the business through value profile, activity mapping, Risks as opportunities, building your own road map

UNIT III

Innovation career lessons : Growing & Sharing Knowledge, The Role of Failure In Achieving Success, Creating vision, Strategy, Action & Resistance: Differentiated Market Transforming Strategy; Dare to Take Action; Fighting Resistance; All About the startup Ecosystem; Building a Team; Keeping it Simple and Working Hard.

UNIT IV

Action driven business plan: Creating a completed non-business plan (a series of actions each of which moves your idea toward implementation), including a list of the activities to be undertaken, with degrees of importance (scale of 1 to 3, where 1 is 'most important'). A revision of the original product or service idea, in light of information gathered in the process, beginning to design the business or organization that will successfully implement your creative idea. Preparing an activity map.

UNIT V

Startup financing cycle: Preparing an initial cash flow statement, showing money flowing out (operations; capital) and flowing in. Estimate your capital needs realistically. Prepare a bootstrapping option (self financing). Prepare a risk map. Prepare a business plan comprising five sections: The Need; The Product; Unique Features; The Market; Future Developments. Include a Gantt chart (project plan – detailed activities and starting and ending dates); and a project budget.

Suggested Readings:

1. Vasant Desai, "Dynamics of Entrepreneurial Development and Management", Himalaya Publishing House, 1997.
2. Prasanna Chandra, "Project – Planning , Analysis, Selection, Implementation and Review", TataMcGraw-Hill Publishing Company Ltd., 1995.
3. B. Badhai, "Entrepreneurship for Engineers", Dhanpath Rai & Co., Delhi, 2001.
4. Stephen R. Covey and A. Roger Merrill, "First Things First", Simon and Schuster, 2002.
5. Robert D. Hisrich and Michael P.Peters, " Entrepreneurship", Tata McGRaw Hill Edition, 2002.

PC 752 CE	Computer Applications in Civil Engineering Lab					
Pre-requisites			**L**	**T**	**P**	**C**
			-	-	2	1
Evaluation	**SEE**	50 Marks	**CIE**		25 Marks	

Course Objectives:	
The course is taught with the objectives of enabling the student to:	
1.	Understand the design steps for preparation algorithm for typical simple structural problems
2.	Understand the algorithm and steps for typical Geotechnical Engineering problems
3.	Understand to prepare steps for hydraulics related problems

Course Outcomes:	
On completion of this course, the student will be able to:	
CO-1	Develop and execute computer code for simple structural elements such as slabs, beams and foundations
CO-2	Develop code for geotechnical application problems such as stress distribution, pressure bulb and settlement
CO-3	Develop code for geotechnical application problems such as bearing capacity of a shallow foundation and design of pile foundation
CO-4	Write computer code for hydraulic problems for flow measurements such as discharge, normal and critical depths and Φ-index
CO-5	Prepare computer code for hydraulic problems for flow measurements of well and pipe network, flood routing and design of an irrigation channels

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

1. Calculation of shear force and bending moment at any section for a simply supported beam carrying a u.d.l. shorter than span.
2. Structural design of an RCC beam section using limit state method, given are the grade of concrete, grade or steel, BM and SF.
3. A rectangular cross section is subjected to a non-central force parallel to the axis of member. Determine the stresses at any location of the section. Direct and bending stresses.
4. Compute distribution of increment in vertical stress due to applied point load ona (a) Horizontal Plane (b) Vertical plane. Using the computed values, plot the distribution utilizing VC as front-end tool.
5. Compute the values of a pressure bulb and using the values plot pressure bulb utilizing VC as front-end tool.

6. Compute the consolidation settlement duly dividing the strata into infinitesimally small layers to fulfill the Terzaghi'sassumption.
7. Compute earth pressure on to a retaining wall and check its stability.
8. Compute bearing capacity of a shallow foundation as per IS: 6403-1980.
9. Develop a code in C to design a single vertical pile, pile group to suit various ground conditions.
10. Computation of discharge over a rectangular notch using velocity of approach.
11. Calculation of normal depth in a trapezoidal channel.
12. Calculation of critical depth in a trapezoidal channel.
13. Calculation of Φ-index.
14. Estimation of specific capacity and maximum pumping rate of a well.
15. Analysis of pipe network in water distribution systems.
16. Flood routing using Muskigham's method.
17. Design of an irrigation channel using Kennedy's theory by 3 approaches.
18. Design of trapezoidal notch canal fall.

PW 762 CE	MAJOR PROJECT PHASE –I					
Pre-requisites			**L**	**T**	**P**	**C**
			-	-	6	3
Evaluation	**SEE**	-	**CIE**		50Marks	

Course Objectives:	
The course is taught with the objectives of enabling the student to:	
1.	To enhance practical and professional skills
2.	To familiarize tools and techniques of systematic literature survey and prepare documentation
3.	To expose the students to industry practices and ability to work as team
4.	To encourage students to work with innovative and entrepreneurial ideas

Course Outcomes:	
On completion of this course, the student will be able to:	
CO-1	Demonstrate the ability to synthesize and apply the knowledge and skills acquired in the Academic program to real-world problems
CO-2	Collect the relevant literature and information in an organized manner and propose the methodology
CO-3	Execute and analyze the project according to proposed methodology
CO-4	Make observations and draw the conclusions based on economic and technical feasibility
CO-5	Demonstrate effective technical write up and oral communication skills

Articulation matrix of Course outcomes with PO's:

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

Correlation rating: Low/ Medium/High:1/2/3 respectively.

The Department can initiate the project allotment procedure at the end of VI semester and finalize it in the first two weeks of VII semester. The department will appoint a project coordinator who will coordinate the following:
Collection of project topics/descriptions from faculty members (Problems can also be invited from the industries)
Grouping of students (3to5 in a group maximum)
Allotment of project guides:
The aim of project work is to develop solutions to realistic problems applying the knowledge and skills obtained in different courses, new technologies and current industry practices. This requires students to understand current problems in their domain and methodologies to solve these problems. After completion of these seminars each group has to formalize the project proposal based on their own ideas or as suggested by the project guide.

Seminar schedule will be prepared by the coordinator for all the students from the 5^{th} week to the last week of the semester which should be strictly adhered to.

Each group will be required to:
1. Submit a one-page synopsis before the seminar for display on notice board.
2. Give a 30 minutes presentation followed by10 minutes discussion.
3. Submit a technical write-up on the talk.

At least two teachers will be associated with the Project Seminar to evaluate students for the award of sessional marks which will be on the basis of performance in all the 3 items stated above.
The seminar presentation should include the following components of the project:

- Problem definition and specification
- Literature survey
- Broad knowledge of available techniques to solve a particular problem.
- Planning of the work, preparation of bar(activity)charts
- Presentation-oral and written

PW 661 CE	SUMMER INTERNSHIP*					
Pre-requisites			**L**	**T**	**P**	**C**
			-	-	4	2
Evaluation	**SEE**	-	**CIE**		50Marks	

Course Objectives:	
The course is taught with the objectives of enabling the student to:	
1.	To expose the students in understanding the real-life practical problems and technologies
2.	To provide an opportunity to integrate various aspects of learning reference of practical problems
3.	To enhance the confidence of the students by interaction with field professionals

Course Outcomes:	
On completion of this course, the student will be able to:	
CO-1	Get exposure to industrial problems
CO-2	Understand the application of theory to practice
CO-3	Able to prepare report and develop professional skills

Articulation matrix of Course outcomes with PO's:

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

Correlation rating: Low/ Medium/High:1/2/3 respectively.

Summer Internship is introduced as part of the curricula to encourage students to work on problems of interest to industries or in a consulting organization. A batch of two or three students will be attached to Industry/R &D Organization/ National Laboratory/ Consultants/ Project offices/ Executing Agencies/ Departments/ Private Builders for a period of SIX weeks. This will be during the summer vacation followed after the completion VI semester course. Faculty member(s) will be acting as an internal guide(s) for the batches to mentor and monitor the progress and also interacts with the Industry guide (s) as per the need.

After the completion of the internship, students need to submit a brief technical report on the project executed and present the work through a seminar talk to be organized by the Department. Award of sessional are based on the performance of the student at the work place and will be judged by internal guide (s) (25 Marks) followed by presentation before the committee constituted by the Department (25 Marks). One faculty member will coordinate the overall activity of Summer Internship.

***Students have to undergo summer internship of 6 Weeks duration at the end of semester VI and the credits will be awarded after evaluation in VII semester.**

VIII SEMESTER

MC801CE	Environmental Science					
Pre-requisites	Water Resources Engineering Subjects		**L**	**T**	**P**	**C**
			3	-	-	0
Evaluation	**SEE**	60Marks	**CIE**		40Marks	

Course Objectives:	
The course is taught with the objectives of enabling the student to:	
1.	Comprehend the need of environmental science, ethics and issues
2.	Realize the availability and utilization of various natural resources
3.	Illustrate the characteristics and functions of Ecosystem
4.	Study various environmental pollution effects, prevention and control acts
5.	Understand the concepts of Biodiversity and its conservation needs

Course Outcomes:	
On completion of this course, the student will be able to:	
CO-1	Application and awareness of various environmental issues for sustainable society
CO-2	Acquaintance with utilization of various natural resources
CO-3	Capacity to understand and practice for sustainability of ecosystem.
CO-4	Knowledge of social and environment related issues and their preventive measures
CO-5	Ability in conserving and protecting the biodiversity

Articulation matrix of Course outcomes with PO's:

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

Correlation rating: Low/ Medium/High:1/2/3 respectively

Unit I

Multidisciplinary nature of Environmental studies:

Definition, scope and importance, Need for public awareness, Environmental ethics: issues and possible solutions, Global Warming and Climate change, Acid rain, Ozone layer depletion. Environment and human health, Population growth, Sustainable development and SDGs

Unit II

Natural Resources:

Types of Natural Resources, Role of individual in conservation of natural resources, Equitable use of resources for sustainable life styles, Natural resources and associated problems.

Land Resources: Land as a resource, land degradation, soil erosion,and desertification.

Forest resources: Use and Overexploitation, Deforestation, Timber Extraction, Mining, Dams, and their Effects on Forests and Tribal People

Water resources: Water Resources: Use and Overutilization of Surface and Ground Water, Floods, Drought, Conflicts over Water, Dams – Benefits and problems

Mineral Resources:Use and Exploitation, Environmental Effects of Extracting and using Mineral Resources

Food Resources: World Food Problems, Changes Caused by Agriculture and Overgrazing, Effects of Modern Agriculture, Fertilizer-Pesticide Problems, Water Logging, Salinity, Energy Resources.

Unit III

Ecosystems:

Concept of an Ecosystem, Types, Structure and function of an ecosystem, Producers, consumers, decomposers. Energy flow in the ecosystems, Ecological succession, Food chains, food webs and ecological pyramids.

Introduction, types, characteristic features, structure and functions - Forest ecosystem, Grass land ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit IV

Environmental Pollution:

Definition, Causes, effects and control measures - Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards,

Environmental Protection: Air (prevention and control of pollution) Act, Water (prevention and control of pollution) Act, Wildlife conservation and protection act, Forest conservation and protection act, Role of an individual's, communities and NGOs in prevention of pollution

Solid waste Management: Causes, effects and control measures of urban and industrial wastes

Unit V

Biodiversity and its Conservation:

Definition: genetics, species and ecosystem diversity, Spatial Patterns of Species Richness, Shannon's, Simpson's Diversity Index. Bio-geographically classification of India. Value of biodiversity - consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, national and local level. India as a mega diversity nation. Hot-spots of biodiversity,

Threats to biodiversity: habitats loss, poaching of wild life, man wildlife conflicts. Endangered and endemic spaces of India.

Conservation of biodiversity: in-situ and ex-situ conservation of biodiversity, Biological Diversity Act, 2002.

Suggested Reading:

1.	Erach Bharucha., Textbook of Environmental Studies, UGC, New Delhi and Bharathi Vidyapeeth Institute of Environment Education and Research, Pune.
2.	Mahua Basu and Xavier Savarimuthu SJ., Fundamentals of Environmental Studies,Cambridge University Press, New Delhi, 2017**.**
3.	Mishra D D., Fundamental Concepts in Environmental Studies, S Chand & Co Ltd., New Delhi, 2010.
4.	Botkin and Keller., Environmental Science, Wiley India Pvt., Ltd., New Delhi, 2012.
5.	Gilbert, M. Masters., Introduction to Environmental Engineering and Science, Prentice- Hall of India Pvt., Ltd., New Delhi, 1995.
6.	Sasi Kumar, K. and Sanoop Gopi Krishna., Solid waste Management, Prentice-Hall of India Pvt., Ltd., New Delhi, 2009.
7.	Daniel D. Chiras, Environmental Science, Jones & Bartlett Learning Publishers Inc, Burlington, MA, 2014.

MC802HS	Intellectual Property Rights					
Pre-requisites			**L**	**T**	**P**	**C**
			3	-	-	0
Evaluation	**SEE**	60Marks	**CIE**		40Marks	

Course Objectives:	
The course is taught with the objectives of enabling the student to:	
1.	Acquaint the students with basics of intellectual property rights with special reference to Indian Laws and its practices
2.	Compare and contrast the different forms of intellectual property protection in terms of their key differences and similarities
3.	Provide an overview of the statutory, procedural, and case law underlining these processes and their interplay with litigation

Course Outcomes:	
On completion of this course, the student will be able to:	
CO-1	Understand the concept of intellectual property rights.
CO-2	Develop proficiency in trademarks and acquisition of trade mark rights.
CO-3	Understand the skill of acquiring the copy rights, ownership rights and transfer.
CO-4	Able to protect trade secrets, liability for misappropriations of trade secrets.
CO-5	Apply the patents and demonstration of case studies.

UNIT – I
Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT – II
Trade Marks: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting, and evaluating trade mark, trade mark registration processes.

UNIT – III
Law of copy rights: Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law. Law of patents: Foundation of

patent law, patent searching process, ownership rights and transfer**.**

UNIT – IV
Trade Secrets: Trade secrete law, determination of trade secrete status, liability for misappropriations of trade secrets, protection for submission, trade secrete litigation. Unfair competition: Misappropriation right of publicity, false advertising.

UNIT –V
New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

Suggested Reading:

1	lbert, “Resisting Intellectual Property”, Taylor & Francis Ltd, 2007.
2	layall, “Industrial Design”, McGraw Hill,1992
3	iebel, “Product Design”, McGraw Hill,1974.
4	simov, “Introduction to Design”, Prentice Hall,1962.
5	obert P. Merges, Peter S. Menell, Mark A. Lemley, “Intellectual Property in New Technological Age”,2016.
6	Ramappa, “Intellectual Property Rights Under WTO”, S. Chand,2008

MC803HS	English for Technical Paper Writing					
Pre-requisites			**L**	**T**	**P**	**C**
			3	-	-	0
Evaluation	**SEE**	60Marks	**CIE**		40Marks	

Course Objectives:	
The course is taught with the objectives of enabling the student to:	
1.	Understand that how to improve your writing skills and level of readability. Learn about what to write in each section.
2.	Understand the skills needed when writing a Title Ensure the good quality of paper at very first-time submission.

Course Outcomes:	
On completion of this course, the student will be able to:	
CO-1	Able to plan and prepare paragraphs, avoiding ambiguity and grammatical errors
CO-2	Writing of abstracts, paraphrasing and plagiarism
CO-3	Providing critical and thorough review of literature, discussions and conclusions
CO-4	Able to exhibit key skills for writing titles, introduction, abstract.
CO-5	Able to show key and necessary skills for paper writing, phrases, results.

UNIT-I

Root Words, Synonyms and Antonyms, One word substitutes, importance of Punctuation, Sentence Structure, Subject Verb Agreement, Noun Pronoun Agreement, Redundancy, Cliche

UNIT-II

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness ,

UNIT-III

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

UNIT-IV

Describing, Defining, Classifying, Providing examples or evidence, Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check,

UNIT-V

Key skills are needed when writing a Title, Abstract, Introduction, Review of the Literature, Methods, Results, Discussion, Conclusions -Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

Suggested Reading:

1. Norman Lewis, Word Power Made Easy, Anchor Books, New York, Reprint Edition, 2014.

2. C.R. Kothari and Gaurav Garg, Research Methodology: Methods and Techniques, 4th Edition, New Age International Publishers, New Delhi, 2019.

3. P.C. Wren and H. Martin, A Comprehensive Grammar of the English Language, Revised and Updated by N.D.V. Prasada Rao, S. Chand Publishing, New Delhi, Latest Edition.

4. Goldbort R, Writing for Science, Yale University Press (available on Google Books), 2006.

5. Day R, How to Write and Publish a Scientific Paper, Cambridge University Press, 2006.

6. Highman N Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book. 1998

7. Adrian Wallwork English for Writing Research Papers, Springer New York Dordrecht Heidelberg London. 2011.

MC 804HS	Constitution of India					
Pre-requisites			**L**	**T**	**P**	**C**
			3	-	-	0
Evaluation	**SEE**	60Marks	**CIE**		40Marks	

Course Objectives:	
The course is taught with the objectives of enabling the student to:	
1.	Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective
2.	To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role
3.	Entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.

Course Outcomes:	
On completion of this course, the student will be able to:	
CO-1	Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
CO-2	Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
CO-3	Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru
CO-4	The eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
CO-5	Discuss the passage of the Hindu Code Bill of 1956.

UNIT-I

History of making of the Indian constitutions: History, Drafting Committee(Composition & Working). Philosophy of the Indian Constitution: Preamble, Salient Features.

UNIT-II

Contours of Constitutional Rights and Duties: Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT-III

Organs of Governance: Parliament: Composition, Qualifications, Powers and Functions, Union executives : President, Governor, Council of Ministers, Judiciary, appointment and transfer of judges, qualifications, powers and functions

UNIT-IV

Local Administration - District's Administration head: Role and importance. Municipalities: Introduction, ayor and role of Elected Representative, CEO of Municipal Corporation. Panchayati Raj: Introduction, PRI: Zilla Panchayat, Elected Officials and their roles, CEO Zilla Panchayat: positions and role. Block level: Organizational Hierarchy (Different departments) Village level: role of elected and appointed officials. Importance of grass root democracy.

UNIT-V

Election commission: Role and functioning, Chief Election Commissioner and Election Commissioners, State Election Commission :Role and functioning. Institute and Bodies for the welfare of SC/ST/OBC and women**.**

Suggested Reading:

1. "The Constitution of India", 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar, "Framing of Indian Constitution", 1st Edition, 2015.
3. M. P. Jain, "Indian Constitution Law", 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, "Introduction to the Constitution of India", Lexis Nexis, 2015.

Web Resource:

1. http://www.nptel.ac.in/courses/103107084/Script.pdf

MC 805 HS	Essence of Indian Traditional Knowledge					
Pre-requisites			**L**	**T**	**P**	**C**
			3	-	-	0
Evaluation	**SEE**	60Marks	**CIE**		40Marks	

Course Objectives:	
The course is taught with the objectives of enabling the student to:	
1.	Comprehend the Basic fundamental aspects of Society, Culture and Heritage
2.	Understand the significant aspects of Traditional Hindu Social Organization and vedic literature both at individual level and societal level
3.	Inculcate a philosophical insight through shad darshanas and a spiritual outlook through Yoga Sutras
4	Realize the significance and the utilitarian aspect of the traditional knowledge system through case studies
5	Appreciate the significance and necessity for the preservation of traditional knowledge system

Course Outcomes:	
On completion of this course, the student will be able to:	
CO-1	Know the fundamental concepts of Society with regard to values, norms, cultural and nature of Indian culture
CO-2	Understand the connect between the vedic literature and the traditional structural organization guiding at the various phases of life of an individual
CO-3	Recognize the importance of Darshanas and significance of Yoga sutra in building up a holistic life perspective
CO-4	To inculcate a pursuit of looking deeper into IKS for addressing the multi faceted contemporary issues both at local and global platform
CO-5	Analyze the significance and the measures for the preservation of Traditional Knowledge System

UNIT - I

Fundamental Concepts : Society, Definition and its Characteristics; Values- Norms, Role-Status, Order and Stability, Habits, Custom; Understanding difference between Belief and Ritual, Tradition and Heritage; Culture : Definition and its Characteristics; Characteristics of Indian Culture; Concept of Unity in Diversity;.

UNIT - II

Indian Traditional System: Traditional Hindu Organization: Purusharthas, Varna Dharma and Ashrama Dharma. Indian Traditional Scriptures and their Classification; General Understanding of Vedas : Rig veda, Sama veda, Yajur Veda, and Atharva veda, Upanishads; Smritis : Itihasa, Puranas, Agamas, Upvedas, and Vedangas.

UNIT - III

Traditional Philosophies / School of thoughts: Darshanas : philosophies of 6 Schools : Nyaya, Vaisheshika, Samkhya, Yoga, Mimamsa and Vedanta; Nastika School of Philosophy : Charvaka, Jainism and Bhuddhism; Yoga and Spirituality.

UNIT - IV

Traditional Knowledge System : Definition of Traditional knowledge, Indigenous Knowledge System; Case studies of Ancient traditional Knowledge System Astronomy,Vastu-Shatras, Wootz Steel lost technology of IKS, Water Management, and Agriculture.

UNIT - V

Protection of Traditional Knowledge - Significance and Need of Protection of Traditional Knowledge ; and measure for protection of TK, Role of the Government to harness TK. Documentation and Preservation of IKS , Approaches for conservation and Management of nature and bio-resources, Approaches and strategies to protection and conservation of IKS.

Suggested Books for Reference:

1. V. Sivaramnkrishna (Ed.). Cultural Heritage of Lndia-Cou rse Material, Bharatiya Vidya Bhavan,Mumbai. 5th Edition, 2014
2. Swami Jirntmanand. Modern Physics and Vedant, Bharati ya V idya Bhavan
3. Fritzof Capra. Tao of Physics
4. Fritzof Capra, The wave of Life
5. V N Jba (Eng. Trans.). Tarkasangraha of Annam Bhana, lnernational Chinmay Foundation, Velliamad. Amaku.am
6. Yoga Sutra of Patanjali, Ramakrishna Mission. Kolkatta
7. GN Jha (Eng. Trans.) Ed. R N Jha, Yoga-darshanam with VyasaBhashya. Vidyanidhi Prakasham, Delhi, 2016
8. RN Jha. Science of Consciousness Psychotherapy and Yoga Practices. Vidya nidhi Prakasham, Delhi. 2016
9. P R Sha.min (English translation). Shodashang Hridayam

MC806HS	STRESS MANAGEMENT BY YOGA					
Pre-requisites			**L**	**T**	**P**	**C**
			3	-	-	0
Evaluation	**SEE**	60Marks	**CIE**		40Marks	

Course Objectives:	
The course is taught with the objectives of enabling the student to:	
1.	Creating awareness about different types of stress and the role of yoga in the management of stress.
2.	Promotion of positive health and overall wellbeing (Physical, mental, emotional, social and spiritual).
3.	Prevention of stress related health problems by yoga practice.

Course Outcomes:	
On completion of this course, the student will be able to:	
CO-1	To understand yoga and its benefits.
CO-2	Enhance Physical strength and flexibility.
CO-3	Learn to relax and focus.
CO-4	Relieve physical and mental tension through Asanas
CO-5	Improve work performance and efficiency.

Course outcome	**Program Outcome**					
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**
CO-1	-	-	-	-	-	
CO-2	-	-	-	-	-	1
CO-3	-	-	-	1	-	1
CO-4	-	-	-	-	1	1
CO-5	-	-	-	-	1	1

UNIT – I
Meaning and definition of Yoga - Historical perspective of Yoga - Principles of Astanga Yoga by Patanjali.

UNIT – II
Meaning and definition of Stress - Types of stress - Eustress and Distress. Anticipatory Anxiety and Intense Anxiety and depression. Meaning of Management- Stress Management.

UNIT – III
Concept of Stress according to Yoga - Stress assessment methods - Role of Asana, Pranayama and Meditation in the management of stress.

UNIT – IV
Asanas- (5 Asanas in each posture) - Warm up - Standing Asanas - Sitting Asanas - Prone Asanas - Supine asanas - Surya Namaskar.

UNIT – V
Pranayama- Anulom and Vilom Pranayama - Nadishudhi Pranayama – Kapalabhati-Pranayama - Bhramari Pranayama - Nadanusandhana Pranayama.
Meditation techniques: Om Meditation - Cyclic meditation : Instant Relaxation technique (QRT), Quick Relaxation Technique (QRT), Deep Relaxation Technique (DRT).

Suggested Reading:

1	"Yogic Asanas for Group Training - Part-I": Janardhan Swami Yogabhyasi Mandal, Nagpur
2	"Rajayoga or Conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata
3	Nagendra H.R nad Nagaratna R, "Yoga Perspective in Stress Management", Bangalore, Swami Vivekananda Yoga Prakashan

Web resource:

1	https://onlinecourses.nptel.ac.in/noc16_ge04/preview
2	https://freevideolectures.com/course/3539/indian-philosophy/11

MC807HS	SPORTS					
Pre-requisites			L	T	P	C
			3	-	-	0
Evaluation	SEE	60Marks	CIE		40Marks	

Course Objectives:	
The course is taught with the objectives of enabling the student to:	
1.	To develop an understanding of the importance of sport in the pursuit of a healthy and active lifestyle at the College and beyond.
2.	To develop an appreciation of the concepts of fair play, honest competition and good sportsmanship
3.	To develop leadership skills and foster qualities of co-operation, tolerance, consideration, trust and responsibility when faced with group and team problem-solving tasks
4	To develop the capacity to maintain interest in a sport or sports and to persevere in order to achieve success
5	To prepare each student to be able to participate fully in the competitive, recreational and leisure opportunities offered outside the school environment

Course Outcomes:	
On completion of this course, the student will be able to:	
CO-1	Students' sports activities are an essential aspect of university education, one of the most efficient means to develop one's character and personal qualities, promote the fair game principles, and form an active life position
CO-2	Over the past year, sports have become much more popular among our students. Let us remember the most memorable events related to sports and physical training
CO-3	Special attention was paid to team sports. Our male and female games and sports have achieved remarkable progress at a number of competitions
CO-4	Our teams in the main sports took part in regional and national competitions. Special thanks to our team in track and field athletics, which has been revitalized this year at ICT and which has won Javelin competition
CO-5	Staff of our faculties and students of Sports, Physical Development, & Healthy Lifestyle of Faculty congratulates everyone on the upcoming New Year and wishes you robust health and new victories in whatever you conceive

Requirements:

i) Track Paint (students should bring)
ii) Shoes
iii) Volley Ball, Foot Ball and Badminton (Shuttle)
iv) Ground, Court, indoor stadium and swimming pool

II. Evaluation Process:

Total Marks 50

i) 20 marks for internal exam (continuous evaluation)
   a) 8 marks for viva
   b) 12 marks for sports & fitness

ii) 30 marks for end exam
   a) 10 marks for viva
   b) 20 marks for sports & fitness

PE706CE	Legal Issues in Construction Management					
Pre-requisites			**L**	**T**	**P**	**C**
			3	-	-	0
Evaluation	**SEE**	60Marks	**CIE**		40Marks	

Course Objectives:	
The course is taught with the objectives of enabling the student to:	
1.	study the various types of construction contracts and their legal aspects and provisions
2.	study the tenders, arbitration, legal requirements, labor and human rights regulations Course Outcomes
3.	Know different types of contracts in construction, arbitration and legal aspects and its provision

Course Outcomes:	
On completion of this course, the student will be able to:	
CO-1	Students shall able to know basics on construction related Contracts
CO-2	Student shall be able to carry out the tendering process
CO-3	Overview of Construction Management , Administration and Present Status of Construction Industry
CO-4	Student shall be aware labour law related legislations
CO-5	Student shall be able to know Dispute resolution mechanism

Unit -1

Introduction to Construction Law - Need for legal issues in Construction–The Indian Contract Act, 1872 - Definition of a Contract and its essentials, Formation of a valid Contract - Offer and Acceptance, Consideration, Capacity to Contract, Free consent, Legality of object, Discharge of a Contract by performance, Impossibility and Frustration, Breach, Damages for breach of a contract, Quasi contracts. Special Contracts Contract of Indemnity and Guarantee, Contract of Bailment and Pledge, Contract of Agency— I T Law and its Influence on Construction Contracts

UNIT-2

Construction Tendering Process: Introduction to Construction Process, Need for tendering, process of Tendering in Construction, Importance of Specifications and Estimates in Construction, Concept of completion of the Contract, Sub-Contracts and requirements, Tendering Models and Strategies, Re Tendering , Prequalification of Bidders, Documents forming a BID and Contract, Agreements and Bonds in Tendering Process – E- Procurement

UNIT-3

Construction Administration: Duties and Responsibilities – Project Manager, Owner, Engineers and Contractors, Important Site Documents, Process of Building Permissions, Provision for Scheduling delays and accelerations, Environmental Provisions for Construction Contracts.

UNIT-4:

Employment legislations - Industrial Dispute Act, Factories Act, Payment of Wages Act, Workmen's Compensation Act. Important Provisions of Employees' State Insurance Act, Payment of Gratuity Act, Employees Provident Fund Act, Worker Compensation and Insurance laws.

UNIT-5:

Disputes and Liabilities in Construction: Major sources of disputes in construction, Reasons for Delays – Types, Claims and solutions Construction Liabilities and Litigations, Disputes in Land Development. Dispute Resolution in Construction and Judicial Process and ADRs, Arbitration and Conciliation Act 1996,Arbitration Agreement, Importance of ADR Methods in Construction, Arbitration Process, Arbitration Clause in Contracts

Suggested Readings:

10) Civil Engineering Contracts and Estimates - B. S. Patil – Universities Press- 2006 Edition, reprinted in 2009.
11) The Indian Contract Act (9 of 1872), 1872- Bare Act- 2018 edition, Asia Law Book Publishers Hyderabad..
12) The Arbitration and Conciliation Act,(1996), 1996 (26 of 1996)- 2006 Edition, Professional Book Publisher.
13) Law of contract Part I and Part II, Dr. R.K. Bangia- 2017 Edition, Allahabad Law Agency.
14) Arbitration, Conciliation and Alternative Dispute Resolution Systems- Dr. S.R. Myneni2004 Edition, reprinted in 2005- Asia Law House Publishers.
15) The Workmen's Compensation Act, 1923 (8 of 1923) Bare Act- 2005- Professional Book Publishers.
16) Standard General Conditions for Domestic Contracts- 2001 Edition- Published by Ministry Of Statistics and Program Implementation, Government of India.
17) FIDIC Document (1999). 9) Dispute Resolution Board foundation manual-www.drbf.org
18) Dispute Resolution Board foundation manual-www.drbf.org.

PW 851 CE	PROJECT WORK –II					
Pre-requisites			**L**	**T**	**P**	**C**
			-	-	12	6
Evaluation	**SEE**	100 Marks	**CIE**		50 Marks	

Course Objectives:	
The course is taught with the objectives of enabling the student to:	
1.	To enhance practical and professional skills
2.	To gain application knowledge to solve real world problem
3.	To expose the students to industrial related problems and practices and ability to work as team
4.	To encourage students to work with innovative and entrepreneurial ideas

Course Outcomes:	
On completion of this course, the student will be able to:	
CO-1	Demonstrate the ability to synthesize and apply the knowledge and skills acquired in the academic program to solve real-world problems
CO-2	Ability to learn modern tools and methods to solve practical problems
CO-3	Evaluate different solutions based on economic and technical feasibility
CO-4	provide a practical/innovative solution with the technical knowledge gained
CO-5	prepare a technical report and findings from the project work carried out.

rating: Low/ Medium/High:1/2/3respectively.

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

Correlation rating: Low/ Medium/High:1/2/3 respectively.

The aim of project work –II is to implement and evaluate the proposal made as part of project work Phase - I. Students can also be encouraged to do full time internship as part of project work-II based on the common guidelines for all the Departments if they get selected. The students placed in internships need to write the new proposal in consultation with industry coordinator and project guide within two weeks from the commencement of instruction. The Department will appoint a project coordinator who will coordinate the following: Re- grouping of students - deletion of internship candidates from groups made as part of project work phase –I and Re-Allotment of internship students to project guides Project monitoring at regular intervals. All re-grouping/re-allotment has to be completed by the 2 nd week of VIII semester so that students get sufficient time for completion of the project. All projects (internship and Departmental) will be monitored at least twice in a semester through student presentation for the award of sessional marks. Sessional marks are awarded by a monitoring committee comprising of faculty members as well as by the supervisor. The first review of projects for 25 marks can be conducted after completion of five weeks. The second review for another 25 marks can be conducted after 12 weeks of instruction. Common norms will be established for the final documentation of the project report by the respective departments. The students are required to submit draft copies of their project report within one week after completion of instruction.

Note: Three periods of contact load will be assigned to each project guide.

The final end semester examination will be in the form of viva-voce examination and comprising of the following.

The student's groups should submit before the schedules date of external viva-voce examination a detailed project report duly approved by their Project work Phase – II guide(s) in the Department to organise the Project work Phase II viva-voce examination.

The Chair-Person BOS (A) will nominate internal examiners and external examiner panel to the examination cell, UCE (A), O.U.

The internal examiner will be coordinating the conduct of examination with external examiner as per the schedule and as per the batches. The Project work Phase – II guide also to be available during the presentation of project of their batch and the final marks awarded by external examiner and internal examiner will be sent to examination cell in sealed cover after the viva-voce examinations is completed. The distribution of 100 marks to be carried out by the external examiner with consultation of Head of Department. The pattern of examination is PPT presentation by the all the students of the entire group by PPT presentation generally limited to 30 minutes per batch including viva-voce questions. The marks will be awarded by the external examiner based on the Project work Phase – II report, presentation and viva-voce performance of students by the external examiner.