



THE KAVERY ENGINEERING COLLEGE

Mecheri, Mettur Tk. Salem Dt – 636 453.

(An Autonomous Institution Approved by AICTE, New Delhi & Affiliated to Anna University)

An ISO 9001:2015 certified Institution and accredited by NAAC with A+ grade

M.E. CONSTRUCTION ENGINEERING AND MANAGEMENT

CHOICE BASED CREDIT SYSTEM

CURRICULUM FOR SEMESTER I TO IV

(Applicable to the students admitted from the Academic year 2024-2025 onwards)



VISION

- ❖ To attain global recognition as a commendable centre for quality Civil Engineering Education and Research

MISSION

- ❖ To impart technical knowledge to the students for innovative design and construction solution providing.
- ❖ To develop the students in team work, leadership and to impart infrastructure project work skills.
- ❖ To imbibe ethical, sustainable and integrity value among students to give solutions to the global challenges.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOS)

Graduates of the programme M E Construction Engineering & Management will

- ❖ Excel in research or will succeed in Construction Engineering and Management profession in the government, public and private sector organizations.
- ❖ Have a sound knowledge in statistics, project management and construction engineering fundamentals required for solving real time construction Engineering and Management problems using modern equipment and software tools.
- ❖ Become entrepreneurs and develop processes and construction technologies through innovation, by integrating their knowledge in multidisciplinary management to meet the needs of society and formulate solutions that are technically sound, economically feasible, and socially acceptable.
- ❖ Have professional and ethical attitude, effective communication skills, teamwork skills, leadership quality, multidisciplinary approach and an ability to relate Construction Engineering and Management issues in broader social context.
- ❖ Have competence of excellence, leadership, written ethical codes and guidelines, and the life-long learning needed for a successful professional career.

PROGRAMME OUTCOMES (POS)

POs describe what students are expected to know or be able to do by the time of post-graduation from the program. The Program Outcomes of M.E Construction Engineering and Management are as follows:

The students will able to

- PO1: An ability to independently carry out research/investigation and development work to solve practical problems.
- PO2: An ability to write and present a substantial technical report/document.
- PO3: Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.


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PO	Graduate attribute	Programme outcome
1.	An ability to independently carry out research/ investigation and development work to solve practical problems.	Modern Construction Materials, Advanced Construction Techniques, Contract Laws and Regulations, Digital Design and Construction, Quantitative Techniques in Management, Computer Applications in Construction Engineering and Planning, Resources Management in Construction, Sustainable Construction, Statistical Methods for Engineers, Project Formulation and Appraisal, Research Methodology and IPR Seminar/ Industrial Training & Thesis.
2.	An ability to write and present a substantial technical report/document.	Construction Management Studio Laboratory, Statistical Analysis For Construction Engineers, Advanced Construction Engineering and Experimental Techniques Laboratory, Industrial Training & Thesis.
3.	Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.	Design of Energy Efficient Buildings, Project Safety Management, Environmental Impact Assessment For Construction Engineers, Shoring, Scaffolding and Formwork, Lean Construction Concepts, Tools & Practices, Construction Planning, Scheduling and Control, Quality control and assurance in construction, Supply chain management and Logistics in construction, Digital Design and Construction, Maintenance, Repair and Rehabilitation Of Structures.

PROGRAM SPECIFIC OUTCOMES (PSOS)

Graduates of the program M.E. Construction Engineering and Management will be able to

	Graduate attribute	PROGRAMME SPECIFIC OUTCOMES (PSOs)
1.	Knowledge of Construction Engineering and Management discipline	In-depth knowledge in the construction management, engineering and technologies necessary to formulate, plan, schedule and execute construction projects.
2.	Critical analysis of Construction management problems and innovation	Critically analyze and solve construction engineering and management problems by applying the modern tools and concepts of Construction Engineering & Management and make innovative advances in theoretical and practical.
3.	Conceptualization and evaluation of engineering solutions to Construction Issues	Conceptualize the problems in construction industry and develop appropriate solutions which are technically feasible and economically viable with due consideration of sustainability.

PEO/PO Mapping:

PEO	PO & PSO					
	PO1	PO2	PO3	PSO1	PSO2	PSO3
I	3	3	2	3	2	3
II	3	2	2	3	2	2
III	2	2	2	2	3	2
IV	2	1	2	2	3	2
V	3	3	3	2	2	3

(3-High, 2- Medium, 1- Low)


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M.E. CONSTRUCTION ENGINEERING AND MANAGEMENT SYLLABUS 2024 R
(Applicable to the students admitted from the Academic year 2024-2025 onwards)

SEMESTER – I									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory/Theory with Practical									
PSMT2401	Statistical Methods for Engineers	4	0	0	4	40	60	100	FC
PCNT2401	Modern Construction Materials	3	0	0	3	40	60	100	PCC
PCNT2402	Project Formulation and Appraisal	3	0	0	3	40	60	100	PCC
PCNT2403	Construction Equipment and Management	3	0	0	3	40	60	100	PCC
PRMT2411	Research Methodology and IPR	2	0	0	2	40	60	100	RMC
PCNE24XX	Professional Elective I	3	0	0	3	40	60	100	PEC
	Audit Course I*	2	0	0	0	0	0	0	AC
Practical / Employability Enhancement									
PCNL2401	Advanced Construction Engineering and Experimental Techniques Laboratory	0	0	4	2	60	40	100	PCC
PCNL2402	Technical Seminar	0	0	2	2	60	40	100	EEC
Total Credits to be earned					22				

* Audit Course is optional

SEMESTER – II									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory/Theory with Practical									
PCNT2421	Advanced Construction Techniques	3	0	0	3	40	60	100	PCC
PCNT2422	Construction Planning, Scheduling and Control	3	0	0	3	40	60	100	PCC
PCNT2423	Contract Laws and Regulations	3	0	0	3	40	60	100	PCC
PCNE24XX	Professional Elective II	3	0	0	3	40	60	100	PEC
PCNE24XX	Professional Elective III	3	0	0	3	40	60	100	PEC
PAXC24XX	Audit Course II*	2	0	0	0	0	0	0	AC
Practical / Employability Enhancement									
PCNL2421	Construction Management Studio Laboratory	0	0	4	2	60	40	100	PCC
PCNL2422	Statistical Analysis for Construction Engineers Laboratory	0	0	4	2	60	40	100	PCC
Total Credits to be earned					19				

* Audit Course is optional


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SEMESTER – III									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory/Theory with Practical									
PCNE24XX	Professional Elective IV	3	0	0	3	40	60	100	PEC
PCNE24XX	Professional Elective V	3	0	0	3	40	60	100	PEC
	Open Elective	3	0	0	3	40	60	100	OEC
Practical / Employability Enhancement									
PCNL2431	Practical Training (4 Weeks)	0	0	0	2	60	40	100	EEC
PCNL2432	Project Work I	0	0	12	6	60	40	100	EEC
Total Credits to be earned					17				

SEMESTER – IV									
Course Code	Course Title	Hours /Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Practical / Employability Enhancement									
PCNL2441	Project Work II	0	0	24	12	60	40	100	EEC
Total Credits to be earned					12				

AUDIT COURSES (AC)									
Course Code	Course Title	Hours /Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
PAXC2401	English for Research Paper Writing	0	0	2	2	60	40	100	AC
PAXC2402	Disaster Management	0	0	0	2	60	40	100	AC
PAXC2403	Constitution of India	0	0	12	6	60	40	100	AC
PAXC2404	நற்றமிழ் இலக்கியம்	0	0	24	12	60	40	100	AC

**LIST OF PROFESSIONAL ELECTIVE COURSES [PEC]
SEMESTER I, ELECTIVE I**

Course Code	Course Title	Hours /Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory/Theory with Practical									
PCNE2401	Advanced Concrete Technology	3	0	0	3	40	60	100	PEC
PCNE2402	Human Resources Management in Construction	3	0	0	3	40	60	100	PEC
PCNE2403	Construction Project Management	3	0	0	3	40	60	100	PEC
PCNE2404	Sustainable Construction	3	0	0	3	40	60	100	PEC
Total Credits to be earned					12				


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SEMESTER II, ELECTIVE II

Course Code	Course Title	Hours /Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory/Theory with Practical									
PCNE2405	Economics and Finance Management in Construction	3	0	0	3	40	60	100	PEC
PCNE2406	Design of Energy Efficient Buildings	3	0	0	3	40	60	100	PEC
PCNE2407	Project Safety Management	3	0	0	3	40	60	100	PEC
PCNE2408	Computer Applications in Construction Engineering and Planning	3	0	0	3	40	60	100	PEC
Total Credits to be earned					12				

SEMESTER II, ELECTIVE III

Course Code	Course Title	Hours /Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory/Theory with Practical									
PCNE2409	Quantitative Techniques in Management	3	0	0	3	40	60	100	PEC
PCNE2410	Resource Management and Control in Construction	3	0	0	3	40	60	100	PEC
PCNE2411	Shoring, Scaffolding and Formwork	3	0	0	3	40	60	100	PEC
PCNE2412	System Integration in Construction	3	0	0	3	40	60	100	PEC
Total Credits to be earned					12				

SEMESTER III, ELECTIVE IV

Course Code	Course Title	Hours /Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory/Theory with Practical									
PCNE2413	Advanced Data Analysis	3	0	0	3	40	60	100	PEC
PCNE2414	Environmental Impact Assessment For Construction Engineers	3	0	0	3	40	60	100	PEC
PCNE2415	Lean Construction Concepts, Tools and Practices	3	0	0	3	40	60	100	PEC
PCNE2416	Maintenance, Repair and Rehabilitation of Structures	3	0	0	3	40	60	100	PEC
Total Credits to be earned					12				


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SEMESTER III, ELECTIVE V

Course Code	Course Title	Hours /Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory/Theory with Practical									
PCNE2417	Quality Control and Assurance in Construction	3	0	0	3	40	60	100	PEC
PCNE2418	Digital Design and Construction	3	0	0	3	40	60	100	PEC
PCNE2419	Organizational Behaviour	3	0	0	3	40	60	100	PEC
PCNE2420	Supply Chain Management and Logistics in Construction	3	0	0	3	40	60	100	PEC
Total Credits to be earned					12				

List of Open Electives

Course Code	Course Title	Hours /Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory/Theory with Practical									
PEVO2414	Renewable Energy Technology	3	0	0	3	40	60	100	OE
POE2401	IPR, Biosafety and Entrepreneurship	3	0	0	3	40	60	100	OE
POE2403	Environmental Sustainability	3	0	0	3	40	60	100	OE
POE2405	Machine Learning and Deep Learning	3	0	0	3	40	60	100	OE
POE2406	IoT for Smart Systems	3	0	0	3	40	60	100	OE
POE2408	Cloud Computing Technologies	3	0	0	3	40	60	100	OE
POE2409	Principles of Multimedia	3	0	0	3	40	60	100	OE
POE2413	Sustainable Management	3	0	0	3	40	60	100	OE
POE2414	Micro and Small Business Management	3	0	0	3	40	60	100	OE
POE2415	Intellectual Property Rights	3	0	0	3	40	60	100	OE
POE2416	Ethical Management	3	0	0	3	40	60	100	OE
POE2420	Blockchain Technologies	3	0	0	3	40	60	100	OE
POE2423	Energy Conservation and Management in Domestic Sectors	3	0	0	3	40	60	100	OE
POE2424	Additive Manufacturing	3	0	0	3	40	60	100	OE
POE2425	Electric Vehicle Technology	3	0	0	3	40	60	100	OE


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CREDITS SUMMARY

S.No.	Name of the Programme: M.E CONSTRUCTION ENGINEERING AND MANAGEMENT					
	SUBJECT AREA	CREDITS PER SEMESTER				CREDITS TOTAL
		I	II	III	IV	
1	FC	04	00	00	00	04
2	PCC	12	13	00	00	25
3	PEC	03	06	06	00	15
4	RMC	02	00	00	00	02
5	OEC	00	00	03	00	03
6	EEC	01	00	08	12	21
7	Non Credit/Audit Course			00	00	00
	TOTAL CREDIT	22	19	17	12	70

- FC –Foundation Courses
PCC – Professional Core Courses
PEC – Professional Elective Courses
RMC – Research Methodology and IPR
OE - Open Elective Courses
EEC - Employment Enhancement Course

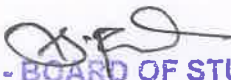

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PSMT2401		STATISTICAL METHODS FOR ENGINEERS				
		Category	L	T	P	Credit
		FC	4	0	0	4
Course objectives						
	This course is designed to provide the solid foundation on topics in various statistical methods which form the basis for many other areas in the mathematical sciences including statistics, modern optimization methods and risk modeling. It is framed to address the issues and the principles of estimation theory, testing of hypothesis, correlation and regression, design of experiments and multivariate analysis.					
UNIT – I	ESTIMATION THEORY					12
Estimators : Unbiasedness, Consistency, Efficiency and sufficiency – Maximum likelihood estimation– Method of moments						
UNIT – II	TESTING OF HYPOTHESIS					12
Sampling distributions - Small and large samples -Tests based on Normal, t, Chi square, and F distributions for testing of means, variance and proportions– Analysis of r x c tables – Goodness of fit.						
UNIT – III	CORRELATION AND REGRESSION					12
Multiple and partial correlation – Method of least squares – Plane of regression – Properties of residuals – Coefficient of multiple correlation – Coefficient of partial correlation – Multiple correlation with total and partial correlations – Regression and partial correlations in terms of lower order co - efficient.						
UNIT – IV	DESIGN OF EXPERIMENTS					12
Analysis of variance – One way and two way classifications – Completely randomized design – Randomized block design – Latin square design - 2 ² Factorial design						
UNIT – V	MULTIVARIATE ANALYSIS					12
Random vectors and matrices – Mean vectors and covariance matrices – Multivariate normal density and its properties – Principal components: Population principal components – Principal components from standardized variables.						
						Total: 60 periods
REFERENCES:						
1.	Jay L. Devore, “Probability and statistics for Engineering and the Sciences”, 8th Edition, Cengage Learning, 2014					
2.	Johnson, R.A., Miller, I and Freund J., "Miller and Freund’s Probability and Statistics for Engineers", 9th Edition, Pearson Education, Asia, 2016.					
3.	Johnson, R.A. and Wichern, D. W. “Applied Multivariate Statistical Analysis”, 6th Edition, Pearson Education, Asia, 2012.					
4.	Rice, J.A. "Mathematical Statistics and Data Analysis", 3rd Edition, Cengage Learning, 2015.					

COURSE OUTCOMES: On completion of the course, the students will be able to												BT Mapped (Highest Level)		
CO1:	Consistency, efficiency and unbiasedness of estimators, method of Maximum likelihood estimation and Central Limit Theorem.											Apply		
CO2:	Use statistical tests in testing hypotheses on data											Analyze		
CO3:	Concept of linear regression, correlation, and its applications											Understand		
CO4:	List the guidelines for designing experiments and recognize the key historical figures in Design of Experiments.											Understand		
CO5:	Perform exploratory analysis of multivariate data, such as multivariate normal density, calculating descriptive statistics, testing for multivariate normality.											Understand		
Mapping of COs with POs and PSOs														
COs/ PO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	2	1	3	-	-	-	-	-	-	-	-	-	-	-
CO3	2	1	3	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	1	-	-	-	-	-	-	-	-	-	-	-
CO5	2	1	3	-	-	-	-	-	-	-	-	-	-	-
Avg.	1.6	0.8	2.6	-	-	-	-	-	-	-	-	-	-	-
1 – Slight, 2 – Moderate, 3 – Substantial , BT – Bloom’s Taxonomy														


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PCNT2401	MODERN CONSTRUCTION MATERIALS				
	Category	L	T	P	Credit
	PCC	3	0	0	3
Course objectives					
	To study and understand the properties of modern construction materials used in construction such as special concretes, metals, composites, water proofing compounds, non-weathering materials, and smart materials.				
UNIT – I	STRUCTURAL MATERIALS				9
Wood and Wood Product - Metals - Types of Steels – Manufacturing process of steel – Advantages of new alloy steels – Properties and advantages of aluminum and its products – Types of Coatings & Coatings to reinforcement – Applications of Coatings.					
UNIT – II	NON-STRUCTURAL MATERIALS, ASSOCESSORIES AND FINISHES				9
Introduction of Non-Structural Materials and Criteria for Selection - Types and properties of Water Proofing Materials – Types of Non-weathering Materials and its uses – Types of Polymer Floor Finishes - Paint - Tiles - Acoustic Treatment materials - Dry Walls - Anchors.					
UNIT – III	COMPOSITES				9
Types of Plastics – Polymer - Properties & Manufacturing process – Advantages of Reinforced polymers – Types of FRP – FRP on different structural elements – Applications of FRP - Bituminous Materials - Glass - Closure - Environmental Concerns.					
UNIT – IV	SPECIAL CONCRETES				9
Concretes - Behavior of concretes – Properties and Advantages of High Strength and High Performance Concrete – Properties and Applications of Fibre Reinforced Concrete, Self-compacting concrete, Geo Polymer Concrete, Alternate Materials to concrete on high performance & high Strength concrete.					
UNIT – V	SMART AND INTELLIGENT MATERIALS				9
Types & Differences between Smart and Intelligent Materials – Special features – Nano Concrete - Nano Technology in Construction - Case studies showing the applications of smart & Intelligent Materials.					
Total: 45 periods					
REFERENCES:					
1.	N.Subramanian ,”Building Materials Testing and Sustainability”, Oxford Higher Education, 2019.				
2.	Shetty M.S, Concrete Technology: Theory and Practice, S.Chand & Company Ltd., 2019				
3.	Ganapathy, C. “Modern Construction Materials”, Eswar Press, 2015.				
4.	Santhakumar A.R. “Concrete Technology”, Oxford University press, New Delhi, 2006				
5.	Ashby, M.F. and Jones D.R.H.H. “Engineering Materials 1: An introduction to Properties, applications and designs”, Elsevier Publications, 2005				


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COURSE OUTCOMES:												BT Mapped (Highest Level)		
On completion of the course, the students will be able to														
CO1:	Explain the various types of special concretes											Understand		
CO2:	Select the different processing of steel and applications of coating											Understand		
CO3:	Explain the manufacturing process and applications of polymer composites											Understand		
CO4:	Identify the different flooring materials and application of façade materials											Understand		
CO5:	Apply the knowledge of smart and intelligent materials in construction field.											Understand		
Mapping of COs with POs and PSOs														
COs/PO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	2	3	-	-	-	-	-	-	-	2	2	3
CO2	3	1	2	3	-	-	-	-	-	-	-	2	2	3
CO3	3	1	3	3	-	-	-	-	-	-	-	1	1	3
CO4	2	1	2	2	-	-	-	-	-	-	-	2	1	1
CO5	3	1	3	3	-	-	-	-	-	-	-	1	1	1
Avg.	3	1	2	3	-	-	-	-	-	-	-	2	1	2
1 – Slight, 2 – Moderate, 3 – Substantial , BT – Bloom’s Taxonomy														


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PCNT2402	PROJECT FORMULATION AND APPRAISAL				
	Category	L	T	P	Credit
	PCC	3	1	0	4
Course objectives					
	To study and understand the formulation, and costing of construction projects, appraisal, finance, and private sector participation				
UNIT – I	PROJECT FORMULATION				12
Project – Concepts – Capital investments - Generation and Screening of Project Ideas - Project identification – Preliminary Analysis, Market, Technical, Financial, Economic and Ecological - Pre- Feasibility Report and its Clearance, Project Estimates and Techno-Economic Feasibility Report, Detailed Project Report – Different Project Clearances required.					
UNIT – II	PROJECT COSTING				12
Project Cash Flows – Principles – Types – New Project and Replacement Project – Biases in Cash flow Estimation – Time Value of Money – Present Value – Future Value – Single amount – Annuity – Cost of Capital – Cost of Debt, Preference, Equity – Proportions - Cost of Capital Calculation – Financial Institutions Considerations.					
UNIT – III	PROJECT APPRAISAL				12
NPV – BCR – IRR – ARR – Urgency – Pay Back Period – Assessment of Various Methods – Indian Practice of Investment Appraisal – International Practice of Appraisal – Analysis of Risk – Different Methods – Selection of a Project and Risk Analysis in Practice.					
UNIT – IV	PROJECT FINANCING				12
Project Financing – Means of Finance – Financial Institutions – Special Schemes – Key Financial Indicators – Ratios – financial cost-benefit analysis, social-cost benefit analysis.					
UNIT – V	PRIVATE SECTOR PARTICIPATION				12
Private sector participation in Infrastructure Development Projects - BOT, BOLT, BOOT-Technology Transfer and Foreign Collaboration - Scope of Technology Transfer.					
Total: 60 periods					
REFERENCES:					
1.	Raina V.K, “Construction Management Practice – The inside Story”, Tata McGraw Hill Publishing Limited, 2005				
2.	Barcus, S.W. and Wilkinson.J.W., Hand Book of Management Consulting Services, McGraw Hill, New York, first edition, 1995				
3.	Joy P.K., Total Project Management - The Indian Context, New Delhi, Laxmi Publications Pvt. Ltd, First edition 2017.				
4.	Prasanna Chandra., Projects – Planning, Analysis, Selection, Implementation Review, McGraw Hill Publishing Company Ltd., New Delhi., Ninth edition, 2019				


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5.	United Nations Industrial Development Organisation (UNIDO) Manual for the Preparation of Industrial Feasibility Studies, (IDBI Reproduction) Bombay, 1995.
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COURSE OUTCOMES:												BT Mapped (Highest Level)		
On completion of the course, the students will be able to														
CO1:	Perform Formulations Of Projects.											Understand		
CO2:	Analyze Project Costing											Analyze		
CO3:	Evaluate Project Appraisal											Evaluate		
CO4:	Apply Project Financing											Analyze		
CO5:	Perform Private Sector Participation & Implementation											Understand		
Mapping of COs with POs and PSOs														
COs/PO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	3	-	-	-	-	-	-	-	-	3	1	2
CO2	3	2	3	-	-	-	-	-	-	-	-	3	1	3
CO3	3	3	3	-	-	-	-	-	-	-	-	3	2	2
CO4	3	2	3	-	-	-	-	-	-	-	-	3	1	3
CO5	3	1	2	-	-	-	-	-	-	-	-	3	2	2
Avg.	3	2	3	-	-	-	-	-	-	-	-	3	1	2
1 – Slight, 2 – Moderate, 3 – Substantial , BT – Bloom’s Taxonomy														


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PCNT2403	CONSTRUCTION EQUIPMENT AND MANAGEMENT					
		Category	L	T	P	Credit
		PCC	3	0	0	3
Course objectives						
	To study and understand the various types of equipments used for earthwork, tunneling, drilling, blasting, dewatering, material handling conveyors and its applications in construction projects.					
UNIT – I	CONSTRUCTION EQUIPMENT SELECTION					9
Identification – Planning of equipment – Selection of Equipment - Equipment Management in Projects - Maintenance Management – Equipment cost – Operating cost – Cost Control of Equipment - Depreciation Analysis – Replacement of Equipment- Replacement Analysis - Safety Management.						
UNIT – II	EQUIPMENT FOR EARTHWORK					9
Fundamentals of Earth Work Operations - Earth Moving Operations - Types of Earth Work Equipment - Tractors, Motor Graders, Scrapers, Front end Waders – Dozer, Excavators, Rippers, Loaders, trucks and hauling equipment, Compacting Equipment, Finishing equipment.						
UNIT – III	OTHER CONSTRUCTION EQUIPMENT					9
Equipment for Dredging, Trenching, Drag line and clamshells, Tunneling – Equipment for Drilling and Blasting - Pile driving Equipment - Erection Equipment - Crane, Mobile crane - Types of pumps used in Construction - Equipment for Dewatering and Grouting – Equipment for Demolition.						
UNIT – IV	ASPHALT AND CONCRETING EQUIPMENT					9
Aggregate production- Different Crushers – Feeders - Screening Equipment - Handling Equipment - Batching and Mixing Equipment - Pumping Equipment – Ready mix concrete equipment, Concrete pouring equipment. Asphalt Plant, Asphalt Pavers, Asphalt compacting Equipment.						
UNIT – V	MATERIALS HANDLING EQUIPMENT					9
Forklifts and related equipment - Portable Material Bins – Material Handling Conveyors – Material Handling Cranes- Industrial Trucks.						
						Total: 45 periods
REFERENCES:						
1.	Peurifoy, R.L., Schexnayder, C. and AviadShapira., Construction Planning, Equipment and Methods, McGraw Hill, Singapore, 2010.					
2.	Granberg G.,Popescu M Construction Equipment and Management for Engineers Estimators and Owners, Taylor and Francis Publishers, New York, 2006					
3.	Deodhar, S.V. Construction Equipment and Job Planning, Khanna Publishers, New Delhi, 2001.					
4.	Arora S.P. and Bindra S.P., Building Construction, Planning Techniques and Method of Construction, DhanpatRai and Sons, 2010.					
5.	Sharma S.C. Construction Equipment and Management, Khanna Publishers, New Delhi, 2019					


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COURSE OUTCOMES: On completion of the course, the students will be able to												BT Mapped (Highest Level)		
CO1:	Develop knowledge on the planning of equipment and selection of equipment											Understand		
CO2:	Explain the knowledge on fundamentals of earth work operations, earth moving operations and types of earth work equipment											Understand		
CO3:	Develop the knowledge on special construction equipments											Understand		
CO4:	Apply the knowledge on asphalt and concrete plants											Understand		
CO5:	Apply the knowledge and select the proper materials handling equipment											Understand		
Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	2	-	-	-	-	-	-	-	-	2	2	2
CO2	3	1	2	-	-	-	-	-	-	-	-	3	2	3
CO3	3	1	3	-	-	-	-	-	-	-	-	3	2	3
CO4	3	1	3	-	-	-	-	-	-	-	-	3	2	3
CO5	3	1	3	-	-	-	-	-	-	-	-	3	2	3
Avg.	3	1	2	-	-	-	-	-	-	-	-	2	2	2
1 – Slight, 2 – Moderate, 3 – Substantial , BT – Bloom’s Taxonomy														


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PRMT2411	RESEARCH METHODOLOGY AND IPR					
		Category	L	T	P	Credit
		PCC	2	0	0	2
Course objectives						
	• Understanding the research principal • Research designing and planning • Data collection and analysis • Critical thinking and evaluation • Understanding the IPR fundamentals					
UNIT – I	RESEARCH DESIGN					6
Overview of research process and design, Use of Secondary and exploratory data to answer the research question, Qualitative research, Observation studies, Experiments and Surveys						
UNIT – II	DATA COLLECTION AND SOURCES					6
Measurements, Measurement Scales, Questionnaires and Instruments, Sampling and methods. Data Preparing, Exploring, examining and displaying.						
UNIT – III	DATA ANALYSIS AND REPORTING					6
Overview of Multivariate analysis, Hypotheses testing and Measures of Association. Presenting Insights and findings using written reports and oral presentation.						
UNIT – IV	INTELLECTUAL PROPERTY RIGHTS					6
Intellectual Property – The concept of IPR, Evolution and development of concept of IPR, IPR development process, Trade secrets, utility Models, IPR & Bio diversity, Role of WIPO and WTO in IPR establishments, Right of Property, Common rules of IPR practices, Types and Features of IPR Agreement, Trademark, Functions of UNESCO in IPR maintenance						
UNIT – V	PATENTS					6
Patents – objectives and benefits of patent, Concept, features of patent, Inventive step, Specification, Types of patent application, process E-filing, Examination of patent, Grant of patent, Revocation, Equitable Assignments, Licences, Licensing of related patents, patent agents, Registration of patent agents.						
Total: 30 periods						
REFERENCES:						
1.	Cooper Donald R, Schindler Pamela S and Sharma JK, “Business Research Methods”, Tata McGraw Hill Education, 11e (2012).					
2.	Catherine J. Holland, “Intellectual property: Patents, Trademarks, Copyrights, Trade Secrets”, Entrepreneur Press, 2007.					
3.	David Hunt, Long Nguyen, Matthew Rodgers, “Patent searching: tools & techniques”, Wiley, 2007..					
4.	The Institute of Company Secretaries of India, Statutory body under an Act of parliament, “Professional Programme Intellectual Property Rights, Law and practice”, September 2013.					


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COURSE OUTCOMES: Students will be able to												BT Mapped (Highest Level)		
CO1:	Analyse and evaluate research studies											Understand		
CO2:	Write clear and concise research proposals											Understand		
CO3:	Collect ,Analyse and interpret data using various statistical analytical techniques											Understand		
CO4:	Develop IPR Strategies and policies for organization and individuals											Understand		
CO5:	Define and explain various IPR Concepts including patents											Understand		
Mapping of COs with POs and PSOs														
COs/PO _s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	-	-	2	-	1	-	-	-	-	-	-	-	-	-
CO2	1	-	-	-	2	-	-	-	-	-	-	-	-	-
CO3	-	-	-	2	-	2	-	-	-	-	-	-	-	-
CO4	-	-	3	1	-	-	-	-	-	-	-	-	-	-
CO5	-	2	-	-	2	-	-	-	-	-	-	-	-	-
Avg.	1	2	3	2	2	2	-	-	-	-	-	-	-	-
1 – Slight, 2 – Moderate, 3 – Substantial , BT – Bloom’s Taxonomy														


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PCNL2401	ADVANCED CONSTRUCTION ENGINEERING AND EXPERIMENTAL TECHNIQUES LABORATORY					
		Category	L	T	P	Credit
		PCC	0	0	4	2
Course objectives						
	• To provide a thorough knowledge of material selection through the material testing based on specification • To provide a detailed account of modern experimental techniques in construction Engineering research. • To introduce the basic working principles, the operational know how, and the strength and limitations of the techniques.					
ADVANCED CONSTRUCTION ENGINEERING LABORATORY						
LIST OF EXPERIMENTS						
1. Mix design of concrete as per IS, ACI & BS methods for high-performance concrete. 2. Flow Characteristics of Self Compacting concrete. 3. Effect of minerals and chemical admixtures in concrete at fresh and hardened state with relevance to workability, strength, and durability. 4. NDT on hardened concrete - UPV, Rebound hammer, and core test. 5. Permeability test on hardened concrete (RCPT) – Demonstration						
						TOTAL:30 PERIODS
OUTCOMES:						
On completion of the course, the student will be able to						
	CO1	Do the mix proportion using IS and ACI codal provisions.				
	CO2	Analyse the flow characteristics of SCC				
	CO3	Analyse the effect of mineral and Chemical Admixtures				
	CO4	Test the concrete in a non-destructive manner using a rebound hammer.				
	CO5	Know the permeability characteristics of concrete.				
B) EXPERIMENTAL TECHNIQUES LABORATORY						
LIST OF EXPERIMENTS						
	1.	Determination of elastic constants – Hyperbolic fringes				
	2.	Determination of elastic constants – Elliptical fringes				
	3.	Strain gauge meter – Determination of Young’s modulus of a metallic wire				
	4.	Ultrasonic interferometer – ultrasonic velocity in liquids				
	5.	Electrical conductivity of metals and alloys with temperature-four probe method				
	6.	Resistivity measurements				
	7.	NDT – Ultrasonic flaw detector				
	8.	Calibration of Proving Ring and LVDT				


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TOTAL :30 PERIODS

OUTCOMES:

- On completion of the course, the student is expected to be able to

CO1	Apply the experimental methods to correlate with the theory.
CO2	Learn the usage of electrical systems for various measurements.
CO3	Learn the usage of optical systems for various measurements.
CO4	Analyse of Data and interpretation
CO5	Apply the analytical techniques and graphical analysis to interpret the experimental data

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	2	2	3	2	1	2
CO2	2	2	3	3	1	2
CO3	2	2	3	3	1	2
CO4	2	2	3	3	2	2
CO5	2	2	3	2	2	2
Avg.	2	2	3	2	2	2


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PCNL2402		TECHNICAL SEMINAR														
		<table><tr><td>Category</td><td>L</td><td>T</td><td>P</td><td>Credit</td></tr><tr><td>EEC</td><td>0</td><td>0</td><td>2</td><td>1</td></tr></table>					Category	L	T	P	Credit	EEC	0	0	2	1
Category	L	T	P	Credit												
EEC	0	0	2	1												
Course objectives																
		To work on a specific technical topic in Construction Engineering and Management in order to acquire the skills of oral presentation and to acquire technical writing abilities for seminars and conferences														
SYLLABUS: The students will work for two hours per week guided by a group of staff members. They will be asked to talk on any topic of their choice related to construction engineering and management and to engage in dialogue with the audience. A brief copy of their talk also should be submitted. Similarly, the students will have to present a seminar of not less than fifteen minutes and not more than thirty minutes on the technical topic. They will also answer the queries on the topic. The students as audience also should interact. Evaluation will be based on the technical presentation and the report and also on the interaction during the seminar TOTAL :30 PERIODS																
OUTCOME: CO1 Identify latest developments in the field of Construction Engineering CO2 Identify latest developments in the field of Construction Management CO3 Presentation Skills and ability to answer the queries during Interaction CO4 Acquire technical writing abilities for seminars, conferences and journal publications CO5 Use modern tools to present the technical details																
Mapping of COs with POs and PSOs																
COs/POs	PO1	PO2	PO3	PSO1	PSO2	PSO3										
CO1	3	3	3	3	2	3										
CO2	2	3	3	3	2	3										
CO3	2	3	3	3	2	3										
CO4	3	3	3	3	2	3										
CO5	3	3	3	3	2	3										
Avg.	3	3	3	3	2	3										


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PCNT2421	ADVANCED CONSTRUCTION TECHNIQUES				
	Category	L	T	P	Credit
	PCC	3	0	0	3
Course objectives					
	- To study and understand the latest construction techniques applied to engineering construction for sub structure, super structure, special structures. - To gain the knowledge about the rehabilitation and strengthening techniques. - To learn about the various demolition techniques.				
UNIT – I	SUB STRUCTURE CONSTRUCTION				9
Box jacking - Pipe jacking - Under water construction of diaphragm walls and basement - Tunneling techniques - Piling techniques - Driving well and caisson - sinking cofferdam - cable anchoring and grouting - Driving diaphragm walls, Sheet piles - Laying operations for built up offshore system - Shoring for deep cutting - Large reservoir construction - well points - Dewatering for underground open excavation					
UNIT – II	SUPER STRUCTURE CONSTRUCTION FOR BUILDINGS				9
Vacuum dewatering of concrete flooring – Concrete paving technology – Techniques of construction for continuous concreting operation in tall buildings of various shapes and varying sections – Erection techniques of tall structures, Large span structures – launching techniques for heavy decks – in-situ prestressing in high rise structures, Post tensioning of slab- Aerial transporting – Handling and erecting lightweight components on tall structures.					
UNIT – III	CONSTRUCTION OF SPECIAL STRUCTURES				9
Erection of lattice towers - Rigging of transmission line structures – Construction sequence in cooling towers, Silos, chimney, and sky scrapers - Bow string bridges, Cable stayed bridges – Launching and pushing of box decks – Construction of jetties and break water structures – Construction sequence and methods in domes – Support structure for heavy equipment and machinery in heavy industries – Erection of articulated structures and space decks.					
UNIT – IV	REHABILITATION AND STRENGTHENING TECHNIQUES				9
Seismic retrofitting - Strengthening of beams, columns, slab and masonry wall - Protection methods of structures, Mud jacking and grouting for foundation – Micro piling and underpinning for strengthening floor and shallow profile - Sub grade water proofing, Soil Stabilization techniques.					
UNIT – V	DEMOLITION				9
Demolition Techniques, Demolition by Machines, Demolition by Explosives, Advanced techniques using Robotic Machines, Demolition Sequence, Dismantling Techniques, Safety precaution in Demolition and Dismantling.					
Total: 45 periods					
REFERENCES:					
1.	Robertwade Brown, Practical foundation engineering hand book, McGraw Hill Publications, 2000.				
2.	Concrete Structures: Repair, Rehabilitation and Strengthening, Dr. Mohamed A. El-Reedy, 2020.				


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3.	Patrick Powers. J., Construction Dewatering: New Methods and Applications, John Wiley & Sons, 1992..
4.	Peter H.Emmons, "Concrete repair and maintenance illustrated", Galgotia Publications Pvt. Ltd., 2001.Press, 2008
5.	Sankar, S.K. and Saraswati, S., Construction Technology, Oxford University, New Delhi, 2008.

COURSE OUTCOMES:

Upon completion of this course, student will be able to

**BT Mapped
(Highest Level)**

CO1:	Classify the modern construction techniques used in the sub structure construction.	Understand
CO2:	Demonstrate knowledge and understanding of the principles and concepts relevant to super structure construction for buildings	Understand
CO3:	Summarize the concepts used in the construction of special structures	Understand
CO4:	Distinguish Various strengthening and repair methods for different cases.	Understand
CO5:	Identify the suitable demolition technique for demolishing a building.	Apply

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PSO1	PSO2	PSO3
CO1	3	1	3	3	2	3
CO2	3	1	3	2	2	2
CO3	3	1	3	3	2	3
CO4	3	1	3	3	2	3
CO5	2	1	3	2	2	2
Avg.	3	1	3	3	2	3


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PCNT2422		CONSTRUCTION PLANNING, SCHEDULING, AND CONTROL				
		Category	L	T	P	Credit
		PCC	3	0	0	3
Course objectives						
		• To study and understand the concept of planning. • To impart concepts in Network representation and analysis. • To impart concepts in Precedence Network analysis. • To impart concepts in resource scheduling. • To learn Concepts in project monitoring and controlling				
UNIT – I	CONSTRUCTION PLANNING					9
Basic Concepts in the Development of Construction Plans – Choice of Technology and Construction Method – Defining Work Tasks and Work Break down Levels – Defining Precedence Relationships among Activities – Estimating Activity Durations – Estimating Resource Requirements for Work Activities – Coding Systems – Planning Project Schedule and Budget.						
UNIT – II	NETWORK REPRESENTATION AND ANALYSIS					9
Duration Estimation – Gantt / Bar Chart – Types of Network and Techniques – Introduction to Floats, Types of Floats, usage of Floats for Project Decisions - Presenting Project Schedules – Scheduling for Activity-on-Node and with Leads, Lags, and Windows – Critical Path Method (CPM) Network Analysis - PERT Network Modeling and Time Analysis - Case Illustrations.						
UNIT – III	PRECEDENCE NETWORK ANALYSIS					9
Introduction to Precedence Diagramming Method (PDM) - PDM network representation, Procedure and Analysis, Issues in PDM, Case Illustrations, Defining Relationship, Project Monitoring and Control Process						
UNIT – IV	SCHEDULING PROJECT WORK AND RESOURCE SCHEDULING					9
Work Scheduling Fundamentals – Bar chart method of Work scheduling – Network Based Project Scheduling – Line of Balance Scheduling for Repetitive Projects - Scheduling with Uncertain Durations – Resources Scheduling Considerations – Crashing and Time/Cost Trade-offs- Case Illustrations – Use of Project management Software for scheduling Process.						
UNIT – V	PROJECT MONITORING AND CONTROLLING					9
The Cost Control Approach – Direct and Indirect Cost Control – Activity Cost Control – Financial Accounting Systems and Cost Accounts – Control of Project Cash Flows - Performance Control using Earned Value Management Concepts – Time progress monitoring and Controlling – Time Reduction Techniques – Guidelines for reviewing project Time and Cost Progress.						
Total: 45 periods						
REFERENCES:						
1.	Albert Lester, Project Management, Planning and Control, 7th Edition, Butterworth- Heinemann, USA, 2017.					


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2.	Chitkara K K., Construction project management, planning, scheduling and control, McGraw Hill (INDIA) publishers, New Delhi, third edition 2014.
3.	Chris Hendrickson and Tung Au, Project Management for Construction – Fundamental Concepts for Owners, Engineers, Architects and Builders, Prentice Hall, Pittsburgh, 2000..
4.	Calin M. Popescu, Chotchai Charoenngam, Project Planning, Scheduling and Control in Construction: An Encyclopaedia of terms and Applications, Wiley, New York, 1995.
5.	Halpin, D. W., Financial and Cost Concepts for Construction Management, John Wiley & Sons, New York, 1985.

COURSE OUTCOMES:												BT Mapped (Highest Level)		
CO1:	Identify and estimate the activity in the construction.											Understand		
CO2:	Schedule the networking of activities using the critical path method											Understand		
CO3:	Evaluate the project budget required for the particular construction project											Analyze		
CO4:	Recognize the various quality control tool required in the construction industry											Understand		
CO5:	Explain the different databases that can be maintained in the construction industry using computers.											Understand		
Mapping of COs with POs and PSOs														
COs/PO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	2	1	1	-	-	-	-	-	-	-	3	1	3
CO2	2	1	2	2	-	-	-	-	-	-	-	3	3	2
CO3	2	2	2	2	1	-	-	-	-	-	-	2	3	2
CO4	3	1	3	3	-	-	-	-	-	-	-	3	2	3
CO5	3	1	3	3	2	2	-	-	-	-	-	2	2	3
Avg.	1	2	1	1	2	2	-	-	-	-	-	3	1	3
1 – Slight, 2 – Moderate, 3 – Substantial , BT – Bloom’s Taxonomy														


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PCNT2423	CONTRACT LAWS AND REGULATIONS					
		Category	L	T	P	Credit
		PCC	3	0	0	3
Course objectives						
	• To study the various types of construction contract and their legal aspects and provisions. • To learn concepts in Tenders. • To learn concepts in Arbitration and legal requirements • To study the concepts in labour regulations.					
UNIT – I	CONSTRUCTION CONTRACTS					9
Indian Contracts Act – Elements of Contracts – Types of Contracts – Features – Suitability – Design of Contract Documents – International Contract Document – Standard Contract Document – Law of Torts.						
UNIT – II	TENDERS					9
Prequalification – Bidding – Accepting – Evaluation of Tender from Technical, Contractual and Commercial Points of View – Contract Formation and Interpretation – Potential Contractual Problems – World Bank Procedures and Guidelines – Tamilnadu Transparency in Tenders Act.						
UNIT – III	ARBITRATION					9
Comparison of Actions and Laws – Agreements – Subject Matter – Violations – Appointment of Arbitrators – Conditions of Arbitration – Powers and Duties of Arbitrator – Rules of Evidence – Enforcement of Award – Costs.						
UNIT – IV	LEGAL REQUIREMENTS					9
Insurance and Bonding – Laws Governing Sale, Purchase and Use of Urban and Rural Land – Land Revenue Codes – Tax Laws – Income Tax, Sales Tax, Excise and Custom Duties and their Influence on Construction Costs – Legal Requirements for Planning – Property Law – Agency Law – Local Government Laws for Approval – Statutory Regulations.						
UNIT – V	LABOUR REGULATIONS					9
Social Security – Welfare Legislation – Laws relating to Wages, Bonus and Industrial Disputes, Labour Administration – Insurance and Safety Regulations – Workmen’s Compensation Act – Indian Factory Act – Tamilnadu Factory Act – Child Labour Act - Other Labour Laws.						
Total: 45 periods						
REFERENCES:						
1.	Gajaria G.T., Laws Relating to Building and Engineering Contracts in India, 2000.					
2.	Jimmie Hinze, Construction Contracts, McGraw Hill, 3rd Edition, 2013					
3.	Ali D. Haidar, Handbook of Contract Management in Construction, Springer Cham, 1st Edition, 2021					
4.	Patil. B.S, Civil Engineering Contracts and Estimates, Universities Press (India) Private Limited, 4th Edition 2015.					
5.	Dharmendra Rautray, Principles of Law of Arbitration in India, Wolters Kluwer, 2018.					



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COURSE OUTCOMES: On completion of the course, the students will be able to												BT Mapped (Highest Level)		
CO1:	Design the construction contracts											Understand		
CO2:	Develop a skill for the tendering process.											Understand		
CO3:	Explain the duties of the arbitrator.											Apply		
CO4:	Develop an idea on the various legal requirements to be met in relation to land and construction.											Apply		
CO5:	Identify and apply the provisions provided in the labour welfare schemes.											Apply		
Mapping of COs with POs and PSOs														
COs/PO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	3	-	-	-	-	-	-	-	-	3	2	2
CO2	3	2	3	-	-	-	-	-	-	-	-	3	3	3
CO3	3	1	3	-	-	-	-	-	-	-	-	3	2	2
CO4	3	1	3	-	-	-	-	-	-	-	-	3	3	2
CO5	3	1	3	-	-	-	-	-	-	-	-	3	3	2
Avg.	3	2	3	-	-	-	-	-	-	-	-	3	2	2
1 – Slight, 2 – Moderate, 3 – Substantial , BT – Bloom’s Taxonomy														


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PCNL2421		CONSTRUCTION MANAGEMENT STUDIO LABORATORY														
												Category	L	T	P	Credit
												PCC	0	0	4	2
Course objectives																
		- To train the students in utilizing the sophisticated spreadsheets programs, - To train the students to handle estimation software. - To train the students to handle the Project management software.														
PRACTICALEXPERIMENTS:																
1. Scheduling of a small construction project using Primavera scheduling systems including reports and tracking.																
2. Scheduling of a small construction project using tools like MS project scheduling systems including reports and tracking.																
3. Simulation models for project risk analysis. Virtual progress tracking of small construction project using Navisworks																
Total: 60 periods																
COURSE OUTCOMES:														BT Mapped (Highest Level)		
• On completion of the course, the student is expected to be able to																
CO1:	Prepare the proposal for a construction project														Understand	
CO2:	Store and retrieve information about the equipments.														Understand	
CO3:	Track the activities and schedule a construction project using PRIMAVERA														Apply	
CO4:	Track and schedule a construction project using MS Project.														Understand	
CO5:	Develop a simulation model for analyzing the project risk														Apply	
Mapping of COs with POs and PSOs																
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3		
CO1	3	3	3	-	-	-	-	-	-	-	-	3	3	3		
CO2	2	3	3	-	-	-	-	-	-	-	-	3	3	3		
CO3	3	2	3	-	-	-	-	-	-	-	-	3	3	3		
CO4	3	3	3	-	-	-	-	-	-	-	-	3	3	2		
CO5	3	3	3	-	-	-	-	-	-	-	-	3	3	3		
Avg.	3	3	3	-	-	-	-	-	-	-	-	3	3	3		
1 – Slight, 2 – Moderate, 3 – Substantial , BT – Bloom’s Taxonomy																


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PCNL2422	STATISTICAL ANALYSIS FOR CONSTRUCTION ENGINEERS LABORATORY															
												Category	L	T	P	Credit
												PCC	0	0	4	2
Course objectives																
- To provide hands on training in basic spread sheet software. - To provide hands on training in advanced spread sheet software. To provide hands on training in data analytical tools.																
LIST OF EXPERIMENTS:																
1. Descriptive Statistics: frequency distribution, Applications (Charts, Graphs etc.)																
2. Use of statistical packages Correlation, ANOVA , Cross Tabulation, <i>t</i> - Test and Simple and Multiple Regression																
3. Solving Linear Programming Problems, Transportation and Assignment Models																
4. Solving Network Flow Models																
5. Solving Decision making Problems in Project Management																
														Total: 60 periods		
COURSE OUTCOMES:														BT Mapped (Highest Level)		
On completion of the course, the student is expected to be able to																
CO1:	Formulate descriptive statistics with charts and graphs using spreadsheet softwares and interpretation of results														Understand	
CO2:	Analyse construction management field data using Statistical tools.														Understand	
CO3:	Solve Linear Programming Problems, transportation and assignment problems by appropriate techniques and evaluate the behaviour under different range of parameters														Understand	
CO4:	Perform network analysis and decision making in project management														Understand	
CO5:	Solve Construction management problems using decision making tool.														Understand	
Mapping of COs with POs and PSOs																
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3		
CO1	3	3	3	-	-	-	-	-	-	-	-	3	3	3		
CO2	2	3	3	-	-	-	-	-	-	-	-	3	3	3		
CO3	3	2	3	-	-	-	-	-	-	-	-	3	3	3		
CO4	3	3	3	-	-	-	-	-	-	-	-	3	3	2		
CO5	3	3	3	-	-	-	-	-	-	-	-	3	3	3		
Avg.	3	3	3	-	-	-	-	-	-	-	-	3	3	3		
1 – Slight, 2 – Moderate, 3 – Substantial , BT – Bloom’s Taxonomy																


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PCNL2431		PRACTICAL TRAINING (4 Weeks)																						
<table><tr><td>Category</td><td>L</td><td>T</td><td>P</td><td>Credit</td></tr><tr><td>PCC</td><td>0</td><td>0</td><td>0</td><td>2</td></tr></table>															Category	L	T	P	Credit	PCC	0	0	0	2
Category	L	T	P	Credit																				
PCC	0	0	0	2																				
Course objectives																								
		To train the students in the fieldwork so as to have firsthand knowledge of practical problems related to Construction Management in carrying out engineering tasks																						
SYLLABUS: The students individually undertake training in reputed engineering companies doing construction during the summer vacation for a specified duration of four weeks. At the end of the training, a detailed report on the work done should be submitted within ten days from the commencement of the semester. The students will be evaluated through a viva-voce examination by a team of internal staff.																								
Total: 60 periods																								
COURSE OUTCOMES:													BT Mapped (Highest Level)											
On completion of the course, the student is expected to be able to																								
CO1:	Describe the Construction Industry												Understand											
CO2:	Realize the various functions of construction activities.												Apply											
CO3:	Develop skills in facing and solving the problems experiencing in the Construction Management field												Apply											
CO4:	Report Preparation												Apply											
CO5:	Presentation of work carried out in Practical Training												Evaluate											
Mapping of COs with POs and PSOs																								
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3										
CO1	2	2	2	-	-	-	-	-	-	-	-	3	2	2										
CO2	2	2	2	-	-	-	-	-	-	-	-	3	2	2										
CO3	3	2	2	-	-	-	-	-	-	-	-	3	2	2										
CO4	3	3	3	-	-	-	-	-	-	-	-	3	3	3										
CO5	2	3	3	-	-	-	-	-	-	-	-	3	3	3										
Avg.	2	2	2	-	-	-	-	-	-	-	-	3	2	2										
1 – Slight, 2 – Moderate, 3 – Substantial , BT – Bloom’s Taxonomy																								


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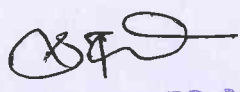
PCNL2432		PROJECT WORK I																						
<table><tr><td>Category</td><td>L</td><td>T</td><td>P</td><td>Credit</td></tr><tr><td>PCC</td><td>0</td><td>0</td><td>12</td><td>6</td></tr></table>															Category	L	T	P	Credit	PCC	0	0	12	6
Category	L	T	P	Credit																				
PCC	0	0	12	6																				
Course objectives		- To identify a specific problem for the current need of the society and collecting information related to the same through detailed review of literature - To develop the methodology to solve the identified problem. - To train the students in preparing project reports and to face reviews and viva-voce examination																						
SYLLABUS:																								
The student individually works on a specific topic approved by faculty member who is familiar in this area of interest. The student can select any topic which is relevant to his/her specialization of the programme. The topic may be experimental or analytical or case studies. At the end of the semester, a detailed report on the work done should be submitted which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work. The students will be evaluated through a viva-voce examination by a panel of examiners including one external examiner																								
Total: 180 periods																								
COURSE OUTCOMES:													BT Mapped (Highest Level)											
On completion of the course, the student is expected to be able to																								
CO1:	Apply the knowledge gained from theoretical and practical courses in solving problems.													Understand										
CO2:	Summarize the importance of literature review													Apply										
CO3:	Identify the problem													Apply										
CO4:	solve the identified problem based on the formulated methodology													Understand										
CO5:	Interpret and present the findings of the work conducted													Evaluate										
Mapping of COs with POs and PSOs																								
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3										
CO1	3	2	3	-	-	-	-	-	-	-	-	3	3	3										
CO2	3	3	3	-	-	-	-	-	-	-	-	3	3	3										
CO3	3	3	3	-	-	-	-	-	-	-	-	3	3	3										
CO4	3	3	3	-	-	-	-	-	-	-	-	3	3	3										
CO5	3	3	3	-	-	-	-	-	-	-	-	3	3	3										
Avg.	3	3	3	-	-	-	-	-	-	-	-	3	3	3										
1 – Slight, 2 – Moderate, 3 – Substantial , BT – Bloom’s Taxonomy																								


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PCNL2441	PROJECT WORK II															
												Category	L	T	P	Credit
												PCC	0	0	24	12
Course objectives																
- To solve the identified problem based on the formulated methodology. - To develop skills to analyze the research problem - To develop skills to discuss the test results, and make conclusions.																
SYLLABUS:																
The student should continue the phase I work on the selected topic as per the formulated methodology. Undergo internship. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report should be prepared and submitted to the head of the department. The students will be evaluated based on the report and the viva-voce examination by a panel of examiners including one external examiner.																
														Total: 360 periods		
COURSE OUTCOMES:														BT Mapped (Highest Level)		
On completion of the course, the student is expected to be able to																
CO1:	Apply the knowledge gained from theoretical and practical courses in solving problems.														Apply	
CO2:	Summarize the importance of literature review														Understand	
CO3:	Identify the problem														Apply	
CO4:	solve the identified problem based on the formulated methodology														Understand	
CO5:	Interpret and present the findings of the work conducted														Evaluate	
Mapping of COs with POs and PSOs																
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3		
CO1	3	2	3	-	-	-	-	-	-	-	-	3	3	3		
CO2	3	3	3	-	-	-	-	-	-	-	-	3	3	3		
CO3	3	3	3	-	-	-	-	-	-	-	-	3	3	3		
CO4	3	3	3	-	-	-	-	-	-	-	-	3	3	3		
CO5	3	3	3	-	-	-	-	-	-	-	-	3	3	3		
Avg.	3	3	3	-	-	-	-	-	-	-	-	3	3	3		
1 – Slight, 2 – Moderate, 3 – Substantial , BT – Bloom’s Taxonomy																


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PCNE2401	ADVANCED CONCRETE TECHNOLOGY				
	Category	L	T	P	Credit
	PEC	3	0	0	3
Course objectives					
	To study the properties of concrete making materials, tests, mix design, special concretes, and various methods for making concrete.				
UNIT – I	CONCRETE MAKING MATERIALS				9
Aggregates classification IS Specifications, Properties, Grading, Methods of combining aggregates, specified gradings, Testing of aggregates - Cement, Grade of cement, Chemical composition, Testing of concrete, Hydration of cement, Structure of hydrated cement, special cements - Water - Chemical admixtures, Mineral admixture.					
UNIT – II	MIX DESIGN				9
Principles of concrete mix design, Methods of concrete mix design, IS Method, ACI Method, DOE Method – Mix design for special concretes- changes in Mix design for special materials.					
UNIT – III	CONCRETING METHODS				9
Process of manufacturing of concrete, methods of transportation, placing and curing, cracking, plastic shrinkage, Extreme weather concreting, special concreting methods. Vacuum dewatering – Underwater Concrete					
UNIT – IV	SPECIAL CONCRETES				9
Light weight concrete Fly ash concrete, Fiber reinforced concrete, Sulphur impregnated concrete, Polymer Concrete – High performance concrete. High performance fiber reinforced concrete, Self- Compacting Concrete, Geo Polymer Concrete, Waste material-based concrete – Ready mixed concrete.					
UNIT – V	TESTS ON CONCRETE				9
Properties of fresh concrete, Hardened concrete, Strength, Elastic properties, Creep and shrinkage – Durability of concrete. Non-destructive Testing Techniques - microstructure of concrete					
Total: 45 periods					
REFERENCES:					
1.	Gupta.B.L., Amit Gupta, “Concrete Technology, Jain Book Agency, 2017				
2.	Shetty M.S., Concrete Technology, S.Chand and Company Ltd. Delhi, 2019.				
3.	Gambhir.M.L., Concrete Technology, McGraw Hill Education, 2006.				
4.	Neville, A.M., Properties of Concrete, Prentice Hall, 1995, London.				
5.	Job Thomas., Concrete Technology, Cengage learning India Private Ltd, New Delhi, 2015.				


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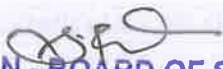
COURSE OUTCOMES: After the completion of the course the students will be able to											BT Mapped (Highest Level)			
CO1:	Develop knowledge on various materials needed for concrete manufacture										Understand			
CO2:	Apply the rules to do mix designs for concrete by various methods										Understand			
CO3:	Develop the methods of manufacturing of concrete.										Apply			
CO4:	Explain about various special concrete										Analyze			
CO5:	Explain various tests on fresh and hardened concrete										Apply			
Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	2	-	-	-	-	-	-	-	-	2	1	1
CO2	2	2	2	-	-	-	-	-	-	-	-	2	2	2
CO3	3	2	3	-	-	-	-	-	-	-	-	3	1	2
CO4	3	2	3	-	-	-	-	-	-	-	-	2	2	1
CO5	2	2	2	-	-	-	-	-	-	-	-	2	2	2
Avg.	2	1	2	-	-	-	-	-	-	-	-	2	1	1
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PCNE2402	HUMAN RESOURCES MANAGEMENT IN CONSTRUCTION				
	Category	L	T	P	Credit
	PEC	3	0	0	3
Course objectives					
	To understand the various aspects of manpower management and to help the student further develop their management, team building and leadership skills so as to increase their effectiveness in their job performance on international projects.				
UNIT – I	MANPOWER PLANNING				9
Manpower planning and forecasting – Recruitment, selection process-Sources- Induction- Orientation and Training -Manpower Planning process - Organising, Staffing, directing, and controlling — Factors influencing supply and demand of human resources – Role of HR manager – Personnel Principles.					
UNIT – II	ORGANISATION				9
Elements of an organisation- Management process in organisations- Planning-Organising-Staffing- Directing-Controlling – Delegation of authority – responsibility – accountability – lines and staff organisation Workforce diversity- international dimensions of Organisation- Organisational structure- determinants of organisational design					
UNIT – III	HUMAN RELATIONS AND ORGANISATIONAL BEHAVIOUR				9
Basic individual psychology – Approaches to job design and job redesign – Self managing work teams – Intergroup – Conflict in organizations – Leadership-Engineer as Manager –aspects of decision making – Significance of human relation and organizational – Individual in organization – Motivation – Personality and creativity – Group dynamics, Team working – Communication and negotiation skills.					
UNIT – IV	WELFARE MEASURES				9
Establishing Pay plans - Basics of compensation - factors determining pay rate - Current trends in compensation - Job evaluation – Incentives- Practices in Indian organisations - Statutory benefits - non-statutory (voluntary) benefits - Insurance benefits - retirement benefits and other welfare measures to build employee commitment – Laws related to welfare measures.					
UNIT – V	MANAGEMENT AND DEVELOPMENT METHODS				9
Management Development - On-the-job and off-the-job- Management Developments - Performance appraisal in practice. Managing careers: Career planning and development - Managing promotions and transfers of operations – Developing policies, practices and establishing process pattern – Competency upgradation and their assessment – New methods of training and development – Performance Management.					
Total: 45 periods					
REFERENCES:					
1.	Charles D Pringle, Justin GooderiLongenecter, Management, CE Merrill Publishing Co. 2001.				
2.	Dwivedi R.S, Human Relations and Organisational Behaviour, Macmillian India Ltd.,2005.				
3.	Josy .J, Familaro, “Handbook of Human Resources Administration”, McGraw-Hill Intemational Edition, 2007				
4.	D. Longford M.R. Hancock, R. Rellows& A. W. Gale, Human Recourse Management In Construction.– Longman Group Limited , fourth impression 2000.				


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5.	Carleton Counter II and Jill Justice Coulter, "The Complete Standard Hand Book of Construction Personnel Management ", Prentice Hall, Inc., New Jersey, 1989.													
COURSE OUTCOMES: At the end of the course the student will be able to												BT Mapped (Highest Level)		
CO1:	Demonstrate practices and techniques for evaluating performance, Structuring teams, coaching and mentoring people.											Understand		
CO2:	Explain the role of the leader and leadership principles and attitudes											Understand		
CO3:	Demonstrate an understanding of professional and ethical responsibilities											Apply		
CO4:	Demonstrate commitment to quality, timeliness, and continuous Improvement.											Understand		
CO5:	Interpret their future managerial role, with emphasis on the management of the human resources and with a multi-cultural perspective											Apply		
Mapping of COs with POs and PSOs														
COs/PO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	3	-	-	-	-	-	-	-	-	3	3	3
CO2	2	1	2	-	-	-	-	-	-	-	-	3	3	3
CO3	1	1	1	-	-	-	-	-	-	-	-	3	3	3
CO4	2	2	2	-	-	-	-	-	-	-	-	3	3	3
CO5	2	1	2	-	-	-	-	-	-	-	-	3	3	3
Avg.	3	1	3	-	-	-	-	-	-	-	-	3	3	3
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PCNE2403	CONSTRUCTION PROJECT MANAGEMENT				
	Category	L	T	P	Credit
	PEC	3	0	0	3
Course objectives					
	- To study the various management techniques for successful completion of construction projects.				
UNIT – I	FUNDAMENTALS OF CONSTRUCTION PROJECT MANAGEMENT				9
Introduction of construction Project Management – Construction Scope – Construction Project Characteristics - Project development and Life Cycle – Construction Project Management Practice - Roles and Functions and Responsibility of Construction Managers and Major causes of Project failure					
UNIT – II	PLANNING AND ORGANIZING CONSTRUCTION PROJECT				9
Construction Project organization – Planning Project work Scope and integration Processes - Defining Project Activities - Scheduling Project - CPM, PERT, Precedence Network Analysis – Planning and organizing project resources such as manpower, material, equipment, Time and cost for construction site.					
UNIT – III	DESIGN AND CONSTRUCTION PROCESS				9
Design and Construction as an Integrated System – Innovation, Economic and Technological Feasibility - Design Methodology - Functional Design - Construction Site Environment - Case Studies - Project Clearance requirement, Procedure and Necessary Documentation for Major Works Like Dams, Multistoried Structures, Ports, Tunnels.					
UNIT – IV	PROJECT RESOURCES UTILIZATION				9
Labor productivity variations, productivity improvement - work study - Materials purchase & inventory control - Construction Equipment - Choice of Equipment and Standard Production Rates – Time management and Cost management - Measuring project progress & performance – Tools and Techniques					
UNIT – V	RISK MANAGEMENT AND PROJECT CONTROLLING				9
Risks management at construction site - Controlling resource productivity – Schedule and Cost Controlling system – Earned value management system – Project Management Information systems.					
Total: 45 Periods					
REFERENCES:					
1.	Chitkara, K.K. Construction Project Management: Planning, Scheduling and Control, Tata McGraw-Hill Publishing Company, New Delhi, 3rd Edition, 2014.				
2.	Choudhury S, Project Management, McGraw-Hill Publishing Company, New Delhi, 2017				
3.	Chris Hendrickson and Tung Au, Project Management for Construction – Fundamental Concepts for Owners, Engineers, Architects and Builders, Prentice Hall, Pittsburgh, 2nd edition, 2000				
4.	Frederick E. Gould, Construction Project Management, Wentworth Institute of Technology, Vary E. Joyce, Massachusetts Institute of Technology,4th Edition, 2013.				
5.	Kumar Neeraj Jha, Construction Project Management Theory and Practices, Pearson, 2012.				


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COURSE OUTCOMES: Upon Completion of the course, the students will be able to												BT Mapped (Highest Level)		
CO1:	Explain the stages involved in a project and analyze the obligatory services to be taken up while performing a construction activity.											Understand		
CO2:	Apply the scheduling techniques for planning construction project.											Understand		
CO3:	Develop the ability to integrate design and construction Process											Apply		
CO4:	Analyzing Resources utilization and resource productivity											Analyze		
CO5:	Assess the risk and controlling systems using project management Information system.											Understand		
Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	3	-	-	-	-	-	-	-	-	3	2	2
CO2	3	1	2	-	-	-	-	-	-	-	-	3	2	2
CO3	3	3	2	-	-	-	-	-	-	-	-	3	3	2
CO4	2	1	2	-	-	-	-	-	-	-	-	2	2	2
CO5	3	1	2	-	-	-	-	-	-	-	-	2	1	2
Avg.	3	2	3	-	-	-	-	-	-	-	-	3	2	2
1 – Slight, 2 – Moderate, 3 – Substantial , BT – Bloom’s Taxonomy														


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PCNE2404	SUSTAINABLE CONSTRUCTION					
		Category	L	T	P	Credit
		PEC	3	0	0	3
Course objectives						
	To impart knowledge about sustainable construction and to understand the concepts of sustainable materials, energy calculations, green buildings and environmental effects					
UNIT – I	INTRODUCTION					9
Introduction and definition of Sustainability - Carbon cycle - role of construction material: concrete and steel, etc. - CO2 contribution from cement and other construction materials						
UNIT – II	MATERIALS USED IN SUSTAINABLE CONSTRUCTION					9
Construction materials and indoor air quality - No/Low cement concrete - Recycled and manufactured aggregate - Role of QC and durability - Life cycle and sustainability.						
UNIT – III	ENERGY CALCULATIONS					9
Components of embodied energy - calculation of embodied energy for construction materials - Energy concept and primary energy - Embodied energy via-a-vis operational energy in conditioned building - Life Cycle energy use						
UNIT – IV	GREEN BUILDINGS					9
Control of energy use in building - ECBC code, codes in neighboring tropical countries - OTTV concepts and calculations – Features of LEED and TERI – Griha ratings - Role of insulation and thermal properties of construction materials - influence of moisture content and modeling - Performance ratings of green buildings - Zero energy building						
UNIT – V	ENVIRONMENTAL EFFECTS					9
Non-renewable sources of energy and Environmental aspects – energy norm, coal, oil, natural gas -Nuclear energy - Global temperature, Green house effects, global warming - Acid rain: Causes, effects and control methods - Regional impacts of temperature change						
Total: 45 periods						
REFERENCES:						
1.	Charles J Kibert, Sustainable Construction : Green Building Design & Delivery, 4th Edition , Wiley Publishers 2016.					
2.	Steve Goodhew, Sustainable Construction Process, Wiley Blackwell,UK, 2016					
3.	Craig A. Langston & Grace K.C. Ding, Sustainable Practices in the Built Environment, Butterworth Heinemann Publishers, 2011.					
4.	William P Spence, Construction Materials, Methods & Techniques (3e), Yesdee Publication Pvt. Ltd, 2012.					
5.	New Building Materials and Construction World magazine					


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COURSE OUTCOMES: Students will be able to												BT Mapped (Highest Level)		
CO1:	Summarize the various sustainable materials used in construction											Understand		
CO2:	Explain the method of estimating the amount of energy required for building.											Understand		
CO3:	Interpret the features of LEED, TERI and GRIHA ratings of buildings											Understand		
CO4:	Relate the concept and performance of zero energy buildings											Apply		
CO5:	Select less carbon emission materials for construction.											Understand		
Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	3	-	-	-	-	-	-	-	-	1	2	1
CO2	3	2	3	-	-	-	-	-	-	-	-	2	2	2
CO3	3	3	2	-	-	-	-	-	-	-	-	1	3	1
CO4	3	3	3	-	-	-	-	-	-	-	-	2	3	2
CO5	3	1	2	-	-	-	-	-	-	-	-	2	3	2
Avg.	3	1	3	-	-	-	-	-	-	-	-	1	2	1
1 – Slight, 2 – Moderate, 3 – Substantial , BT – Bloom’s Taxonomy														


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PCNE2405	ECONOMICS AND FINANCE MANAGEMENT IN CONSTRUCTION				
	Category	L	T	P	Credit
	PEC	3	0	0	3
Course objectives	To introduce the various aspects of Construction economics and finance with the systematic evaluation of cost and benefit associated with different projects.				
UNIT – I	BASIC PRINCIPLES				9
Time Value of Money – Cash Flow diagram – Nominal and effective interest- continuous interest. Single Payment Compound Amount Factor (P/F,F/P) – Uniform series of Payments (F/A,A/F,F/P.A/P)– Problem time zero (PTZ)- equation time zero (ETZ). Constant increment to periodic payments – Arithmetic Gradient (G), Geometric Gradient (C).					
UNIT – II	COMPARING ALTERNATIVES PROPOSALS				9
Comparing alternatives- Present Worth Analysis, Annual Worth Analysis, Future Worth Analysis, Rate of Return Analysis (ROR) and Incremental Rate of Return (IROR) Analysis, Benefit/Cost Analysis, Break Even Analysis.					
UNIT – III	EVALUATING ALTERNATIVE INVESTMENTS				9
Real Estate - Investment Property, Equipment Replace Analysis, Depreciation – Tax before and after depreciation – GST– Input Tax Credit (ITC) – Assessment and Administration of GST – Inflation.					
UNIT – IV	FUNDS MANAGEMENT				9
Project Finance – Sources of finance - Long-term and short -term finance, Working Capital Management, Inventory valuation, Mortgage Financing - International financial management- foreign currency management.					
UNIT – V	FUNDAMENTALS OF MANAGEMENT ACCOUNTING				9
Management accounting, Financial accounting principles- basic concepts, Financial statements – accounting ratios - funds flow statement – cash flow statement.					
					Total: 45 periods
REFERENCES:					
1.	Patel, B M Project management- strategic Financial Planning, Evaluation and Control, Vikas Publishing House Pvt. Ltd. New Delhi, 2000				
2.	Shrivastava,U.K., Construction Planning and Management,2nd Edn. Galgotia Publication Pvt. Ltd. New Delhi., 2001				
3.	Blank, L.T., and Tarquin,a.J Engineering Economy,4th Edn. Mc-Graw Hill Book Co., 1988.				
4.	Collier C and GlaGola C Engineering Economics & Cost Analysis, 3rd Edn. Addison Wesley Education Publishers.,1998.				
5.	Steiner, H.M. Engineering Economic principles, 2nd Edn. McGraw Hill Book, 1996.				


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COURSE OUTCOMES: Students will be able to												BT Mapped (Highest Level)		
CO1:	Summarize the basic principles of Economic in construction											Understand		
CO2:	Evaluate alternate proposals											Analyze		
CO3:	Evaluate alternative investments											Analyze		
CO4:	Select best source of finance for a project											Understand		
CO5:	Elaborate the finance and accounting											Understand		
Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1	1	-	-	-	-	-	-	-	-	3	3	1
CO2	2	2	1	-	-	-	-	-	-	-	-	2	2	1
CO3	1	2	2	-	-	-	-	-	-	-	-	3	3	2
CO4	2	2	1	-	-	-	-	-	-	-	-	2	2	1
CO5	1	1	2	-	-	-	-	-	-	-	-	1	1	3
Avg.	1	1	1	-	-	-	-	-	-	-	-	3	3	1
1 – Slight, 2 – Moderate, 3 – Substantial , BT – Bloom’s Taxonomy														

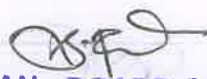

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PCNE2406	DESIGN OF ENERGY EFFICIENT BUILDINGS					
		Category	L	T	P	Credit
		PEC	3	0	0	3
Course objectives						
	To understanding the concept of energy consumption in buildings and design a energy efficient building.					
UNIT – I	INTRODUCTION					9
Climate adapted and climate rejecting buildings – Heat Transfer – Measuring Conduction – Thermal Storage – Measurement of Radiation – The Greenhouse Effect – Convection – Measuring latent and sensible heat – Psychrometry Chart – Thermal Comfort – Microclimate, Site Planning and Development – Temperature – Humidity – Wind – Optimum Site Locations – Sun Path Diagrams – Sun Protection – Types of Shading Devices – Design responses to energy conservation strategies.						
UNIT – II	PASSIVE SOLAR HEATING AND COOLING					9
General Principles of passive Solar Heating – Key Design Elements – Sunspace – Direct gain – Trombe Walls, Water Walls – Convective Air loops – Concepts – Case Studies – General Principles of Passive Cooling – Ventilation – Principles – Case studies – Courtyards – Roof Ponds – Cool Pools – Predicting ventilation in buildings – Window Ventilation Calculations – Room Organization Strategies for Cross and Stack Ventilation – Radiation – Evaporation and dehumidification – Wind Catchers – Mass Effect – Zoning – Load Control – Air Filtration and odor removal.						
UNIT – III	DAYLIGHTING AND ELECTRICAL LIGHTING					9
Materials, components and details – Insulation – Optical materials – Radiant Barriers – Glazing materials – Glazing Spectral Response – Day lighting – Sources and concepts –Building Design Strategies – Case Studies – Daylight apertures – Light Shelves – Codal requirements – Day lighting design – Electric Lighting – Light Distribution – Electric Lighting control for day lighted buildings – Switching controls – Coefficient of utilization – Electric Task Lighting – Electric Light Zones – Power Adjustment Factors.						
UNIT – IV	HEAT CONTROL AND VENTILATION					9
Hourly Solar radiation – Heat insulation – Terminology – Requirements – Heat transmission through building sections – Thermal performance of Building sections – Orientation of buildings – Building characteristics for various climates – Thermal Design of buildings – Influence of Design Parameters- Mechanical controls – Examples. Ventilation – Requirements – Minimum standards for ventilation - Ventilation Design – Energy Conservation in Ventilating systems – Design for Natural Ventilation- Calculation of probable indoor wind speed.						


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UNIT – V	DESIGN FOR CLIMATIC ZONES	9
Energy efficiency – An Overview of Design Concepts and Architectural Interventions – Embodied Energy – Low Embodied Energy Materials – Passive Downdraft Evaporative Cooling – Design of Energy Efficient Buildings for Various Zones – Cold and cloudy – Cold and sunny – Composite – Hot and dry – Moderate – Warm and humid – Case studies of residences, office buildings and other buildings in each zones – Commonly used software packages in energy efficient building analysis and design - Energy Audit – Certification		
		Total: 45 Periods
REFERENCES:		
1.	Energy Conservation Building Code, Bureau of Energy Efficiency, New Delhi, 2018.	
2.	Brown, G.Z. and DeKay, M., Sun, Wind and Light - Architectural Design Strategies, John Wiley and Sons Inc, 3rd Edition, 2014.	
3.	Handbook on Functional Requirements of Buildings Part 1 to 4 SP : 41 (S and T) 1995	
4.	Residential Energy: Cost Savings and Comfort for Existing Buildings by John Krigger and Chris Dorsi, Published by Saturn Resource Management, 2013.	
5.	Majumdar, M (Ed), Energy - Efficient Buildings in India, Tata Energy Research Institute, Ministry of Non-Conventional Energy Sources, 2009.	

COURSE OUTCOMES: On completion of this course, the student is expected to be able to												BT Mapped (Highest Level)			
CO1:	Explain environmental energy supplies on buildings												Understand		
CO2:	Explain the passive solar heating, cooling system												Understand		
CO3:	Discuss the various aspects of day-lighting and electrical lighting in a building.												Understand		
CO4:	Predict and design building ventilation and heat control for indoor comfort												Understand		
CO5:	Design a building for climatic zone and apply simulation programs of buildings to perform energy calculations												Analyze		
Mapping of COs with POs and PSOs															
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	
CO1	3	2	2	-	-	-	-	-	-	-	-	3	2	1	
CO2	2	3	2	-	-	-	-	-	-	-	-	3	2	1	
CO3	3	2	2	-	-	-	-	-	-	-	-	3	2	2	
CO4	2	2	3	-	-	-	-	-	-	-	-	3	3	3	
CO5	3	2	2	-	-	-	-	-	-	-	-	2	3	3	
Avg.	3	2	2	-	-	-	-	-	-	-	-	3	2	1	
1 – Slight, 2 – Moderate, 3 – Substantial , BT – Bloom’s Taxonomy															


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PCNE2407		PROJECT SAFETY MANAGEMENT				
		Category	L	T	P	Credit
		PEC	3	0	0	3
Course objectives						
		To study and understand the various safety concepts and requirements applied to construction projects				
UNIT – I		CONSTRUCTION ACCIDENTS				9
Accidents and their Causes – Human Factors in Construction Safety – Costs of Construction Injuries						
– Occupational and Safety Hazard Assessment – Legal Implications.						
UNIT – II		SAFETY PROGRAMMES				9
Problem Areas in Construction Safety – Elements of an Effective Safety Programme – Job-Site Safety Assessment – Safety Meetings – Safety Incentives...						
UNIT – III		CONTRACTUAL OBLIGATIONS				9
Safety in Construction Contracts – Substance Abuse – Safety Record Keeping - Occupational Safety and Health Administration Manuals, Laws and Act - Indian and International Practices..						
UNIT – IV		HEAT CONTROL AND VENTILATION				9
Safety Culture – Safe Workers – Safety and First Line Supervisors – Safety and Middle Managers-Top Management Practices, Company Activities and Safety – Safety Personnel – Sub contractual Obligation – Project Coordination and Safety Procedures – Workers Compensation.						
UNIT – V		OWNERS’ AND DESIGNERS’ OUTLOOK				9
Owners and Designers – Roles and responsibility in ensuring safety – Preparedness – Role of the designer in ensuring safety – Safety clause in the design document.						
Total: 45 Periods						
REFERENCES:						
1.	Jimmy W. Hinze, Construction Safety, Prentice Hall Inc., 1997					
2.	Richard J. Coble, Jimmie Hinze and Theo C. Haupt, Construction Safety and Health Management, Prentice Hall Inc., 2001.					
3.	Sathyanarayanan Rajendran and Mandi Kime, Construction Project Safety-Management BestPractices Handbook, 2013.					
4.	Safety, Health and Environmental Handbook, CPWD, 2019					
5.	Bhattacharjee S.K. Safety Management in Construction (Principles and Practice), Khanna Publishers, New Delhi 2011.					


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COURSE OUTCOMES: On completion of this course, the student is expected to be able to		BT Mapped (Highest Level)
CO1:	Develop knowledge on accidents and their causes	Understand
CO2:	Develop knowledge about safety programs and job-site safety assessments	Understand
CO3:	Apply the knowledge of contractual obligations.	Apply
CO4:	Explain about designing for safety and safety procedures	Understand
CO5:	Develop the knowledge of owners' and designers' responsibilities.	Apply

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1	1	-	-	-	-	-	-	-	-	2	2	2
CO2	2	1	2	-	-	-	-	-	-	-	-	2	2	2
CO3	1	1	1	-	-	-	-	-	-	-	-	2	1	2
CO4	1	1	2	-	-	-	-	-	-	-	-	2	2	2
CO5	1	1	2	-	-	-	-	-	-	-	-	2	2	2
Avg.	1	1	1	-	-	-	-	-	-	-	-	2	2	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy


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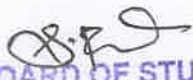
PCNE2408	COMPUTER APPLICATIONS IN CONSTRUCTION ENGINEERING AND PLANNING					
		Category	L	T	P	Credit
		PEC	3	0	0	3
Course objectives						
	• To study and understand the optimization techniques, inventory models and scheduling techniques applied to construction engineering					
UNIT – I	INTRODUCTION					9
Overview of IT Applications in Construction – Construction process – Computerization in Construction – Computer-aided Cost Estimation – Developing applications with database software.						
UNIT – II	OPTIMIZATION TECHNIQUES					9
Linear, Dynamic, and Integer Programming - Branch and Bound Techniques – Application to Production Scheduling, Equipment Replacement, Material Transportation and Work Assignment Problems – Software applications.						
UNIT – III	INVENTORY MODELS					9
Deterministic and Probabilistic Inventory Models - Software applications.						
UNIT – IV	SCHEDULING APPLICATION					9
PERT and CPM - Advanced planning and scheduling concepts – Computer applications – Case study.						
UNIT – V	OTHER PROBLEMS					9
Sequencing problems – Simulation – Enterprises – Introduction to ERP systems..						
Total: 45 Periods						
REFERENCES:						
1.	Billy E. Gillet., Introduction to Operations Research – A Computer Oriented Algorithmic Approach, McGraw Hill, 2008.					
2.	Feigenbaum, L., Construction Scheduling with Primavera Project Planner Prentice Hall Inc., 2002					
3.	Ming Sun and Rob Howard, “Understanding I.T. in Construction, Spon Press, Taylor and Francis Group, 2004					
4.	Paulson, B.R., Computer Applications in Construction, McGraw Hill, 1995.					
5.	Tarek Hegazy, Computer-Based Construction Project Management, Pearson New International Edition, 2013.					


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COURSE OUTCOMES: On completion of this course, the student is expected to be able to											BT Mapped (Highest Level)			
CO1:	Use of software's in construction Industry										Understand			
CO2:	Apply various optimization techniques										Understand			
CO3:	Apply Deterministic and Probabilistic Inventory Models.										Apply			
CO4:	Analyze the scheduling concepts.										Analyze			
CO5:	Solve problems using simulation and ERP systems										Apply			
Mapping of COs with POs and PSOs														
COs/PO s	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PSO 1	PSO 2	PSO 3
CO1	2	1	2	-	-	-	-	-	-	-	-	2	1	1
CO2	1	1	2	-	-	-	-	-	-	-	-	3	2	2
CO3	3	2	2	-	-	-	-	-	-	-	-	3	2	2
CO4	2	1	1	-	-	-	-	-	-	-	-	3	2	2
CO5	1	1	2	-	-	-	-	-	-	-	-	2	1	2
Avg.	2	1	2	-	-	-	-	-	-	-	-	2	1	1
1 – Slight, 2 – Moderate, 3 – Substantial , BT – Bloom's Taxonomy														


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PCNE2409	QUANTITATIVE TECHNIQUES IN MANAGEMENT					
		Category	L	T	P	Credit
		PEC	3	0	0	3
Course objectives						
	To study the various quantitative methods applied to the elements of management the effect of production management, finance management, decision theory, and managerial economics.					
UNIT – I	OPERATIONS RESEARCH					9
Introduction to Operations Research - Linear Programming – Graphical and Simplex Methods, Duality and Post–Optimality Analysis – Transportation and Assignment Problems.						
UNIT – II	PRODUCTION MANAGEMENT					9
Inventory Control - EOQ Model - Quantity Discounts - Safety Stock – Replacement Theory – PERT and CPM – Simulation Models – Quality Control.						
UNIT – III	FINANCIAL MANAGEMENT					9
Working Capital Management – Compound Interest and Present Value methods – Discounted Cash Flow Techniques – Capital Budgeting.						
UNIT – IV	DECISION THEORY					9
Decision Theory – Decision Rules – Decision making under conditions of certainty, risk and uncertainty – Decision trees – Utility Theory.						
UNIT – V	MANAGERIAL ECONOMICS					9
Cost Concepts – Break-even analysis – Pricing Techniques – Game theory - Applications						
Total: 45 Periods						
REFERENCES:						
1.	Frank Harrison, E., The Managerial Decision-Making Process, Houghton Mifflin Co., Boston, 1999.					
2.	Hamdy. A.Taha, Operations Research: An Introduction, Prentice Hall, 2010.					
3.	Levin, R.I, Rubin,D.S., and Stinson J., Quantitative Approaches to Management, McGraw Hill College, 1993					
4.	Tang S.L., Irtishad U.Ahmad, Syed M.Ahmed, Ming Lu, Quantitative Technique for Decision making in Construction, Hongkong University Press, HKU, 2004.					
5.	Vohra, Nd., Quantitative Techniques in Management, Fifth Edition, Tata McGraw-Hill Company Ltd, 2017.					


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COURSE OUTCOMES: On completion of this course, the student is expected to be able to											BT Mapped (Highest Level)			
CO1:	Apply the knowledge of science and engineering fundamentals in learning the concept of operations research and its practical applicability for solving Challenges in construction.										Understand			
CO2:	Identify, formulate, plan and schedule construction engineering projects.										Understand			
CO3:	Apply the knowledge of financial management and cost concepts.										Apply			
CO4:	Design the required man, material, equipment, cost and time as per needs by proper decision rules.										Analyze			
CO5:	Analyze the cost by break-even analysis and modern construction management software.										Analyze			
Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	-	-	-	-	-	-	-	-	3	2	1
CO2	2	2	2	-	-	-	-	-	-	-	-	3	3	3
CO3	2	1	1	-	-	-	-	-	-	-	-	3	3	2
CO4	2	1	2	-	-	-	-	-	-	-	-	3	3	3
CO5	1	1	2	-	-	-	-	-	-	-	-	3	3	3
Avg.	3	2	2	-	-	-	-	-	-	-	-	3	2	1
1 – Slight, 2 – Moderate, 3 – Substantial , BT – Bloom’s Taxonomy														


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PCNE2410	RESOURCE MANAGEMENT AND CONTROL IN CONSTRUCTION				
	Category	L	T	P	Credit
	PEC	3	0	0	3
Course objectives	• To impart the concepts of resource planning • To impart the concepts of labor management. • To impart the concepts of material and equipment. • To impart the concepts of time management. • To impart the concepts of resource allocation and resource leveling in construction.				
UNIT – I	RESOURCE PLANNING				9
Resource Planning, Procurement, Identification, Personnel, Planning for material, Labour, time schedule and cost control, Types of resources, manpower, Equipment, Material, Money, Time					
UNIT – II	LABOUR MANAGEMENT				9
Systems approach, Characteristics of resources, Utilization, measurement of actual resources required, Tools for measurement of resources, Labour, Classes of Labour, Cost of Labour, Labour schedule, optimum use Labour.					
UNIT – III	MATERIALS AND EQUIPMENT				9
Material: Time of purchase, the quantity of material, sources, Transportation, Delivery, and Distribution Equipment: Planning and selecting by optimistic choice with respect to cost, Time, Source, and handling.					
UNIT – IV	TIME MANAGEMENT				9
Personnel time, Management and planning, managing time on the project, forecasting the future, Critical path measuring the changes and their effects – Cash flow and cost control.					
UNIT – V	RESOURCE ALLOCATION AND LEVELLING				9
Time-cost trade-off, Computer application – Resource levelling, resource list, resource allocation, Resource loading, Cumulative cost – Value Management.					
Total: 45 Periods					
REFERENCES:					
1.	Sharma, S C., Construction equipment management, Khanna publishers, Delhi, 2016..				
2.	Kumar Neeraj Jha Construction project management, Pearson publishers, 2015.				
3.	Andrew, D., Szilagg, Hand Book of Engineering Management, 1982.				
4.	Oxley Rand Poslcit, Management Techniques applied to the Construction Industry, Granda Publishing Ltd., 1996.				
5.	Paul Netscher, Construction Project Management: Tips and Insights, Panet Publications, 2017.				


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COURSE OUTCOMES: On completion of this course, the student is expected to be able to												BT Mapped (Highest Level)		
CO1:	Identify the different types of resources in a construction industry											Understand		
CO2:	Evaluate the labour productivity and the influencing factors											Analyze		
CO3:	Calculate the equipment output and the operation condition of construction equipment											Analyze		
CO4:	Describe the terms of cash inflow, cash outflow, and balance sheet											Understand		
CO5:	Categorize the time and cost-related information in a construction sector											Understand		
Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	1	-	-	-	-	-	-	-	-	3	2	2
CO2	3	2	2	-	-	-	-	-	-	-	-	3	2	2
CO3	2	2	2	-	-	-	-	-	-	-	-	3	2	2
CO4	3	2	3	-	-	-	-	-	-	-	-	3	2	2
CO5	2	2	2	-	-	-	-	-	-	-	-	3	2	2
Avg.	2	2	1	-	-	-	-	-	-	-	-	3	2	2
1 – Slight, 2 – Moderate, 3 – Substantial , BT – Bloom’s Taxonomy														


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PCNE2411	SHORING, SCAFFOLDING AND FORMWORK				
	Category	L	T	P	Credit
	PEC	3	0	0	3
Course objectives	- To disseminate knowledge about detailed planning. - To impart knowledge about materials used in formwork. - To learn design of formwork and shores. - To disseminate knowledge about erection of form work. - To impart knowledge about design of formwork for domes, shells, and tunnels.				
UNIT – I	PLANNING, SITE EQUIPMENT & PLANT FOR FORM WORK				9
Introduction - Forms for foundations, columns, beams walls etc., General objectives of formwork building - Planning for safety - Development of a Basic System - Key Areas of cost reduction - Planning examples. Overall Planning - Detailed planning - Standard units - Corner units - Pass units - Calculation of labour-constants - Formwork hours - Labour Requirement - Overall programme - Detailed programme - Costing - Planning crane arrangements - Site layout plan - Transporting plant - Formwork beams - Scaffold frames - Framed panel formwork - Formwork accessories.					
UNIT – II	MATERIALS ACCESSORIES PROPRIETARY PRODUCTS & PRESSURES				9
Lumber - Types - Finish - Sheathing boards working stresses - Repetitive member stress – Plywood-Types and grades - Jointing Boarding - Textured surfaces and strength - Reconstituted wood - Steel - Aluminum - Hardware and fasteners - Nails in Plywood - Allowable withdrawal load and lateral load. Pressures on formwork - Examples - Vertical loads for design of slab forms - Uplift on shores-Laterals loads on slabs and walls.					
UNIT – III	DESIGN OF FORMS AND SHORES				9
Basic simplification - Beam formulae - Allowable stresses - Deflection, Bending - Lateral stability - Shear, Bearing - Design of Wall forms - Slab forms - Beam forms - Column forms - Examples in each. Simple wood stresses - Slenderness ratio - Allowable load vs length behaviour of wood shores - Form lining Design Tables for Wall formwork - Slab Formwork - Column Formwork - Slab props - Stacking Towers - Free standing and restrained - Rosett Shoring - Shoring Tower - Heavy Duty props.					
UNIT – IV	BUILDING AND ERECTING THE FORM WORK				9
Carpentry Shop and job mill - Forms for Footings - Wall footings - Column footings - Sloped footing forms - Strap footing - Stepped footing - Slab form systems - Sky deck and Multiflex - Customized slab table - Standard Table module forms - Swivel head and uniportal head - Assembly sequence - Cycling with lifting fork - Moving with table trolley and table prop. Various causes of failures - ACI - Design deficiencies - Permitted and gradual irregularities.					
UNIT – V	FORMS FOR DOMES AND TUNNELS, SLIP FORMS AND SCAFFOLDS				9


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Hemispherical, Parabolic, Translational shells - Typical barrel vaults Folded plate roof details - Forms for Thin Shell roof slabs design considerations - Building the forms - Placing concrete - Form removed -Strength requirements -Tunnel forming components - Curb forms invert forms - Arch forms- Concrete placement methods - Cut and cover construction - Bulk head method - Pressures on tunnels - Continuous Advancing Slope method - Form construction - Shafts. Slip Forms - Principles-Types - advantages - Functions of various components - Planning -Desirable characteristics of concrete -Common problems faced - Safety in slip forms special structures built with slip form Technique - Types of scaffolds - Putlog and independent scaffold - Single pole scaffolds - Truss suspended - Gantry and system scaffolds.

Total: 45 Periods

REFERENCES:

1. Austin, C.K., Formwork for Concrete, Cleaver -Hume Press Ltd., London, 1996.
2. Hurd, M.K., Formwork for Concrete, Seventh Edition, American Concrete Institute, Detroit, 2016
3. Michael P. Hurst, Construction Press, London and New York, 2003..
4. Robert L. Peurifoy and Garold D. Oberlender, Formwork for Concrete Structures, McGraw - Hill, 2010.
5. Kumar Neeraj Jha, Formwork for Concrete Structures, 2017

COURSE OUTCOMES:

On completion of this course, the student is expected to be able to

**BT Mapped
(Highest Level)**

CO1:	Explain detailed planning of formwork, plant, and site equipment.	Understand
CO2:	Select material accessories for formwork connection and analyze pressures on formworks	Understand
CO3:	Design the forms and shores.	Apply
CO4:	Apply the knowledge of erecting forms for beams, slabs, columns, walls, and Causes of failures.	Apply
CO5:	Apply the knowledge of forms and their erection for domes and tunnels, types of slip forms, and scaffolds	Apply

Mapping of COs with POs and PSOs

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

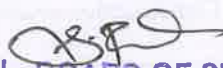
1 – Slight, 2 – Moderate, 3 – Substantial , BT – Bloom's Taxonomy


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PCNE2412	SYSTEM INTEGRATION IN CONSTRUCTION					
		Category	L	T	P	Credit
		PEC	3	0	0	3
Course objectives						
	• To understand how the various systems that constitute a building design which are interwoven and integrated with a view to achieving a high-performance building • To understand about the various environmental factors. • To understand about the various services. • To understand about the various maintenance.					
UNIT – I	STRUCTURAL INTEGRATION					9
Structural System, Systems for enclosing Buildings, Functional aesthetic system, Materials Selection and Specification.						
UNIT – II	ENVIRONMENTAL FACTORS					9
Qualities of enclosure necessary to maintain a specified level of interior environmental quality – weather resistance – Thermal infiltration – Acoustic Control – Transmission reduction – Air quality – illumination – Relevant systems integration with structural systems.						
UNIT – III	SERVICES					9
Plumbing – Electricity – Vertical circulation and their interaction – Heating Ventilation and Air- conditioning Systems in Buildings and implementation techniques in High Rise Buildings.						
UNIT – IV	MAINTENANCE					9
Component longevity in terms of operation performance and resistance to deleterious forces - Planning systems for least maintenance materials and construction – access for maintenance – Feasibility for replacement of damaged components – equal life elemental design – maintenance free exposed and finished surfaces.						
UNIT – V	SAFETY PLANNING					9
Ability of systems to protect fire – Preventive systems – fire escape system design – Planning for pollution free construction environmental – Hazard free Construction execution for High Rise Buildings.						
Total: 45 Periods						
REFERENCES:						
1.	A.J. Elder and Martiz Vinden Barg, Handbook of Building Enclosure, McGraw-Hill Book Company, 1983.					
2.	David V. Chadderton, Building Services Engineering, Taylor and Francis, 2013.					
3.	Jane Taylor and Gordon Cooke, The Fire Precautions Act in Practices, 1987.					
4.	Peter R. Smith and Warren G. Julian, Building Services, Applied Science Publishers Ltd., London, 1993..					
5.	William T. Mayer, Energy Economics and Building Design, McGraw-Hill Book Company, 1983					


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COURSE OUTCOMES: On completion of this course, the student is expected to be able to											BT Mapped (Highest Level)			
CO1:	Integrate the various construction techniques and incorporate into the building process										Understand			
CO2:	Appreciate the requirements and elements of HVAC, mechanical, electrical, hydraulic and transportation services in buildings										Understand			
CO3:	Design and integrate services into high-rise buildings										Apply			
CO4:	Interpret the intricacies of physical installation of services and their critical Sequence in the construction process.										Understand			
CO5:	Adopt an approach relating systems to aim for a high performance building in various categories of major use										Understand			
Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	3	-	-	-	-	-	-	-	-	2	2	2
CO2	2	2	3	-	-	-	-	-	-	-	-	2	3	2
CO3	2	3	1	-	-	-	-	-	-	-	-	2	3	2
CO4	3	1	1	-	-	-	-	-	-	-	-	2	3	2
CO5	3	2	3	-	-	-	-	-	-	-	-	2	3	2
Avg.	3	2	3	-	-	-	-	-	-	-	-	2	2	2
1 – Slight, 2 – Moderate, 3 – Substantial , BT – Bloom’s Taxonomy														


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PCNE2413	ADVANCED DATA ANALYSIS					
		Category	L	T	P	Credit
		PEC	3	0	0	3
Course objectives	- To learn concepts of data for construction management - To learn concepts of various data analysis - To learn concepts of regression and factor analysis - To learn concepts of discriminant and cluster analysis - To learn concepts of advanced multivariate data analysis techniques.					
UNIT – I	STATISTICAL DATA ANALYSIS					9
Data and Statistics- Review of Basic Statistical Measures-Probability Distributions-Testing of Hypotheses-Non-Parametric Tests.						
UNIT – II	BASIC CONCEPTS					9
Introduction – Basic concepts – Uni-variate, Bi-variate and Multi-variate techniques – Types of multivariate techniques – Classification of multivariate techniques – Guidelines for multivariate analysis and interpretation – Approaches to multivariate model building.						
UNIT – III	REGRESSION AND FACTOR ANALYSIS					9
Simple and Multiple Linear Regression Analysis – Introduction – Basic concepts – Multiple linear regression model – Least square estimation – Inferences from the estimated regression function – Validation of the model. Factor Analysis: Definition – Objectives – Approaches to factor analysis – methods of estimation – Factor rotation – Factor scores - Sum of variance explained – interpretation of results. Canonical Correlation Analysis - Objectives – Canonical variates and canonical correlation – Interpretation of variates and correlations.						
UNIT – IV	DISCRIMINANT AND CLUSTER ANALYSIS					9
Discriminant Analysis - Basic concepts – Separation and classification of two populations - Evaluating classification functions – Validation of the model. Cluster Analysis – Definitions – Objectives – Similarity of measures – Hierarchical and Non – Hierarchical clustering methods –Interpretation and validation of the model.						
UNIT – V	ADVANCED TECHNIQUES					9
Conjoint Analysis – Definitions – Basic concepts – Attributes – Preferences – Ranking of Preferences – Output of Conjoint measurements – Utility - Interpretation. Multi-Dimensional Scaling – Definitions – Objectives – Basic concepts – Scaling techniques – Attribute and Non-Attributes based MDS Techniques – Interpretation and Validation of models. Advanced Techniques – Structural Equation modeling						
Total: 45 Periods						
REFERENCES:						
1.	Joseph F Hair, Rolph E Anderson, Ronald L. Tatham& William C. Black, Multivariate Data Analysis, Pearson Education, New Delhi, 2015.					
2.	Barbara G. Tabachnick, Linda S. Fidell, Using Multivariate Statistics, 6th Edition, Pearson,2012					
3.	Richard A Johnson and Dean W. Wichern, Applied Multivariate Statistical Analysis, Prentice					


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	Hall, New Delhi, 2012.
4.	David R Anderson, Dennis J Sweeney and Thomas A Williams, Statistics for Business and Economics, Thompson, Singapore, 2002.
5.	Howard E.A. Tinsley & Steven D. Brown, Handbook of Applied Multivariate Statistics & Mathematical modeling, Academic Press, 2000.

COURSE OUTCOMES: On completion of this course, the student is expected to be able to		BT Mapped (Highest Level)
CO1:	Describe the different statistical analysis techniques	Understand
CO2:	Students will be able to formulate hypothesis	Understand
CO3:	Explore the basic concepts of statistical analysis	Apply
CO4:	Develop regression and factor analysis model and its interpretation	Understand
CO5:	Create discriminant and cluster analysis model and its interpretation	Understand

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	2	-	-	-	-	-	-	-	-	2	3	1
CO2	2	3	2	-	-	-	-	-	-	-	-	2	3	3
CO3	2	1	2	-	-	-	-	-	-	-	-	2	2	2
CO4	3	1	2	-	-	-	-	-	-	-	-	2	2	3
CO5	1	2	3	-	-	-	-	-	-	-	-	2	3	3
Avg.	3	2	2	-	-	-	-	-	-	-	-	2	2	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy


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PCNE2414	ENVIRONMENTAL IMPACT ASSESSMENT FOR CONSTRUCTION ENGINEERS					
		Category	L	T	P	Credit
		PEC	3	0	0	3
Course objectives	- To impart the knowledge and skills required for understanding the various impacts of infrastructure projects on the environment - To impart knowledge about prediction and assessment of EIA - To impart the knowledge of health and socio-economic impact assessment - To impart the knowledge and expose the students to the various methodologies available to assess. - To impart the knowledge to develop the skill to prepare Environmental Impact Assessment report					
UNIT – I	INTRODUCTION					9
Sustainable Development challenges and needs - Key approaches for Impact Assessment – EIA approach: historical development - Legal and Regulatory aspects in India - Types and Objectives, Components, Process of EIA.						
UNIT – II	PREDICTION AND ASSESSMENT					9
Prediction and Assessment: tools - impact on air, water, soil & Noise - Role of Biodiversity impact Assessment - Identification, Prediction and Evaluation of Impacts on Biodiversity - Techniques of Biodiversity impact assessment - EIA Report Preparation - Environmental Management Plan: Preparation and implementation - Mitigation and Rehabilitation plans - Post Project Audit.						
UNIT – III	HEALTH AND SOCIO-ECONOMIC IMPACT ASSESSMENT					9
Health Assessment: Impact of Environment on Health - Developing framework for Health impact analysis, tools, and techniques - Socio-Economic Impact Assessment: Overview and Scope of Social Impact Assessment - SIA model and the planning process - Land acquisition: Legal aspects, Resettlement & Rehabilitation, and Development.						
UNIT – IV	INTEGRATED ANALYSIS					9
Integrated Analysis of Environmental, Social, and Health Impacts - Challenges for Integrated Approach - Scope for Integrated approach in economic analysis - CBA, Social CBA, and Cost effectiveness Analysis - Analytic Hierarchy process-based Approach - Emerging Dimensions and Future Directions.						
UNIT – V	IMPACT OF INFRASTRUCTURE AND ENVIRONMENTAL SERVICES					9
Case Studies: EIA for Mining, extraction of natural resources and power generation – Primary Processing and Material Production - Material Processing, Manufacturing/Fabrication – Service Sectors - Physical Infrastructure including Environmental Services - Building and Construction Projects - Area Development Projects and Townships - Strategic Environmental Assessment, Technological Assessment, and Risk Assessment.						
						Total: 45 Periods
REFERENCES:						
1.	Anjaneyulu, Yerramilli, and Valli Manickam, “Environmental impact assessment methodologies”, Hyderabad: BS Publications, Third Edition 2022.					


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2.	Lawrence, D.P., "Environmental Impact Assessment – Practical Solutions to recurrent problems", Wiley-Interscience, New Jersey, 2003.
3.	Petts, J., "Handbook of Environmental Impact Assessment", Vol., I and II, Blackwell Science, London, 1999
4.	Canter, L.W., "Environmental Impact Assessment", McGraw Hill, New York, 1996.
5.	World Bank – Source Book on Environmental Impact Assessment, 2010

COURSE OUTCOMES: On completion of this course, the student is expected to be able to											BT Mapped (Highest Level)			
CO1:	Apply the knowledge of science and engineering fundamentals to sustainable development challenges.										Understand			
CO2:	Explain the identification, prediction, and evaluation of impacts that will be caused by projects or industries on biodiversity.										Understand			
CO3:	Identify the legal requirements of environmental impact assessment for projects.										Apply			
CO4:	Develop the ability to perform integrated analysis by considering environmental, social, and health impacts.										Understand			
CO5:	select appropriate methods for environmental impact assessment for Infrastructure and environmental service.										Understand			
Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	-	-	-	-	-	-	-	-	3	2	3
CO2	2	2	3	-	-	-	-	-	-	-	-	3	3	2
CO3	2	2	1	-	-	-	-	-	-	-	-	3	2	3
CO4	1	1	3	-	-	-	-	-	-	-	-	3	3	2
CO5	3	2	2	-	-	-	-	-	-	-	-	3	3	3
Avg.	2	2	2	-	-	-	-	-	-	-	-	3	3	3
1 – Slight, 2 – Moderate, 3 – Substantial , BT – Bloom’s Taxonomy														


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PCNE2415	LEAN CONSTRUCTION CONCEPTS, TOOLS, AND PRACTICES					
		Category	L	T	P	Credit
		PEC	3	0	0	3
Course objectives	• To impart knowledge about the basics of lean construction. • To impart knowledge about the lean principles. • To impart knowledge about the core concepts of lean construction. • To impart knowledge about the lean tools and techniques. • To impart knowledge about the basics of lean implementation in the construction industry.					
UNIT – I	INTRODUCTION					9
Introduction and overview of the construction project management -Review of Project Management& Productivity Measurement Systems – Productivity in Construction– Daily Progress Report-The state of the industry for its management practices –construction project phases - Essential features of contemporary construction management techniques - The problems with current construction management techniques– Current production planning.						
UNIT – II	LEAN MANAGEMENT					9
Introduction to lean management – Toyota's management principle-Evolution of lean in the construction industry - Production theories in construction –Lean construction value - Value in construction - Target value design – Lean project delivery system- Forms of waste in the construction industry – Waste Elimination.						
UNIT – III	CORE CONCEPTS IN LEAN					9
Concepts in lean thinking – Principles of lean construction – Variability and its impact – Traditional construction and lean construction – Traditional project delivery - Lean construction and workflow reliability – Work structuring – Production control						
UNIT – IV	LEAN CONSTRUCTION TOOLS AND TECHNIQUES					9
Value Stream Mapping – Work sampling – Last planner system – Flow and pull-based production – Last Planner System – Look ahead schedule – constraint analysis – weekly planning meeting- Daily Huddles – Root cause analysis – Continuous improvement – Just in time.						
UNIT – V	LEAN CONSTRUCTION IMPLEMENTATION					9
Lean construction implementation- Enabling lean through information technology – Lean in design - Design Structure Matrix Location Based Management System-BIM (Building Information Modelling) - IPD (Integrated Project Delivery) – Sustainability through lean construction approach.						
						Total: 45 Periods
REFERENCES:						
1.	Corfe, C. and Clip, B., Implementing lean in construction: Lean and the sustainability agenda, CIRIA, 2013.					
2.	Shang Gao and Sui Pheng Low, Lean Construction Management: The Toyota Way, Springer, 2014.					
3.	Dave, B., Koskela, L., Kiviniemi, A., Owen, R., andTzortzopoulos, P., Implementing lean in construction: Lean construction and BIM, CIRIA, 2013.					


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4.	Ballard, G., Tommelein, I., Koskela, L. and Howell, G., Lean construction tools and techniques, 2002.
5.	Salem, O., Solomon, J., Genaidy, A. and Luegring, M., Site Implementation and Assessment of Lean Construction Techniques, Lean Construction Journal, 2005.

COURSE OUTCOMES: On completion of this course, the student is expected to be able to		BT Mapped (Highest Level)
CO1:	Explains the contemporary management techniques and the issues in the present scenario	Understand
CO2:	Apply the basics of lean management principles and their evolution from the manufacturing industry to the construction industry.	Analyze
CO3:	Develops a better understanding of core concepts of lean construction tools and techniques and their importance in achieving better productivity.	Analyze
CO4:	Apply lean techniques to achieve sustainability in construction projects.	Apply
CO5:	Apply lean construction techniques in design and modeling.	Apply

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	2	-	-	-	-	-	-	-	-	3	2	2
CO2	2	1	1	-	-	-	-	-	-	-	-	3	3	2
CO3	2	1	1	-	-	-	-	-	-	-	-	3	1	2
CO4	3	1	1	-	-	-	-	-	-	-	-	3	2	1
CO5	2	1	1	-	-	-	-	-	-	-	-	3	2	1
Avg.	2	1	1	-	-	-	-	-	-	-	-	3	3	2

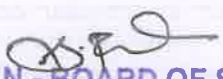
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy


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PCNE2416	MAINTENANCE, REPAIR AND REHABILITATION OF STRUCTURES					
		Category	L	T	P	Credit
		PEC	3	0	0	3
Course objectives						
	• To study the damages, repair and rehabilitation of structures.					
UNIT – I	MAINTENANCE AND REPAIR STRATEGIES					9
Maintenance, Repair and Rehabilitation, retrofit and strengthening, need for rehabilitation of structures- Service life behaviour - importance of Maintenance, causes and effects of deterioration. Non-destructive Testing Techniques						
UNIT – II	STRENGTH AND DURABILITY OF CONCRETE					9
Quality assurance for concrete based on Strength , Durability and Microstructure of concrete - NDT techniques- Cracks- different types, causes – Effects due to Environment, Fire , Earthquake, Corrosion of steel in concrete, Mechanism, quantification of corrosion damage.						
UNIT – III	REPAIR MATERIALS AND SPECIAL CONCRETES					9
Repair materials-Variou repair materials, Criteria for material selection, Methodology of selection, Special mortars and concretes- Polymer Concrete and Grouting materials- Bonding agents-Latex emulsions, Epoxy bonding agents, Protective coatings-Protective coatings for Concrete and Steel, FRP sheets.						
UNIT – IV	PROTECTION METHODS AND STRUCTURAL HEALTH MONITORING					9
Concrete protection methods – reinforcement protection methods- cathodic protection - Sacrificial anode - Corrosion protection techniques – Corrosion inhibitors, concrete coatings-Corrosion resistant steels, Coatings to reinforcement, Structural health monitoring.						
UNIT – V	REPAIR, RETROFITTING AND DEMOLITION OF STRUCTURES					9
Various methods of crack repair, Grouting, Routing and sealing, Stitching, Dry packing, Autogenous healing, Repair to active cracks, Repair to dormant cracks. Repair of various corrosion damaged of structural elements (slab, beam and columns) Jacketing Techniques, Strengthening Methods for Structural Elements. Engineered Demolition -Case studies.						
Total: 45 Periods						
REFERENCES:						
1.	Dodge Woodson, Concrete Structures, Protection, Repair and Rehabilitation, ButterworthHeinemann,Elsevier,New Delhi 2012.					
2.	DovKominetzky.M.S., - Design and Construction Failures, Galgotia Publications Pvt.Ltd.,2001					
3.	Ravishankar.K.,Krishnamoorthy.T.S, Structural Health Monitoring, Repair and Rehabilitation of Concrete Structures, Allied Publishers, 2004					
4.	Hand book on Seismic Retrofit of Buildings, CPWD and Indian Buildings Congress, Narosa Publishers, 2008.					
5.	Hand Book on “Repair and Rehabilitation of RCC Buildings” – Director General works CPWD ,Govt of India , New Delhi – 2002					


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COURSE OUTCOMES: On completion of this course, the student is expected to be able to												BT Mapped (Highest Level)		
CO1:	Explain the importance of maintenance assessment and repair strategies											Understand		
CO2:	Acquire knowledge of strength and durability properties and their effects due to climate and temperature..											Apply		
CO3:	Gain knowledge of recent developments in repair.											Understand		
CO4:	Explain the techniques for repair and protection methods											Understand		
CO5:	Explain the repair, rehabilitation and retrofitting of structures and demolition methods.											Understand		
Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	-	2	-	-	-	-	-	-	-	-	3	2	2
CO2	3	1	-	-	-	-	-	-	-	-	-	2	2	1
CO3	3	-	2	-	-	-	-	-	-	-	-	3	3	1
CO4	3	1	-	-	-	-	-	-	-	-	-	2	2	2
CO5	3	2	1	-	-	-	-	-	-	-	-	3	2	1
Avg.	3	1.33	1.67	-	-	-	-	-	-	-	-	3	2	1
1 – Slight, 2 – Moderate, 3 – Substantial , BT – Bloom’s Taxonomy														

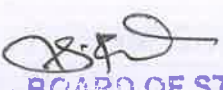

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PCNE2417	QUALITY CONTROL AND ASSURANCE IN CONSTRUCTION				
	Category	L	T	P	Credit
	PEC	3	0	0	3
Course objectives	- To study the concepts of quality management in construction. - To study the concepts of quality systems. - To study the concepts of quality planning. - To study the concepts of quality assurance and control techniques in construction. - To study the concepts of quality improvement techniques.				
UNIT – I	QUALITY MANAGEMENT				9
Introduction – Definitions and objectives – Dimensions of quality - Factors influencing construction quality – Responsibilities and authority – Methods to improve quality – Quality Process - Quality plan – Quality Management Guidelines – Quality circles.					
UNIT – II	QUALITY SYSTEMS				9
Introduction – History of standards - Quality system standard – ISO 9000 family of standards – Requirements – Preparing Quality System Documents – Quality related training – Implementing a Quality system – Third-party Certification – Emission Norms – BS Norms.					
UNIT – III	QUALITY PLANNING				9
Quality Policy, Objectives and methods in the Construction industry - Consumers satisfaction, Ergonomics - Time of Completion - Statistical tolerance – TQM – Traditional approach vs. Modern approach – Principles of TQM - Taguchi's concept of quality – Quality function deployment - Codes and Standards – Documents – Contract and construction programming – Inspection procedures - Processes and products – Total QA / QC programme and cost implication.					
UNIT – IV	QUALITY ASSURANCE AND CONTROL				9
Objectives – Regularity agent, owner, design, contract, and construction-oriented objectives, methods – Techniques and needs of QA/QC – Different aspects of quality – Appraisals – Sampling techniques – Sampling plan – Sampling Terms – AQL, LTPD, AOL - Factors influencing construction quality – Critical, major failure aspects and failure mode analysis, – Stability methods and tools, optimum design – Reliability testing, reliability coefficient and reliability prediction – Failure rate – Mean time to failure – Mean time to repair – Mean time between failures.					
UNIT – V	QUALITY IMPROVEMENT TECHNIQUES				9
Selection of new materials – Influence of drawings, detailing, specification, standardization – Bid preparation – Construction activity, environmental safety, social and environmental factors – Natural causes and speed of construction – Life cycle costing – Value engineering and value analysis.					
Total: 45 Periods					
REFERENCES:					
1.	Hutchins. G, ISO 9000: A Comprehensive Guide to Registration, Audit Guidelines and Successful Certification, Viva Books Pvt. Ltd., 1994.				
2.	James, J.O' Brian, Construction Inspection Handbook – Total Quality Management, Van Nostrand, 1997.				
3.	KB Rajoria, Deepak Naryan, Deepak Gupta, ISO 9000 Practices in construction, CBS Publishers & Distributors Pvt. Ltd.,ISBN:978-93-90709-33-5, 2021.				


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4.	Juran Frank, J.M. and Gryna, F.M. Quality Planning and Analysis, McGraw Hill, 2001
5.	Steven McCabe, Quality Improvement Techniques in Construction, Addison Wesley Longman Ltd, 1998.

COURSE OUTCOMES: On completion of this course, the student is expected to be able to											BT Mapped (Highest Level)			
CO1:	Achieve the knowledge of quality management guidelines, and quality circles.										Understand			
CO2:	Apply the quality standards for preparing Quality system documents.										Apply			
CO3:	Explain the skill of preparing inspection procedures for quality planning.										Understand			
CO4:	Select the techniques and tools for Quality Assurance and Control in Construction Industry.										Understand			
CO5:	Achieve the knowledge of quality improvement techniques										Understand			
Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	1	-	-	-	-	-	-	-	-	3	2	2
CO2	2	2	1	-	-	-	-	-	-	-	-	2	1	1
CO3	1	2	1	-	-	-	-	-	-	-	-	1	3	2
CO4	2	2	3	-	-	-	-	-	-	-	-	3	2	2
CO5	1	2	1	-	-	-	-	-	-	-	-	1	2	2
Avg.	2	2	1	-	-	-	-	-	-	-	-	2	2	2
1 – Slight, 2 – Moderate, 3 – Substantial , BT – Bloom’s Taxonomy														


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PCNE2418	DIGITAL DESIGN AND CONSTRUCTION														
					<table><tr><td>Category</td><td>L</td><td>T</td><td>P</td><td>Credit</td></tr><tr><td>PEC</td><td>3</td><td>0</td><td>0</td><td>3</td></tr></table>	Category	L	T	P	Credit	PEC	3	0	0	3
Category	L	T	P	Credit											
PEC	3	0	0	3											
Course objectives															
	• To learn basic concepts of BIM for construction. • To learn and acquire knowledge in the BIM-based construction design process. • To understand the challenges in BIM implementation • To learn and acquire knowledge in BIM-based construction automation technologies														
UNIT – I	INTRODUCTION TO BIM FOR CONSTRUCTION				9										
Fundamentals of BIM – terminology, CAD & BIM. IFCs, schemas, interoperability, parametric modeling.															
UNIT – II	DEVELOPMENT OF DESIGN PROCESS				9										
BIM-based design process and analysis - design coordination. BIM-based construction process – 4D, 5D, nD BIM.															
UNIT – III	CHALLENGES IN BIM IMPLEMENTATION				9										
BIM-based operation issues – facility management. Drivers and barriers in BIM adoption, BIM global practices..															
UNIT – IV	CONSTRUCTION AUTOMATION				9										
Automation in design and construction, virtual experiments – augmented reality, virtual reality, use of sensors in construction.															
UNIT – V	MODERN DIGITAL TECHNOLOGIES IN CONSTRUCTION				9										
Robots in construction, autonomous robots, and 3D printing technology in construction. Drones for Construction monitoring, Internet of Things, Smart Manufacturing, etc.															
Total: 45 Periods															
REFERENCES:															
1.	Daniotti, Bruno, Gianinetto, Marco, Della Torre, Stefano (Eds.), Digital Transformation of the Design, Construction and Management Processes of the Built Environment, Research for Development, Springer Open, 2020.														
2.	Dominik Holzer, The BIM Manager's Handbook: Guidance for Professionals in Architecture, Engineering, and Construction, Wiley, 2016.														
3.	Erica Epstein, Implementing Successful Building Information Modeling, Artech House, 2012.														
4.	Javad Majrouhi Sardroud, Automation in Construction Management, Scholars' Press, 2014.														
5.	Thomas R. Kurfess, Robotics and Automation Handbook, CRC Press, 2018.														


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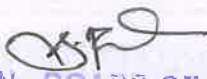
COURSE OUTCOMES: On completion of this course, the student is expected to be able to												BT Mapped (Highest Level)		
CO1:	To create a BIM model											Apply		
CO2:	To develop the construction design process using BIM.											Apply		
CO3:	To identify the challenges in BIM implementation.											Understand		
CO4:	To use automation techniques in construction.											Apply		
CO5:	To implement modern digital technologies in construction											Apply		
Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	3	-	-	-	-	-	-	-	-	3	2	2
CO2	3	3	2	-	-	-	-	-	-	-	-	3	3	2
CO3	1	1	1	-	-	-	-	-	-	-	-	3	2	3
CO4	3	3	3	-	-	-	-	-	-	-	-	3	2	2
CO5	1	1	3	-	-	-	-	-	-	-	-	3	3	3
Avg.	3	2	3	-	-	-	-	-	-	-	-	3	2	2
1 – Slight, 2 – Moderate, 3 – Substantial , BT – Bloom’s Taxonomy														


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PCNE2419	ORGANIZATIONAL BEHAVIOUR				


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COURSE OUTCOMES: On completion of this course, the student is expected to be able to											BT Mapped (Highest Level)			
CO1:	Identify the need and importance of organizational behavior and the framework of organizational models										Understand			
CO2:	Explain the various learning theories and develop alternative organizational behavior approaches in the workplace										Understand			
CO3:	Describe the importance of group dynamics and team building.										Apply			
CO4:	Explore the various leadership styles and politics.										Understand			
CO5:	Explain the dynamics of organizational behaviour with the balance of work life.										Understand			
Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	1	3	-	-	-	-	-	-	-	-	2	1	2
CO2	2	1	1	-	-	-	-	-	-	-	-	2	3	2
CO3	1	2	2	-	-	-	-	-	-	-	-	2	2	3
CO4	1	1	1	-	-	-	-	-	-	-	-	2	3	1
CO5	1	1	1	-	-	-	-	-	-	-	-	3	2	1
Avg.	1	1	1	-	-	-	-	-	-	-	-	2	2	2
1 – Slight, 2 – Moderate, 3 – Substantial , BT – Bloom’s Taxonomy														


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PCNE2420	SUPPLY CHAIN MANAGEMENT AND LOGISTICS IN CONSTRUCTION					
		Category	L	T	P	Credit
		PEC	3	0	0	3
Course objectives						
	• To gain knowledge about construction supply chain management. • To understand the concepts of strategic perspectives. • To understand the concepts of integrated data management. • To understand the concepts of construction logistics and sustainability. • To understand the concepts of logistics operations.					
UNIT – I	INTRODUCTION					9
Definition of Logistics and SCM: Evolution, Scope, Importance - Supply chain stages and decision phases process view of a supply chain - Supply chain flows- Examples of supply chains- Competitive and supply chain strategies- Achieving strategic fit- Expanding strategic scope- Drivers of supply chain performance- Framework for structuring drivers -Obstacles to achieving fit.						
UNIT – II	STRATEGIC PERSPECTIVES					9
Challenge of construction logistics-Aggregating global products for just-in-time delivery to construction sites – Construction Logistics – Supply of bulk materials – Effective management of a construction project supply chain – Construction supply chain management strategy.						
UNIT – III	INTEGRATED DATA MANAGEMENT					9
Impact of BIM and new data management capabilities on supply chain management in construction – Data management for integrated supply chains in construction						
UNIT – IV	CONSTRUCTION LOGISTICS AND SUSTAINABILITY					9
Role of logistics in achieving sustainable construction – Resource efficiency benefits of effective logistics						
UNIT – V	LOGISTICS OPERATIONS					9
Role of the construction logistics manager – Third-party logistics operators in construction – Managing construction logistics for confined sites in urban areas - Consolidation centers in construction logistics – Delivery management systems.						
Total: 45 Periods						
REFERENCES:						
1.	GregerLundesjö, Supply Chain Management and Logistics in Construction: Delivering Tomorrow's Built Environment, Kogan Page Publishers, 2015.					
2.	Supply Chain Management, Strategy, Planning, and Operation – Sunil Chopra, Peter Meindl, and Kalra, Pearson Education, 2011					
3.	A. Ravi Ravindran, Donald P. Warsing, Supply Chain Engineering: Models and Applications, CRC Press, 2012.					
4.	G Srinivasan, Quantitative Models in Operations and Supply Chain Management, PHI Learning (P) Ltd, New Delhi, 2010					
5.	David J.Bloomberg, Stephen Lemay and Joe B.Hanna, Logistics, PHI					


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COURSE OUTCOMES: On completion of this course, the student is expected to be able to											BT Mapped (Highest Level)			
CO1:	Describe the conceptual and theoretical backgrounds of Supply Chain Management and logistics.										Understand			
CO2:	Apply the strategy in logistics functions ranging from planning to execution and control.										Apply			
CO3:	Identify the Impact of BIM and new data management capabilities on supply chain management in construction.										Understand			
CO4:	Analyze the implications of various strategic choices and decide on a better course of action.										Apply			
CO5:	Understand the role of construction logistic Managers and Delivery management systems.										Understand			
Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	1	-	-	-	-	-	-	-	-	3	1	3
CO2	3	3	3	-	-	-	-	-	-	-	-	3	2	1
CO3	1	2	1	-	-	-	-	-	-	-	-	3	3	2
CO4	3	1	3	-	-	-	-	-	-	-	-	3	2	2
CO5	3	3	3	-	-	-	-	-	-	-	-	3	2	3
Avg.	3	1	3	-	-	-	-	-	-	-	-	3	2	2
1 – Slight, 2 – Moderate, 3 – Substantial , BT – Bloom’s Taxonomy														


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PEVO2414	RENEWABLE ENERGY TECHNOLOGY														
					<table><tr><td>Category</td><td>L</td><td>T</td><td>P</td><td>Credit</td></tr><tr><td>OE</td><td>3</td><td>0</td><td>0</td><td>3</td></tr></table>	Category	L	T	P	Credit	OE	3	0	0	3
Category	L	T	P	Credit											
OE	3	0	0	3											
Course objectives															
	To impart knowledge on - Different types of renewable energy technologies - Standalone operation, grid connected operation of renewable energy systems														
UNIT – I	INTRODUCTION				9										
Classification of energy sources – Co2 Emission - Features of Renewable energy - Renewable energy scenario in India -Environmental aspects of electric energy conversion: impacts of renewable energy generation on environment Per Capital Consumption - CO2 Emission - importance of renewable energy sources, Potentials – Achievements– Applications.															
UNIT – II	SOLAR PHOTOVOLTAICS				9										
Solar Energy: Sun and Earth-Basic Characteristics of solar radiation- angle of sunrays on solar collector- Estimating Solar Radiation Empirically - Equivalent circuit of PV Cell- Photovoltaic cell characteristics: P-V and I-V curve of cell-Impact of Temperature and Insolation on I-V characteristics Shading Impacts on I-V characteristics-Bypass diode -Blocking diode.															
UNIT – III	PHOTOVOLTAIC SYSTEM DESIGN				9										
Block diagram of solar photo voltaic system : Line commutated converters (inversion mode) - Boost and buck-boost converters - selection of inverter, battery sizing, array sizing - PV systems classification-standalone PV systems - Grid tied and grid interactive inverters- grid connection issues.															
UNIT – IV	WIND ENERGY CONVERSION SYSTEMS				9										
Origin of Winds: Global and Local Winds- Aerodynamics of Wind turbine-Derivation of Betz’s limit Power available in wind-Classification of wind turbine: Horizontal Axis wind turbine and Vertical axis wind turbine- Aerodynamic Efficiency-Tip Speed-Ratio-Solidity-Blade Count-Power curve of wind turbine - Configurations of wind energy conversion systems: Type A, Type B, Type C and Type D Configurations- Grid connection Issues - Grid integrated SCIG and PMSG based WECS.															
UNIT – V	OTHER RENEWABLE ENERGY SOURCES				9										
Qualitative study of different renewable energy resources: ocean, Biomass, Hydrogen energy systems, Fuel cells, Ocean Thermal Energy Conversion (OTEC), Tidal and wave energy, Geothermal Energy Resources.															
Total: 45 periods															
TEXT BOOK:															
REFERENCES:															
1.	Andrew Hoffman, Competitive Environmental Strategy - A Guide for the Changing Business Landscape, Island Press.														
2.	Stephen Doven, Environment and Sustainability Policy: Creation, Implementation, Evaluation, the Federation Press, 2005														
3.	Robert Brinkmann., Introduction to Sustainability, Wiley-Blackwell., 2016														
4.	Niko Roorda., Fundamentals of Sustainable Development, 3rd Edn, Routledge, 2020														
5.	Bhavik R Bakshi., Sustainable Engineering: Principles and Practice, Cambridge University Press, 2019														

COURSE OUTCOMES: The students completing the course will have												BT Mapped (Highest Level)			
CO1:	Demonstrate the need for renewable energy sources.											Understand			
CO2:	Develop a stand-alone photo voltaic system and implement a maximum power point tracking in the PV system.											Understand			
CO3:	Design a stand-alone and Grid connected PV system.											Understand			
CO4:	Analyze the different configurations of the wind energy conversion systems.											Understand			
CO5:	Realize the basic of various available renewable energy sources.											Understand			
Mapping of COs with POs and PSOs															
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO1 1	PO1 2	PSO1	PSO2	PSO3
CO1	3	1	1	-	-	-	-	-	-	-	-	3	1	3	3
CO2	3	3	3	-	-	-	-	-	-	-	-	3	2	1	3
CO3	2	2	1	-	-	-	-	-	-	-	-	3	3	2	1
CO4	3	2	3	-	-	-	-	-	-	-	-	3	2	2	3
CO5	3	3	3	-	-	-	-	-	-	-	-	3	2	3	3
Avg.	3	2	3	-	-	-	-	-	-	-	-	3	2	2	3
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom’s Taxonomy															


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POE2401	IPR, BIOSAFETY AND ENTREPRENEURSHIP					
		Category	L	T	P	Credit
		OEC	3	0	0	3
UNIT – I	IPR					9
Intellectual property rights – Origin of the patent regime – Early patents act & Indian pharmaceutical industry – Types of patents – Patent Requirements – Application preparation filing and prosecution – Patentable subject matter – Industrial design, Protection of GMO's IP as a factor in R&D,IP's of relevance to biotechnology and few case studies.						
UNIT – II	AGREEMENTS, TREATIES AND PATENT FILING PROCEDURES					9
History of GATT Agreement – Madrid Agreement – Hague Agreement – WIPO Treaties –Budapest Treaty – PCT – Ordinary – PCT – Conventional – Divisional and Patent of Addition – Specifications – Provisional and complete – Forms and fees Invention in context of "prior art" –Patent databases – Searching International Databases – Country-wise patent searches (USPTO,espacenet(EPO) – PATENT Scope (WIPO) – IPO, etc National & PCT filing procedure – Time frame and cost – Status of the patent applications filed – Precautions while patenting – disclosure/non-disclosure – Financial assistance for patenting – Introduction to existing schemes Patent licensing and agreement Patent infringement – Meaning, scope, litigation, case studies						
UNIT – III	BIOSAFETY					9
Introduction – Historical Background – Introduction to Biological Safety Cabinets – Primary Containment for Biohazards – Biosafety Levels – Biosafety Levels of Specific Microorganisms – Recommended Biosafety Levels for Infectious Agents and Infected Animals – Biosafety guidelines – Government of India.						
UNIT – IV	GENETICALLY MODIFIED ORGANISMS					9
Definition of GMOs & LMOs – Roles of Institutional Biosafety Committee – RCGM – GEAC etc. for GMO applications in food and agriculture – Environmental release of GMOs – Risk Analysis – Risk Assessment – Risk management and communication – Overview of National Regulations and relevant International Agreements including Cartegana Protocol.						
UNIT – V	ENTREPRENEURSHIP DEVELOPMENT					9
Introduction – Entrepreneurship Concept – Entrepreneurship as a career – Entrepreneurial personality – Characteristics of successful Entrepreneur – Factors affecting entrepreneurial growth –						

Entrepreneurial Motivation – Competencies – Mobility – Entrepreneurship Development Programmes (EDP) - Launching Of Small Enterprise - Definition, Characteristics – Relationship between small and large units – Opportunities for an Entrepreneurial career – Role of small enterprise in economic development – Problems of small scale industries – Institutional finance to entrepreneurs - Institutional support to entrepreneurs.

Total: 45 periods

REFERENCES:

1. Bouchoux, D.E., “Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets for the Paralegal”, 3rd Edition, Delmar Cengage Learning, 2008.
2. Fleming, D.O. and Hunt, D.L., “Biological Safety: Principles and Practices”, 4th Edition, American Society for Microbiology, 2006.
3. Irish, V., “Intellectual Property Rights for Engineers”, 2nd Edition, The Institution of Engineering and Technology, 2005.
4. Mueller, M.J., “Patent Law”, 3rd Edition, Wolters Kluwer Law & Business, 2009.
5. Young, T., “Genetically Modified Organisms and Biosafety: A Background Paper for Decision-Makers and Others to Assist in Consideration of GMO Issues” 1st Edition, World Conservation Union, 2004.

T. Selvarani

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POE2403		ENVIRONMENTAL SUSTAINABILITY				
		Category	L	T	P	Credit
		OE	3	0	0	3
Course objectives						
		• To gain knowledge about Valuing the Environment. • To understand the Sustainable Development. • To understand the concepts of significance of biodiversity • To understand the concepts of pollution impacts • To understand the concepts of environmental economics				
UNIT – I		INTRODUCTION				9
Valuing the Environment: Concepts, Valuing the Environment: Methods, Property Rights, Externalities, and Environmental Problems						
UNIT – II		CONCEPT OF SUSTAINABILITY				9
Sustainable Development: Defining the Concept, the Population Problem, Natural Resource Economics: An Overview, Energy, Water, Agriculture						
UNIT – III		SIGNIFICANCE OF BIODIVERSITY				9
Biodiversity, Forest Habitat, Commercially Valuable Species, Stationary - Source Local Air Pollution, Acid Rain and Atmospheric Modification, Transportation						
UNIT – IV		POLLUTION IMPACTS				9
Water Pollution, Solid Waste and Recycling, Toxic Substances and Hazardous Wastes, Global Warming.						
UNIT – V		ENVIRONMENTAL ECONOMICS				9
Development, Poverty, and the Environment, Visions of the Future, Environmental economics and policy by Tom Tietenberg, Environmental Economics						
		Total: 45 periods				
TEXT BOOK:						
REFERENCES:						
1.	Andrew Hoffman, Competitive Environmental Strategy - A Guide for the Changing Business Landscape, Island Press.					
2.	Stephen Doven, Environment and Sustainability Policy: Creation, Implementation, Evaluation, the Federation Press, 2005					
3.	Robert Brinkmann., Introduction to Sustainability, Wiley-Blackwell., 2016					
4.	Niko Roorda., Fundamentals of Sustainable Development, 3rd Edn, Routledge, 2020					
5.	Bhavik R Bakshi., Sustainable Engineering: Principles and Practice, Cambridge University Press, 2019					

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COURSE OUTCOMES: The students completing the course will have											BT Mapped (Highest Level)				
CO1:	Identify the need and importance of Environmental Sustainability										Understand				
CO2:	Explain the various concept of sustainability										Understand				
CO3:	Describe the importance of Biodiversity										Understand				
CO4:	Describe the importance of pollution impacts										Understand				
CO5:	Explain the dynamics of environmental economics.										Understand				
Mapping of COs with POs and PSOs															
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO1 1	PO1 2	PSO1	PSO2	PSO3
CO1	3	1	1	-	-	-	-	-	-	-	-	3	1	3	3
CO2	3	3	3	-	-	-	-	-	-	-	-	3	2	1	3
CO3	2	2	1	-	-	-	-	-	-	-	-	3	3	2	1
CO4	3	2	3	-	-	-	-	-	-	-	-	3	2	2	3
CO5	3	3	3	-	-	-	-	-	-	-	-	3	2	3	3
Avg.	3	2	3	-	-	-	-	-	-	-	-	3	2	2	3
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom’s Taxonomy															

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POE2405	MACHINE LEARNING AND DEEP LEARNING				
	Category	L	T	P	Credit
	OE	3	0	0	3
Course objectives					
	The course is aimed at • Understanding about the learning problem and algorithms • Providing insight about neural networks • Introducing the machine learning fundamentals and significance • Enabling the students to acquire knowledge about pattern recognition. • Motivating the students to apply deep learning algorithms for solving real life problems.				
UNIT – I	LEARNING PROBLEMS AND ALGORITHMS				9
Various paradigms of learning problems, Supervised, Semi-supervised and Unsupervised algorithms					
UNIT – II	NEURAL NETWORKS				9
Differences between Biological and Artificial Neural Networks - Typical Architecture, Common Activation Functions, Multi-layer neural network, Linear Separability, Hebb Net, Perceptron, Adaline, Standard Back propagation Training Algorithms for Pattern Association - Hebb rule and Delta rule, Hetero associative, Auto associative, Kohonen Self Organising Maps, Examples of Feature Maps, Learning Vector Quantization, Gradient descent, Boltzmann Machine Learning.					
UNIT – III	MACHINE LEARNING – FUNDAMENTALS & FEATURE SELECTIONS & CLASSIFICATIONS				9
Classifying Samples: The confusion matrix, Accuracy, Precision, Recall, F1- Score, the curse of dimensionality, training, testing, validation, cross validation, overfitting, under-fitting the data, early stopping, regularization, bias and variance. Feature Selection, normalization, dimensionality reduction, Classifiers: KNN, SVM, Decision trees, Naïve Bayes, Binary classification, multi class classification, clustering.					
UNIT – IV	DEEP LEARNING: CONVOLUTIONAL NEURAL NETWORKS				9
Feed forward networks, Activation functions, back propagation in CNN, optimizers, batch normalization, convolution layers, pooling layers, fully connected layers, dropout, Examples of CNNs.					
UNIT – V	DEEP LEARNING: RNNs, AUTOENCODERS AND GANS				9
State, Structure of RNN Cell, LSTM and GRU, Time distributed layers, Generating Text, Autoencoders: Convolutional Autoencoders, Denoising autoencoders, Variational autoencoders, GANs: The discriminator, generator, DCGANs					
Total: 45 periods					
REFERENCES:					
1.	J. S. R. Jang, C. T. Sun, E. Mizutani, Neuro Fuzzy and Soft Computing - A Computational Approach to Learning and Machine Intelligence, 2012. PHI learning				

2.	Deep Learning, Ian Good fellow, YoshuaBengio and Aaron Courville, MIT Press, ISBN:9780262035613, 2016.
3.	The Elements of Statistical Learning. Trevor Hastie, Robert Tibshirani and Jerome Friedman. Second Edition. 2009.
4.	Pattern Recognition and Machine Learning. Christopher Bishop. Springer. 2006.
5.	Understanding Machine Learning. Shai Shalev-Shwartz and Shai Ben-David. Cambridge University Press. 2017.

COURSE OUTCOMES: At the end of the course the student will be able to		BT Mapped (Highest Level)
CO1:	Illustrate the categorization of machine learning algorithms.	K2
CO2:	Compare and contrast the types of neural network architectures, activation functions	K2
CO3:	Acquaint with the pattern association using neural networks	K2
CO4:	Elaborate various terminologies related with pattern recognition and architectures of convolutional neural networks	K4
CO5:	Construct different feature selection and classification techniques and advanced neural network architectures such as RNN, Autoencoders, and GANs.	K2



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POE2406	IoT FOR SMART SYSTEMS				
	Category	L	T	P	Credit
	OEC	3	0	0	3
Course objectives					
	- To study about Internet of Things technologies and its role in real time applications. - To introduce the infrastructure required for IoT - To familiarize the accessories and communication techniques for IoT. - To provide insight about the embedded processor and sensors required for IoT - To familiarize the different platforms and Attributes for IoT				
UNIT – I	INTRODUCTION TO INTERNET OF THINGS				
Overview, Hardware and software requirements for IOT, Sensor and actuators, Technology drivers, Business drivers, Typical IoT applications, Trends and implications.					
UNIT – II	IOT ARCHITECTURE				
IoT reference model and architecture -Node Structure - Sensing, Processing, Communication, Powering, Networking - Topologies, Layer/Stack architecture, IoT standards, Cloud computing for IoT, Bluetooth, Bluetooth Low Energy beacons.					
UNIT – III	PROTOCOLS AND WIRELESS TECHNOLOGIES FOR IOT				
PROTOCOLS: NFC, SCADA and RFID, Zigbee MIPI, M-PHY, UniPro, SPMI, SPI, M-PCIe GSM, CDMA, LTE, GPRS, small cell. Wireless technologies for IoT: WiFi (IEEE 802.11), Bluetooth/Bluetooth Smart, ZigBee/ZigBee Smart, UWB (IEEE 802.15.4), 6LoWPAN, Proprietary systems-Recent trends.					
UNIT – IV	IOT PROCESSORS				
Services/Attributes: Big-Data Analytics for IOT, Dependability,Interoperability, Security, Maintainability. Embedded processors for IOT : Introduction to Python programming -Building IOT with RASPERRY PI and Arduino.					
UNIT – V	CASE STUDIES				
Industrial IoT, Home Automation, smart cities, Smart Grid, connected vehicles, electric vehicle charging, Environment, Agriculture, Productivity Applications, IOT Defense					
Total: 45 periods					
REFERENCES:					

1.	ArshdeepBahga and VijaiMadiseti : A Hands-on Approach “Internet of Things”,Universities Press 2015.
2.	Oliver Hersent , David Boswarthick and Omar Elloumi “ The Internet of Things”, Wiley,2016.
3.	Samuel Greengard, “ The Internet of Things”, The MIT press, 2015.
4.	Adrian McEwen and Hakim Cassimally“Designing the Internet of Things “Wiley,2014.
5.	Jean- Philippe Vasseur, Adam Dunkels, “Interconnecting Smart Objects with IP: The Next Internet” Morgan Kuffmann Publishers, 2010.
6.	Adrian McEwen and Hakim Cassimally, “Designing the Internet of Things”, John Wiley and sons, 2014.
7.	Lingyang Song/DusitNiyato/ Zhu Han/ Ekram Hossain,” Wireless Device-to-Device Communications and Networks, CAMBRIDGE UNIVERSITY PRESS,2015.
8.	OvidiuVermesan and Peter Friess (Editors), “Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems”, River Publishers Series in Communication, 2013.
9.	Vijay Madiseti , ArshdeepBahga, “Internet of Things (A Hands on-Approach)”, 2014.
10	Zach Shelby, Carsten Bormann, “6LoWPAN: The Wireless Embedded Internet”, John Wileyand sons, 2009.

COURSE OUTCOMES:

At the end of the course the student will be able to

**BT Mapped
(Highest Level)**

CO1:	Analyze the concepts of IoT and its present developments.	K4
CO2:	Compare and contrast different platforms and infrastructures available for IoT	K4
CO3:	Explain different protocols and communication technologies used in IoT	K2
CO4:	Analyze the big data analytic and programming of IoT	K4
CO5:	Implement IoT solutions for smart applications	K6

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	-	1	3	-	-	-
CO2	-	-	2	-	-	-
CO3	-	-	2	1	-	-
CO4	-	-	3	-	-	-
CO5	-	-	2	1	-	-
Avg.	-	1	2	1	-	-

1 – Slight, 2 – Moderate, 3 – Substantial , BT – Bloom’s Taxonomy

POE2408	CLOUD COMPUTING TECHNOLOGIES					
		Category	L	T	P	Credit
		OEC	3	0	0	3
Course objectives						
	· To gain expertise in Virtualization, Virtual Machines and deploy practical virtualization solution · To understand the architecture, infrastructure and delivery models of cloud computing. · To explore the roster of AWS services and illustrate the way to make applications in AWS · To gain knowledge in the working of Windows Azure and Storage services offered by Windows Azure · To develop the cloud application using various programming model of Hadoop and Aneka					
UNIT – I	VIRTUALIZATION AND VIRTUALIZATION INFRASTRUCTURE					6
Basics of Virtual Machines - Process Virtual Machines – System Virtual Machines –Emulation – Interpretation – Binary Translation - Taxonomy of Virtual Machines. Virtualization –Management Virtualization — Hardware Maximization – Architectures – Virtualization Management – Storage Virtualization – Network Virtualization- Implementation levels of virtualization – virtualization structure – virtualization of CPU, Memory and I/O devices – virtual clusters and Resource Management – Virtualization for data center automation (WASH) and Integrated Water Resources Management (IWRM) - Need and Importance of WASH						
UNIT – II	CLOUD PLATFORM ARCHITECTURE					12
Cloud Computing: Definition, Characteristics - Cloud deployment models: public, private, hybrid, community – Categories of cloud computing: Everything as a service: Infrastructure, platform, software- A Generic Cloud Architecture Design – Layered cloud Architectural Development Architectural Design Challenges						
UNIT – III	AWS CLOUD PLATFORM - IAAS					9
Amazon Web Services: AWS Infrastructure- AWS API- AWS Management Console - Setting up AWS Storage - Stretching out with Elastic Compute Cloud - Elastic Container Service for Kubernetes- AWS Developer Tools: AWS Code Commit, AWS Code Build, AWS Code Deploy, AWS Code Pipeline, AWS code Star - AWS Management Tools: Cloud Watch, AWS Auto Scaling, AWS control Tower, Cloud Formation, Cloud Trail, AWS License Manager						
UNIT – IV	PAAS CLOUD PLATFORM					9
Windows Azure: Origin of Windows Azure, Features, The Fabric Controller – First Cloud APP in Windows Azure- Service Model and Managing Services: Definition and Configuration, Service						

runtime API- Windows Azure Developer Portal- Service Management API- Windows Azure Storage Characteristics-Storage Services- REST API- Blobs		
UNIT – V	PROGRAMMING MODEL	9
Introduction to Hadoop Framework - Mapreduce, Input splitting, map and reduce functions, specifying input and output parameters, configuring and running a job –Developing Map Reduce Applications - Design of Hadoop file system –Setting up Hadoop Cluster- Aneka: Cloud Application Platform, Thread Programming, Task Programming and Map-Reduce Programming in Aneka		
		Total: 45 periods
REFERENCES:		
1.	Bernard Golden, Amazon Web Service for Dummies, John Wiley & Sons, 2013.	
2.	Raoul Alongi, AWS: The Most Complete Guide to Amazon Web Service from Beginner to Advanced Level, Amazon Asia- Pacific Holdings Private Limited, 2019.	
3.	Sriram Krishnan, Programming: Windows Azure, O'Reilly, 2010.	
4.	Rajkumar Buyya, Christian Vacchiola, S.Thamarai Selvi, Mastering Cloud Computing , McGraw Hill Education (India) Pvt. Ltd., 2013.	
5.	Danielle Ruest, Nelson Ruest, —Virtualization: A Beginner"s Guide II , McGraw-Hill Osborne Media, 2009.	

COURSE OUTCOMES:		BT Mapped (Highest Level)
On completion of the course, the students will be able to		
CO1:	Employ the concepts of virtualization in the cloud computing	K3
CO2:	Identify the architecture, infrastructure and delivery models of cloud computing	K2
CO3:	Develop the Cloud Application in AWS platform	K6
CO4:	Apply the concepts of Windows Azure to design Cloud Application	K3
CO5:	Develop services using various Cloud computing programming models.	K6


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POE2409	PRINCIPLES OF MULTIMEDIA					
		Category	L	T	P	Credit
		OEC	3	0	0	3
Course objectives						
	• To get familiarity with gamut of multimedia and its significance • To acquire knowledge in multimedia components. • To acquire knowledge about multimedia tools and authoring. • To acquire knowledge in the development of multimedia applications • To explore the latest trends and technologies in multimedia					
UNIT – I	INTRODUCTION					6
Introduction to Multimedia – Characteristics of Multimedia Presentation – Multimedia Components– Promotion of Multimedia Based Components – Digital Representation – Media and Data Streams – Multimedia Architecture – Multimedia Documents, Multimedia Tasks and Concerns, Production, sharing and distribution, Hypermedia, WWW and Internet, Authoring, Multimedia over wireless and mobile networks.						
Suggested Activities:						
1. Flipped classroom on media Components.						
2. External learning – Interactive presentation.						
Suggested Evaluation Methods:						
1. Tutorial – Handling media components						
2. Quizzes on different types of data presentation.						
UNIT – II	ELEMENTS OF MULTIMEDIA					12
Text-Types, Font, Unicode Standard, File Formats, Graphics and Image data representations –data types, file formats, color models; video – color models in video, analog video, digital video, file formats, video display interfaces, 3D video and TV: Audio – Digitization, SNR, SQNR, quantization, audio quality, file formats, MIDI; Animation- Key Frames and Tweening, other Techniques, 2D and 3D Animation.						
Suggested Activities:						
1. Flipped classroom on different file formats of various media elements.						
2. External learning – Adobe after effects, Adobe Media Encoder, Adobe Audition.						
Suggested Evaluation Methods:						
1. Demonstration on after effects animations.						
2. Quizzes on file formats and color models.						
UNIT – III	MULTIMEDIA TOOLS					9
Authoring Tools – Features and Types – Card and Page Based Tools – Icon and Object Based Tools –						

Time Based Tools – Cross Platform Authoring Tools – Editing Tools – Painting and Drawing Tools – 3D Modeling and Animation Tools – Image Editing Tools – Sound Editing Tools – Digital Movie Tools.

Suggested Activities:

1. Flipped classroom on multimedia tools.
2. External learning – Comparison of various authoring tools.

Suggested Evaluation Methods:

1. Tutorial – Audio editing tool.
2. Quizzes on animation tools.

UNIT – IV

MULTIMEDIA SYSTEMS

9

Compression Types and Techniques: CODEC, Text Compression: GIF Coding Standards, JPEG standard – JPEG 2000, basic audio compression – ADPCM, MPEG Psychoacoustics, basic Video compression techniques – MPEG, H.26X – Multimedia Database System – User Interfaces – OS Multimedia Support – Hardware Support – Real Time Protocols – Play Back Architectures – Synchronization – Document Architecture – Hypermedia Concepts: Hypermedia Design – Digital Copyrights, Content analysis.

Suggested Activities:

1. Flipped classroom on concepts of multimedia hardware architectures.
2. External learning – Digital repositories and hypermedia design.

Suggested Evaluation Methods:

1. Quizzes on multimedia hardware and compression techniques.
2. Tutorial – Hypermedia design.

UNIT – V

MULTIMEDIA APPLICATIONS FOR THE WEB AND MOBILE PLATFORMS

9

ADDIE Model – Conceptualization – Content Collection – Storyboard–Script Authoring Metaphors – Testing – Report Writing – Documentation. Multimedia for the web and mobile platforms. Virtual Reality, Internet multimedia content distribution, Multimedia Information sharing – social media sharing, cloud computing for multimedia services, interactive cloud gaming. Multimedia information retrieval.

Suggested Activities:

1. External learning – Game consoles.
2. External learning – VRML scripting languages.

Suggested Evaluation Methods:

1. Demonstration of simple interactive games.
2. Tutorial – Simple VRML program.

Total: 45 periods

REFERENCES:

1. Li, Ze-Nian, Drew, Mark, Liu, Jiangchuan, "Fundamentals of Multimedia", Springer, Third Edition, 2021.
2. Prabhat K. Andleigh, Kiran Thakrar, "MULTIMEDIA SYSTEMS DESIGN", Pearson Education, 2015.

3.	Gerald Friedland, Ramesh Jain, "Multimedia Computing", Cambridge University Press, 2018. (digital book)
4.	Ranjan Parekh, "Principles of Multimedia", Second Edition, McGraw-Hill Education, 2017

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1:	Handle the multimedia elements effectively.	K3
CO2:	Articulate the concepts and techniques used in multimedia applications.	K3
CO3:	Develop effective strategies to deliver Quality of Experience in multimedia applications.	K6
CO4:	Design and implement algorithms and techniques applied to multimedia objects.	K5
CO5:	Design and develop multimedia applications following software engineering models.	K6

POE2413	SUSTAINABLE MANAGEMENT					
		Category	L	T	P	Credit
		OEC	3	0	0	3
Course objectives						
	· To provide students with fundamental knowledge of the notion of corporate sustainability. · To determine how organizations impacts on the environment and socio-technical systems, the relationship between social and environmental performance and competitiveness, the approaches and methods.					
UNIT – I	MANAGEMENT OF SUSTAINABILITY					9
Management of sustainability -rationale and political trends: An introduction to sustainability management, International and European policies on sustainable development, theoretical pillars in sustainability management studies.						
UNIT – II	CORPORATE SUSTAINABILITY AND RESPONSIBILITY					9
Corporate sustainability parameter, corporate sustainability institutional framework, integration of sustainability into strategic planning and regular business practices, fundamentals of stakeholder engagement.						
UNIT – III	SUSTAINABILITY MANAGEMENT: STRATEGIES AND APPROACHES					9
Corporate sustainability management and competitiveness: Sustainability-oriented corporate strategies, markets and competitiveness, Green Management between theory and practice, Sustainable Consumption and Green Marketing strategies, Environmental regulation and strategic postures; Green Management approaches and tools; Green engineering: clean technologies and innovation processes; Sustainable Supply Chain Management and Procurement.						
UNIT – IV	SUSTAINABILITY AND INNOVATION					9
Socio-technical transitions and sustainability, Sustainable entrepreneurship, Sustainable pioneers in green market niches, Smart communities and smart specializations.						
UNIT – V	SUSTAINABLE MANAGEMENT OF RESOURCES, COMMODITIES AND COMMONS					9
Energy management, Water management, Waste management, Wild Life Conservation, Emerging trends in sustainable management, Case Studies.						
						Total: 45 periods
REFERENCES:						
1.	Daddi, T., Iraldo, F., Testa, Environmental Certification for Organizations and Products: Management. 2015					

2.	Christian N. Madu, Handbook of Sustainability Management 2012
3.	Petra Molthan-Hill, The Business Student's Guide to Sustainable Management: Principles and Practice, 2014
4.	Margaret Robertson, Sustainability Principles and Practice, 2014
5.	Peter Rogers, An Introduction to Sustainable Development, 2006

COURSE OUTCOMES: Upon completion of this course, the students will be able to:		BT Mapped (Highest Level)
CO1:	An understanding of sustainability management as an approach to aid in evaluating and minimizing environmental impacts while achieving the expected social impact.	K2
CO2:	An understanding of corporate sustainability and responsible Business Practices	K2
CO3:	Knowledge and skills to understand, to measure and interpret sustainability performances. landscape system.	K2
CO4:	Knowledge of innovative practices in sustainable business and community management	K2
CO5:	Deep understanding of sustainable management of resources and commodities	K2

POE2414	MICRO AND SMALL BUSINESS MANAGEMENT					
		Category	L	T	P	Credit
		OEC	3	0	0	3
Course objectives						
	- To familiarize students with the theory and practice of small business management. - To learn the legal issues faced by small business and how they impact operations.					
UNIT – I	INTRODUCTION TO SMALL BUSINESS					9
Creation, Innovation, entrepreneurship and small business - Defining Small Business –Role of Owner – Manager – government policy towards small business sector –elements of entrepreneurship –evolution of entrepreneurship –Types of Entrepreneurship – social, civic, corporate - Business life cycle - barriers and triggers to new venture creation – process to assist start ups – small business and family business.						
UNIT – II	SCREENING THE BUSINESS OPPORTUNITY AND FORMULATING THE BUSINESS PLAN					9
Concepts of opportunity recognition; Key factors leading to new venture failure; New venture screening process; Applying new venture screening process to the early stage small firm Role planning in small business – importance of strategy formulation – management skills for small business creation and development.						
UNIT – III	BUILDING THE RIGHT TEAM AND MARKETING STRATEGY					9
Management and Leadership – employee assessments – Tuckman’s stages of group development The entrepreneurial process model - Delegation and team building - Comparison of HR management in small and large firms - Importance of coaching and how to apply a coaching model.Marketing within the small business - success strategies for small business marketing - customer delight and business generating systems, - market research, - assessing market performance- sales management and strategy - the marketing mix and marketing strategy.						
UNIT – IV	FINANCING SMALL BUSINESS					9
Main sources of entrepreneurial capital; Nature of ‘bootstrap’ financing - Difference between cash and profit - Nature of bank financing and equity financing - Funding-equity gap for small firms. Importance of working capital cycle - Calculation of break-even point - Power of gross profit margin- Pricing for profit - Credit policy issues and relating these to cash flow management and profitability.						
UNIT – V	VALUING SMALL BUSINESS AND CRISIS MANAGEMENT					9
Causes of small business failure - Danger signals of impending trouble - Characteristics of poorly performing firms - Turnaround strategies - Concept of business valuation - Different valuation measurements - Nature of goodwill and how to measure it - Advantages and disadvantages of buying an established small firm - Process of preparing a business for sale.						
Total: 45 periods						

REFERENCES:

1.	Hankinson,A.(2000). "The key factors in the profile of small firm owner-managers that influence business performance. The South Coast Small Firms Survey, 1997-2000." Industrial and Commercial Training 32(3):94-98.
2.	Parker,R.(2000). "Small is not necessarily beautiful: An evaluation of policy support for small and medium-sized enterprise in Australia." Australian Journal of Political Science 35(2):239-253.
3.	Journal articles on SME's.

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

**BT Mapped
(Highest Level)**

CO1:	Familiarise the students with the concept of small business	K2
CO2:	In depth knowledge on small business opportunities and challenges	K2
CO3:	Ability to devise plans for small business by building the right skills and marketing strategies	K2
CO4:	Identify the funding source for small start ups	K4
CO5:	Business evaluation for buying and selling of small firms	K2

POE2415	INTELLECTUAL PROPERTY RIGHTS				
	Category	L	T	P	Credit
	OEC	3	0	0	3
Course objectives					
	To understand intellectual property rights and its valuation.				
UNIT – I	INTRODUCTION				9
Intellectual property rights - Introduction, Basic concepts, Patents, Copyrights, Trademarks, Trade Secrets, Geographic Indicators; Nature of Intellectual Property, Technological Research, Inventions and Innovations, History - the way from WTO to WIPO, TRIPS.					
UNIT – II	PROCESS				9
New Developments in IPR, Procedure for grant of Patents, TM, GIs, Patenting under Patent Cooperation Treaty, Administration of Patent system in India, Patenting in foreign countries.					
UNIT – III	STATUTES				9
International Treaties and conventions on IPRs, The TRIPs Agreement, PCT Agreement, The Patent Act of India, Patent Amendment Act (2005), Design Act, Trademark Act, Geographical Indication Act, Bayh- Dole Act and Issues of Academic Entrepreneurship.					
UNIT – IV	STRATEGIES IN INTELLECTUAL PROPERTY				9
Strategies for investing in R&D, Patent Information and databases, IPR strength in India, Traditional Knowledge, Case studies.					
UNIT – V	MODELS				9
The technologies Know-how, concept of ownership, Significance of IP in Value Creation, IPValuation and IP Valuation Models, Application of Real Option Model in Strategic Decision Making, Transfer and Licensing.					
Total: 45 periods					
REFERENCES:					
1.	V. Sople Vinod, Managing Intellectual Property by (Prentice hall of India Pvt.Ltd), 2006.				
2.	Primer, R. Anita Rao and Bhanoji Rao, Intellectual Property Rights, Lastain Book company.				
3.	Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2006.				

COURSE OUTCOMES:		BT Mapped (Highest Level)
CO1:	Understanding of intellectual property and appreciation of the need to protect it	K2
CO2:	Awareness about the process of patenting	K2
CO3:	Understanding of the statutes related to IPR	K2
CO4:	Ability to apply strategies to protect intellectual property	K4
CO5:	Ability to apply models for making strategic decisions related to IPR	K2

POE2416	ETHICAL MANAGEMENT					
		Category	L	T	P	Credit
		OEC	3	0	0	3
Course objectives						
	To help students develop knowledge and competence in ethical management and decisionmaking in organizational contexts.					
UNIT – I	ETHICS AND SOCIETY					9
Ethical Management- Definition, Motivation, Advantages-Practical implications of ethical management. Managerial ethics, professional ethics, and social Responsibility-Role of culture and society's expectations- Individual and organizational responsibility to society and the community						
UNIT – II	ETHICAL DECISION MAKING AND MANAGEMENT IN A CRISIS					9
Managing in an ethical crisis, the nature of a crisis, ethics in crisis management, discuss case studies, analyze real-world scenarios, develop ethical management skills, knowledge, and competencies. Proactive crisis management.						
UNIT – III	STAKEHOLDERS IN ETHICAL MANAGEMENT					9
Stakeholders in ethical management, identifying internal and external stakeholders, nature of stakeholders, ethical management of various kinds of stakeholders: customers (product and service issues), employees (leadership, fairness, justice, diversity) suppliers, collaborators, business, community, the natural environment (the sustainability imperative, green management, Contemporary issues).						
UNIT – IV	INDIVIDUAL VARIABLES IN ETHICAL MANJAGEMENT					9
Understanding individual variables in ethics, managerial ethics, concepts in ethical psychology- ethical awareness, ethical courage, ethical judgment, ethical foundations, ethical emotions/intuitions/intensity. Utilization of these concepts and competencies for ethical decision- making and management.						
UNIT – V	PRACTICAL FIELD-GUIDE, TECHNIQUES AND SKILLS					9
Ethical management in practice, development of techniques and skills, navigating challenges and dilemmas, resolving issues and preventing unethical management proactively. Role modelling and creating a culture of ethical management and human flourishing.						
Total: 45 periods						
REFERENCES:						
1.	Brad Agle, Aaron Miller, Bill O` Rourke, The Business Ethics Field Guide: the essential companion to leading your career and your company, 2016.					
2.	Steiner & Steiner, Business, Government & Society: A managerial Perspective, 2011.					
3.	Lawrence & Weber, Business and Society: Stakeholders, Ethics, Public Policy, 2020.					
COURSE OUTCOMES:						BT Mapped (Highest Level)

CO1:	Role modelling and influencing the ethical and cultural context.	K2
CO2:	Respond to ethical crises and proactively address potential crises situations.	K2
CO3:	Understand and implement stakeholder management decisions.	K2
CO4:	Develop the ability, knowledge, and skills for ethical management.	K4
CO5:	Develop practical skills to navigate, resolve and thrive in management situations	K2

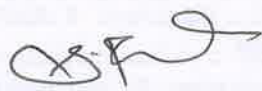
POE2417	INTEGRATED WATER RESOURCES MANAGEMENT				
	Category	L	T	P	Credit
	PCC	3	0	0	3
Course objectives					
	Students will be introduced to the concepts and principles of IWRM, which is inclusive of the economics, public-private partnership, water & health, water & food security and legal & regulatory settings.				
UNIT – I	CONTEXT FOR IWRM				9
Water as a global issue: key challenges – Definition of IWRM within the broader context of development – Key elements of IWRM - Principles – Paradigm shift in water management - Complexity of the IWRM process – UN World Water Assessment - SDGs.					
UNIT – II	WATER ECONOMICS				9
Economic view of water issues: economic characteristics of water good and services – Non-market monetary valuation methods – Water economic instruments – Private sector involvement in water resources management: PPP objectives, PPP models, PPP processes, PPP experiences through case studies.					
UNIT – III	LEGAL AND REGULATORY SETTINGS				9
Basic notion of law and governance: principles of international and national law in the area of water management - Understanding UN law on non-navigable uses of international water courses – International law for groundwater management – World Water Forums – Global Water Partnerships - Development of IWRM in line with legal and regulatory framework.					
UNIT – IV	WATER AND HEALTH WITHIN THE IWRM CONTEXT				9
Links between water and health: options to include water management interventions for health – Health protection and promotion in the context of IWRM – Global burden of Diseases - Health impact assessment of water resources development projects – Case studies.					
UNIT – V	AGRICULTURE IN THE CONCEPT OF IWRM				9
Water for food production: ‘blue’ versus ‘green’ water debate – Water foot print - Virtual water trade for achieving global water and food security — Irrigation efficiencies, irrigation methods - current water pricing policy– scope to relook pricing.					
Total: 45 periods					

REFERENCES:	
1.	Cech Thomas V., Principles of water resources: history, development, management and policy. John Wiley and Sons Inc., New York. 2003.
2.	Mollinga .P. etal “ Integrated Water Resources Management”, Water in South Asia Volume I, Sage Publications, 2006.
3.	Technical Advisory Committee, Integrated Water Resources management, Technical Advisory Committee Background Paper No: 4. Global water partnership, Stockholm, Sweden. 2002.
4.	Technical Advisory Committee, Dublin principles for water as reflected in comparative assessment of institutional and legal arrangements for Integrated Water Resources Management, Technical Advisory Committee Background paper No: 3. Global water partnership, Stockholm,

	Sweden. 1999.
5.	Technical Advisory Committee, Effective Water Governance". Technical Advisory Committee Background paper No: 7. Global water partnership, Stockholm, Sweden, 2003.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1:	Describe the context and principles of IWRM; Compare the conventional and integrated ways of water management.	K2
CO2:	Select the best economic option among the alternatives; illustrate the pros and cons of PPP through case studies.	K4
CO3:	Apply law and governance in the context of IWRM.	K3
CO4:	Discuss the linkages between water-health; develop a HIA framework.	K6
CO5:	Analyse how the virtual water concept pave way to alternate policy options.	K4

Mapping of COs with POs and PSOs						
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	-	-	1	2	-	3
CO2	1	-	2	1	-	2
CO3	2	-	1	2	1	3
CO4	-	-	1	2	1	2
CO5	1	-	1	2	3	3
Avg.	1	-	1	2	1	3
1 – Slight, 2 – Moderate, 3 – Substantial , BT – Bloom's Taxonomy						


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POE2418	WATER, SANITATION AND HEALTH				
	Category	L	T	P	Credit
	OE	3	0	0	3
Course objectives					
	Understand the accelerating health impacts due to the present managerial aspects and initiatives in water and sanitation and health sectors in the developing scenario				
UNIT – I	FUNDAMENTALS WASH				9
Meanings and Definition: Safe Water- Health, Nexus: Water- Sanitation - Health and Hygiene – Equity issues-Water security - Food Security. Sanitation And Hygiene (WASH) and Integrated Water Resources Management (IWRM) - Need and Importance of WASH					
UNIT – II	MANAGERIAL IMPLICATIONS AND IMPACT				9
Third World Scenario – Poor and Multidimensional Deprivation--Health Burden in Developing Scenario -Factors contribute to water, sanitation and hygiene related diseases-Social: Social Stratification and Literacy Demography: Population and Migration- Fertility - Mortality- Environment: Water Borne-Water Washed and Water Based Diseases - Economic: Wage - Water and Health Budgeting -Psychological: Non-compliance - Disease Relapse - Political: Political Will					
UNIT – III	CHALLENGES IN MANAGEMENT AND DEVELOPMENT				9
Common Challenges in WASH - Bureaucracy and Users- Water Utilities -Sectoral Allocation:- Infrastructure- Service Delivery: Health services: Macro and Micro- level: Community and Gender Issues- Equity Issues - Paradigm Shift: Democratization of Reforms and Initiatives.					
UNIT – IV	GOVERNANCE				9
Public health -Community Health Assessment and Improvement Planning (CHA/CHIP)- Infrastructure and Investments on Water, (WASH) - Cost Benefit Analysis – Institutional Intervention-Public Private Partnership - Policy Directives - Social Insurance -Political Will vs Participatory Governance -					
UNIT – V	INITIATIVES				9
Management vs Development -Accelerating Development- Development Indicators -Inclusive Development-Global and Local- Millennium Development Goal (MDG) and Targets - Five Year Plans - Implementation - Capacity Building - Case studies on WASH.					
Total: 45 periods					
REFERENCES:					
1.	Bonitha R., Beaglehole R., Kjellstorm, 2006, “Basic Epidemiology”, 2 nd Edition, World Health Organization				
2.	Van Note Chism, N. and Bickford, D. J. (2002), Improving the environment for learning: An expanded agenda. New Directions for Teaching and Learning, 2002: 91–98. doi: 10.1002/tl.83Improving the Environment for learning: An Expanded Agenda				
3.	National Research Council. <i>Global Issues in Water, Sanitation, and Health: Workshop Summary</i> .				

	Washington, DC: The National Academies Press, 2009.
4.	Sen, Amartya 1997. On Economic Inequality. Enlarged edition, with annex by James Foster and Amartya Sen, Oxford: Clarendon Press, 1997.
5.	Inter sectoral Water Allocation Planning and Management, 2000, World Bank Publishers www.Amazon.com

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1:	Capture to fundamental concepts and terms which are to be applied and understood all through the study.	K4
CO2:	Comprehend the various factors affecting water sanitation and health through the lens of third world scenario.	K2
CO3:	Critically analyse and articulate the underlying common challenges in water, sanitation and health.	K4
CO4:	Acquire knowledge on the attributes of governance and its say on water sanitation and health	K2
CO5:	Gain an overarching insight in to the aspects of sustainable resource management in the absence of a clear level playing field in the developmental aspects.	K2

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6
CO1	-	-	1	2	-	3
CO2	1	-	2	1	-	2
CO3	2	-	1	2	1	3
CO4	-	-	1	2	1	2
CO5	1	-	1	2	3	3
Avg.	1	-	1	2	1	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy


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POE2420		BLOCK CHAIN TECHNOLOGIES				
		Category	L	T	P	Credit
		OEC	3	0	0	3
Course objectives						
		• This course is intended to study the basics of Block chain technology. • During this course the learner will explore various aspects of Block chain technology like application in various domains. • By implementing, learners will have idea about private and public Block chain, and smartcontract.				
UNIT – I		INTRODUCTION OF CRYPTOGRAPHY AND BLOCKCHAIN				9
Introduction to Block chain, Block chain Technology Mechanisms & Networks, Block chain Origins, Objective of Block chain, Block chain Challenges, Transactions and Blocks, P2P Systems, Keys as Identity, Digital Signatures, Hashing, and public key cryptosystems, private vs. public Block chain.						
UNIT – II		BITCOIN AND CRYPTOCURRENCY				9
Introduction to Bit coin, The Bit coin Network, The Bit coin Mining Process, Mining Developments, Bit coin Wallets, Decentralization and Hard Forks, Ethereum Virtual Machine (EVM), Merkle Tree, Double-Spend Problem, Block chain and Digital Currency, Transactional Blocks, Impact of Block chain Technology on Crypto currency.						
UNIT – III		INTRODUCTION TO ETHEREUM				9
Introduction to Ethereum, Consensus Mechanisms, Metamask Setup, Ethereum Accounts, Transactions, Receiving Ethers, Smart Contracts.						
UNIT – IV		INTRODUCTION TO HYPERLEDGER AND SOLIDITY PROGRAMMING				10
Introduction to Hyper ledger, Distributed Ledger Technology & its Challenges, Hyper ledger & Distributed Ledger Technology, Hyper ledger Fabric, Hyper ledger Composer. Solidity - Language of Smart Contracts, Installing Solidity & Ethereum Wallet, Basics of Solidity, Layout of a Solidity Source File & Structure of Smart Contracts, General Value Types.						
UNIT – V		BLOCKCHAIN APPLICATIONS				8
Internet of Things, Medical Record Management System, Domain Name Service and Future of Block chain, Alt Coins. Coding of Speech Signals, Quadrature Mirror Filters, Over Sampling A/D and D/A Conversion.						
Total: 45 periods						
REFERENCES:						
1.	Imran Bashir, “Mastering Block chain: Distributed Ledger Technology, Decentralization, and Smart Contracts Explained”, Second Edition, Packt Publishing, 2018.					
2.	Narayanan, J. Bonneau, E. Felten, A. Miller, S. Goldfeder, “Bitcoin and Crypto currency Technologies: A Comprehensive Introduction” Princeton University Press, 2016					

3.	Antonopoulos, Mastering Bit coin, O'Reilly Publishing, 2014.
4.	Antonopoulos and G. Wood, "Mastering Ethereum: Building Smart Contracts and Dapps", O'Reilly Publishing, 2018.
5.	D. Drescher, Block chain Basics. Apress, 2017.

COURSE OUTCOMES: After the completion of this course, student will be able to		BT Mapped (Highest Level)
CO1:	Understand and explore the working of Block chain technology	K2
CO2:	Analyze the working of Smart Contracts	K2
CO3:	Understand and analyze the working of Hyper ledger	K2
CO4:	Apply the learning of solidity to build de-centralized apps on Ethereum	K4
CO5:	Develop applications on Block chain	K2

POE2423		ENERGY CONSERVATION AND MANAGEMENT IN DOMESTIC SECTORS				
		Category	L	T	P	Credit
		OEC	3	0	0	3
Course objectives						
	1. To learn the present energy scenario and the need for energy conservation. 2. To understand the different measures for energy conservation in utilities. 3. Acquaint students with principle theories, materials, and construction techniques to create energy efficient buildings. 4. To identify the energy demand and bridge the gap with suitable technology for sustainable habitat 5. To get familiar with the energy technology, current status of research and find the ways to optimize a system as per the user requirement					
UNIT – I	ENERGY SCENARIO					9
Primary energy resources - Sectorial energy consumption (domestic, industrial and other sectors), Energy pricing, Energy conservation and its importance, Energy Conservation Act-2001 and its features – Energy star rating.						
UNIT – II	HEATING, VENTILLATION & AIR CONDITIONING					9
Basics of Refrigeration and Air Conditioning – COP / EER / SEC Evaluation – SPV system design & optimization for Solar Refrigeration.						
UNIT – III	LIGHTING, COMPUTER, TV					9
Specification of Luminaries – Types – Efficacy – Selection & Application – Time Sensors – Occupancy Sensors – Energy conservation measures in computer – Television – Electronic devices.						
UNIT – IV	ENERGY EFFICIENT BUILDINGS					9
Conventional versus Energy efficient buildings – Landscape design – Envelope heat loss and heat gain – Passive cooling and heating – Renewable sources integration.						
UNIT – V	ENERGY STORAGE TECHNOLOGIES					9
Necessity & types of energy storage – Thermal energy storage – Battery energy storage, charging and discharging– Hydrogen energy storage & Super capacitors – energy density and safety issues – Applications.						
						Total: 45 periods
REFERENCES:						
1.	Yogi Goswami, Frank Kreith, Energy Efficiency and Renewable energy Handbook, CRC Press, 2016					
2.	ASHRAE Handbook 2020 – HVAC Systems & Equipment					
3.	Paolo Bertoldi, Andrea Ricci, Anibal de Almeida, Energy Efficiency in Household Appliances and Lighting, Conference proceedings, Springer, 2001					
4.	David A. Bainbridge, Ken Haggard, Kenneth L. Haggard, Passive Solar Architecture: Heating, Cooling, Ventilation, Daylighting, and More Using Natural Flows, Chelsea Green Publishing, 2011.					

COURSE OUTCOMES: Upon completion of this course, the students will be able to:		BT Mapped (Highest Level)
CO1:	Understand technical aspects of energy conservation scenario.	K2
CO2:	Energy audit in any type for domestic buildings and suggest the conservation measures.	K4
CO3:	Perform building load estimates and design the energy efficient landscape system.	K4
CO4:	Gain knowledge to utilize an appliance/device sustainably.	K2
CO5:	Understand the status and current technological advancement in energy storage field.	K2

POE2424	ADDITIVE MANUFACTURING				
	Category	L	T	P	Credit
	OE	3	0	0	3
Course objectives					
	• This course is intended to study the basics of Additive Manufacturing. • During this course the learner will explore various design aspects of Additive Manufacturing. • By implementing, learners will deal with real time Case studies				
UNIT – I	INTRODUCTION				9
Need - Development - Rapid Prototyping Rapid Tooling – Rapid Manufacturing – Additive Manufacturing. AM Process Chain- Classification – Benefits.					
UNIT – II	DESIGN FOR ADDITIVE MANUFACTURING				9
CAD Model Preparation - Part Orientation and Support Structure Generation -Model Slicing - Tool Path Generation Customized Design and Fabrication - Case Studies.					
UNIT – III	VAT POLYMERIZATION				9
Stereolithography Apparatus (SLA)- Materials -Process -Advantages Limitations- Applications. Digital Light Processing (DLP) - Materials – Process - Advantages - Applications. Multi Jet Modelling (MJM) - Principles - Process - Materials - Advantages and Limitations.					
UNIT – IV	MATERIAL EXTRUSION AND SHEET LAMINATION				9
Fused Deposition Modeling (FDM)- Process-Materials - Applications and Limitations. Sheet Lamination Process: Laminated Object Manufacturing (LOM)- Basic Principle- Mechanism: Gluing or Adhesive Bonding – Thermal Bonding- Materials- Application and Limitation - Bio-Additive Manufacturing Computer Aided Tissue Engineering (CATE) – Case studies Selective Laser Sintering (SLS): Process –Mechanism– Typical Materials and Application- Multi Jet Fusion - Basic Principle— Materials- Application and Limitation - Three Dimensional Printing - Materials -Process - Benefits and Limitations. Selective Laser Melting (SLM) and Electron Beam Melting (EBM): Materials – Process - Advantages and Applications. Beam Deposition Process: Laser Engineered Net Shaping (LENS)- Process -Material Delivery - Process Parameters - Materials - Benefits -Applications.					
UNIT – V	CASE STUDIES AND OPPORTUNITIES ADDITIVE MANUFACTURING PROCESSES				9
Education and training - Automobile- pattern and mould - tooling - Building Printing-Bio Printing - medical implants -development of surgical tools Food Printing -Printing Electronics. Business					

REFERENCES:

1. Andreas Gebhardt and Jan-Steffen Hötter "Additive Manufacturing: 3D Printing for Prototyping and Manufacturing", Hanser publications, United States, 2015, ISBN: 978-1- 56990-582-1..
2. Ian Gibson, David W. Rosen and Brent Stucker "Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing", 2nd edition, Springer., United States, 2015, ISBN13: 978-1493921126.
3. Amit Bandyopadhyay and Susmita Bose, "Additive Manufacturing", 1st Edition, CRC Press., United States, 2015, ISBN-13: 978-1482223590
4. Andreas Gebhardt, "Understanding Additive Manufacturing: Rapid Prototyping, Rapid Manufacturing", Hanser Gardner Publication, Cincinnati., Ohio, 2011, ISBN :9783446425521.
5. Chua C.K., Leong K.F., and Lim C.S., "Rapid prototyping: Principles and applications", Third edition, World Scientific Publishers, 2010.

POE2425	ELECTRIC VEHICLE TECHNOLOGY					
		Category	L	T	P	Credit
		OEC	3	0	0	3
UNIT – I	NEED FOR ELECTRIC VEHICLES					9
History and need for electric and hybrid vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies, comparison of diesel, petrol, electric and hybrid vehicles, limitations, technical challenges						
UNIT – II	ELECTRIC VEHICLE ARCHITECHTURE					9
Electric vehicle types, layout and power delivery, performance – traction motor characteristics, tractive effort, transmission requirements, vehicle performance, energy consumption, Concepts of hybrid electric drive train, architecture of series and parallel hybrid electric drive train, merits and demerits, mild and full hybrids, plug-in hybrid electric vehicles and range extended hybrid electric vehicles, Fuel cell vehicles.						
UNIT – III	ENERGY STORAGE					9
Batteries – types – lead acid batteries, nickel based batteries, and lithium based batteries, electrochemical reactions, thermodynamic voltage, specific energy, specific power, energy efficiency, Battery modeling and equivalent circuit, battery charging and types, battery cooling, Ultra-capacitors, Flywheel technology, Hydrogen fuel cell, Thermal Management of the PEM fuel cell						
UNIT – IV	ELECTRIC DRIVES AND CONTROL					9
Types of electric motors – working principle of AC and DC motors, advantages and limitations, DC motor drives and control, Induction motor drives and control, PMSM and brushless DC motor - drives and control , AC and Switch reluctance motor drives and control – Drive system efficiency – Inverters – DC and AC motor speed controllers						
UNIT – V	DESIGN OF ELECTRIC VEHICLES					9
Materials and types of production, Chassis skate board design, motor sizing, power pack sizing, component matching, Ideal gear box – Gear ratio, torque–speed characteristics, Dynamic equation of vehicle motion, Maximum tractive effort – Power train tractive effort Acceleration performance, rated vehicle velocity – maximum gradability, Brake performance, Electronic control system, safety and challenges in electric vehicles. Case study of Nissan leaf, Toyota Prius, tesla model 3, and Renault Zoe cars.						
Total: 45 periods						
REFERENCES:						
1.	Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, 2 nd edition CRC Press, 2011.					
2.	Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004.					
3.	James Larminie, John Lowry, Electric Vehicle Technology Explained - Wiley, 2003.					
4.	Ehsani, M, “Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design”, CRC Press, 2005					

PAXCC2401	ENGLISH FOR RESEARCH PAPER WRITING				
	Category	L	T	P	Credit
	AC	2	0	0	0
Course objectives	• Teach how to improve writing skills and level of readability • Tell about what to write in each section • Summarize the skills needed when writing a Title • Infer the skills needed when writing the Conclusion • Ensure the quality of paper at very first-time submission				
UNIT – I	INTRODUCTION TO RESEARCH PAPER WRITING				6
Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness.					
UNIT – II	PRESENTATION SKILLS				6
Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction					
UNIT – III	TITLE WRITING SKILLS				6
Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check					
UNIT – IV	RESULT WRITING SKILLS				6
Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions					
UNIT – V	VERIFICATION SKILLS				6
Useful phrases, checking Plagiarism, how to ensure paper is as good as it could possibly be the first- time submission					
Total: 30 periods					
TEXT BOOK:					
1. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011					
2. Day R How to Write and Publish a Scientific Paper, Cambridge University Press 2006					
REFERENCES:					
1. Goldbart R Writing for Science, Yale University Press (available on Google Books) 2006					
2. Highman N, Handbook of Writing for the Mathematical Sciences, SIAM, Highman's book 1998.					


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PAXCC2402		DISASTER MANAGEMENT				
		Category	L	T	P	Credit
		AC	2	0	0	0
Course objectives		- Summarize basics of disaster - Explain a critical understanding of key concepts in disaster risk reduction and humanitarian response. - Illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives. - Describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations. - Develop the strengths and weaknesses of disaster management approaches				
UNIT - I		INTRODUCTION				
Disaster: Definition, Factors and Significance; Difference between Hazard And Disaster: Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.		6				
UNIT - II		REPERCUSSIONS OF DISASTERS AND HAZARDS				
Economic Damage, Loss of Human and Animal Life, Destruction Of Ecosystem, Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.		6				
UNIT - III		DISASTER PRONE AREAS IN INDIA				
Study of Seismic Zones; Areas Prone To Floods and Droughts, Landslides And Avalanches; Areas Prone To Cyclonic and Coastal Hazards with Special Reference To Tsunami; Post-Disaster Diseases and Epidemics		6				
UNIT - IV		DISASTER PREPAREDNESS AND MANAGEMENT				
Preparedness: Monitoring Of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological And Other Agencies, Media Reports: Governmental and Community Preparedness.		6				
UNIT - V		RISK ASSESSMENT				
Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation, Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment, Strategies for Survival		6				
REFERENCES:		Total: 30 periods				
1. Goel S. L., Disaster Administration And Management Text And Case Studies", Deep & Deep Publication Pvt. Ltd., New Delhi, 2009						
2. Nishitha Rai, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "New Royal book Company, 2007.						
3. Sahni, Pardeep I.L.M. "Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi, 2001.						


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COURSE OUTCOMES: On completion of the course, the students will be able to												BT Mapped (Highest Level)		
CO1:	Ability to summarize basics of disaster.											K1		
CO2:	Ability to explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.											K1		
CO3:	Ability to illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.											K1		
CO4:	Ability to describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.											K1		
CO5:	Ability to develop the strengths and weaknesses of disaster management approaches.											K1		
Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	1	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	1	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	1	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	1	2	-	-	-	-	-	-	-	-	-	-	-	-
Avg.	1	2	-	-	-	-	-	-	-	-	-	-	-	-
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy														


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PAXCC2403		CONSTITUTION OF INDIA				
		Category AC	L 2	T 0	P 0	Credit 0
Course objectives		- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective. - To address the growth of Indian opinion regarding modern Indian intellectuals constitutional Role and entitlement to civil and economic rights as well as the emergence nation hood in the early years of Indian nationalism. - To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.				
UNIT – I		HISTORY OF MAKING OF THE INDIAN CONSTITUTION				
History, Drafting Committee, (Composition & Working)		5				
UNIT – II		PHILOSOPHY OF THE INDIAN CONSTITUTION				
Preamble, Salient Features		5				
UNIT – III		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.		5				
UNIT – IV		ORGANS OF GOVERNANCE				
Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.		5				
UNIT – V		LOCAL ADMINISTRATION				
District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO, Municipal Corporation, Panchayati raj: Introduction, PRI: Zila Panchayat, Elected officials and their roles, CEO Zila Panchayat: Position and role, Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.		5				
UNIT – VI		ELECTION COMMISSION				
Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners - Institute and Bodies for the welfare of SC/ST/OBC and women.		5				
REFERENCES:		Total: 30 periods				
1.	Goel S. L., Disaster Administration And Management Text And Case Studies", Deep & Deep Publication Pvt. Ltd., New Delhi, 2009					
2.	Nishintha Rai, Singh AK, "Disaster Management in India: Perspectives, issues and strategies" New Royal book Company, 2007					
3.	Sahni, Pardeep LAL, "Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi, 2001.					


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COURSE OUTCOMES: On completion of the course, the students will be able to												BT Mapped (Highest Level)		
CO1:	Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.											K1		
CO2:	Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.											K1		
CO3:	Discuss the circumstances surrounding the foundation of the Congress Socialist Party[CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution											K1		
CO4:	Discuss the passage of the Governance.											K1		
CO5:	Discuss the passage of the Local Administration.											K1		
CO6:	Discuss the passage of the Hindu Code Bill of 1956.											K1		
Mapping of COs with POs and PSOs														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	1	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	1	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	1	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	1	2	-	-	-	-	-	-	-	-	-	-	-	-
CO6	1	2	-	-	-	-	-	-	-	-	-	-	-	-
Avg.	1	2	-	-	-	-	-	-	-	-	-	-	-	-
1 – Slight, 2 – Moderate, 3 – Substantial , BT – Bloom's Taxonomy														


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PAXCC2404	நற்றமிழ் இலக்கியம்				
	Category	L	T	P	Credit
	AC	2	0	0	0
Course objectives	- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective. - To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional Role and entitlement to civil and economic rights as well as the emergence nation hood in the early years of Indian nationalism. - To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.				
UNIT - I	சங்க இலக்கியம்				5
1. தமிழின் துவக்க நூல் தொல்காப்பியம் - எழுத்து, சொல், பொருள் 2. அகநானூறு (82) - இயற்கை இன்னிசை அரங்கம் 3. குறிஞ்சிப் பாட்டின் மலர்க்காட்சி 4. புறநானூறு (95, 195) - போரை நிறுத்திய ஒளவையார்					
UNIT - II	அறநெறிதமிழ்				5
1. அறநெறி வகுத்த திருவள்ளுவர் - அறம் வலியுறுத்தல், அன்புடைமை, ஒப்புரவறிதல், ஈகை, புகழ் 2. பிற அறநூல்கள் - இலக்கிய மருந்து - ஏலாதி, சிறுபஞ்சமூலம், திரிகடுகம், ஆசாரக்கோவை (தூய்மையை வலியுறுத்தும் நூல்)					
UNIT - III	இரட்டை காப்பியங்கள்				5
1. கண்ணகியின் புரட்சி - சிலப்பதிகார வழக்குரை காதை 2. சமூகசேவை இலக்கியம் மணிமேகலை - சிறைக்கோட்டம் அறக்கோட்டமாகிய காதை					
UNIT - IV	அருள் நெறித்தமிழ்				5


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1. சிறுபாணாற்றுப்படை

- பாரி முல்லைக்குத் தேர் கொடுத்தது. பேகன் மயிலுக்குப் போர்வை கொடுத்தது. அதியமான் ஓளவைக்கு நெல்லிக்கனி கொடுத்தது. அரசர் பண்புகள்

2. நற்றிணை

- அன்னைக்குரிய புன்னை சிறப்பு

3. திருமந்திரம் (617, 618)

- இயமம் நியமம் விதிகள்

4. தர்மச்சாலையை நிறுவிய வள்ளலார்

5. புறநானூறு

- சிறுவனே வள்ளலானான்

6. அகநானூறு (4) - வண்டு

UNIT - V

நவீன தமிழ் இலக்கியம்

5

1. உரைநடைத் தமிழ்,

- தமிழின் முதல் புதினம்,
- தமிழின் முதல் சிறுகதை,
- கட்டுரை இலக்கியம்,
- பயண இலக்கியம்,
- நாடகம்,

2. நாட்டு விடுதலை போராட்டமும் தமிழ் இலக்கியமும்,

3. சமுதாய விடுதலையும் தமிழ் இலக்கியமும்,

4. பெண் விடுதலையும் விளிம்பு நிலையினரின் மேம்பாட்டில் தமிழ் இலக்கியமும்.

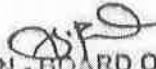
5. அறிவியல் தமிழ்.

6. இணையத்தில் தமிழ்,

7. சுற்றுச்சூழல் மேம்பாட்டில் தமிழ் இலக்கியம்.

Total: 30 periods

REFERENCES:


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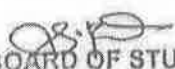
தமிழ் இலக்கிய வெளியீடுகள் / புத்தகங்கள்

1. தமிழ் இணைய கல்விக்கழகம் (Tamil Virtual University)
- www.tamilvu.org
2. தமிழ் விக்கிப்பீடியா (Tamil Wikipedia)
- <https://ta.wikipedia.org>
3. தர்மபுர ஆதீன வெளியீடு
4. வாழ்வியல் களஞ்சியம்
- தமிழ்ப் பல்கலைக்கழகம், தஞ்சாவூர்
5. தமிழ்கலைக் களஞ்சியம்
- தமிழ் வளர்ச்சித் துறை (thamilvalarchilthurai.com)
6. அறிவியல் களஞ்சியம்
- தமிழ்ப் பல்கலைக்கழகம், தஞ்சாவூர்

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	1	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	1	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	1	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	1	2	-	-	-	-	-	-	-	-	-	-	-	-
CO6	1	2	-	-	-	-	-	-	-	-	-	-	-	-
Avg.	1	2	-	-	-	-	-	-	-	-	-	-	-	-

1 - Slight, 2 - Moderate, 3 - Substantial, BT - Bloom's Taxonomy


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