

ROHINI COLLEGE OF ENGINEERING AND TECHNOLOGY

(AUTONOMOUS)

(Anjugramam-Kanyakumari Main Road, Palkulam, Variyoor P.O.-629 401, K.K.Dist.)

Approved by AICTE, New Delhi and Affiliated to Anna University, Chennai

Accredited with A+ Grade by NAAC



ME. CONSTRUCTION ENGINEERING AND MANAGEMENT

Curriculum & Syllabus

(2024-2025 Admitted Students Onwards)

Vision Statement of RCET

To be an academic institute of continuous excellence towards education and research in rural regime and provide service to nation in terms of nurturing potentially higher social, ethical and engineering companion graduands.

Mission Statement of RCET

To foster and promote technically competent graduands by imparting the state of art Engineering education in rural regime. To enunciate research assisted scientific learning by dissemination of knowledge towards science, agriculture, industry and national security.

Vision of the Department

To develop professional knowledge and competent Civil Engineers to create ethically skilled students for better contribution to the society.

Mission of the Department

M1: To provide technically valuable education for the development of Civil Professionals

M2: To make a platform for the students to explore their potential and critical thinking in research field.

M3: To create awareness and spirit of ethical thoughts in societal concerns for professional development.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1 Excel in research or will succeed in Construction Engineering and Management profession in the government, public and private sector organizations.

PEO2 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.

PEO3 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.

PEO4 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.

PEO5 Have competence of excellence, leadership, written ethical codes and guidelines, and the life-long learning needed for a successful professional career.

PROGRAMME OUTCOMES (PO)

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

PROGRAMME SPECIFIC OUTCOMES (PSOS)

PSO1: In-depth knowledge in the construction management, engineering and technologies necessary to formulate, plan, schedule and execute construction projects

PSO2: 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.

PSO3: Conceptualize the problems in construction industry and develop appropriate solutions which are technically feasible and economically viable with due consideration of sustainability.

CREDIT INFO		
Sl.No	Category	Credits
1	Foundation Courses (FC)	4
2	Professional Core Courses (PCC)	25
3	Professional Electives (PEC)	15
4	Open Electives (OEC)	3
5	Research Methodology And IPR Courses (RMC)	2
6	Employability Enhancement Courses (EEC)	21
7	Non Credit/ Audit Course	--
Total Credits		70

Foundation Courses (FC)							
Sl.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24CN101	Statistical Methods for Engineers	FC	4	0	0	4
Professional Core Courses (PCC)							
Sl.No	Course Code	Course Title	Course Type	L	T	P	Credit
1	24CN102	Modern Construction Materials	PCC	3	0	0	3
2	24CN103	Construction Equipment and Management	PCC	3	0	0	3
3	24CN104	Contract Laws and Regulations	PCC	3	0	0	3
4	24CN201	Advanced Construction Techniques	PCC	3	0	0	3
5	24CN202	Project Formulation and Appraisal	PCC	3	0	0	3
6	24CN203	Construction Planning, Scheduling And Control	PCC	3	0	0	3
7	24CN204	Safety Practices and Management	PCC	3	0	0	3
8	24CN131	Construction Engineering Laboratory	PCC	0	0	4	2
9	24CN231	Advanced Computing Techniques Laboratory	PCC	0	0	4	2

Professional Electives Courses (PEC)							
1	24CN211	Advanced Concrete Technology	PEC	3	0	0	3
2	24CN212	Human Resources Management in Construction	PEC	3	0	0	3
3	24CN213	Construction Project Management	PEC	3	0	0	3
4	24CN214	Sustainable Construction	PEC	3	0	0	3
5	24CN221	Economics and Finance Management in Construction	PEC	3	0	0	3
6	24CN222	Design of Energy Efficient Buildings	PEC	3	0	0	3
7	24CN223	Personnel Management in Construction	PEC	3	0	0	3
8	24CN224	Computer Applications in Construction Engineering and Planning	PEC	3	0	0	3
9	24CN241	Quality Control and Assurance in Construction	PEC	3	0	0	3
10	24CN242	Resource Management And Control In Construction	PEC	3	0	0	3
11	24CN243	Shoring, Scaffolding and Formwork	PEC	3	0	0	3
12	24CN244	System Integration in Construction	PEC	3	0	0	3
13	24CN311	Advanced Data Analysis	PEC	3	0	0	3
14	24CN312	Environmental Impact Assessment for Construction Engineers	PEC	3	0	0	3
15	24CN313	Lean Construction Concepts, Tools and Practices	PEC	3	0	0	3
16	24CN314	Maintenance, Repair and Rehabilitation of Structures	PEC	3	0	0	3
17	24CN321	Material Management	PEC	3	0	0	3
18	24CN322	Digital Design and Construction	PEC	3	0	0	3
19	24CN323	Organizational Behaviour	PEC	3	0	0	3
20	24CN324	Supply Chain Management And Logistics in Construction	PEC	3	0	0	3

Open Electives Courses (OEC)							
1	24CP311	Block Chain Technologies	OEC	3	0	0	3
2	24CP310	Deep Learning	OEC	3	0	0	3
3	24IS342	Vibration and Noise Control Strategies	OEC	3	0	0	3
4	24TE341	Energy Conservation and Management in Domestic Sectors	OEC	3	0	0	3
5	24TE342	Electric Vehicle Technology	OEC	3	0	0	3
6	24TE343	New Product Development	OEC	3	0	0	3
7	24IS341	Micro and Small Business Management	OEC	3	0	0	3
8	24IS343	Intellectual Property Rights	OEC	3	0	0	3
9	24IS344	Ethical Management	OEC	3	0	0	3
10	24EM341	IoT for Smart Systems	OEC	3	0	0	3
11	24EM342	Smart Grid	OEC	3	0	0	3
12	24CP301	Security Practices	OEC	3	0	0	3
13	24CP206	Cloud Computing Technologies	OEC	3	0	0	3
14	24TE344	Design Thinking	OEC	3	0	0	3
15	24CP341	Principles of Multimedia	OEC	3	0	0	3
16	24CP342	Big Data Analytics	OEC	3	0	0	3
17	24CM341	Medical Robotics	OEC	3	0	0	3
18	24EM343	Embedded Automation	OEC	3	0	0	3
19	24TE345	Textile Reinforced Composites	OEC	3	0	0	3
20	24TE346	Nanocomposite Materials	OEC	3	0	0	3
Research Methodology And IPR Courses (RMC)							
1	24RM101	Research Methodology and IPR	RMC	2	0	0	2
Employability Enhancement Courses (EEC)							
1	24CN151	Technical Seminar	EEC	0	0	2	1
2	24CN251	Practical Training -I	EEC	0	0	0	1
3	24CN331	Practical Training -II	EEC	0	0	0	1
4	24CN351	Project Phase I	EEC	0	0	12	6
5	24CN451	Project Phase II	EEC	0	0	24	12
Non Credit/ Audit Course (AC)							
1	24AC201	English for Research Paper Writing	AC	2	0	0	0
2	24AC202	Disaster Management	AC	2	0	0	0
3	24AC203	Constitution Of India	AC	2	0	0	0
4	24AC204	நற்றமிழ் இலக்கியம்	A	2	0	0	0

SEMESTER – III

Sl. No.	Course Code	Course Title	Course Category	L	T	P	C
THEORY COURSES							
1	24CN31X	Professional Elective IV	PEC	3	0	0	3
2	24CN32X	Professional Elective V	PEC	3	0	0	3
3	24XX XXX	Open Elective	OEC	3	0	0	3
LABORATORY COURSES							
4	24CN331	Practical Training -II	EEC	0	0	0	1
5	24CN351	Project Phase I	EEC	0	0	12	6
Total				9	0	12	16

SEMESTER – IV

Sl. No.	Course Code	Course Title	Course Category	L	T	P	C
LABORATORY COURSES							
1	24CN451	Project Phase II	EEC	0	0	24	12

SEMESTER – I

S. No.	Course Code	Course Title	Course Category	L	T	P	C
THEORY COURSES							
1	24CN101	Statistical methods for Engineers	FC	4	0	0	4
2	24CN102	Modern construction Materials	PCC	3	0	0	3
3	24CN103	Construction equipment and Management	PCC	3	0	0	3
4	24CN104	Contract laws and regulations	PCC	3	0	0	3
5	24RM101	Research Methodology and IPR	RMC	2	0	0	2
6	24CN11X	Professional elective I	PEC	3	0	0	3
7	24AC2XX	Audit course I*	AC	2	0	0	0
LABORATORY COURSES							
8	24CN131	Construction Engineering laboratory	PCC	0	0	4	2
9	24CN151	Technical seminar	EEC	0	0	2	1
Total				18+2	0	6	21

* Audit Course is optional

SEMESTER – II

S. No	Course Code	Course Title	Course Category	L	T	P	C
THEORY COURSES							
1	24CN201	Advanced construction Techniques	PCC	3	0	0	3
2	24CN202	Project formulation and Appraisal	PCC	3	0	0	3
3	24CN203	Construction planning, scheduling and control	PCC	3	0	0	3
4	24CN204	Safety practices and Management	PCC	3	0	0	3
5	24CN22X	Professional Elective II	PEC	3	0	0	3
6	24CN24X	Professional Elective III	PEC	3	0	0	3
7	24AC2XX	Audit course II*	AC	2	0	0	0
LABORATORY COURSES							
8	24CN231	Advanced computing techniques laboratory	PCC	0	0	4	2
9	24CN251	Practical training -I	EEC	0	0	0	1
Total				18+2	1	4	21

Course Code:	24CN101	Course Title:	STATISTICAL METHODS FOR ENGINEERS
Credits:	4	L – T – P	4-0-4

Course objectives:

To impart knowledge on the

- To develop the ability to apply the concepts of Estimation Theory and Correlation & Regression in Engineering problems.
- To understand basic concepts of Probability theory and Random Variables, how to deal with multiple Random Variables.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To use the concepts of multivariate normal distribution and principal components analysis.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Lab experiment videos
4. Blended Mode of Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I- ESTIMATION THEORY	[12hours]
Estimators: Unbiasedness, Consistency, Efficiency and sufficiency – Maximum likelihood estimation – Method of moments.	

UNIT II ESTIMATION THEORY	[12hours]
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 ESTIMATION THEORY	[12hours]
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 ESTIMATION THEORY	[12hours]
Analysis of variance – One way and two way classifications – Completely randomized design – Randomized block design – Latin square design - 2 ² Factorial design.	

UNIT V ESTIMATION THEORY	[12hours]
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

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Highest Cognitive Level
CO1	Use the method of moments and method of maximum likelihood to obtain the value of the point estimators	K3
CO2	Apply the various statistical methods in hypothesis testing for mean and variances of large and small samples	K3
CO3	Apply the method of least square to obtain the regression line and also to calculate the partial and multiple correlation coefficient for the given set of data points.	K3
CO4	Apply various ANOVA techniques like CRD, RBD, LSD etc. to obtain the variances	K3
CO5	Obtain principal component analysis of random vectors and matrices by multivariate statistical methods	K3

COs and POs Mapping:

COs	POs					
	1	2	3	4	5	6
CO1	2	1	3	-	-	-
CO2	2	1	3	-	-	-
CO3	2	1	3	-	-	-
CO4	-	-	1	-	-	-
CO5	2	1	3	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped,
Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	20	20	20
Understand	20	20	20
Apply	60	60	60
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

Reference Books:

1. Gupta.S.C., and Kapoor, V.K., “Fundamentals of Mathematical Statistics”, 12th Edition, Sultan Chand and Sons, 2020.
2. Jay L. Devore, “Probability and statistics for Engineering and the Sciences”, 8th Edition, Cengage Learning, 2014.
3. Johnson, R.A., Miller, I and Freund J., "Miller and Freund’s Probability and Statistics for Engineers", 9th Edition, Pearson Education, Asia, 2016
4. Johnson, R.A. and Wichern, D. W. “Applied Multivariate Statistical Analysis”, 6th Edition, Pearson Education, Asia, 2012.
5. Rice, J.A. "Mathematical Statistics and Data Analysis", 3rd Edition, Cengage Learning, 2015.

Web Links and Video Lectures (E-Resources):

1. Probability and Statistics <https://nptel.ac.in/courses/111105090>

Activity-Based Learning /Practical-Based Learning:

1. <http://nptel.ac.in>
2. <https://swayam.gov.in>

Course Code:	24CN102	Course Title:	MODERN CONSTRUCTION MATERIALS
Credits:	3	L – T – P	3-0-3

Course objectives:

To impart knowledge on the

- To study and understand the properties of modern construction materials
- Use of modern construction materials such as special concretes, metals, composites, water proofing compounds, non-weathering materials, and smart materials.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Lab experiment videos
4. Blended Mode of Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I SPECIAL CONCRETES	[9 hours]
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 II METALS	[9 hours]
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 III COMPOSITES	[9 hours]
. 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 NON STRUCTURAL MATERIALS, ASSOCESSORIES AND FINISHES	[9 hours]
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 V SMART AND INTELLIGENT MATERIALS	[9 hours]
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

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Highest Cognitive Level
CO1	Apply knowledge of modern materials in production of variety of concrete.	K3
CO2	Apply different type of steel and insulating materials in constructions.	K3
CO3	Explain the composites and chemicals in production of modern concrete.	K2
CO4	Choose the different flooring materials and application of façade materials	K3
CO5	Apply the knowledge of smart and intelligent materials in construction field	K3

COs and POs Mapping:

COs	POs					
	1	2	3	4	5	6
CO1	2	1	3	-	-	-
CO2	2	1	3	-	-	-
CO3	2	1	3	-	-	-
CO4	-	-	1	-	-	-
CO5	2	1	3	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final Marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	Assignment/Project	20	40		
	Skill Assessment - I	40			
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	30	30	30
Understand	30	30	30
Apply	40	40	40
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

REFERENCE BOOKS :

1. Shetty, M.S. and Jain, A.K., Concrete Technology: Theory and Practice, S.Chand & Company Ltd., New Delhi, Eighth Edition, 2018.
2. Rajput, R.K., Engineering Materials, S. Chand & Company Ltd., New Delhi, Third Edition, 2006.
3. IS 11384 -1985, Code of Practice for Composite Construction in structural steel and concrete, 1985.
4. <http://nptel.ac.in/downloads/105106053>.

Web Links and Video Lectures (E-Resources):

<http://nptel.ac.in/downloads/105106053>.

Activity-Based Learning /Practical-Based Learning:

1. <http://nptel.ac.in>
2. <https://swayam.gov.in>

Course Code:	24CN103	Course Title:	CONSTRUCTION EQUIPMENT AND MANAGEMENT
Credits:	3	L – T – P	3-0-3

Course objectives:

To impart knowledge on the

- To study and understand the various types of equipment's used for earthwork, tunneling, drilling, blasting, dewatering, material handling conveyors and its applications in construction projects.
- To study and understand appropriate equipment contributes to economy, quality, safety, speed and timely completion of a project

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Lab experiment videos
4. Blended Mode of Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I CONSTRUCTION EQUIPMENT SELECTION

[9 hours]

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 hours]

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 hours]
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 hours]
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 hours]
Forklifts and related equipment - Portable Material Bins – Material Handling Conveyors – Material Handling Cranes- Industrial Trucks.	

TOTAL: 45 PERIODS

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Highest Cognitive Level
CO1	Develop knowledge on the planning of equipment and selection of equipment	K3
CO2	Explain the knowledge on fundamentals of earth work operations, earth moving operations and types of earth work equipment	K2
CO3	Develop the knowledge on special construction equipment	K3
CO4	Apply the knowledge on asphalt and concrete plants	K3
CO5	Apply the knowledge and select the proper materials handling equipment	K3

COs and POs Mapping:

COs	POs					
	1	2	3	4	5	6
CO1	2	1	3	-	-	-
CO2	2	1	3	-	-	-
CO3	2	1	3	-	-	-
CO4	-	-	1	-	-	-
CO5	2	1	3	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped,
Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	30	30	30
Understand	30	30	30
Apply	40	40	40
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

REFERENCE BOOKS :

1. Peurifoy, R.L., Schexnayder, C. and Aviad Shapira., 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, Dhanpat Rai and Sons, 2010.
5. Sharma S.C. Construction Equipment and Management, Khanna Publishers, New Delhi, 2019

Activity-Based Learning /Practical-Based Learning:

1. <http://nptel.ac.in>
2. <https://swayam.gov.in>

Course Code:	24CN104	Course Title:	CONTRACT LAWS AND REGULATIONS
Credits:	3	L – T – P	3-0-3

Course objectives:

To impart knowledge on the

- 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.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Lab experiment videos
4. Blended Mode of Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I CONSTRUCTION CONTRACTS	[9 hours]
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 hours]
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 hours]
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 hours]
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 hours]
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 – Tamil nadu Factory Act – Child Labour Act - Other Labour Laws.	

TOTAL: 45 PERIODS

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Highest Cognitive Level
CO1	Examine the elements of concluding, and administering contracts	K4
CO2	Determine about the procedure for tendering and documentation.	K4
CO3	Explain the duties of the arbitrator and legal procedures	K2
CO4	Identify about the labour requirements in terms of tax and cost analysis.	K3
CO5	Analyse about labour regulations and their impact on managing of contracts	K4

COs and POs Mapping:

COs	POs					
	1	2	3	4	5	6
CO1	2	1	3	-	-	-
CO2	2	1	3	-	-	-
CO3	2	1	3	-	-	-
CO4	-	-	1	-	-	-
CO5	2	1	3	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final Marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	30	30	30
Understand	30	30	30
Apply	20	20	20
Analyse	20	20	20
Evaluate	0	0	0
Create	0	0	0

Reference Books:

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.

Activity-Based Learning /Practical-Based Learning:

1. <http://nptel.ac.in>
2. <https://swayam.gov.in>

Course Code:	24RM101	Course Title:	RESEARCH METHODOLOGY AND IPR
Credits:	2	L – T – P	2-0-2

Course objectives:

To impart knowledge on the

- To give an overview of the research methodology and explain the technique of defining a research problem
- To explain the functions of the literature review in research.
- To explain various research designs and their characteristics.
- To explain the details of sampling designs, measurement and scaling techniques and also different methods of data collections.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Lab experiment videos
4. Blended Mode of Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I RESEARCH DESIGN	[6 hours]
.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 hours]
Measurements, Measurement Scales, Questionnaires and Instruments, Sampling and methods. Data - Preparing, Exploring, examining and displaying	
UNIT III DATA ANALYSIS AND REPORTING	[6 hours]
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 hours]
. 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 hours]
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	

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Highest Cognitive Level
CO1	To explain various research designs and their characteristics.	K2
CO2	To explain the details of sampling designs, and also different methods of data collections	K2
CO3	To explain the art of interpretation and the art of writing research reports.	K2
CO4	Explain and summarise the need of information about Intellectual Property Right to be promoted among student community in general & engineering in particular	K2
CO5	Relate that IPR protection provides an incentive to inventors for further research work and investment in R & D	K2

COs and POs Mapping:

COs	POs					
	1	2	3	4	5	6
CO1	2	1	3	-	-	-
CO2	2	1	3	-	-	-
CO3	2	1	3	-	-	-
CO4	-	-	1	-	-	-
CO5	2	1	3	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped,
Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	40	40	40
Understand	60	60	60
Apply	0	0	0
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

Reference Books:

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.

Activity-Based Learning /Practical-Based Learning:

1. <http://nptel.ac.in>
2. <https://swayam.gov.in>

Course Code:	24CN131	Course Title:	CONSTRUCTION ENGINEERING LABORATORY
Credits:	2	L – T – P	0-0-4

Course objectives:

To impart knowledge on the

- To provide a thorough knowledge of material selection through the material testing based on specification

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Lab experiment videos
4. Blended Mode of Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

List of Experiments:

1. Mix Design of Concrete as per Indian Standards (IS), American Concrete Institute (ACI) , BS Method for high performance concrete
2. Mix Design of self-compacting concrete as per European Federation of National Associations Representing for Concrete (EFNARC) guidelines.
3. Flow characteristics of self-compacting concrete
4. Effect of minerals in concrete at fresh and hardened state with relevance to workability, strength and durability.
5. Effect of chemical admixtures in concrete at fresh and hardened state with relevance to workability, strength and durability.
6. Permeability tests on hardened concrete
7. Determination of in-situ strength and quality of concrete using
 - i. Rebound hammer
 - ii. Ultrasonic pulse velocity tester
8. Ultrasonic interferometer – ultrasonic velocity in liquid

9. Electrical conductivity of metals and alloys with temperature-four probe method
10. Resistivity measurements
11. NDT – Ultrasonic flaw detector
12. Strain gauge meter – Determination of Young's modulus of a metallic wire

TOTAL:60 PERIODS**Course outcomes:**

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Highest Cognitive Level
CO1	Explain the high performance Concrete mix design procedure as per ACI IS and BS method	K2
CO2	Experiment with method of testing of workability of flow Characteristics of Self Compacting concrete.	K4
CO3	Examine the properties of fresh and hardened concrete	K4
CO4	Examine the concrete quality through NDT	K4

COs and POs Mapping:

COs	POs					
	1	2	3	4	5	6
CO1	2	1	3	-	-	-
CO2	2	1	3	-	-	-
CO3	2	1	3	-	-	-
CO4	-	-	1	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

The weightage of Continuous Internal Evaluation (CIE) is 60% and for End Semester Examination (ESE) is 40%

S.No	Component	Type of Assessment	Max Marks	Reduced Marks	Total	Final Marks
1.	Continuous Internal Examination(CIE) - Laboratory	Continuous Assessment	75	75	100	60
2.		Model Lab Exam	25	25		
3.	End Semester Examination (ESE)	Lab Exam	100	40	40	40
Total						100

Assessment Pattern

Bloom's Category	Terminal Examination
Remember	0
Understand	0
Apply	100
Analyse	0
Evaluate	0
Create	0

Course Code:	24CN151	Course Title:	TECHNICAL SEMINAR
Credits:	1	L – T – P	0-0-2

Course objectives:

To impart knowledge on the

- 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.
- The students have to refer the journals and conference proceedings and collect the literature.
- The student can select a course oriented topic.
- The students have to collect at least 30 research papers published in the last decades.
- Student has to make presentation for 20 minutes followed by 10 minutes discussion using power point
- The student has to make three presentations in the semester.
- The student has to write a technical report for about 30 - 50 pages (Title page, one-page Abstract, Review of Research paper under various sub - headings, concluding remarks and list of references).
- The technical report has to be submitted to the course coordinator one week before the final presentation.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. PowerPoint presentation
2. Lab experiment videos
3. Blended Mode of Learning
4. Experiential Learning
5. NPTEL and Other Videos
6. Smart Class Room

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Highest Cognitive Level
CO1	Identify the area of interest of the student.	K2
CO2	Identify the thrust areas by referring journals, conference proceedings etc.	K2
CO3	Demonstrate own ideas in the current advancement in construction industry	K2
CO4	Develop report writing and presentation	K3

COs and POs Mapping:

COs	POs					
	1	2	3	4	5	6
CO1	2	1	3	-	-	-
CO2	2	1	3	-	-	-
CO3	2	1	3	-	-	-
CO4	-	-	1	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

The weightage of Continuous Evaluation (CE) is 100%

S.No	Type of Assessment	Max Marks	Reduced Marks	Total	Final Marks
1.	Continuous Assessment-I	100	50	100	100
2.	Continuous Assessment-II	100	50		
Total					100

Course Code:	24CN201	Course Title:	ADVANCED CONSTRUCTION TECHNIQUES
Credits:	3	L – T – P	3-0-0

Course objectives:

To impart knowledge on the

- 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.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Lab experiment videos
4. Blended Mode of Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I- SUB STRUCTURE CONSTRUCTION	[9hours]
<p>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.</p>	

UNIT II SUPER STRUCTURE CONSTRUCTION FOR BUILDINGS	[9hours]
<p>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.</p>	

UNIT III CONSTRUCTION OF SPECIAL STRUCTURES	[9hours]
<p>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.</p>	

UNIT IV REHABILITATION AND STRENGTHENING TECHNIQUES	[9hours]
<p>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.</p>	

UNIT V DEMOLITION	[9hours]
<p>Demolition Techniques, Demolition by Machines, Demolition by Explosives, Advanced techniques using Robotic Machines, Demolition Sequence, Dismantling Techniques, Safety precaution in Demolition and Dismantling.</p>	

TOTAL:45 PERIODS

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Explain the various processes and techniques involved in sub-structure construction	K2
CO2	Choose the different methods used in super-structure construction.	K3
CO3	Categorize the construction process of special structures and offshore structures with advanced machinery and equipment.	K4
CO4	Discover the idea about the rehabilitation techniques carried out for strengthening of a structure	K4
CO5	Explain about the advanced demolition techniques carried out for dismantling a structure	K2

COs and POs Mapping:

COs	POs					
	1	2	3	4	5	6
CO1	2	1	3	-	-	-
CO2	2	1	3	-	-	-
CO3	2	1	3	-	-	-
CO4	-	-	1	-	-	-
CO5	2	1	3	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final Marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
Total					100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	30	30	30
Understand	30	30	30
Apply	20	20	20
Analyse	20	20	20
Evaluate	0	0	0
Create	0	0	0

Reference Books:

1. Robert Wade Brown, Practical foundation engineering handbook, McGrawHill Publications, 2000.
2. Concrete Structures: Repair, Rehabilitation and Strengthening, Dr. Mohamed A. El-Reedy, 2020
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.

Web Links and Video Lectures (E-Resources):

1. Probability and Statistics <https://nptel.ac.in/courses/111105090>

Activity-Based Learning /Practical-Based Learning:

1. <http://nptel.ac.in>
2. <https://swayam.gov.in>

Course Code:	24CN202	Course Title:	PROJECT FORMULATION AND APPRAISAL
Credits:	3	L – T – P	3-0-0

Course objectives:

To impart knowledge on the

- To study and understand the formulation, and costing of construction projects, appraisal, finance, and private sector participation.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Lab experiment videos
4. Blended Mode of Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I- PROJECT FORMULATION	[9hours]
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	[9hours]
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	[9hours]
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	[9hours]
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	[9hours]
Private sector participation in Infrastructure Development Projects - BOT, BOLT, BOOT-Technology Transfer and Foreign Collaboration - Scope of Technology Transfer.	

TOTAL:45 PERIODS

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Highest Cognitive Level
CO1	Explain the elements of Project formulation and appraisal.	K2
CO2	Develop the cost analysis report on the project.	K3
CO3	Classify the investment Appraisal the risk analysis and its assessment in practice.	K3
CO4	Analyse Financial aspects of projects	K4
CO5	Analyze the Implementations of Private Sector Participation in construction projects.	K4

COs and POs Mapping:

COs	POs					
	1	2	3	4	5	6
CO1	2	1	3	-	-	-
CO2	2	1	3	-	-	-
CO3	2	1	3	-	-	-
CO4	-	-	1	-	-	-
CO5	2	1	3	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped,
Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final Marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	30	30	30
Understand	30	30	30
Apply	20	20	20
Analyse	20	20	20
Evaluate	0	0	0
Create	0	0	0

Reference Books:

1. Barcus, S.W. and Wilkinson. J.W., Hand Book of Management Consulting Services, McGraw Hill, New York, first edition, 1995.
2. Joy P.K., Total Project Management - The Indian Context, New Delhi, Laxmi Publications Pvt. Ltd, First edition 2017.
3. PrasannaChandra., Projects—Planning, Analysis, Selection, Implementation Review, McGrawHill Publishing Company Ltd., New Delhi., Ninth edition, 2019.
4. United Nations Industrial Development Organisation (UNIDO) Manual for the Preparation of Industrial Feasibility Studies, (IDBI Reproduction) Bombay, 1995.
5. Raina V.K., "Construction Management Practice—The inside Story", Tata McGrawHill Publishing Limited, 2005

Web Links and Video Lectures (E-Resources):

1. Probability and Statistics <https://nptel.ac.in/courses/111105090>

Activity-Based Learning /Practical-Based Learning:

1. <http://nptel.ac.in>

2. <https://swayam.gov.in>

Course Code:	24CN203	Course Title:	CONSTRUCTION PLANNING, SCHEDULING AND CONTROL
Credits:	3	L – T – P	3-0-0
Course objectives:			
To impart knowledge on the			
<ul style="list-style-type: none"> • 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 			
Teaching-Learning Process:			
Suggested strategies that teachers may use to effectively achieve the course outcomes:			
<ol style="list-style-type: none"> 1. Chalk and Talk 2. PowerPoint presentation 3. Lab experiment videos 4. Blended Mode of Learning 5. Experiential Learning 6. NPTEL and Other Videos 7. Smart Class Room 8. Flipped Class 			

UNIT I- CONSTRUCTION PLANNING	[9hours]
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	[9hours]
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	[9hours]
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	[9hours]
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	[9hours]
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

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Highest Cognitive Level
CO1	Identify and estimate the activity in the construction.	K3
CO2	Develop the networking of activities using the critical path method.	K3
CO3	Analyze the project budget required for the particular construction project.	K4
CO4	Explain the various quality control tool required in the construction industry	K2
CO5	Explained the different databases that can be maintained in the construction industry using computers	K2

COs and POs Mapping:

COs	POs					
	1	2	3	4	5	6
CO1	2	1	3	-	-	-
CO2	2	1	3	-	-	-
CO3	2	1	3	-	-	-
CO4	-	-	1	-	-	-
CO5	2	1	3	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	30	30	30
Understand	30	30	30
Apply	20	20	20
Analyse	20	20	20
Evaluate	0	0	0
Create	0	0	0

Reference Books:

1. Albert Lester, Project Management, Planning and Control, 7th Edition, Butterworth-Heinemann, USA, 2017.
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

Web Links and Video Lectures (E-Resources):

2. Probability and Statistics <https://nptel.ac.in/courses/111105090>

Activity-Based Learning /Practical-Based Learning:

1. <http://nptel.ac.in>
2. <https://swayam.gov.in>

Course Code:	24CN204	Course Title:	SAFETY PRACTICES AND MANAGEMENT
Credits:	3	L – T – P	3-0-3

Course objectives:

- Using risk assessment methods to determine priorities for eliminating hazards and reducing risks
- Improved compliance with laws related to workforce safety and security

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Lab experiment videos
4. Blended Mode of Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I- CONSTRUCTION ACCIDENTS	[9hours]
Construction Accidents - Construction Safety Management: Importance – Causes of Accidents, Safety Measures –Environmental Issues in Construction – Construction Industry related laws. Human Factors in Construction Safety - Legal and Financial aspects of accident in Construction - Occupational and Safety Hazard Assessment.	
UNIT II SAFETY PROGRAMMES AND CONTRACTUAL OBLIGATIONS	[9hours]
Safety Programmes – Construction safety – Element of effective safety programmes – job –site assessment – Safety meetings – Safety Incentives. Contractual Obligations – Safety in Construction Contracts – Substance abuse – Safety Record keeping.	
UNIT III DESIGNING FOR SAFETY	[9hours]
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 IV OWNER’S AND DESIGNER’S OUTLOOK	[9hours]
Accident Prevention – Cost of Accidents – Safety and Productivity – Safety Provision in the Factories act – Accident Reporting Investigation and Statistics – Total loss control and damage control – Safety sampling – Safety audit – Critical incidents technique – Safety equipment – Planning and Site preparation – safety system of storing construction materials – excavation – Blasting –Timbering – Scaffolding – Safe use of Ladder – Safety in Welding.	
UNIT V SAFETY IN HANDLING EQUIPMENT	[9hours]
Safety in hand tools – Safety in grinding – Hoisting Apparatus and Conveyors – Safety in the Use of Mobile Cranes –manual Handling – Safety in Demolition work – Trusses , Girders and beams – First aid - Fire hazard and Prevention Methods – Interesting experience at the construction site against the fire accident.	

TOTAL:45 PERIODS

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Highest Cognitive Level
CO1	Define all staff their accountabilities and responsibilities for the development and delivery of safety	K2
CO2	Plan the adequate and appropriate safety information and training provided to all staff	K3
CO3	Infer that all staff is provided with adequate and appropriate safety information	K2
CO4	Develop the necessary training to build and maintain a meaningful operational safety	K3
CO5	Make use of the measurement of the organizational safety performance and safety targets are in place.	K3

COs and POs Mapping:

COs	POs					
	1	2	3	4	5	6
CO1	2	1	3	-	-	-
CO2	2	1	3	-	-	-
CO3	2	1	3	-	-	-
CO4	-	-	1	-	-	-
CO5	2	1	3	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final Marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	Assignment/Project	20	40		
	Skill Assessment - I	40			
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	30	30	30
Understand	30	30	30
Apply	20	20	20
Analyse	20	20	20
Evaluate	0	0	0
Create	0	0	0

Reference Books:

1. Tim Howarth. and Paul Watson., Construction Safety Management, Wiley-Blackwell Publishing, New Jersey, First Edition, 2009.
2. Richard Coble, J. Jimmie Hinze. and Theo C. Haupt., Construction Safety and Health Management, Prentice Hall Inc., New Jersey, First Edition, 2009.
3. Alan Griffith. and Tim Howarth., Construction Health and Safety Management, CRC Press, Florida, First Edition, 2014.
4. Handbook On Construction Safety Practice, SP – 70, BIS, 2001.

Web Links and Video Lectures (E-Resources):

1. Probability and Statistics <https://nptel.ac.in/courses/111105090>

Activity-Based Learning /Practical-Based Learning:

1. <http://nptel.ac.in>
2. <https://swayam.gov.in>

Course Code:	24CN231	Course Title:	ADVANCED COMPUTING TECHNIQUES LABORATORY
Credits:	2	L – T – P	0-0-4

Course objectives:

To impart knowledge on the

- 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.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. PowerPoint presentation
2. NPTEL and Other Videos
3. Smart Class Room
4. Flipped Class

List of Experiments:

1. Quantity take off, Preparation and delivery of the bid or proposal of an engineering construction project.
2. Design of a simple equipment information system for a construction project.
3. Scheduling of a construction project using software.
4. Scheduling of a construction project using tools like MS project scheduling systems.
5. Resource allocation for construction project and levelling of the resources.
6. Monitoring of the construction project, tracking and taking reports using tools like MS project scheduling systems.
7. Inventory management system for the given construction project.
8. Simulation models for project risk analysis

TOTAL:60 PERIODS**List of Software**

- MS OFFICE
- MS PROJECT
- PRIMAVERA SOFTWARE

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Highest Cognitive Level
CO1	Apply computational techniques in optimization and sequencing problems	K3
CO2	Plan using management tools	K3
CO3	Analyze resources for construction projects	K4
CO4	Explain the volume of activities involved in a project	K3

COs and POs Mapping:

COs	POs					
	1	2	3	4	5	6
CO1	2	1	3	-	-	-
CO2	2	1	3	-	-	-
CO3	2	1	3	-	-	-
CO4	-	-	1	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped,
Level 0- Not Mapped

Scheme of Evaluation:

The weightage of Continuous Internal Evaluation (CIE) is 60% and for End Semester Examination (ESE) is 40%

S.No	Component	Type of Assessment	Max Marks	Reduced Marks	Total	Final Marks
1.	Continuous Internal Examination(CIE) - Laboratory	Continuous Assessment	75	75	100	60
2.		Model Lab Exam	25	25		
3.	End Semester Examination (ESE)	Lab Exam	100	40	40	40
					Total	100

Assessment Pattern

Bloom's Category	Terminal Examination
Remember	0
Understand	0
Apply	100
Analyse	0
Evaluate	0
Create	0

Course Code:	24CN251	Course Title:	PRACTICAL TRAINING I
Credits:	1	L – T – P	0-0-2

Course objectives:

- To train the students in the field work so as to have a first-hand knowledge of practical problems related to Construction Management in carrying out engineering tasks.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. PowerPoint presentation
2. NPTEL and Other Videos
3. Smart Class Room
4. Flipped Class

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 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.

Course Code:	24CN211	Course Title:	ADVANCED CONCRETE TECHNOLOGY
Credits:	3	L – T – P	3-0-3

Course objectives:

To impart knowledge on the

- To develop the ability to apply the concepts of Estimation Theory and Correlation & Regression in Engineering problems.
- To understand basic concepts of Probability theory and Random Variables, how to deal with multiple Random Variables.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To use the concepts of multivariate normal distribution and principal components analysis.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Lab experiment videos
4. Blended Mode of Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I- CONCRETE MAKING MATERIALS	[9hours]
Aggregates classification IS Specifications, Properties, Grading, Methods of combining aggregates, specified grading, Testing of aggregates - Cement, Grade of cement, Chemical composition, Testing of cement, Hydration of cement, Structure of hydrated cement, special cements - Water - Chemical admixtures, Mineral admixture.	

UNIT II MIX DESIGN	[9hours]
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	[9hours]
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	[9hours]
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	[9hours]
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**Course outcomes:**

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Highest Cognitive Level
CO1	Develop knowledge on various materials needed for concrete manufacture	K3
CO2	Apply the rules to do mix designs for concrete by various methods	K3
CO3	Develop the methods of manufacturing of concrete.	K3
CO4	Explain about various special concrete	K2
CO5	Explain various tests on fresh and hardened concrete	K2

COs and POs Mapping:

COs	POs					
	1	2	3	4	5	6
CO1	2	1	3	-	-	-
CO2	2	1	3	-	-	-
CO3	2	1	3	-	-	-
CO4	-	-	1	-	-	-
CO5	2	1	3	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped,
Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final Marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	30	30	30
Understand	40	40	40
Apply	30	30	30
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

Reference Books:

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

Activity-Based Learning /Practical-Based Learning:

1. <http://nptel.ac.in>
2. <https://swayam.gov.in>

Course Code:	24CN212	Course Title:	HUMAN RESOURCES MANAGEMENT IN CONSTRUCTION
Credits:	3	L – T – P	3-0-3

Course objectives:

To impart knowledge on the

- To impart knowledge on manpower planning.
- To learn the organization structure.
- To study the human relations and organizational behavior.
- To gain knowledge on welfare measures, job evaluation, insurance.
- To understand the managerial roles and development methods

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Lab experiment videos
4. Blended Mode of Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I- MANPOWER PLANNING	[9hours]
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	[9hours]
Elements of an organization- Management process in organizations- Planning- Organizing-Staffing- Directing- Controlling – Delegation of authority – responsibility – accountability – lines and staff organization Workforce diversity-international dimensions of Organization- Organizational structure determinants of organizational design	

UNIT III HUMAN RELATIONS AND ORGANISATIONAL BEHAVIOUR	[9hours]
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	[9hours]
Compensation – Safety and health – GPF – EPF – Group Insurance – Housing - Pension – Laws related to welfare measures.	

UNIT V MANAGEMENT AND DEVELOPMENT METHODS	[9hours]
Wages and Salary, Employee benefits, Employee appraisal and assessment - Management Development - On-the-job and off-the-job- Management Developments – Performance appraisal in practice. Managing careers: Career planning and development - Managing promotions and transfer of operations – Developing policies, practices and establishing process pattern – Competency up gradation and their assessment – New methods of training and development – Performance Management - Total Quality Management	

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Highest Cognitive Level
CO1	Apply the practices and techniques for evaluating performance and structuring teams	K3
CO2	Explain the role of the leader and leadership principles & attitudes.	K2
CO3	Demonstrate the professional and ethical responsibilities	K2
CO4	Develop commitment to quality, timeliness, and continuous improvement.	K3
CO5	Organize managerial role with emphasis on the management of the human resources.	K3

COs and POs Mapping:

COs	POs					
	1	2	3	4	5	6
CO1	2	1	3	-	-	-
CO2	2	1	3	-	-	-
CO3	2	1	3	-	-	-
CO4	-	-	1	-	-	-
CO5	2	1	3	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped,
Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	Assignment/Project	20	40		
	Skill Assessment - I	40			
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	30	30	30
Understand	40	40	40
Apply	30	30	30
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

Reference Books:

1. D. Longford M.R. Hancock, R. Rellows & A. W. Gale, “Human Recourse Management In Construction” Longman Group Limited, fourth impression 2000.
2. Carleton Counter II and Jill Justice Coulter, “The Complete Standard Hand Book of Construction Personnel Management ”, Prentice Hall, Inc., New Jersey, 1989.
3. Memoria,C.B., “Personnel Management”, Himalaya Publishing Co., 1997.
4. Andrew,D., Szilagg, “Hand Book of Engineering Management”, 1982.
5. Oxley Rand Poslcit, “Management Techniques applied to the Construction Industry”,Granda Publishing Ltd., 1980.

Activity-Based Learning /Practical-Based Learning:

1. <http://nptel.ac.in>
2. <https://swayam.gov.in>

Course Code:	24CN213	Course Title:	CONSTRUCTION PROJECT MANAGEMENT
Credits:	3	L – T – P	3-0-3

Course objectives:

To impart knowledge on the

- To learn the various stages of a project, project life cycle and the role of project managers.
- To learn the strategic planning and organization of project participants.
- To gain knowledge on project design and construction process.
- To study the utilization of labour, materials & equipments and also cost estimation.
- To learn the thrust areas of construction project management.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Lab experiment videos
4. Blended Mode of Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I- THE OWNERS' PERSPECTIVE	[9hours]
Introduction - Project Life Cycle - Types of Construction - Selection of Professional Services - Construction Contractors - Financing of Constructed Facilities - Legal and Regulatory Requirements - Changing Environment of the Construction Industry - Role of Project Managers.	
UNIT II ORGANIZING FOR PROJECT MANAGEMENT	[9hours]
Project Management – Modern trends - Strategic Planning - Effects of Project Risks on Organization - Organization of Project Participants -Traditional Designer-Constructor Sequence -Professional Construction Management - Owner-Builder Operation - Turnkey Operation - Leadership and Motivation for the Project Team.	
UNIT III DESIGN AND CONSTRUCTION PROCESS	[9hours]
Design and Construction as an Integrated System - Innovation and Technological Feasibility -Innovation and Economic Feasibility - Design Methodology - Functional Design - Construction Site Environment.	
UNIT IV LABOUR, MATERIALS, EQUIPMENTS AND COST ESTIMATION	[9hours]
Labour Productivity – Labour Relations in Construction - Problems in Collective Bargaining - Material Procurement and Delivery - Inventory Control - Construction Equipments - Choice of Equipments and Standard Production Rates – Type of Construction Cost Estimates - Effects of Scale on Construction Cost - Unit Cost Method of Estimation - Methods for Allocation of Joint Costs - Historical Cost Data - Estimate Based on Engineer's List of Quantities - Estimation of Operating Costs.	

UNIT V THRUST AREAS IN PROJECT MANAGEMENT	[9hours]
Strengths, Weaknesses, opportunities, threats analysis (SWOT) - S. W. O. T. matrix utility of S. W. O. T. matrix on strategic planning and management - Supply Chain Management (SCM) - Management strategy for implementing SCM in construction organizations and on construction projects - Concepts of critical chain in construction projects based on the theory of constraints -Earned Value Analysis.	

TOTAL:45 PERIODS**Course outcomes:**

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Highest Cognitive Level
CO1	Apply the practices and techniques for evaluating performance and structuring teams	K3
CO2	Explain the role of the leader and leadership principles & attitudes.	K2
CO3	Demonstrate the professional and ethical responsibilities	K2
CO4	Develop commitment to quality, timeliness, and continuous improvement.	K3
CO5	Organize managerial role with emphasis on the management of the human resources.	K3

COs and POs Mapping:

COs	POs					
	1	2	3	4	5	6
CO1	2	1	3	-	-	-
CO2	2	1	3	-	-	-
CO3	2	1	3	-	-	-
CO4	-	-	1	-	-	-
CO5	2	1	3	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped,
Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	30	30	30
Understand	40	40	40
Apply	30	30	30
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

Reference Books:

1. Prasanna Chandra "Project Planning, Analysis, Selection, Implementation and review", Tata McgrawHill, 8th Edition, 2017.
2. Choudhury S, "Project Management", McGraw-Hill Publishing Company, New Delhi, 2017.
3. Chitkara, K.K. "Construction Project Management: Planning, Scheduling and Control", Tata McGraw-Hill Publishing Company, New Delhi, 3rd Edition, 2014.
4. Frederick E. Gould, "Construction Project Management", Wentworth Institute of Technology, Vary E. Joyce, Massachusetts Institute of Technology, 4th Edition, 2013.
5. Chris Hendrickson and Tung Au, "Project Management for Construction
6. Fundamental Concepts for Owners", Engineers, Architects and Builders, Prentice Hall, Pittsburgh, 2nd edition, 2000.

Activity-Based Learning /Practical-Based Learning:

1. <http://nptel.ac.in>
2. <https://swayam.gov.in>

Course Code:	24CN214	Course Title:	SUSTAINABLE CONSTRUCTION
Credits:	3	L – T – P	3-0-3

<p>Course objectives:</p> <p>To impart knowledge on the</p> <ul style="list-style-type: none"> To impart knowledge about sustainable construction and to understand the concepts of sustainable materials, energy calculations, green buildings and environmental effects.
<p>Teaching-Learning Process:</p> <p>Suggested strategies that teachers may use to effectively achieve the course outcomes:</p> <ol style="list-style-type: none"> Chalk and Talk PowerPoint presentation Lab experiment videos Blended Mode of Learning Experiential Learning NPTEL and Other Videos Smart Class Room Flipped Class

UNIT I INTRODUCTION	[9hours]
Introduction and definition of Sustainability - Carbon cycle - role of construction material: concrete and steel, etc. - CO2 contribution from cement and other construction materials.	

UNITII MATERIALS USED IN SUSTAINABLE CONSTRUCTION	[9hours]
Construction materials and indoor air quality - No/Low cement concrete - Recycled and manufactured aggregate - Role of QC and durability - Life cycle and sustainability.	

UNITIII ENERGY CALCULATIONS	[9hours]
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	

UNITIV GREEN BUILDINGS	[9hours]
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	

UNITV ENVIRONMENTAL EFFECTS	[9hours]
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.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Highest Cognitive Level
CO1	Select the various sustainable materials used in construction.	K3
CO2	Apply the method of estimating the amount of energy required for building.	K3
CO3	Interpret the features of LEED, TERI and GRIHA ratings of buildings	K2
CO4	Explain the concept and performance of zero energy buildings.	K2
CO5	Select less carbon emission materials for construction.	K2

COs and POs Mapping:

COs	POs					
	1	2	3	4	5	6
CO1	2	1	3	-	-	-
CO2	2	1	3	-	-	-
CO3	2	1	3	-	-	-
CO4	-	-	1	-	-	-
CO5	2	1	3	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped,
Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final Marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	30	30	30
Understand	40	40	40
Apply	30	30	30
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

Reference Books:

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.

Activity-Based Learning /Practical-Based Learning:

1. <http://nptel.ac.in>

2.<http://Swayam.gov.in>

Course Code:	24CN221	Course Title:	ECONOMICS AND FINANCE MANAGEMENT IN CONSTRUCTION
Credits:	3	L – T – P	3-0-3

Course objectives:

To impart knowledge on the

- To learn the basic principles of economics in Civil Engineering.
- To discuss the financial management system.
- To study the fundamentals of financial accounting principles.
- To learn the various alternative proposals methods to financial reporting purposes.
- To study the investment alternatives and property evaluation.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Lab experiment videos
4. Blended Mode of Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT- I BASIC PRINCIPLES OF ECONOMICS IN CIVIL ENGINEERING	[9hours]
Role of civil engineering in industrial development - Advances in civil engineering and engineering economics - Support matters of economy as related to engineering Market demand and supply -Time Value of Money – Cash Flow diagram – Constant increment to periodic payments –Arithmetic Gradient (G), Geometric Gradient (C).	

UNIT-II FINANCIAL MANAGEMENT	[9hours]
Project Finance – Sources of finance - Long-term and short -term finance, Working Capital Management, Inventory valuation, Mortgage Financing - Leasing - Equity financing - Internal generation of funds - External commercial borrowings - International financial management - Foreign currency management.	

UNIT-III FUNDAMENTALS OF MANAGEMENT ACCOUNTING	[9hours]
Management accounting, Financial accounting principles- basic concepts, Financial statements –accounting ratios - funds flow statement -Ratio analysis - Investment and financing decision –Financial control Job control and centralized management– Cash flow statement- Balance Sheet -Profit and Loss account.	

UNIT-IV ALTERNATIVES PROPOSALS	[9hours]
Investigation and evaluation – 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- Accounting for tax reporting purposes and financial reporting purposes.	

UNIT-V EVALUATING ALTERNATIVE INVESTMENTS	[9hours]
Alternative investments – Real Estate - Investment Property, Equipment Replace Analysis, Depreciation – Tax before and after depreciation – Valuation- Value Added Tax (VAT) – Inflation.	

TOTAL:45 PERIODS

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Highest Cognitive Level
CO1	Explain the elements of construction economics	K2
CO2	Summarize the financial management system and practical problems.	K2
CO3	Apply accounting principles in construction management.	K3
CO4	Explain the alternative methods for proposals	K2
CO5	Plan to Prepare income, profit and loss statements and implement management accounting	K3

COs and POs Mapping:

COs	POs					
	1	2	3	4	5	6
CO1	2	1	3	-	-	-
CO2	2	1	3	-	-	-
CO3	2	1	3	-	-	-
CO4	-	-	1	-	-	-
CO5	2	1	3	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped,
Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	30	30	30
Understand	40	40	40
Apply	30	30	30
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

Reference Books:

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 Publications Pvt. Ltd. New Delhi, 2000.
3. Collier.C and GlaGola .C., "Engineering Economics & Cost Analysis", 3rd Edn. Addison Wesley Education Publishers,1998.
4. Blank, L.T., and Tarquin,a.J "Engineering Economy",4th Edn. Mc-Graw Hill Book Co,1988.
5. Steiner, H.M. "Engineering Economic principles", 2nd Edn. Mc-Graw Hill Book, New York,1996.

Activity-Based Learning /Practical-Based Learning:

1.<http://nptel.ac.in>

2.<http://Swayam.gov.in>

Course Code:	24CN222	Course Title:	DESIGN OF ENERGY EFFICIENT BUILDINGS
Credits:	3	L – T – P	3-0-3

Course objectives:

To impart knowledge on the

- To understanding the concept of energy consumption in buildings and design a energy efficient building

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Lab experiment videos
4. Blended Mode of Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I INTRODUCTION	[9hours]
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	[9hours]
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	[9hours]
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	[9hours]
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.		

UNIT IV	DESIGN FOR CLIMATIC ZONES	[9hours]
Energy efficiency – An Overview of Design Concepts and Architectural Interventions – Embodied Energy – Low Embodied Energy Materials – Passive Dwindraft 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

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Highest Cognitive Level
CO1	Explain environmental energy supplies on buildings	K2
CO2	Explain the passive solar heating, cooling system	K2
CO3	Choose the various aspects of day-lighting and electrical lighting in a building	K2

CO4	Identify and design building ventilation and heat control for in door comfort	K3
CO5	Plan a building for climatic zone and apply simulation programs of buildings toper form energy calculations	K3

COs and POs Mapping:

COs	POs					
	1	2	3	4	5	6
CO1	2	1	3	-	-	-
CO2	2	1	3	-	-	-
CO3	2	1	3	-	-	-
CO4	-	-	1	-	-	-
CO5	2	1	3	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final Marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	30	30	30

Understand	40	40	40
Apply	30	30	30
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

Reference Books:

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.

Activity-Based Learning /Practical-Based Learning:

1. <http://nptel.ac.in>
2. <http://Swayam.gov.in>

Course Code:	24CN223	Course Title:	PERSONNEL MANAGEMENT IN CONSTRUCTION
Credits:	3	L – T – P	3-0-3

Course objectives:**Teaching-Learning Process:**

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Lab experiment videos
4. Blended Mode of Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT - I MAN POWER PLANNING	[9hours]
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Manpower Planning process , Organizing, Staffing, directing, and controlling – Estimation, manpower requirement – Factors influencing supply and demand of human resources – Role of HR manager – Personnel Principles.

UNIT - II ORGANISATION	[9hours]
Organization – Span of Control – Organization Charts – Staffing Plan - Development and Operation of human resources - Managerial Staffing – Recruitment – Selection - Placement, Training and Development	

UNIT - III HUMAN BEHAVIOUR	[9hours]
Introduction to the field of people management - basic individual psychology; motivation - Job design and performance management - Managing groups at work - self-managing work teams - intergroup behaviour and conflict in organizations – Leadership - Behavioural aspects of decision-making; and communication for people management	

UNIT - IV WELFARE MEASURES	[9hours]
Compensation – Safety and health – GPF – EPF – Group Insurance – Housing - Pension – Laws related to welfare measures.	

UNIT - V MANAGEMENT AND DEVELOPMENT METHODS	[9hours]
Compensation - Wages and Salary, Employee Benefits, employee appraisal and assessment - Employee services - Safety and Health – Discipline and discharge - Special Human resource problems, Performance appraisal. - Employee hand book and personnel manual - Job descriptions and organization structure and human relations – Productivity of Human resources	

TOTAL:45 PERIODS

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Highest Cognitive Level
CO1	Explain the various processes in manpower planning, organizational and welfare measures	K2

CO2	Identify the development and operation of human resources.	K2
CO3	Analyze the field of people management and intergroup behavior and conflict in organizations.	K4
CO4	Explain the welfare measures and Laws related to welfare measures.	K2
CO5	Illustrate the elements of management and development methods of the employee services.	K2

COs and POs Mapping:

COs	POs					
	1	2	3	4	5	6
CO1	2	1	3	-	-	-
CO2	2	1	3	-	-	-
CO3	2	1	3	-	-	-
CO4	-	-	1	-	-	-
CO5	2	1	3	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped,
Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	

Remember	30	30	30
Understand	40	40	40
Apply	30	30	30
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

Reference Books:

1. Matthias Zeuch., Handbook of Human Resources Administration, Springer, Berlin Heidelberg, First Edition, 2016.
2. Tyagi, A.K., Handbook on Energy Audits and Management, Tata Energy Research Institute, Bangalore, First Edition, 2003.
3. Rao, V.S.P. and Mamoria, C.B., Personnel Management (Text and Cases), Himalaya Publishing House, Bangalore, First Edition, 2019.
4. Dwivedi, R.S., Human Relations and Organisational Behaviour, Macmillian India Ltd., Noida, First Edition, 2008.

Web Links and Video Lectures (E-Resources):

Activity-Based Learning /Practical-Based Learning:

1.<http://nptel.ac.in>

2.<http://Swayam.gov.in>

Course Code:	24CN224	Course Title:	COMPUTER APPLICATIONS IN CONSTRUCTION ENGINEERING AND PLANNING
Credits:	3	L – T – P	3-0-3

Course objectives:

To impart knowledge on the

- To acquire knowledge on software requirements in construction process.
- To learn the various optimization techniques.
- To gain knowledge on inventory models.
- To acquire knowledge on project planning and scheduling.
- To understand the various problems in construction field.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Lab experiment videos
4. Blended Mode of Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I SOFTWARE APPLICATIONS	[9hours]
Overview of IT Applications in Construction – Construction process – Computerization in Construction – Computer aided Cost Estimation – Developing application with database software.	
UNIT II OPTIMIZATION TECHNIQUES	[9hours]
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	[9hours]
Deterministic: Economic order quantity (EOQ) model, EOQ with finite supply, EOQ with backorders, EOQ with constraints, All-units quantity discounts model. and Probabilistic Inventory Models - discrete and continuous demand - Software applications..	
UNIT IV SCHEDULING APPLICATION	[9hours]
Program Evaluation & Review Techniques and Critical Path Method – Advanced planning and scheduling concepts – computer application - Project cost considerations, Project duration, and updating and Resource allocation: Resource smoothing and leveling	
UNIT V SEQUENCING AND SIMULATION	[9hours]

Sequencing and replacement model: Sequencing problem -Simulation - Enterprises – Introduction to Enterprise Resource Planning(ERP) systems – Interaction of simulation tool with ERP –Simulation Analysis for ERP – Case Studies.

TOTAL:45 PERIODS

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Highest Cognitive Level
CO1	Outline the application with database software in construction engineering.	K2
CO2	Apply linear programming techniques in construction	K3
CO3	Summarize the various types of inventory model.	K2
CO4	Apply the scheduling knowledge in engineering projects.	K3
CO5	Solve problems using simulation and ERP systems.	K3

COs and POs Mapping:

COs	POs					
	1	2	3	4	5	6
CO1	2	1	3	-	-	-
CO2	2	1	3	-	-	-
CO3	2	1	3	-	-	-
CO4	-	-	1	-	-	-
CO5	2	1	3	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks

Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
Total					100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	30	30	30
Understand	40	40	40
Apply	30	30	30
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

Reference Books:

1. Tarek Hegazy, "Computer-Based Construction Project Management", Pearson New International Edition, 2013.
2. Billy E.Gillet., "Introduction to Operations Research – A Computer Oriented Algorithmic Approach", Mc Graw Hill, 2008.
3. Feigenbaum,L., "Construction Scheduling with Primavera Project Planner" Prentice Hall Inc.,2002.
4. Ming Sun and Rob Howard, "Understanding I.T. in Construction", Spon Press, Taylor and Francis Group, 2004.
5. Paulson, B.R., "Computer Applications in Construction", Mc Graw Hill, 1995

Activity-Based Learning /Practical-Based Learning:

1. <http://nptel.ac.in>
2. <http://Swayam.gov.in>

Course Code:	24CN241	Course Title:	QUALITY CONTROL AND ASSURANCE IN CONSTRUCTION
Credits:	3	L – T – P	3-0-3

Course objectives:

To impart knowledge on the

- 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.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Lab experiment videos
4. Blended Mode of Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I- QUALITY MANAGEMENT	[9 hours]
Introduction – Definitions and Objectives – Factor Influencing Construction Quality - Responsibilities and Authority - Quality Plan - Quality Management Guidelines – Quality Circles	

UNIT II QUALITY SYSTEMS	[9 hours]
Introduction - Quality System Standard – ISO 9000 Family of Standards – Requirements – Preparing Quality System Documents – Quality Related Training – Implementing a Quality System – Third Party Certification	

UNIT III QUALITY PLANNING	[9 hours]
Quality Policy, Objectives and Methods in Construction Industry - Consumers Satisfaction, Ergonomics - Time of Completion - Statistical Tolerance – Taguchi’s Concept of Quality – 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 hours]
Objectives - Regularity Agent, Owner, Design, Contract and Construction Oriented Objectives, Methods -Techniques and Needs of QA/QC - Different Aspects of Quality - Appraisals, 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	

UNIT V QUALITY IMPROVEMENT TECHNIQUES	[9 hours]
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

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Highest Cognitive Level
CO1	Explain the principles of Quality management	K2
CO2	Illustrate the basic in quality management system.	K2
CO3	Summarize the feasibility in planning in quality procedures.	K2
CO4	Explain the quality assuring and control systems	K2
CO5	Develop the quality techniques to be followed in improving the construction field.	K3

COs and POs Mapping:

COs	POs					
	1	2	3	4	5	6
CO1	2	1	3	-	-	-
CO2	2	1	3	-	-	-
CO3	2	1	3	-	-	-
CO4	-	-	1	-	-	-
CO5	2	1	3	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
Total					100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	40	40	40
Understand	40	40	40
Apply	20	20	20
Analyse	0	0	0
Evaluate	0	0	0

Create	0	0	0
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REFERENCE BOOKS:

1. James Brien, J.o., Construction Inspection Handbook – Quality Assurance and Quality Control, Van Nostrand, New York, Third Edition, 2013.
2. Steven McCabe., Quality Improvement Techniques in Construction, Taylor & Francis, New York, Third Edition, 2014.
3. Ashford, J.L., The Management of Quality in Construction, CRC Press, Taylor & Francis Group, Oxfordshire ,Fourth Edition, 2020.
4. Clarkson Oglesby, H., Productivity Improvement in Construction, McGraw-Hill, New York, First Edition, 1989.

Course Code:	24CN242	Course Title:	RESOURCE MANAGEMENT AND CONTROL IN CONSTRUCTION
Credits:	3	L – T – P	3-0-3

Course objectives:

To impart knowledge on the

- To impart the concept 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.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

- 1.Chalk and Talk
- 2.PowerPoint presentation
- 3.Lab experiment videos
- 4.Blended Mode of Learning
- 5.Experiential Learning
- 6.NPTEL and Other Videos
- 7.Smart Class Room
- 8.Flipped Class

UNIT I- RESOURCE PLANNING	[9 hours]
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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 hours]
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 hours]
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 hours]
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 hours]
Time-cost trade-off, Computer application – Resource levelling, resource list, resource allocation, Resource loading, Cumulative cost – Value Management.	

CO No.	Course Outcomes	Highest Cognitive Level
CO1	Identify the different types of resources in a construction industry	K2
CO2	Analyze the labour productivity and the influencing factors	K4
CO3	Select the equipment output and the operation condition of construction equipment	K2
CO4	Explain the terms of cash inflow, cash outflow, and balance sheet	K2
CO5	Identify the time and cost-related information in a construction sector	K2

Course outcomes:

On completion of the course, the student will have the ability to:

COs and POs Mapping:

COs	POs					
	1	2	3	4	5	6
CO1	2	1	3	-	-	-
CO2	2	1	3	-	-	-
CO3	2	1	3	-	-	-
CO4	-	-	1	-	-	-
CO5	2	1	3	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped,
Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	

Remember	30	30	30
Understand	40	40	40
Apply	30	30	30
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

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.

Course Code:	24CN243	Course Title:	SHORING, SCAFFOLDING AND FORMWORK
Credits:	3	L – T – P	3-0-3

Course objectives:

To impart knowledge on the

- 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

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

- 1.Chalk and Talk
- 2.PowerPoint presentation
- 3.Lab experiment videos
- 4.Blended Mode of Learning
- 5.Experiential Learning
- 6.NPTEL and Other Videos
- 7.Smart Class Room
- 8.Flipped Class

UNIT I- PLANNING, SITE EQUIPMENT & PLANT FOR FORM WORK	[9hours]
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	[9hours]
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	[9hours]
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	[9hours]
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	[9hours]

FORMS AND SCAFFOLDS
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

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Highest Cognitive Level
CO1	Explain basic concepts and ideas related with detailed planning of framework	K2
CO2	Classify the materials accessories proprietary products and its pressures	K2
CO3	Make out the comprehensive design aspects of forms and shores	K2
CO4	Apply the knowledge of erecting forms for beams, slabs, columns, walls, and causes of failures.	K3
CO5	Explain the entire system of forms for domes and tunnels, slip forms and scaffolds	K2

COs and POs Mapping:

COs	POs					
	1	2	3	4	5	6
CO1	2	1	3	-	-	-
CO2	2	1	3	-	-	-
CO3	2	1	3	-	-	-
CO4	-	-	1	-	-	-
CO5	2	1	3	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped,
Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	30	30	30
Understand	40	40	40
Apply	30	30	30
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

REFERENCE BOOKS:

1. Austin, C.K., Form work for Concrete ,Cleaver -HumePressLtd.,London,1996.
2. Hurd,M.K., Formwork for Concrete,Seventh Edition, American Concrete Institute, Detroit, 2016
3. MichaelP.Hurst, Construction Press, LondonandNewYork,2003.
4. Robert L. Peurifoy and Garold D. Oberlender, Formwork for Concrete Structures, McGraw - Hill, 2010.
5. Kumar NeerajJha, FormworkforConcreteStructures,2017

Course Code:	24CN244	Course Title:	SYSTEM INTEGRATION IN CONSTRUCTION
Credits:	3	L – T – P	3-0-3

<p>Course objectives: To impart knowledge on the</p> <ul style="list-style-type: none"> • 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 and safety planning.
<p>Teaching-Learning Process: Suggested strategies that teachers may use to effectively achieve the course outcomes:</p> <ol style="list-style-type: none"> 1.Chalk and Talk 2.PowerPoint presentation 3.Lab experiment videos 4.Blended Mode of Learning 5.Experiential Learning 6.NPTEL and Other Videos 7.Smart Class Room 8.Flipped Class

UNIT I-STRUCTURALINTEGRATION	[9 hours]
Structural System, Systems for enclosing Buildings, Functional aesthetic system, Materials Selection and Specification.	

UNIT II ENVIRONMENTALFACTORS	[9hours]
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 hours]
Plumbing—Electricity—Verticalcirculationandtheirinteraction— HeatingVentilationandAir- conditioning Systems in Buildings and implementation techniques in High Rise Buildings.	

UNIT IV MAINTENANCE	[9 hours]
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 hours]
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

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Highest Cognitive Level
CO1	Explain the various construction techniques and incorporate into the building process	K2
CO2	Explain the requirements and elements of HVAC, mechanical, electrical, hydraulic and transportation services in buildings	K2
CO3	Construct and integrate services into high-rise buildings	K3
CO4	Interpret the intricacies of physical installation of services and their critical sequence in the construction maintenance process.	K2
CO5	Explain the safety planning in construction of highrise building	K2

COs and POs Mapping:

COs	POs					
	1	2	3	4	5	6
CO1	2	1	3	-	-	-
CO2	2	1	3	-	-	-
CO3	2	1	3	-	-	-
CO4	-	-	1	-	-	-
CO5	2	1	3	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final marks
Continuous Internal Examination (CIE) - Theory	CIE – I	100	50	100	40
	CIE – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	30	30	30
Understand	40	40	40
Apply	30	30	30
Analyse	0	0	0
Evaluate	0	0	0
Create	0	0	0

REFERENCES:

1. A.J.Elderand Martiz Vinden Barg, Handbook of Building Enclosure, McGraw-Hill Book Company, 1983.
2. David V. Chadderton, Building Services Engineering, Taylor and Francis, 2013.
3. Safety planning. 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

Course Code:	24AC201	Course Title:	ENGLISH FOR RESEARCH PAPER WRITING
Credits:	0	L – T – P	2-0-0

Course objectives:

To impart knowledge on the

- 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

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

- 1.Chalk and Talk
- 2.PowerPoint presentation
- 3.Lab experiment videos
- 4.Blended Mode of Learning
- 5.Experiential Learning

UNIT I INTRODUCTION TO RESEARCH PAPER WRITING	[6 hours]
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 hours]
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 hours]
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 hours]
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 hours]
Useful phrases, checking Plagiarism, how to ensure paper is as good as it could possibly be the first- time submission	

TOTAL: 30 PERIODS

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Highest Cognitive Level
CO1	Understand that how to improve your writing skills and level of readability	K1
CO2	Learn about what to write in each section	K1
CO3	Understand the skills needed when writing a Title	K1
CO4	Understand the skills needed when writing the Conclusion	K1
CO5	Ensure the good quality of paper at very first-time submission	K2

REFERENCES

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
3. Goldbort R Writing for Science, Yale University Press (available on Google Books) 2006
4. Highman N, Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book 1998.

Course Code:	24AC202	Course Title:	DISASTER MANAGEMENT
Credits:	0	L – T – P	2-0-0

Course objectives:

To impart knowledge on the

- 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

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

- 1.Chalk and Talk
- 2.PowerPoint presentation
- 3.Lab experiment videos
- 4.Blended Mode of Learning
- 5.Experiential Learning

UNIT I INTRODUCTION	[6 hours]
Disaster: Definition, Factors and Significance; Difference between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude	

UNIT II REPERCUSSIONS OF DISASTERS AND HAZARDS	[6 hours]
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.	

UNIT III DISASTER PRONE AREAS IN INDIA	[6 hours]
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	

UNIT IV DISASTER PREPAREDNESS AND MANAGEMENT	[6 hours]
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.	

UNIT V RISK ASSESSMENT	[6 hours]
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	

TOTAL: 30 PERIODS

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Highest Cognitive Level
CO1	Ability to summarize basics of disaster	K2
CO2	Ability to explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.	K2
CO3	Ability to illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.	K2
CO4	Ability to describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.	K2
CO5	Ability to develop the strengths and weaknesses of disaster management approaches	K2

REFERENCES

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 “NewRoyal book Company, 2007.
3. Sahni, Pardeep Et. Al. ,” Disaster Mitigation Experiences And Reflections”, Prentice Hall Of India, New Delhi, 2001.

Course Code:	24AC203	Course Title:	CONSTITUTION OF INDIA
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Credits:	0	L – T – P	2-0-0
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Course objectives:

To impart knowledge on the

- 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.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Lab experiment videos
4. Blended Mode of Learning
5. Experiential Learning

UNIT I HISTORY OF MAKING OF THE INDIAN CONSTITUTION	[6 hours]
History, Drafting Committee, (Composition & Working)	
UNIT II PHILOSOPHY OF THE INDIAN CONSTITUTION	[6 hours]
Preamble, Salient Features	
UNIT III CONTOURS OF CONSTITUTIONAL RIGHTS AND DUTIES	[6 hours]
Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.	
UNIT IV ORGANS OF GOVERNANCE	[6 hours]
Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary,	

Appointment and Transfer of Judges, Qualifications, Powers and Functions.

UNIT V LOCAL ADMINISTRATION	[6 hours]
District's Administration head: Role and Importance Municipalities: Introduction, Mayor and role of Elected Representative, CEO, Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy(Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.	

UNIT VI	[6 hours]
Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners - Institute and Bodies for the welfare of SC/ST/OBC and women.	

TOTAL: 30 PERIODS

Course outcomes:

On completion of the course, the student will have the ability to:

CO No.	Course Outcomes	Highest Cognitive 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.	K2
CO2	Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.	K2
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.	K2
CO4	Discuss the passage of the Hindu Code Bill of 1956.	K2

REFERENCES

1. The Constitution of India,1950(Bare Act),Government Publication.
2. Dr.S.N.Busi, Dr.B. R.Ambedkar framing of Indian Constitution,1st Edition, 2015.

3. M.P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Course Code:	24AC204	Course Title:	நற்றமிழ் இலக்கியம்
Credits:	0	L - T - P	2-0-0

UNIT I சங்க இலக்கியம்	[6 hours]
<p>1. தமிழனின் துவக்க நூல் தொல்காப்பியம் – எழுத்து சொல் பொருள்</p> <p>2. அகநானூறு (82)- இயற்கை இன்னிசை அரங்கம்</p> <p>3. குறிஞ்சிப்பாட்டின் மலர்காட்சி</p> <p>4. புறநானூறு (95,195) போரை நிறுத்தி ஓளவையார்</p>	
UNIT II அறநெறித் தமிழ்	[6 hours]
<p>1. அறநெறி வகுத்த திருவள்ளுவர் - அறம் வலியுறுத்தல், அன்புடைமை, ஒப்புரவறிதல், ஈகை, புகழ்</p> <p>2. பிற அற நூல்கள் - இலக்கிய மருந்து - ஏலாதி சிறுபஞ்சமூலம், திரிகடுகம், ஆசாரக்கோவை (தூய்மையை வலியுறுத்தும் நூல்)</p>	
UNIT III இரட்டைக்காப்பியங்கள்	[6 hours]
<p>1. கண்ணகியின் புரட்சி சிலப்பதிகார வழக்குரை காதை சமூக சேவை இலக்கியம் மணிமேகலை சிறைக்கோட்டம் அறக்கோட்டமாகிய கதை</p>	

UNIT IV அருள்நெறித் தமிழ்	[6 hours]
<p>1. சிறுபாணாற்றுப்படை -பாரி முல்லைக்கு தேர் கொடுத்தது பேகன் மயிலுக்கு போர்வை கொடுத்தது அதியமான் ஓளவைக்கு நெல்லி கொடுத்தது, அரசர் பண்புகள்</p> <p>2. நற்றிணை- அன்னைக்குரிய புன்னை சிறப்பு</p> <p>3. திருமந்திரம்(617,618)- இயமம் நியமம் விதிகள்</p> <p>4. தர்மச்சாலையை நிறுவிய வள்ளலார்</p> <p>5. புறநானூறு- சிறுவனே வள்ளலானான்</p> <p>6. அகநானூறு (4) - வண்டு நற்றிணை(11) - நண்டு கலித்தொகை(11) - யானை, புறா ஐந்திணை 50(27) - மான் ஆகியவை பற்றிய செய்திகள்</p>	
UNIT V நவீன தமிழ் இலக்கியம்	[6 hours]
<p>1. உரைநடை தமிழ் - தமிழின் முதல் புதினம், - தமிழிலன் முதல் சிறுகதை , - கட்டுர இலக்கியம் , - பயண இலக்கியம், - நாடகம்.</p> <p>2, நாட்டு விடுதலைப் போராட்டமும் தமிழ் இலக்கியமும்</p> <p>3. சமுதாய விடுதலையும் தமிழ் இலக்கியமும்</p> <p>4. பெண் விடுதலையும் விளிம்பு நிலைநரின் மேம்பாட்டில் தமிழ் இலக்கியமும்</p> <p>5. அறிவியல் தமிழ்</p> <p>6. இணையத்தில் தமிழ்</p> <p>7. சுற்றுச்சூழல் மேம்பாட்டில் தமிழ் இலக்கியம்</p>	

TOTAL: 30 PERIODS

தமிழ் இலக்கிய வெளியீடுகள் புத்தகங்கள்

1. தமிழ் இணைய கல்விக்கழகம் (Tamil Virtual University) – www.tamilvu.org
2. தமிழ் விக்கிபீடியா (Tamil Wikipedia) -<https://ta.wikipedia.org>
3. தர்மபுர ஆதீன வெளியீடு
4. வாழ்வியல் களஞ்சியம் தமிழ் பல்கலைக்கழகம்

தஞ்சாவூர்

5. தமிழ் கலைக்களஞ்சியம் தமிழ் வளர்ச்சித் துறை
(thamilvalarchithurai.com)

6. அறிவியல் களஞ்சியம் தமிழ் பல்கலைக்கழகம் தஞ்சாவூர்



**Recommended Courses for III & IV Semester
SEMESTER – III**

Sl. No.	Course Code	Course Title	Course Category	L	T	P	C
THEORY COURSES							
1	24CN31X	Professional Elective IV	PEC	3	0	0	3
2	24CN32X	Professional Elective V	PEC	3	0	0	3
3	24XX XXX	Open Elective	OEC	3	0	0	3
LABORATORY COURSES							
4	24CN331	Practical Training -II	EEC	0	0	0	1
5	24CN351	Project Phase I	EEC	0	0	12	6
Total				9	0	12	16

SEMESTER – IV

Sl. No.	Course Code	Course Title	Course Category	L	T	P	C
LABORATORY COURSES							
1	24CN451	Project Phase II	EEC	0	0	24	12

Course Code:	24CN331	Course Title:	PRACTICAL TRAINING -II
Credits:	1	L – T – P	0-0-0

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.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. PowerPoint presentation
2. NPTEL and Other Videos
3. Smart Class Room
4. Flipped Class

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.

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Describe the Construction Industry
CO2	Realize the various functions of construction activities
CO3	Develop skills in facing and solving the problems experiencing in the Construction Management field
CO4	Report Preparation
CO5	Presentation of work carried out in Practical Training

COs and POs Mapping:

Cos	POs					
	1	2	3	4	5	6
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

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Course Code:	24CN351	Course Title:	PROJECT PHASE I
Credits:	6	L – T – P	0-0-12

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.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. PowerPoint presentation
2. NPTEL and Other Videos
3. Smart Class Room
4. Flipped Class

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.

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Apply the knowledge gained from theoretical and practical courses in solving problems.
CO2	Summarize the importance of literature review
CO3	Identify the problem
CO4	solve the identified problem based on the formulated methodology
CO5	Interpret and present the findings of the work conducted.

COs and POs Mapping:

COs	POs					
	1	2	3	4	5	6
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

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped,
Level 0- Not Mapped

Course Code:	24CN451	Course Title:	PROJECT PHASE II
Credits:	12	L – T – P	0-0-24

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

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. PowerPoint presentation
2. NPTEL and Other Videos
3. Smart Class Room
4. Flipped Class

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.

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Discover the potential research areas
CO2	Apply the knowledge gained from theoretical and practical courses to be creative, well planned, organized and coordinated
CO3	Identify the problem.
CO4	solve the identified problem based on the formulated methodology
CO5	Interpret and present the findings of the work conducted

COs and POs Mapping:

COs	POs					
	1	2	3	4	5	6
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

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped,
Level 0- Not Mapped

Course Code:	24CN311	Course Title:	ADVANCED DATA ANALYSIS
Credits:	3	L – T – P	3-0-3

Course objectives:

To impart knowledge on the

- 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

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Lab experiment videos
4. Blended Mode of Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I STATISTICAL DATA ANALYSIS	[9 hours]
Data and Statistics- Review of Basic Statistical Measures-Probability Distributions- Testing of Hypotheses-Non-Parametric Tests.	

UNIT II BASIC CONCEPTS	[9 hours]
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 hours]
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 hours]
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 hours]
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	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Describe the different statistical analysis techniques.
CO2	Students will be able to formulate hypothesis
CO3	Explore the basic concepts of statistical analysis
CO4	Develop regression and factor analysis model and its interpretation
CO5	Create discriminant and cluster analysis model and its interpretation

COs and POs Mapping:

COs	POs					
	1	2	3	4	5	6
CO1	2	1	2	-	-	-
CO2	2	3	2	-	-	-
CO3	2	1	2	-	-	-
CO4	3	2	2	-	-	-
CO5	1	2	3	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped,
Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final Marks
Continuous Internal Examination (CIA) - Theory	CIA – I	100	50	100	40
	CIA – II	100			
	Assignment/Project	20	40		
	Skill Assessment - I	40			
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	30	30	30
Understand	30	30	30
Apply	20	20	20
Analyse	20	20	20
Evaluate	0	0	0
Create	0	0	0

REFERENCE BOOKS:

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 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 Code:	24CN312	Course Title:	ENVIRONMENTAL IMPACT ASSESSMENT FOR CONSTRUCTION ENGINEERS
Credits:	3	L – T – P	3-0-3

Course objectives:

To impart knowledge on the

- 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

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Lab experiment videos
4. Blended Mode of Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I INTRODUCTION	[9 hours]
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 hours]
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 hours]
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 hours]
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 hours]
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.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Apply the knowledge of science and engineering fundamentals to sustainable development challenges.
CO2	Explain the identification, prediction, and evaluation of impacts that will be caused by projects or industries on biodiversity.
CO3	Identify the legal requirements of environmental impact assessment for projects.
CO4	Develop the ability to perform integrated analysis by considering environmental, social, and health impacts.
CO5	select appropriate methods for environmental impact assessment for Infrastructure and environmental service.

COs and POs Mapping:

COs	POs					
	1	2	3	4	5	6
CO1	3	2	2	-	-	-
CO2	2	2	3	-	-	-
CO3	2	1	1	-	-	-
CO4	1	1	3	-	-	-
CO5	3	2	2	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped, Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final Marks
Continuous Internal Examination (CIA) - Theory	CIA – I	100	50	100	40
	CIA – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	30	30	30
Understand	30	30	30
Apply	20	20	20
Analyse	20	20	20
Evaluate	0	0	0
Create	0	0	0

REFERENCE BOOKS :

1. Anjaneyulu, Yerramilli, and Valli Manickam, "Environmental impact assessment methodologies", Hyderabad: BS Publications, Third Edition 2022.
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 Code:	24CN313	Course Title:	LEAN CONSTRUCTION CONCEPTS, TOOLS AND PRACTICES
Credits:	3	L – T – P	3-0-3

<p>Course objectives:</p> <p>To impart knowledge on the</p> <ul style="list-style-type: none"> • 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.
<p>Teaching-Learning Process:</p> <p>Suggested strategies that teachers may use to effectively achieve the course outcomes:</p> <ol style="list-style-type: none"> 1. Chalk and Talk 2. PowerPoint presentation 3. Lab experiment videos 4. Blended Mode of Learning 5. Experiential Learning 6. NPTEL and Other Videos 7. Smart Class Room 8. Flipped Class

UNIT I INTRODUCTION	[9 hours]
<p>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.</p>	

UNIT II LEAN MANAGEMENT	[9 hours]
<p>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</p>	

UNIT III CORE CONCEPTS IN LEAN	[9 hours]
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 hours]
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 hours]
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	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Explains the contemporary management techniques and the issues in the present scenario.
CO2	Apply the basics of lean management principles and their evolution from the manufacturing industry to the construction industry.
CO3	Develops a better understanding of core concepts of lean construction tools and techniques and their importance in achieving better productivity.
CO4	Apply lean techniques to achieve sustainability in construction projects.
CO5	Apply lean construction techniques in design and modeling

COs and POs Mapping:

COs	POs					
	1	2	3	4	5	6
CO1	2	1	2	-	-	-
CO2	2	1	1	-	-	-
CO3	2	1	1	-	-	-
CO4	3	1	1	-	-	-
CO5	2	1	1	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped,
Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final Marks
Continuous Internal Examination (CIA) - Theory	CIA – I	100	50	100	40
	CIA – II	100			
	Assignment/Project	20	40		
	Skill Assessment - I	40			
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	30	30	30
Understand	30	30	30
Apply	20	20	20
Analyse	20	20	20
Evaluate	0	0	0
Create	0	0	0

REFERENCE BOOKS :

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., and Tzortzopoulos, P., Implementing lean in construction: Lean construction and BIM, CIRIA, 2013.
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.
6. Lincoln H. Forbes, Syed M. Ahmed, Lean Project Delivery and Integrated Practices in Modern Construction, Routledge Publishers, 2nd Edition, 2020.

Course Code:	24CN314	Course Title:	MAINTENANCE, REPAIR AND REHABILITATION OF STRUCTURES
Credits:	3	L – T – P	3-0-3

Course objectives:

- To study the damages, repair and rehabilitation of structures

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

- Chalk and Talk
- PowerPoint presentation
- Lab experiment videos
- Blended Mode of Learning
- Experiential Learning
- NPTEL and Other Videos
- Smart Class Room
- Flipped Class

UNIT I MAINTENANCE AND REPAIR STRATEGIES INTRODUCTION	[9 hours]
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 hours]
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 hours]
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 hours]
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 hours]
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	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Explain the importance of maintenance assessment and repair strategies
CO2	Acquire knowledge of strength and durability properties and their effects due to climate and temperature.
CO3	Gain knowledge of recent developments in repair
CO4	Explain the techniques for repair and protection methods
CO5	Explain the repair, rehabilitation and retrofitting of structures and demolition methods.

COs and POs Mapping:

COs	POs					
	1	2	3	4	5	6
CO1	3	-	2	-	-	-
CO2	3	1	-	-	-	-
CO3	3	-	2	-	-	-
CO4	3	1	-	-	-	-
CO5	3	2	1	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped,
Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final Marks
Continuous Internal Examination (CIA) - Theory	CIA – I	100	50	100	40
	CIA – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	30	30	30
Understand	30	30	30
Apply	20	20	20
Analyse	20	20	20
Evaluate	0	0	0
Create	0	0	0

REFERENCE BOOKS :

1. Dodge Woodson, Concrete Structures, Protection, Repair and Rehabilitation, Butterworth- Heinemann, Elsevier, New Delhi 2012
2. Dov Kominetzky.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
6. BS EN 1504 - Products and systems for the protection and repair of concrete structures - Definitions, requirements, quality control and evaluation of conformity

Course Code:	24CN321	Course Title:	MATERIAL MANAGEMENT
Credits:	3	L – T – P	3-0-3

Course objectives:

- To get familiar with the material management organization and procurement process.
- To understand the inventory management and material storage systems
- To know the concept of material quality control and wastage management of materials

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Lab experiment videos
4. Blended Mode of Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I MATERIALS MANAGEMENT IMPORTANCE**[9 hours]**

Importance -its role in construction industry-scope, objectives and functions of material management, Integrated approach to materials management, Role of materials manager. Organizing for materials management – basis for forming organizations – conventional and modern approaches to organizing materials management. Materials identification – classification and codification of materials – standardization – simplification and variety reduction of materials

UNIT II MATERIAL PROCUREMENT**[9 hours]**

Material research, Identification of sources of procurement, Planning and creative Purchasing of Materials – Purchase under different situations - Bulk purchasing - budgeting- Norms of Vendor Rating – vendor analysis- Concept of (MRP)- Supply Management – Sources of Supply – Out Sourcing Material Management- Procurement Organization - Procurement Planning and Methods – Legal Aspects – Insurance of Materials, concept of international purchase

UNIT III INVENTORY MANAGEMENT**[9 hours]**

Inventory Control techniques. Economical Order Quantity (EOQ), Advantages and limitation, ABC analysis-Procedure and its use, concept of (JIT)- Just in time management, Use of (MMS) – Materials Management Systems in materials planning, procurement, inventory, control, cost control etc. Introduction to application of software used for material management

UNIT IV STORES MANAGEMENT	[9 hours]
Storing of Materials- Management of stores –Receipt and inspection- location -site layout and site organization– different types of stores – methods of storing –store accounts -stock verification- care, safety and security of materials - losses on storage-wastage, stores equipment – materials handling equipment – factors affecting materials handling	

UNIT V QUALITY CONTROL AND WASTE MANAGEMENT	[9 hours]
Conventional methods of quality control of Construction materials. Statistical method of quality control, sampling techniques quality control in process. Quality management and its economics. OR techniques in material management- Obsolete, surplus and Scrap Materials Management – reasons for accumulation of surplus obsolete and scrap materials – methods of disposal – regulations and procedures	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Decide the plan for organizing material and store management.
CO2	Create purchase order for procuring material
CO3	Apply inventory control techniques for material Management.
CO4	Apply storage techniques for material Management.
CO5	Suggest quality control techniques and remedial measures to control material wastage.

COs and POs Mapping:

COs	POs					
	1	2	3	4	5	6
CO1	3	-	2	-	-	-
CO2	3	1	-	-	-	-
CO3	3	-	2	-	-	-
CO4	3	1	-	-	-	-
CO5	3	2	1	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped,
Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final Marks
Continuous Internal Examination (CIA) - Theory	CIA – I	100	50	100	40
	CIA – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	30	30	30
Understand	30	30	30
Apply	20	20	20
Analyse	20	20	20
Evaluate	0	0	0
Create	0	0	0

REFERENCE BOOKS :

1. Gopala Krishnan, Handbook of Material management, Prentice Hall Publications.
2. Richard J. Tersine, Modern Materials Management, John Hardin Campbell-2007
3. Arnold, Introduction to materials management, Pearson Education India, 2009
4. Lee and Dobler, Purchasing and Material Management, Mcgraw hill Publications
5. K S Menon Purchasing and Inventory control, Wheeler Publications

Course Code:	24CN322	Course Title:	DIGITAL DESIGN AND CONSTRUCTION
Credits:	3	L – T – P	3-0-3

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.
- To learn and acquire knowledge in Modern Digital Technologies in Construction

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Lab experiment videos
4. Blended Mode of Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I INTRODUCTION TO BIM FOR CONSTRUCTION	[9 hours]
Fundamentals of BIM – terminology, CAD & BIM. IFCs, schemas, interoperability, parametric modeling.	
UNIT II DEVELOPMENT OF DESIGN PROCESS	[9 hours]
BIM-based design process and analysis - design coordination. BIM-based construction process – 4D, 5D, nD BIM.	
UNIT III CHALLENGES IN BIM IMPLEMENTATION	[9 hours]
BIM-based operation issues – facility management. Drivers and barriers in BIM adoption, BIM global practices.	
UNIT IV CONSTRUCTION AUTOMATION	[9 hours]
Automation in design and construction, virtual experiments – augmented reality, virtual reality, use of sensors in construction.	
UNIT V MODERN DIGITAL TECHNOLOGIES IN CONSTRUCTION	[9 hours]
Robots in construction, autonomous robots, and 3D printing technology in construction. Drones for Construction monitoring, Internet of Things, Smart Manufacturing, etc.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Create a BIM model
CO2	Develop the construction design process using BIM
CO3	Identify the challenges in BIM implementation
CO4	To use automation techniques in construction
CO5	To implement modern digital technologies in construction

COs and POs Mapping:

COs	POs					
	1	2	3	4	5	6
CO1	3	2	3	-	-	-
CO2	3	3	2	-	-	-
CO3	1	1	1	-	-	-
CO4	3	3	3	-	-	-
CO5	1	1	1	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped,
Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final Marks
Continuous Internal Examination (CIA) – Theory	CIA – I	100	50	100	40
	CIA – II	100			
	Assignment/Project	20	40		
	Skill Assessment - I	40			
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	30	30	30
Understand	30	30	30
Apply	20	20	20
Analyse	20	20	20
Evaluate	0	0	0
Create	0	0	0

REFERENCE BOOKS :

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.

Course Code:	24CN323	Course Title:	ORGANIZATIONAL BEHAVIOUR
Credits:	3	L – T – P	3-0-3

<p>Course objectives:</p> <ul style="list-style-type: none"> • To learn basic concepts of organizational behavior. • To gain a solid understanding of human behavior in the workplace from an individual. • To gain a solid understanding of human behavior in the workplace in the group • To learn the concepts of Leadership and power. • To learn the dynamics of organizational behavior.
<p>Teaching-Learning Process: Suggested strategies that teachers may use to effectively achieve the course outcomes:</p> <ol style="list-style-type: none"> 1. Chalk and Talk 2. PowerPoint presentation 3. Lab experiment videos 4. Blended Mode of Learning 5. Experiential Learning 6. NPTEL and Other Videos 7. Smart Class Room 8. Flipped Class

UNIT I INTRODUCTION TO ORGANIZATIONAL BEHAVIOUR	[9 hours]
Definition, need, and importance of organizational behaviour –Nature and scope – Frame work – Organizational behaviour models.	

UNIT II INDIVIDUAL BEHAVIOUR	[9 hours]
Personality: types –Factors influencing personality, theories–Types of learners – The learning process –Learning theories –Organizational behaviour modification –Misbehaviour: Types and Management Intervention - Emotions: Emotional Labour –Emotional Intelligence –Theories – Attitudes: Characteristics, Components, Formation, Measurement, and Values - Perceptions: Importance, Factors influencing perception –Interpersonal perception -Impression Management Motivation –importance –Types –Effects on work behavior	

UNIT III GROUP BEHAVIOUR	[9 hours]
Organization structure –Formation –Groups in organizations –Influence –Group dynamics – Emergence of informal leaders and working norms –Group decision-making techniques –Team building -Interpersonal relations –Communication –Control.	

UNIT IV LEADERSHIP AND POWER	[9 hours]
Meaning –Importance–Leadership styles –Theories –Leaders Vs Managers –Sources of power – Power centers –Power and Politics.	

UNIT V DYNAMICS OF ORGANIZATIONAL BEHAVIOUR	[9 hours]
Organizational culture and climate –Factors affecting organizational climate – Importance of Job satisfaction –Determinants–Measurements – Influence on behavior - Organizational change – Importance –Stability Vs Change – Proactive Vs Reaction change– The change process – Resistance to change – Managing change - Stress - Work Stressors–Prevention and Management of stress – Balancing work and Life - Organizational development –Characteristics and objectives –.Organizational effectiveness.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Identify the need and importance of organizational behavior and the framework of organizational models
CO2	Explain the various learning theories and develop alternative organizational behavior approaches in the workplace
CO3	Describe the importance of group dynamics and team building.
CO4	Explore the various leadership styles and politics.
CO5	Explain the dynamics of organizational behaviour with the balance of work life.

COs and POs Mapping:

COs	POs					
	1	2	3	4	5	6
CO1	1	1	3	-	-	-
CO2	2	1	1	-	-	-
CO3	1	2	2	-	-	-
CO4	1	1	1	-	-	-
CO5	1	1	1	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped,
Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final Marks
Continuous Internal Examination (CIA) - Theory	CIA – I	100	50	100	40
	CIA – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	30	30	30
Understand	30	30	30
Apply	20	20	20
Analyse	20	20	20
Evaluate	0	0	0
Create	0	0	0

REFERENCE BOOKS :

1. Stephen P. Robins, "Organizational Behavior", PHI Learning / Pearson Education, 15th edition, 2012.
2. Fred Luthans, "Organisational Behavior", McGraw Hill, 12th Edition, 2005.
3. Schermerhorn, Hunt, and Osborn, "Organizational Behavior", John Wiley, 12th Edition, 2011.
4. Udai Pareek, "Understanding Organizational Behaviour", 2nd Edition, Oxford Higher Education, 2008.
5. Mc Shane & Von Glinov, "Organizational Behaviour", 6th Edition, Tata McGraw Hill, 2012.

Course Code:	24CN324	Course Title:	SUPPLY CHAIN MANAGEMENT AND LOGISTICS IN CONSTRUCTION
Credits:	3	L – T – P	3-0-3

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.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Lab experiment videos
4. Blended Mode of Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I INTRODUCTION	[9 hours]
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 hours]
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 hours]
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 hours]
Role of logistics in achieving sustainable construction – Resource efficiency benefits of effective logistics	

UNIT V LOGISTICS OPERATIONS	[9 hours]
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.	

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Describe the conceptual and theoretical backgrounds of Supply Chain Management and logistics
CO2	Apply the strategy in logistics functions ranging from planning to execution and control.
CO3	Identify the Impact of BIM and new data management capabilities on supply chain management in construction.
CO4	Analyze the implications of various strategic choices and decide on a better course of action.
CO5	Understand the role of construction logistic Managers and Delivery management systems.

COs and POs Mapping:

COs	POs					
	1	2	3	4	5	6
CO1	3	1	1	-	-	-
CO2	3	3	3	-	-	-
CO3	1	1	1	-	-	-
CO4	3	1	3	-	-	-
CO5	3	3	3	-	-	-

Level 3- Highly Mapped, Level 2- Moderately Mapped, Level 1- Low Mapped,
Level 0- Not Mapped

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final Marks
Continuous Internal Examination (CIA) - Theory	CIA – I	100	50	100	40
	CIA – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	30	30	30
Understand	30	30	30
Apply	20	20	20
Analyse	20	20	20
Evaluate	0	0	0
Create	0	0	0

REFERENCE BOOKS:

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 2010

OPEN ELECTIVES

Course Code:	24CP311	Course Title:	BLOCKCHAIN TECHNOLOGIES
Credits:	3	L – T – P	3-0-3

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 smart contract.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Lab experiment videos
4. Blended Mode of Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I	INTRODUCTION OF CRYPTOGRAPHY AND BLOCKCHAIN	[9 hours]
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 hours]
Introduction to Bitcoin, The Bitcoin Network, The Bitcoin Mining Process, Mining Developments, Bitcoin Wallets, Decentralization and Hard Forks, Ethereum Virtual Machine (EVM), Merkle Tree, Double-Spend Problem, Blockchain and Digital Currency, Transactional Blocks, Impact of Blockchain Technology on Cryptocurrency.		
UNIT III	INTRODUCTION TO ETHEREUM	[9 hours]
Introduction to Ethereum, Consensus Mechanisms, Metamask Setup, Ethereum Accounts,, Transactions, Receiving Ethers, Smart Contracts.		

UNIT IV INTRODUCTION TO HYPERLEDGER AND SOLIDITY PROGRAMMING	[9 hours]
Introduction to Hyperledger, Distributed Ledger Technology & its Challenges, Hyperledger & Distributed Ledger Technology, Hyperledger Fabric, Hyperledger 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 IV BLOCKCHAIN APPLICATIONS	[9 hours]
Internet of Things, Medical Record Management System, Domain Name Service and Future of Block chain, Alt Coins.	

TOTAL: 45 PERIODS**Course outcomes:**

On completion of the course, the student will have the ability to:

CO1	Understand and explore the working of Block chain technology
CO2	Analyze the working of Smart Contracts
CO3	Understand and analyze the working of Hyperledger
CO4	Apply the learning of solidity to build de-centralized apps on Ethereum
CO5	Develop applications on Block chain

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final Marks
Continuous Internal Examination (CIA) - Theory	CIA – I	100	50	100	40
	CIA – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
Total					100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	30	30	30
Understand	30	30	30
Apply	20	20	20
Analyse	20	20	20
Evaluate	0	0	0
Create	0	0	0

REFERENCES:

1. Imran Bashir, "Mastering Blockchain: 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 Cryptocurrency Technologies: A Comprehensive Introduction" Princeton University Press, 2016
3. Antonopoulos, Mastering Bitcoin, O'Reilly Publishing, 2014. .
4. Antonopoulos and G. Wood, "Mastering Ethereum: Building Smart Contracts and Dapps", O'Reilly Publishing, 2018.
5. D. Drescher, Blockchain Basics. Apress, 2017.

Course Code:	24CP310	Course Title:	DEEP LEARNING
Credits:	3	L – T – P	3-0-3

Course objectives:

- Develop and Train Deep Neural Networks.
- Develop a CNN, R-CNN, Fast R-CNN, Faster-R-CNN, Mask-RCNN for detection and recognition
- Build and train RNNs, work with NLP and Word Embeddings
- The internal structure of LSTM and GRU and the differences between them
- The Auto Encoders for Image Processing

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Lab experiment videos
4. Blended Mode of Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I DEEP LEARNING CONCEPTS	[9 hours]
Fundamentals about Deep Learning. Perception Learning Algorithms. Probabilistic modelling. Early Neural Networks. How Deep Learning different from Machine Learning. Scalars. Vectors. Matrixes, Higher Dimensional Tensors. Manipulating Tensors. Vector Data. Time Series Data. Image Data. Video Data.	
UNIT II NEURAL NETWORKS	[9 hours]
About Neural Network. Building Blocks of Neural Network. Optimizers. Activation Functions. Loss Functions. Data Pre-processing for neural networks, Feature Engineering. Overfitting and Under fitting. Hyper parameters.	
UNIT III CONVOLUTIONAL NEURAL NETWORK	[9 hours]
About CNN. Linear Time Invariant. Image Processing Filtering. Building a convolutional neural network. Input Layers, Convolution Layers. Pooling Layers. Dense Layers. Backpropagation Through the Convolutional Layer. Filters and Feature Maps. Backpropagation Through the Pooling Layers. Dropout Layers and Regularization. Batch Normalization. Various Activation Functions. Various Optimizers. LeNet, AlexNet, VGG16, ResNet. Transfer Learning with Image Data. Transfer Learning using Inception Oxford VGG Model, Google Inception Model, Microsoft ResNet Model. R-CNN, Fast R-CNN, Faster R-CNN, Mask-RCNN, YOLO	
UNIT IV NATURAL LANGUAGE PROCESSING USING RNN	[9 hours]
About NLP & its Toolkits. Language Modeling . Vector Space Model (VSM). Continuous Bag of Words (CBOW). Skip-Gram Model for Word Embedding. Part of Speech (PoS) Global Co- occurrence Statistics–based Word Vectors. Transfer Learning. Word2Vec. Global Vectors for Word Representation GloVe. Backpropagation Through Time. Bidirectional RNNs (BRNN) . Long Short Term Memory (LSTM). Bi-directional LSTM. Sequence-to-Sequence Models (Seq2Seq). Gated recurrent unit GRU.	
UNIT V DEEP REINFORCEMENT & UNSUPERVISED LEARNING	[9 hours]
About Deep Reinforcement Learning. Q-Learning. Deep Q-Network (DQN). Policy Gradient Methods. Actor-Critic Algorithm. About Autoencoding. Convolutional Auto Encoding. Variational Auto Encoding. Generative Adversarial Networks. Autoencoders for Feature Extraction. Auto Encoders for Classification. Denoising Autoencoders. Sparse Autoencoders	

TOTAL: 45 PERIODS

Course outcomes:

On completion of the course, the student will have the ability to:

CO1	Feature Extraction from Image and Video Data
CO2	Implement Image Segmentation and Instance Segmentation in Images
CO3	Implement image recognition and image classification using a pretrained network (Transfer Learning)
CO4	Traffic Information analysis using Twitter Data
CO5	Auto encoder for Classification & Feature Extraction

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final Marks
Continuous Internal Examination (CIA) - Theory	CIA – I	100	50	100	40
	CIA – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
Total					100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	30	30	30
Understand	30	30	30
Apply	20	20	20
Analyse	20	20	20
Evaluate	0	0	0
Create	0	0	0

REFERENCES

1. Deep Learning A Practitioner’s Approach Josh Patterson and Adam Gibson O’Reilly Media, Inc.2017
2. Learn Keras for Deep Neural Networks, Jojo Moolayil, Apress,2018
3. Deep Learning Projects Using TensorFlow 2, Vinita Silaparasetty, Apress, 2020
4. Deep Learning with Python, FRANÇOIS CHOLLET, MANNING SHELTER ISLAND,2017
5. Pro Deep Learning with TensorFlow, Santanu Pattanayak, Apress,2017

Course Code:	24IS342	Course Title:	VIBRATION AND NOISE CONTROL STRATEGIES
Credits:	3	L – T – P	3-0-3

<p>Course objectives:</p> <ul style="list-style-type: none"> • To appreciate the basic concepts of vibration in damped and undamped systems • To appreciate the basic concepts of noise, its effect on hearing and related terminology • To use the instruments for measuring and analyzing the vibration levels in a body • To use the instruments for measuring and analyzing the noise levels in a system • To learn the standards of vibration and noise levels and their control techniques
<p>Teaching-Learning Process: Suggested strategies that teachers may use to effectively achieve the course outcomes:</p> <ol style="list-style-type: none"> 1. Chalk and Talk 2. PowerPoint presentation 3. Lab experiment videos 4. Blended Mode of Learning 5. Experiential Learning 6. NPTEL and Other Videos 7. Smart Class Room 8. Flipped Class

UNIT I BASICS OF VIBRATION	[9 hours]
Introduction — Sources and causes of Vibration-Mathematical Models - Displacement, velocity and Acceleration - Classification of vibration: free and forced vibration, undamped and damped vibration, linear and non-linear vibration - Single Degree Freedom Systems - Vibration isolation - Determination of natural frequencies	

UNIT II BASICS OF NOISE	[9 hours]
Introduction - Anatomy of human ear - Mechanism of hearing - Amplitude, frequency, wavelength and sound pressure level - Relationship between sound power, sound intensity and sound pressure level - Addition, subtraction and averaging decibel levels - sound spectra -Types of sound fields - Octave band analysis - Loudness.	

UNIT III INSTRUMENTATION FOR VIBRATION MEASUREMENT	[9 hours]
Experimental Methods in Vibration Analysis.- Vibration Measuring Instruments - Selection of Sensors - Accelerometer Mountings - Vibration Exciters - Mechanical, Hydraulic, Electromagnetic and Electrodynamics – Frequency Measuring Instruments - . System Identification from Frequency Response -Testing for resonance and mode shapes	

UNIT IV INSTRUMENTATION FOR NOISE MEASUREMENT AND ANALYSIS	[9 hours]
Microphones - Weighting networks - Sound Level meters, its classes and calibration - Noise measurements using sound level meters - Data Loggers - Sound exposure meters - Recording of noise - Spectrum analyser - Intensity meters - Energy density sensors - Sound source localization	

UNIT V METHODS OF VIBRATION CONTROL, SOURCES OF NOISE AND ITS CONTROL	[9 hours]
Specification of Vibration Limits – Vibration severity standards - Vibration as condition Monitoring Tool — Case Studies - Vibration Isolation methods - Dynamic Vibration Absorber — Need for Balancing - Static and Dynamic Balancing machines – Field balancing - Major sources of noise - Noise survey techniques – Measurement technique for vehicular noise - Road vehicles Noise standard – Noise due to construction equipment and domestic appliances – Industrial noise sources and its strategies – Noise control at the source – Noise control along the path – Acoustic Barriers – Noise control at the receiver -- Sound transmission through barriers — Noise reduction Vs Transmission loss - Enclosures	

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On Completion of the course the student will be able to

CO1	Apply the basic concepts of vibration in damped and undamped systems
CO2	Apply the basic concepts of noise and to understand its effects on systems
CO3	Select the instruments required for vibration measurement and its analysis
CO4	Select the instruments required for noise measurement and its analysis.
CO5	Recognize the noise sources and to control the vibration levels in a body and to control noise under different strategies.

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final Marks
Continuous Internal Examination (CIA) – Theory	CIA – I	100	50	100	40
	CIA – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	30	30	30
Understand	30	30	30
Apply	20	20	20
Analyse	20	20	20
Evaluate	0	0	0
Create	0	0	0

REFERENCES:

1. Singiresu S. Rao, "Mechanical Vibrations", Pearson Education Incorporated, 2017.
2. Graham Kelly. Sand Shashidhar K. Kudari, "Mechanical Vibrations", Tata McGraw –Hill Publishing Com. Ltd., 2007.
3. Ramamurti. V, "Mechanical Vibration Practice with Basic Theory", Narosa Publishing House, 2000.
4. William T. Thomson, "Theory of Vibration with Applications", Taylor & Francis, 2003.
5. G.K. Grover, "Mechanical Vibrations", Nem Chand and Bros., Roorkee, 2014.
6. A.G. Ambekar, "Mechanical Vibrations and Noise Engineering", PHI Learning Pvt. Ltd., 2014.
7. David A. Bies and Colin H. Hansen, "Engineering Noise Control — Theory and Practice", Spon Press, London and New York, 2009.

Course Code:	24TE341	Course Title:	ENERGY CONSERVATION AND MANAGEMENT IN DOMESTIC SECTORS
Credits:	3	L – T – P	3-0-3

Course objectives:

- To learn the present energy scenario and the need for energy conservation.
- To understand the different measures for energy conservation in utilities.
- Acquaint students with principle theories, materials, and construction techniques to create energy efficient buildings.
- To identify the energy demand and bridge the gap with suitable technology for sustainable habitat
- To get familiar with the energy technology, current status of research and find the ways to optimize a system as per the user requirement

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Lab experiment videos
4. Blended Mode of Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I ENERGY SCENARIO	[9 hours]
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 hours]
Basics of Refrigeration and Air Conditioning — COP / EER / SEC Evaluation — SPV system design & optimization for Solar Refrigeration.	
UNIT III LIGHTING, COMPUTER, TV	[9 hours]
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 hours]
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 hours]
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**COURSE OUTCOMES:**

CO1	Understand technical aspects of energy conservation scenario.
CO2	Energy audit in any type for domestic buildings and suggest the conservation measures.
CO3	Perform building load estimates and design the energy efficient landscape system.
CO4	Gain knowledge to utilize an appliance/device sustainably. Understand the status and current technological advancement
CO5	Understand the status and current technological advancement in energy storage field.

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final Marks
Continuous Internal Examination (CIA) - Theory	CIA – I	100	50	100	40
	CIA – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	30	30	30
Understand	30	30	30
Apply	20	20	20
Analyse	20	20	20
Evaluate	0	0	0
Create	0	0	0

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.
5. Guide book for National Certification Examination for Energy Managers and Energy Auditors (Could be downloaded from www.energymanagertraining.com)
6. Ibrahim Dincer and Mark A. Rosen, Thermal Energy Storage Systems and Applications, John Wiley & Sons 2002.
7. Robert Huggins, Energy Storage: Fundamentals, Materials and Applications, 2nd edition, Springer, 2015
8. Ru-shiliu, Leizhang, Xueliang sun, Electrochemical technologies for energy storage and conversion, Wiley publications, 2012.

Course Code:	24TE342	Course Title:	ELECTRIC VEHICLE TECHNOLOGY
Credits:	3	L – T – P	3-0-3

Course objectives:

- Understand the architecture and vehicle dynamics of electric and hybrid vehicles
- Analyze and model the power management systems for electric and hybrid vehicles

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Lab experiment videos
4. Blended Mode of Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I	NEED FOR ELECTRIC VEHICLES	[9 hours]
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 ARCHITECTURE	[9 hours]
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 hours]
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 hours]
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 hours]
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**COURSE OUTCOMES:**

CO1	Understand the architecture and vehicle dynamics of electric and hybrid vehicles
CO2	Analyze and model the power management systems for electric and hybrid vehicles
CO3	Devise power electronics based control strategies for electric and hybrid vehicles
CO4	Analyze and design various components of electric and hybrid vehicles with environment concern
CO5	Investigate and model the issues in mathematical domain related to grid interconnections of electric and hybrid vehicle.

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final Marks
Continuous Internal Examination (CIA) - Theory	CIA – I	100	50	100	40
	CIA – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	30	30	30
Understand	30	30	30
Apply	20	20	20
Analyse	20	20	20
Evaluate	0	0	0
Create	0	0	0

REFERENCES:

1. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, 2nd 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

Course Code:	24TE343	Course Title:	NEW PRODUCT DEVELOPMENT
Credits:	3	L – T – P	3-0-3

Course objectives:

- Applying the principles of generic development process; and understanding the organization structure for new product design and development.
- Identifying opportunity and planning for new product design and development.
- Conducting customer need analysis; and setting product specification for new product design and development.
- Generating, selecting, and testing the concepts for new product design and development.
- Applying the principles of Industrial design and prototype for new product design and development.

<p>Teaching-Learning Process: Suggested strategies that teachers may use to effectively achieve the course outcomes:</p> <ol style="list-style-type: none"> 1. Chalk and Talk 2. PowerPoint presentation 3. Lab experiment videos 4. Blended Mode of Learning 5. Experiential Learning 6. NPTEL and Other Videos 7. Smart Class Room 8. Flipped Class
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UNIT I INTRODUCTION TO PRODUCT DESIGN & DEVELOPMENT	[9 hours]
Introduction – Characteristics of Successful Product Development – People involved in Product Design and Development – Duration and Cost of Product Development – The Challenges of Product Development – The Product Development Process – Concept Development: The Front- End Process – Adapting the Generic Product Development Process – Product Development Process Flows – Product Development Organizations.	
UNIT II OPPORTUNITY IDENTIFICATION & PRODUCT PLANNING	[9 hours]
Opportunity Identification: Definition – Types of Opportunities – Tournament Structure of Opportunity Identification – Effective Opportunity Tournaments – Opportunity Identification Process – Product Planning: Four types of Product Development Projects – The Process of Product Planning.	
UNIT III IDENTIFYING CUSTOMER NEEDS & PRODUCT SPECIFICATIONS	[9 hours]
Identifying Customer Needs: The Importance of Latent Needs – The Process of Identifying Customer Needs. Product Specifications: Definition – Time of Specifications Establishment – Establishing Target Specifications – Setting the Final Specifications	
UNIT IV CONCEPT GENERATION, SELECTION & TESTING	[9 hours]
Concept Generation: Activity of Concept Generation – Structured Approach – Five step method of Concept Generation. Concept Selection: Methodology – Concept Screening and Concepts Scoring. Concept testing: Seven Step activities of concept testing.	
UNIT V INDUSTRIAL DESIGN & PROTOTYPING	[9 hours]
Industrial Design: Need and Impact–Industrial Design Process. Prototyping – Principles of Prototyping – Prototyping Technologies – Planning for Prototypes	

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1	Apply the principles of generic development process; and understand the organization structure for new product design and development
CO2	Identify opportunity and plan for new product design and development.
CO3	Conduct customer need analysis; and set product specification for new product design and development.
CO4	Generate, select, and test the concepts for new product design and development
CO5	Apply the principles of Industrial design and prototype for design and develop new products.

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final Marks
Continuous Internal Examination (CIA) - Theory	CIA – I	100	50	100	40
	CIA – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
Total					100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	30	30	30
Understand	30	30	30
Apply	20	20	20
Analyse	20	20	20
Evaluate	0	0	0
Create	0	0	0

TEXT BOOK:

1. Ulrich K.T., Eppinger S. D. and Anita Goyal, “Product Design and Development” McGraw-Hill Education; 7 edition, 2020.

REFERENCES:

1. Belz A., 36-Hour Course: “Product Development” McGraw-Hill, 2010.
2. Rosenthal S., “Effective Product Design and Development”, Business One Orwin, Homewood, 1992, ISBN1-55623-603-4.
3. Pugh.S, “Total Design Integrated Methods for Successful Product Engineering”, Addison Wesley Publishing, 1991, ISBN0-202-41639-5.
4. Chitale, A. K. and Gupta, R. C., Product Design and Manufacturing, PHI Learning, 2013.
5. Jamnia, A., Introduction to Product Design and Development for Engineers, CRC Press, 2018.

Course Code:	24IS341	Course Title:	MICRO AND SMALL BUSINESS MANAGEMENT
Credits:	3	L – T – P	3-0-3

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.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Lab experiment videos
4. Blended Mode of Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I	INTRODUCTION TO SMALL BUSINESS	[9 hours]
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 hours]
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 hours]
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 hours]
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 hours]
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**COURSE OUTCOMES:**

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

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final Marks
Continuous Internal Examination (CIA) - Theory	CIA – I	100	50	100	40
	CIA – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	30	30	30
Understand	30	30	30
Apply	20	20	20
Analyse	20	20	20
Evaluate	0	0	0
Create	0	0	0

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.

Course Code:	24IS343	Course Title:	INTELLECTUAL PROPERTY RIGHTS
Credits:	3	L – T – P	3-0-3

Course objectives:

- To understand intellectual property rights and its valuation.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

- Chalk and Talk
- PowerPoint presentation
- Lab experiment videos
- Blended Mode of Learning
- Experiential Learning
- NPTEL and Other Videos
- Smart Class Room
- Flipped Class

UNIT I INTRODUCTION	[9 hours]
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 hours]
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 hours]
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 hours]
Strategies for investing in R&D, Patent Information and databases, IPR strength in India, Traditional Knowledge, Case studies.	
UNIT V MODELS	[9 hours]
The technologies Know-how, concept of ownership, Significance of IP in Value Creation, IP Valuation and IP Valuation Models, Application of Real Option Model in Strategic Decision Making, Transfer and Licensing.	

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1	Understanding of intellectual property and appreciation of the need to protect
CO2	Awareness about the process of patenting
CO3	Understanding of the statutes related to IPR
CO4	Ability to apply strategies to protect intellectual property
CO5	Ability to apply models for making strategic decisions related to IPR

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final Marks
Continuous Internal Examination (CIA) – Theory	CIA – I	100	50	100	40
	CIA – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	30	30	30
Understand	30	30	30
Apply	20	20	20
Analyse	20	20	20
Evaluate	0	0	0
Create	0	0	0

REFERENCES

1. V. Sople Vinod, Managing Intellectual Property by (Prentice hall of India Pvt.Ltd), 2006.
2. Intellectual Property rights and copyrights, EssEss Publications.
3. Primer, R. Anita Rao and Bhanoji Rao, Intellectual Property Rights, Lastain Book company.
4. Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2006.
5. WIPO Intellectual Property Hand book.

Course Code:	24IS344	Course Title:	ETHICAL MANAGEMENT
Credits:	3	L – T – P	3-0-3

Course objectives:

- To help students develop knowledge and competence in ethical management and decision making in organizational contexts.

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Lab experiment videos
4. Blended Mode of Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I ETHICS AND SOCIETY	[9 hours]
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 hours]
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 hours]
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 MANAGEMENT	[9 hours]
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 hours]
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

COURSE OUTCOMES:

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

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final Marks
Continuous Internal Examination (CIA) - Theory	CIA – I	100	50	100	40
	CIA – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	30	30	30
Understand	30	30	30
Apply	20	20	20
Analyse	20	20	20
Evaluate	0	0	0
Create	0	0	0

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 Code:	24EM341	Course Title:	IoT FOR SMART SYSTEMS
Credits:	3	L – T – P	3-0-3

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

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Lab experiment videos
4. Blended Mode of Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I INTRODUCTION TO INTERNET OF THINGS	[9 hours]
Overview, Hardware and software requirements for IOT, Sensor and actuators, Technology drivers, Business drivers, Typical IoT applications, Trends and implications.	

UNIT II IOT ARCHITECTURE	[9 hours]
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:	[9 hours]
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	[9 hours]
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	[9 hours]
Industrial IoT, Home Automation, smart cities, Smart Grid, connected vehicles, electric vehicle charging, Environment, Agriculture, Productivity Applications, IOT Defense	

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final Marks
Continuous Internal Examination (CIA) - Theory	CIA – I	100	50	100	40
	CIA – II	100			
	Assignment/Project	20	40		
	Skill Assessment - I	40			
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	30	30	30
Understand	30	30	30
Apply	20	20	20
Analyse	20	20	20
Evaluate	0	0	0
Create	0	0	0

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 Wiley and sons, 2009.
11. Lars T.Berger and Krzysztof Iniewski, “Smart Grid applications, communications and security”, Wiley, 2015.
12. JanakaEkanayake, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama and Nick Jenkins, “Smart Grid Technology and Applications”, Wiley, 2015.
13. UpenaDalal,” Wireless Communications & Networks, Oxford,2015.

Course Code:	24EM342	Course Title:	SMART GRID
Credits:	3	L – T – P	3-0-3

Course objectives:

- To Study about Smart Grid technologies, different smart meters and advanced metering infrastructure.
- To know about the function of smart grid.
- To familiarize the power quality management issues in Smart Grid.
- To familiarize the high performance computing for Smart Grid applications
- To get familiarized with the communication networks for Smart Grid applications

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Lab experiment videos
4. Blended Mode of Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I INTRODUCTION TO SMART GRID	[9 hours]
Evolution of Electric Grid, Concept, Definitions and Need for Smart Grid, Smart grid drivers, functions, opportunities, challenges and benefits, Difference between conventional & Smart Grid, Comparison of Micro grid and Smart grid, Present development & International policies in Smart Grid, Smart Grid Initiative for Power Distribution Utility in India — Case Study.	

UNIT II SMART GRID TECHNOLOGIES	[9 hours]
Technology Drivers, Smart Integration of energy resources, Smart substations, Substation Automation, Feeder Automation, Transmission systems: EMS, FACTS and HVDC, Wide area monitoring, Protection and control, Distribution systems: DMS, Volt/Var control, Fault Detection, Isolation and service restoration, Outage management, High-Efficiency Distribution Transformers, Phase Shifting Transformers, Plug in Hybrid Electric Vehicles (PHEV) — Grid to Vehicle and Vehicle to Grid charging concepts.	

UNIT III SMART METERS AND ADVANCED METERING INFRASTRUCTURE	[9 hours]
Introduction to Smart Meters, Advanced Metering infrastructure (AMI) drivers and benefits, AMI protocols, standards and initiatives, AMI needs in the smart grid, Phasor Measurement Unit(PMU) & their application for monitoring & protection. Demand side management and demand response programs, Demand pricing and Time of Use, Real Time Pricing, Peak Time Pricing.	

UNIT IV POWER QUALITY MANAGEMENT IN SMART GRID	[9 hours]
Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring, Power Quality Audit.	

Unit V HIGH PERFORMANCE COMPUTING FOR SMART GRID APPLICATIONS	[9 hours]
Architecture and Standards -Local Area Network (LAN), House Area Network (HAN), Wide Area Network (WAN), Broadband over Power line (BPL), PLC, Zigbee, GSM, IP based Protocols, Basics of Web Service and CLOUD Computing, Cyber Security for Smart Grid.	

TOTAL : 45 PERIODS

COURSE OUTCOMES:

CO1	Relate with the smart resources, smart meters and other smart devices.
CO2	Explain the function of Smart Grid.
CO3	Experiment the issues of Power Quality in Smart Grid
CO4	Analyze the performance of Smart Grid.
CO5	Recommend suitable communication networks for smart grid applications

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final Marks
Continuous Internal Examination (CIE) - Theory	CIA – I	100	50	100	40
	CIA – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	30	30	30
Understand	30	30	30
Apply	20	20	20
Analyse	20	20	20
Evaluate	0	0	0
Create	0	0	0

REFERENCES

1. Stuart Borlase 'Smart Grid: Infrastructure, Technology and Solutions', CRC Press 2012.
2. JanakaEkanayake, Nick Jenkins, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama, 'Smart Grid: Technology and Applications', Wiley, 2012.
3. Mini S. Thomas, John D McDonald, 'Power System SCADA and Smart Grids', CRC Press, 2015
4. Kenneth C.Budka, Jayant G. Deshpande, Marina Thottan, 'Communication Networks for Smart Grids', Springer, 2014
5. SMART GRID Fundamentals of Design and Analysis, James Momoh, IEEE press, A John Wiley & Sons, Inc., Publication.

Course Code:	24CP301	Course Title:	SECURITY PRACTICES
Credits:	3	L – T – P	3-0-3

Course objectives:

- To learn the core fundamentals of system and web security concepts
- To have through understanding in the security concepts related to networks
- To deploy the security essentials in IT Sector
- To be exposed to the concepts of Cyber Security and cloud security
- To perform a detailed study of Privacy and Storage security and related Issues

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Lab experiment videos
4. Blended Mode of Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I SYSTEM SECURITY	[9 hours]
Model of network security – Security attacks, services and mechanisms – OSI security architecture -A Cryptography primer- Intrusion detection system- Intrusion Prevention system - Security web applications- Case study: OWASP - Top 10 Web Application Security Risks.	
UNIT II NETWORK SECURITY	[9 hours]
Internet Security - Intranet security- Local Area Network Security - Wireless Network Security - Wireless Sensor Network Security- Cellular Network Security - Mobile security - IOT security - Case Study - Kali Linux.	
UNIT III SECURITY MANAGEMENT	[9 hours]
Information security essentials for IT Managers- Security Management System - Policy Driven System Management- IT Security - Online Identity and User Management System. Case study: Metasploit	
UNIT IV CYBER SECURITY AND CLOUD SECURITY	[9 hours]
Cyber Forensics- Disk Forensics – Network Forensics – Wireless Forensics – Database Forensics – Malware Forensics – Mobile Forensics – Email Forensics- Best security practices for automate Cloud infrastructure management – Establishing trust in IaaS, PaaS, and SaaS Cloud types. Case study: DVWA	

UNIT V PRIVACY AND STORAGE SECURITY	[9 hours]
Privacy on the Internet - Privacy Enhancing Technologies - Personal privacy Policies - Detection of Conflicts in security policies- privacy and security in environment monitoring systems. Storage Area Network Security - Storage Area Network Security Devices - Risk management - Physical Security Essentials.	

TOTAL: 45 PERIODS**COURSE OUTCOMES:**

CO1	Understand the core fundamentals of system security
CO2	Apply the security concepts to wired and wireless networks
CO3	Implement and Manage the security essentials in IT Sector
CO4	Explain the concepts of Cyber Security and Cyber forensics
CO5	Be aware of Privacy and Storage security Issues.

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final Marks
Continuous Internal Examination (CIE) - Theory	CIA – I	100	50	100	40
	CIA – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
Total					100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	30	30	30
Understand	30	30	30
Apply	20	20	20
Analyse	20	20	20
Evaluate	0	0	0
Create	0	0	0

REFERENCES

1. John R. Vacca, Computer and Information Security Handbook, Third Edition, Elsevier 2017
2. Michael E. Whitman, Herbert J. Mattord, Principles of Information Security, Seventh Edition, Cengage Learning, 2022
3. Richard E. Smith, Elementary Information Security, Third Edition, Jones and Bartlett Learning, 2019
4. Mayor, K.K.Mookhey, Jacopo Cervini, Fairuzan Roslan, Kevin Beaver, Metasploit Toolkit for Penetration Testing, Exploit Development and Vulnerability Research, Syngress publications, Elsevier, 2007. ISBN : 978-1-59749-074-0
5. John Sammons, “The Basics of Digital Forensics- The Primer for Getting Started in Digital Forensics”, Syngress, 2012
6. Cory Altheide and Harlan Carvey, “Digital Forensics with Open Source Tools”, 2011 Syngress, ISBN: 9781597495875.
7. Siani Pearson, George Yee "Privacy and Security for Cloud Computing" Computer Communications and Networks, Springer, 2013.

Course Code:	24CP206	Course Title:	CLOUD COMPUTING TECHNOLOGIES
Credits:	3	L – T – P	3-0-3

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

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Lab experiment videos
4. Blended Mode of Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I VIRTUALIZATION AND VIRTUALIZATION INFRASTRUCTURE	[9 hours]
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	

UNIT II CLOUD PLATFORM ARCHITECTURE	[9 hours]
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 III AWS CLOUD PLATFORM - IAAS	[9 hours]
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 hours]
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- Blops	

UNIT V PROGRAMMING MODEL	[9 hours]
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	

COURSE OUTCOMES:

CO1	Employ the concepts of virtualization in the cloud computing
CO2	Identify the architecture, infrastructure and delivery models of cloud computing
CO3	Develop the Cloud Application in AWS platform
CO4	Apply the concepts of Windows Azure to design Cloud Application
CO5	Develop services using various Cloud computing programming models.

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, McGraw-Hill Osborne Media, 2009.
6. Jim Smith, Ravi Nair , "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.
7. John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010.
8. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", McGraw-Hill Osborne Media, 2009.
9. Tom White, "Hadoop: The Definitive Guide", Yahoo Press, 2012.



Course Code:	24TE344	Course Title:	DESIGN THINKING
Credits:	3	L – T – P	3-0-3

Course objectives:

- To provide a sound knowledge in UI & UX
- To understand the need for UI and UX
- Research Methods used in Design
- Tools used in UI & UX
- Creating a wireframe and prototype

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Lab experiment videos
4. Blended Mode of Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I UX LIFECYCLE TEMPLATE	[9 hours]
Introduction. A UX process lifecycle template. Choosing a process instance for your project. The system complexity space. Meet the user interface team. Scope of UX presence within the team. More about UX lifecycles. Business Strategy. Value Innovation. Validated User Research. Killer UX Design. The Blockbuster Value Proposition. What Is a Value Proposition.	

UNIT II CONTEXTUAL INQUIRY	[9 hours]
The system concept statement. User work activity data gathering. Look for emotional aspects of work practice. Abridged contextual inquiry process. Data-driven vs. model-driven inquiry. Organizing concepts: work roles and flow model. Creating and managing work activity notes. Constructing your work activity affinity diagram (WAAD). Abridged contextual analysis process. History of affinity diagrams.	

UNIT III DESIGN THINKING, IDEATION, AND SKETCHING	[9 hours]
Design-informing models: second span of the bridge . Some general “how to” suggestions. A New example domain: slideshow presentations. User models. Usage models. Work environment models. Barrier summaries. Model consolidation. Protecting your sources. Abridged methods for design- informing models extraction. Design paradigms. Design thinking. Design perspectives. User personas. Ideation. Sketching	

UNIT IV UX GOALS, METRICS, AND TARGETS	[9 hours]
Introduction. UX goals. UX target tables. Work roles, user classes, and UX goals. UX measures. Measuring instruments. UX metrics. Baseline level. Target level. Setting levels. Observed results. Practical tips and cautions for creating UX targets. How UX targets help manage the user experience engineering process.	

UNIT V ANALYSING USER EXPERIENCE	[9 hours]
Sharpening Your Thinking Tools. UX Research and Strength of Evidence. Agile Personas. How to Prioritize Usability Problems. Creating Insights, Hypotheses and Testable Design Ideas. How to Manage Design Projects with User Experience Metrics. Two Measures that Will Justify Any Design Change. Evangelizing UX Research. How to Create a User Journey Map. Generating Solutions to Usability Problems. Building UX Research Into the Design Studio Methodology. Dealing with Common objections to UX Research. The User Experience Debrief Meeting. Creating a User Experience Dashboard.	

SUGGESTED ACTIVITIES:

- 1: Hands on Design Thinking process for a product
- 2: Defining the Look and Feel of any new Project
- 3: Create a Sample Pattern Library for that product (Mood board, Fonts, Colors based on UI principles)
- 4: Identify a customer problem to solve.
- 5: Conduct end-to-end user research - User research, creating personas, Ideation process (User stories, Scenarios), Flow diagrams, Flow Mapping

TOTAL: 45 PERIODS**COURSE OUTCOMES:**

CO1	Build UI for user Applications
CO2	Use the UI Interaction behaviors and principles
CO3	Evaluate UX design of any product or application
CO4	Demonstrate UX Skills in product development
CO5	Implement Sketching principles

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final Marks
Continuous Internal Examination (CIA) - Theory	CIA – I	100	50	100	40
	CIA – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	30	30	30
Understand	30	30	30
Apply	20	20	20
Analyse	20	20	20
Evaluate	0	0	0
Create	0	0	0

REFERENCES

1. UX for Developers: How to Integrate User-Centered Design Principles Into Your Day-to- Day Development Work, Westley Knight. Apress, 2018
2. The UX Book: Process and Guidelines for Ensuring a Quality User Experience, Rex Hartson, Pardha Pyla. Morgan Kaufmann, 2012
3. UX Fundamentals for Non-UX Professionals: User Experience Principles for Managers, Writers, Designers, and Developers, Edward Stull. Apress, 2018
4. Lean UX: Designing Great Products with Agile Teams, Gothelf, Jeff, Seiden, and Josh. O'Reilly Media, 2016
5. Designing UX: Prototyping: Because Modern Design is Never Static, Ben Coleman, and Dan Goodwin. SitePoint, 2017

Course Code:	24CP341	Course Title:	PRINCIPLES OF MULTIMEDIA
Credits:	3	L – T – P	3-0-3

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

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Lab experiment videos
4. Blended Mode of Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I INTRODUCTION	[9 hours]
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	[9 hours]
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 hours]
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 hours]
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 hours]
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 Evaluation Methods:

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

COURSE OUTCOMES:

CO1	Handle the multimedia elements effectively.
CO2	Articulate the concepts and techniques used in multimedia applications.
CO3	Develop effective strategies to deliver Quality of Experience in multimedia applications
CO4	Design and implement algorithms and techniques applied to multimedia objects.
CO5	Design and develop multimedia applications following software engineering models

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final Marks
Continuous Internal Examination (CIA) - Theory	CIA – I	100	50	100	40
	CIA – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	30	30	30
Understand	30	30	30
Apply	20	20	20
Analyse	20	20	20
Evaluate	0	0	0
Create	0	0	0

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 Code:	24CP342	Course Title:	BIG DATA ANALYTICS
Credits:	3	L – T – P	3-0-3

Course objectives:

- To understand the basics of big data analytics
- To understand the search methods and visualization
- To learn mining data streams
- To learn frameworks
- To gain knowledge on R language

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Lab experiment videos
4. Blended Mode of Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I INTRODUCTION TO BIG DATA	[9 hours]
Introduction to Big Data Platform — Challenges of Conventional Systems - Intelligent data analysis –Nature of Data - Analytic Processes and Tools - Analysis Vs Reporting - Modern Data Analytic Tools- Statistical Concepts: Sampling Distributions - Re-Sampling - Statistical Inference - Prediction Error.	

UNIT II SEARCH METHODS AND VISUALIZATION	[9 hours]
Search by simulated Annealing – Stochastic, Adaptive search by Evaluation – Evaluation Strategies –Genetic Algorithm – Genetic Programming – Visualization – Classification of Visual Data Analysis Techniques – Data Types – Visualization Techniques – Interaction techniques – Specific Visual data analysis Techniques	

UNIT III MINING DATA STREAMS	[9 hours]
Introduction To Streams Concepts – Stream Data Model and Architecture - Stream Computing - Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating Moments – Counting Oneness in a Window – Decaying Window - Real time Analytics Platform(RTAP) Applications - Case Studies - Real Time Sentiment Analysis, Stock Market Predictions	

UNIT IV FRAMEWORKS	[9 hours]
MapReduce – Hadoop, Hive, MapR – Sharding – NoSQL Databases - S3 - Hadoop Distributed File Systems – Case Study- Preventing Private Information Inference Attacks on Social Networks- Grand Challenge: Applying Regulatory Science and Big Data to Improve Medical Device Innovation	

UNIT V R LANGUAGE	[9 hours]
Overview, Programming structures: Control statements -Operators -Functions -Environment and scope issues -Recursion -Replacement functions, R data structures: Vectors -Matrices and arrays - Lists -Data frames -Classes, Input/output, String manipulations	

TOTAL:45 PERIODS**COURSE OUTCOMES:**

CO1	Understand the basics of big data analytics
CO2	Ability to use Hadoop, Map Reduce Framework.
CO3	Ability to identify the areas for applying big data analytics for increasing the business outcome.
CO4	Gain knowledge on R language
CO5	Contextually integrate and correlate large amounts of information to gain faster insights.

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final Marks
Continuous Internal Examination (CIA) - Theory	CIA – I	100	50	100	40
	CIA – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	30	30	30
Understand	30	30	30
Apply	20	20	20
Analyse	20	20	20
Evaluate	0	0	0
Create	0	0	0

REFERENCE:

1. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, 2007.
2. Anand Rajaraman and Jeffrey David Ullman, Mining of Massive Datasets, Cambridge University Press, 3rd edition 2020.
3. Norman Matloff, The Art of R Programming: A Tour of Statistical Software Design, No Starch Press, USA, 2011.
4. Bill Franks, Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics, John Wiley & sons, 2012.
5. Glenn J. Myatt, Making Sense of Data, John Wiley & Sons, 2007.

Course Code:	24CM341	Course Title:	MEDICAL ROBOTICS
Credits:	3	L – T – P	3-0-3

Course objectives:

- To explain the basic concepts of robots and types of robots
- To discuss the designing procedure of manipulators, actuators and grippers
- To impart knowledge on various types of sensors and power sources
- To explore various applications of Robots in Medicine
- To impart knowledge on wearable robots

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Lab experiment videos
4. Blended Mode of Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I INTRODUCTION TO ROBOTICS	[9 hours]
Introduction to Robotics, Overview of robot subsystems, Degrees of freedom, configurations and concept of workspace, Dynamic Stabilization Sensors and Actuators Sensors and controllers, Internal and external sensors, position, velocity and acceleration sensors, Proximity sensors, force sensors Pneumatic and hydraulic actuators, Stepper motor control circuits, End effectors, Various types of Grippers, PD and PID feedback actuator models	
UNIT II MANIPULATORS & BASIC KINEMATICS	[9 hours]
Construction of Manipulators, Manipulator Dynamic and Force Control, Electronic and pneumatic manipulator, Forward Kinematic Problems, Inverse Kinematic Problems, Solutions of Inverse Kinematic problems	
UNIT III SURGICAL ROBOTS	[9 hours]
Da Vinci Surgical System, Image guided robotic systems for focal ultrasound based surgical applications, System concept for robotic Tele-surgical system for off-pump, CABG surgery, Urologic applications, Cardiac surgery, Neuro-surgery, Pediatric and General Surgery, Gynecologic Surgery, General Surgery and Nanorobotics. Case Study	
UNIT IV REHABILITATION AND ASSISTIVE ROBOTS	[9 hours]
Pediatric Rehabilitation, Robotic Therapy for the Upper Extremity and Walking, Clinical-Based Gait Rehabilitation Robots, Motion Correlation and Tracking, Motion Prediction, Motion Replication. Portable Robot for Tele rehabilitation, Robotic Exoskeletons — Design considerations, Hybrid assistive limb. Case Study	
UNIT V WEARABLE ROBOTS	[9 hours]
Augmented Reality, Kinematics and Dynamics for Wearable Robots, Wearable Robot technology, Sensors, Actuators, Portable Energy Storage, Human–robot cognitive interaction (cHRI), Human– robot physical interaction (pHRI), Wearable Robotic Communication - case study	

TOTAL:45 PERIODS**COURSE OUTCOMES:**

CO1	Describe the configuration, applications of robots and the concept of grippers and actuators
CO2	Explain the functions of manipulators and basic kinematics
CO3	Describe the application of robots in various surgeries
CO4	Design and analyze the robotic systems for rehabilitation
CO5	Design the wearable robots

REFERENCES

1. Nagrath and Mittal, “Robotics and Control”, Tata McGraw Hill, First edition, 2003
2. Spong and Vidhyasagar, “Robot Dynamics and Control”, John Wiley and Sons, First edition, 2008
3. Fu.K.S, Gonzalez. R.C., Lee, C.S.G, “Robotics, control”, sensing, Vision and Intelligence, Tata McGraw Hill International, First edition, 2008
4. Bruno Siciliano, Oussama Khatib, Springer Handbook of Robotics, 1st Edition, Springer, 2008
5. Shane (S.Q.) Xie, Advanced Robotics for Medical Rehabilitation - Current State of the Art and Recent Advances, Springer, 2016
6. Jose L. Pons, Wearable Robots: Biomechatronic Exoskeletons, John Wiley & Sons Ltd, England, 2008
7. Howie Choset, Kevin Lynch, Seth Hutchinson, “Principles of Robot Motion: Theory, Algorithms, and Implementations”, Prentice Hall of India, First edition, 2005
8. Jacob Rosen, Blake Hannaford & Richard M Satava, “Surgical Robotics: System Applications & Visions”, Springer 2011
9. Jocelyn Troccaz, Medical Robotics, Wiley, 2012
10. Achim Schweikard, Floris Ernst, Medical Robotics, Springer, 2015

Course Code:	24EM343	Course Title:	EMBEDDED AUTOMATION
Credits:	3	L – T – P	3-0-3

Course objectives:

- To learn about the process involved in the design and development of real-time embedded system
- To develop the embedded C programming skills on 8-bit microcontroller
- To study about the interfacing mechanism of peripheral devices with 8-bit microcontrollers
- To learn about the tools, firmware related to microcontroller programming
- To build a home automation system

Teaching-Learning Process:

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Lab experiment videos
4. Blended Mode of Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I INTRODUCTION TO EMBEDDED C PROGRAMMING	[9 hours]
C Overview and Program Structure - C Types, Operators and Expressions - C Control Flow - C Functions and Program Structures - C Pointers And Arrays - FIFO and LIFO - C Structures - Development Tools	
UNIT II AVR MICROCONTROLLER	[9 hours]
ATMEGA 16 Architecture - Nonvolatile and Data Memories - Port System - Peripheral Features : Time Base, Timing Subsystem, Pulse Width Modulation, USART, SPI, Two Wire Serial Interface, ADC, Interrupts - Physical and Operating Parameters	
UNIT III HARDWARE AND SOFTWARE INTERFACING WITH 8-BIT SERIES CONTROLLERS	[9 hours]
Lights and Switches - Stack Operation - Implementing Combinational Logic - Expanding I/O - Interfacing Analog To Digital Convertors - Interfacing Digital To Analog Convertors - LED Displays : Seven Segment Displays, Dot Matrix Displays - LCD Displays - Driving Relays - Stepper Motor Interface - Serial EEPROM - Real Time Clock - Accessing Constants Table - Arbitrary Waveform Generation - Communication Links - System Development Tools	
UNIT IV VISION SYSTEM	[9 hours]
Fundamentals of Image Processing - Filtering - Morphological Operations - Feature Detection and Matching - Blurring and Sharpening - Segmentation - Thresholding - Contours - Advanced Contour Properties - Gradient - Canny Edge Detector - Object Detection - Background Subtraction	
UNIT V HOME AUTOMATION	[9 hours]
Home Automation - Requirements - Water Level Notifier - Electric Guard Dog - Tweeting Bird Feeder- Package Delivery Detector - Web Enabled Light Switch - Curtain Automation - Android Door Lock- Voice Controlled Home Automation - Smart Lighting - Smart Mailbox - Electricity Usage Monitor - Proximity Garage Door Opener - Vision Based Authentic Entry System	

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1	Analyze the 8-bit series microcontroller architecture, features and pin details
CO2	Write embedded C programs for embedded system application
CO3	Design and develop real time systems using AVR microcontrollers
CO4	Design and develop the systems based on vision mechanism
CO5	Design and develop a real time home automation system

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final Marks
Continuous Internal Examination (CIA) - Theory	CIA – I	100	50	100	40
	CIA – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	30	30	30
Understand	30	30	30
Apply	20	20	20
Analyse	20	20	20
Evaluate	0	0	0
Create	0	0	0

REFERENCES:

1. Dhananjay V. Gadre, "Programming and Customizing the AVR Microcontroller", McGraw-Hill, 2001.
2. Joe Pardue, "C Programming for Microcontrollers ", Smiley Micros, 2005.
3. Steven F. Barrett, Daniel J. Pack, "ATMEL AVR Microcontroller Primer : Programming and Interfacing", Morgan & Claypool Publishers, 2012
4. Mike Riley, "Programming Your Home - Automate With Arduino, Android and Your Computer", the Pragmatic Programmers, Llc, 2012.
5. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer, 2011.
6. Kevin P. Murphy, "Machine Learning - a Probabilistic Perspective", the MIT Press Cambridge, Massachusetts, London, 2012.

Course Code:	24TE345	Course Title:	TEXTILE REINFORCED COMPOSITES
Credits:	3	L – T – P	3-0-3

Course objectives:**Teaching-Learning Process:**

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Lab experiment videos
4. Blended Mode of Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I REINFORCEMENTS	[9 hours]
Introduction – composites –classification and application; reinforcements- fibres and its properties; preparation of reinforced materials and quality evaluation; preforms for various composites	
UNIT II MATRICES	[9 hours]
Preparation, chemistry, properties and applications of thermoplastic and thermoset resins; mechanism of interaction of matrices and reinforcements; optimization of matrices	
UNIT III COMPOSITE MANUFACTURING	[9 hours]
Preparation, chemistry, properties and applications of thermoplastic and thermoset resins; mechanism of interaction of matrices and reinforcements; optimization of matrices	
UNIT IV TESTING	[9 hours]
Fibre volume and weight fraction, specific gravity of composites, tensile, flexural, impact, compression, inter laminar shear stress and fatigue properties of thermoset and thermoplastic composites.	
UNIT V MECHANICS	[9 hours]
Micro mechanics, macro mechanics of single layer, macro mechanics of laminate, classical lamination theory, failure theories and prediction of inter laminar stresses using at ware	

TOTAL: 45 PERIODS

Scheme of Evaluation:

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final Marks
Continuous Internal Examination (CIA) – Theory	CIA – I	100	50	100	40
	CIA – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	30	30	30
Understand	30	30	30
Apply	20	20	20
Analyse	20	20	20
Evaluate	0	0	0
Create	0	0	0

REFERENCES

1. BorZ.Jang, "Advanced Polymer composites", ASM International, USA, 1994.
2. Carlsson L.A. and Pipes R.B., "Experimental Characterization of advanced composite Materials", Second Edition, CRC Press, New Jersey, 1996.
3. George Lubin and Stanley T. Peters, "Handbook of Composites", Springer Publications, 1998.
4. Mel. M. Schwartz, "Composite Materials", Vol. 1 & 2, Prentice Hall PTR, New Jersey, 1997.
5. Richard M. Christensen, "Mechanics of composite materials", Dover Publications, 2005.
6. Sanjay K. Mazumdar, "Composites Manufacturing: Materials, Product, and Process Engineering", CRC Press, 2001

Course Code:	24TE346	Course Title:	NANOCOMPOSITE MATERIALS
Credits:	3	L – T – P	3-0-3

Course objectives:**Teaching-Learning Process:**

Suggested strategies that teachers may use to effectively achieve the course outcomes:

1. Chalk and Talk
2. PowerPoint presentation
3. Lab experiment videos
4. Blended Mode of Learning
5. Experiential Learning
6. NPTEL and Other Videos
7. Smart Class Room
8. Flipped Class

UNIT I BASICS OF NANOCOMPOSITES**[9 hours]**

Nomenclature, Properties, features and processing of nanocomposites. Sample Preparation and Characterization of Structure and Physical properties. Designing, stability and mechanical properties and applications of super hard nanocomposites.

UNIT II METAL BASED NANOCOMPOSITES**[9 hours]**

Metal-metal Nano composites, some simple preparation techniques and their properties. Metal- Oxide or Metal-Ceramic composites, Different aspects of their preparation techniques and their final properties and functionality. Fractal based glass-metal Nano composites, its designing and fractal dimension analysis. Core-Shell structured Nano composites

UNIT III POLYMER BASED NANOCOMPOSITES**[9 hours]**

Preparation and characterization of diblock Copolymer based nanocomposites; Polymer Carbon nanotubes based composites, their mechanical properties, and industrial possibilities.

UNIT IV NANOCOMPOSITE FROM BIOMATERIALS**[9 hours]**

Natural Nano composite systems - spider silk, bones, shells; organic-inorganic Nano composite formation through self-assembly. Biomimetic synthesis of Nano composites material; Use of synthetic Nano composites for bone, teeth replacement.

UNIT V NANOCOMPOSITE TECHNOLOGY	[9 hours]
Nano composite membrane structures- Preparation and applications. Nanotechnology in Textiles and Cosmetics-Nano-fillers embedded polypropylene fibers – Soil repellence, Lotus effect - Nano finishing in textiles (UV resistant, anti-bacterial, hydrophilic, self-cleaning, flame retardant finishes), Sun-screen dispersions for UV protection using titanium oxide — Colour cosmetics. Nanotechnology in Food Technology - Nano packaging for enhanced shelf life - Smart/Intelligent packaging.	

TOTAL: 45 PERIODS**Scheme of Evaluation:**

Component	Type of assessment	Max Marks	Reduced Marks	Total	Final Marks
Continuous Internal Examination (CIA) - Theory	CIA – I	100	50	100	40
	CIA – II	100			
	Assignment/Project	20	10		
	Skill Assessment - I	40	40		
	Skill Assessment - II	40			
End Semester Examination (ESE)	Theory Exam	100	100	100	60
				Total	100

End semester Examination: (QP PATTERN)

- Each unit consists of two 2 marks questions and one 16 marks question (either or).
- All the fifteen questions have to be answered.

Assessment Pattern

Bloom's Category	Continuous Assessment Test		Terminal Examination
	1	2	
Remember	30	30	30
Understand	30	30	30
Apply	20	20	20
Analyse	20	20	20
Evaluate	0	0	0
Create	0	0	0

REFERENCES:

1. Introduction to Nanocomposite Materials. Properties, Processing, Characterization- Thomas E. Twardowski. 2007. DEStech Publications. USA.
2. Nanocomposites Science and Technology - P. M. Ajayan, L.S. Schadler, P. V.Braun 2006.
3. Physical Properties of Carbon Nanotubes- R. Saito 1998.
4. Carbon Nanotubes (Carbon , Vol 33) - M. Endo, S. Iijima, M.S. Dresselhaus 1997.
5. The search for novel, superhard materials- Stan Veprjek (Review Article) JVST A, 1999
6. Nanometer versus micrometer-sized particles-Christian Brosseau, Jamal BeN Youssef, Philippe Talbot, Anne-Marie Konn, (Review Article) J. Appl. Phys, Vol 93, 2003
7. Diblock Copolymer, - Aviram (Review Article), Nature, 2002
8. Bikramjit Basu, Kantesh Balani Advanced Structural Ceramics, A John Wiley & Sons, Inc.,
9. P. Brown and K. Stevens, Nanofibers and Nanotechnology in Textiles, Woodhead publication, London, 2006

