AARUPADAI VEEDU INSTITUTE OF TECHNOLOGY, PAIYANOOR

&

VINAYAKA MISSION'S KIRUPANANDA VARIYAR ENGINEERING COLLEGE, SALEM

(Constituent Colleges of Vinayaka Mission's Research Foundation Deemed to be University)

AICTE APPROVED & NAAC Accredited

VINAYAKA MISSION'S RESEARCH FOUNDATION

(Deemed to be University under section 3 of the UGC Act 1956)

Faculty of Engineering and Technology

Department of Civil Engineering Programme:

M.E – Construction Engineering and Management

Part Time (3 Years)

CHOICE BASED CREDIT SYSTEM (CBCS)

Curriculum & Syllabus (Semester I to VI)

Regulations 2021

AARUPADAI VEEDU INSTITUTE OF TECHNOLOGY, PAIYANOOR
&
VINAYAKA MISSION'S KIRUPANANDA VARIYAR ENGINEERING COLLEGE, SALEM

Department of Civil Engineering

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO 1	Graduates will perform as professional engineers in the field of Construction Engineering and Management.
PEO 2	Graduates will perform well in their specialized field and also trained in teamwork and leadership positions.
PEO 3	Graduates will pursue lifelong learning in the specialized fields of Construction Engineering and Management.
PEO 4	Graduates will exhibit entrepreneurship qualities.
PEO 5	Graduates will contribute to the development of the profession, nation and society

PROGRAM SPECIFIC OUTCOMES (PSOs)

To achieve the mission of the program, Civil Engineering graduates will be able:

PSO 1	To work independently as well as in team to formulate, design, execute solutions for engineering problems and also analyze, synthesize technical data for application to product, process, system design & development
PSO 2	To understand & contribute towards social, environmental issues, following professional ethics and codes of conduct and embrace lifelong learning for continuous improvement
PSO 3	To develop expertise towards use of modern engineering tools, careers in industries and research and demonstrate entrepreneurial skill

PROGRAMME OUTCOMES

Engineering Graduates will be able to:

PO 1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

VINAYAKA MISSIONS RESEARCH FOUNDATIONS
FACULTY OF ENGINEERING AND TECHNOLOGY

CREDIT STRUCTURE FOR POST GRADUATE ENGINEERING PROGRAM
(M.E / M.TECH –PART TIME) -2021

S.No	Category of courses	Type of courses	Suggested break up of credits
1.	A. Foundation courses	Statistical Methods and Queuing Theory	3
		Research Methodology and IPR	2
2.	B. Program core courses	Core courses	32
3.	C. Elective courses	Program Electives	15
		Open Electives (Courses on Emerging Areas)	03
4.	D. Employability Enhancement Courses and courses for presentation of Technical skills related to the specialization	Project Work Phase I	06
		Project Work Phase II	12
		Technical Seminar	1
		Research Presentation Skills	1
5.	E. Audit courses	Any two courses on: 1. English for Research Paper Writing 2. Value Education 3. Constitution of India 4. Pedagogy Studies 5. Personality Development Through Life Enlighten Skills	Zero credit
Total credits to be earned for the award of M.E /M.Tech degree			**75**

CREDIT STRUCTURE FOR POST GRADUATE ENGINEERING PROGRAM (M.E / M.TECH – PART TIME) -2021

S.No	Category of courses	Type of courses	Suggested break up of credits	Course Title
1.	A.Foundation courses	Mathematics/ Applied Mathematics	3	Statistical Methods and QueuingTheory
		Research Methodology and IPR	2	Research Methodology and IPR
2.	B. Program core courses	Core courses	32	1. Construction Materials and ConcreteDesign 2. Project Formulation and Appraisal 3. Construction Planning, Schedulingand Control 4. Computer Applications in Construction Engineering andPlanning 5. Advanced Concrete Technology 6. Modernistic approaches inconstruction 7. Automation in ConstructionManagement 8. Advanced Project Management Concepts 9. Quality and safety in construction 10. Quantitative Techniques inConstruction Management 11. Quality Control and Assurance in Construction
3.	C. Elective courses	Program electives	15	1. Contract Laws and Regulations 2. System Integration in Construction 3. Energy efficient buildings 4. Construction economics and Financial Management 5. Construction Personnel Management 6. Business Economics and FinanceManagement 7. Resource Management and Control in Construction 8. Project Safety Management 9. Maintenance and Rehabilitation ofStructures
		Open electives (Courses on emerging areas)	03	1.Management Information System 2.Waste to Energy 3. Biomedical Product Design and Development 4.Advanced Cyber Security 5. Bio Mems 6. Solar and Energy Storage Systems 7.Operations Research 8. Metal Additive Manufacturing

4.	D. Employability Enhancement Courses and courses for presentation of Technical skills related to the specialization	Project work phase I	6	
		Project work phase II	12	
		Technical Seminar	1	
		Research Presentation Skills	1	
5.	E.Audit courses	Any two courses on: 1. English for Research Paper Writing 2. Value Education 3. Constitution of India 4. Pedagogy Studies 5. Personality Development Through Life Enlighten Skills	Zero credit	
Total credits to be earned for the award of M.E /M.Tech degree			**75**	

A. Foundation Courses - Credits (5)									
S.No	**CODE**	**COURSE**	**OFFERING DEPT.**	**CATEGORY**	**L**	**T**	**P**	**C**	**PREREQUISITE**
1.		STATISTICAL METHODS AND QUEUINGTHEORY	MATH	FC-BS	3	0	0	3	NIL
2.		RESEARCH METHODOLOGY AND IPR	CIVIL	FC-HS	2	0	0	2	NIL

B. Program core courses – Credits 32									
S.No	**CODE**	**COURSE**	**OFFERING DEPT.**	**CATEGORY**	**L**	**T**	**P**	**C**	**PREREQUISITE**
1.		CONSTRUCTION MATERIALS AND CONCRETE DESIGN	CIVIL	CC	3	1	0	4	NIL
2.		PROJECT FORMULATION AND APPRAISAL	CIVIL	CC	3	1	0	4	NIL
3.		CONSTRUCTION PLANNING, SCHEDULING AND CONTROL	CIVIL	CC	3	1	0	4	NIL
4.		COMPUTER APPLICATIONS IN CONSTRUCTION ENGINEERING AND PLANNING	CIVIL	CC	0	0	4	2	NIL
5.		ADVANCED CONCRETE TECHNOLOGY	CIVIL	CC	3	1	0	4	NIL
6.		MODERNISTIC APPROACHES IN CONSTRUCTION	CIVIL	CC	3	1	0	4	NIL
7.		AUTOMATION IN CONSTRUCTION MANAGEMENT	CIVIL	CC	3	0	0	3	NIL
8.		ADVANCED PROJECT MANAGEMENT CONCEPTS	CIVIL	CC	3	1	0	4	NIL
9.		QUALITY AND SAFETY IN CONSTRUCTION	CIVIL	CC	3	0	0	3	NIL
10.		QUANTITATIVE TECHNIQUES IN CONSTRUCTION MANAGEMENT	CIVIL	CC	3	0	0	3	NIL
11.		QUALITY CONTROL AND ASSURANCE IN CONSTRUCTION	CIVIL	CC	3	0	0	3	NIL

Elective courses									
Program electives – Credits 15									
S.No	**CODE**	**COURSE**	**OFFERING DEPT.**	**CATEGORY**	**L**	**T**	**P**	**C**	**PREREQUISITE**
1.		CONTRACT LAWS AND REGULATIONS	CIVIL	EC-PS	3	0	0	3	NIL
2.		SYSTEM INTEGRATION IN CONSTRUCTION	CIVIL	EC-PS	3	0	0	3	NIL
3.		ENERGY EFFICIENT BUILDINGS	CIVIL	EC-PS	3	0	0	3	NIL
4.		CONSTRUCTION ECONOMICS AND FINANCIAL MANAGEMENT	CIVIL	EC-PS	3	0	0	3	NIL
5.		CONSTRUCTION PERSONNEL MANAGEMENT	CIVIL	EC-PS	3	0	0	3	NIL
6.		BUSINESS ECONOMICS AND FINANCE MANAGEMENT	CIVIL	EC-PS	3	0	0	3	NIL
7.		RESOURCE MANAGEMENT AND CONTROL IN CONSTRUCTION	CIVIL	EC-PS	3	0	0	3	NIL
8.		PROJECT SAFETY MANAGEMENT	CIVIL	EC-PS	3	0	0	3	NIL
9.		MAINTENANCE AND REHABILITATION OF STRUCTURES	CIVIL	EC-PS	3	0	0	3	NIL

Open electives (Courses on emerging areas..) – Credits 03									
S.No	**CODE**	**COURSE**	**OFFERING DEPT.**	**CATEGORY**	**L**	**T**	**P**	**C**	**PREREQUISITE**
1.		METAL ADDITIVE MANUFACTURING	MECH	OE-EA	3	0	0	3	NIL
2.		WASTE TO ENERGY	BTE	OE-EA	3	0	0	3	NIL
3.		BIOMEDICAL PRODUCT DESIGN AND DEVELOPMENT	BME	OE-EA	3	0	0	3	NIL
4.		ADVANCED CYBER SECURITY	CSE	OE-EA	3	0	0	3	NIL
5.		BIO MEMS	ECE	OE-EA	3	0	0	3	NIL
6.		SOLAR AND ENERGY STORAGE SYSTEMS	EEE	OE-EA	3	0	0	3	NIL

D. Employability Enhancement Courses and courses for presentation of technical skills related to the specialization (Credits - 21)									
S.No	**CODE**	**COURSE**	**OFFERING DEPT.**	**CATEGORY**	**L**	**T**	**P**	**C**	**PREREQUISITE**
1.		PROJECT WORK PHASE I	CIVIL	EE-P	0	0	12	6	NIL
2.		PROJECT WORK PHASE II	CIVIL	EE-P	0	0	24	12	NIL
3.		TECHNICAL SEMINAR	CIVIL	EE-S	0	0	2	1	NIL
4.		RESEARCH PRESENTATION SKILLS	CIVIL	EE-D	0	0	2	1	NIL

E. Audit courses-Zero Credit									
S.No	**CODE**	**COURSE**	**OFFERING DEPT.**	**CATEGORY**	**L**	**T**	**P**	**C**	**PREREQUISITE**
1.		ENGLISH FOR RESEARCH PAPER WRITING	ENG	AC	0	0	2	0	NIL
2.		VALUE EDUCATION	HS	AC	0	0	2	0	NIL
3.		CONSTITUTION OF INDIA	LAW	AC	0	0	2	0	NIL
4.		PEDAGOGY STUDIES	HS	AC	0	0	2	0	NIL
5.		PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTEN SKILLS	ENG	AC	0	0	2	0	NIL

IMPLEMENTATION PLAN
PROGRAMME STRUCTURE

Semester I

SL. NO	COURSE CODE	COURSE TITLE	DEPT OFFERING THE COURSE	CATEGORY	L	T	P	C
THEORY								
1.		Statistical Methods and Queuing Theory	MATHS	FC	3	0	0	3
2.		Construction Materials and Concrete Design	CIVIL	CC	3	1	0	4
3.		Modernistic approaches in Construction	CIVIL	CC	3	1	0	4
4.		Program Core Elective I	CIVIL	PE	3	0	0	3

SEMESTER II

SL. NO.	COURSE CODE	COURSE TITLE	DEPT OFFERING THE COURSE	CATEGORY	L	T	P	C
THEORY								
1.		Project Formulation and Appraisal	CIVIL	CC	3	1	0	4
2.		Construction Planning, Scheduling and Control	CIVIL	CC	3	1	0	4
3.		Quantitative Techniques in Construction Management	CIVIL	CC	3	0	0	3
4.		Program Core Elective II	CIVIL	PE	3	0	0	3

SEMESTER III

SL. NO.	COURSE CODE	COURSE TITLE	DEPT OFFERING THE COURSE	CATEGORY	L	T	P	C
THEORY								
1		Advanced Project Management concepts	CIVIL	CC	3	1	0	4
2		Advanced Concrete Technology	CIVIL	CC	3	1	0	4
3		Program Core Elective III	CIVIL	PE	3	0	0	3
4		Program Core Elective IV	CIVIL	PE	3	0	0	3
PRACTICAL								
5		Computer Applications in Construction Engineering and Planning Laboratory	CIVIL	CC	0	0	4	2
6		RESEARCH PRESENTATION SKILLS	CIVIL	EE-D	0	0	2	1

SEMESTER IV

SL. NO.	COURSE CODE	COURSE TITLE	DEPT OFFERING THE COURSE	CATEGORY	L	T	P	C
1		Quality and safety in construction	CIVIL	CC	3	0	0	3
2		Program Core Elective V	CIVIL	PE	3	0	0	3
3		Open Elective		OE	3	0	0	3
4		Technical Seminar	CIVIL	PI	0	0	2	1
5		Audit Course I		AC	0	0	0	0
6		Audit Course II		AC	0	0	0	0

SEMESTER V

SL. NO.	COURSE CODE	COURSE TITLE	DEPT OFFERING THE COURSE	CATEGORY	L	T	P	C
1		Research Methodology and IPR	CIVIL	FC	2	0	0	2
2		Project work phase I	CIVIL	PI	0	0	12	6

SEMESTER VI

SL. NO.	COURSE CODE	COURSE TITLE	DEPT OFFERING THE COURSE	CATEGORY	L	T	P	C
1		Project Work phase II	CIVIL	PI	0	0	24	**12**

TOTAL CREDITS : 75

FOUNDATION COURSES

	STATISTICAL METHODS AND QUEUEING THEORY	Category	L	T	P	Credit
		FC-BS	3	0	0	3

PREAMBLE

This course is designed to provide the solid foundation on various statistical methods which form the basis for many other areas in the mathematical sciences including statistics, modern optimization methods and risk modelling. Queuing theory is the mathematical study of waiting lines and it's a primary tool for studying the problem of congestion.

PREREQUISITE – Nil

COURSE OBJECTIVES

1	To get the knowledge on concepts of random variables and distributions with respect to how they are applied to statistical data.
2	To introduce the concepts of sampling distributions and the test statistics
3	To acquire knowledge of Testing of Hypothesis useful in making decision and test them by means of the measurements made on the sample.
4	To train the students in design experiments and use these concepts for research
5	To study queuing models for analyzing the real world systems.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1; Select an appropriate probability distribution to determine the probability function for solving engineering problem.	Apply
CO2: Use the appropriate and relevant estimates	Apply
CO3: Make appropriate decisions using inferential statistical tools that are central to experimental Research	Apply
CO4: Construct standard experimental designs and describe statistical models Estimated using the data.	Apply
CO5: Derive and apply main formulas for some properties (such as stationary probabilities, average waiting and system time, expected number of customers in the queue, etc.) M/M/1, M/M/C – finite and infinite capacity queueing system.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO3
CO1	S	S	M	M	--	--	--	M	--	--	--	M	--	--	--
CO2	S	S	M	M	--	--	--	M	--	--	--	M	--	--	--
CO3	S	S	M	M	--	--	--	M	--	--	--	M	--	--	--
CO4	S	S	M	M	--	--	--	M	--	--	--	M	--	--	--
CO5	S	S	M	M	--	--	--	M	--	--	--	M	--	--	--

S- Strong; M-Medium; L-Low

SYLLABUS

PROBABILITY AND RANDOM VARIABLES:

Probability Concepts – Bayes Theorem –Random Variable - Discrete and continuous random variables- Probability mass function – Probability density functions - Moment generating functions and their properties– Standard distributions – Binomial, Poisson, Uniform, Exponential, Normal distribution.

ESTIMATION THEORY

Sampling distributions – Estimation of parameters (consistent and unbiased) – Point and interval estimates for population proportions, mean and variance - Maximum likelihood estimate method - Method of moments – Curve fitting by Principle of least squares – Regression Lines.

TESTING OF HYPOTHESES

Sampling distributions–Normal distribution – Area properties – Statistical hypothesis – Type I and Type II errors– Testing of hypothesis for mean, variance, and proportions for large and Small Samples (Z, t and F test) – Chi- square Tests for Goodness of fit –Independence of attributes.

DESIGN OF EXPERIMENTS

Analysis of variance – One-way and two-way classifications – Latin square design – 2^k Factorial Design -Fractional Factorial Design - Response Surface Methods – Central Composite Design

QUEUEING MODELS

Poisson Process – Markovian queues – Single and Multi Server Models – Little's formula Machine Interference Model – Steady State analysis – Self Service queue.

Text Book:

1. T.Veerarajan, "Probability and Statistics, Random Processes and Queueing Theory", 4th Edition, Tata McGraw Hill, (2018).
2. Milton J. S and Arnold J.C, "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition (2007).
3. Gupta P.K, Hira D.S, Problem in Operations Research, S.Chand and Co (2007)

REFERENCE:

4. S.C.Gupta and V.K.Kapoor, "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, New Delhi, 2017.
5. Kanti Swarup, P K Gupta, Man Mohan, "Operations Research", Sultan Chand &Sons (2014)

COURSE DESIGNERS

S.No	Name of the Faculty	Designation	Department	Mail ID
1	Dr.P.Sasikala	Professor	Mathematics/ VMKVEC	sasikala@vmkvec.edu.in
2.	Dr.L.Tamilselvi	Professor	Mathematics/ AVIT	ltamilselvi@avit.ac.in

Course Code	Course Title	Category	L	T	P	C
	Research Methodology and IPR	FC-HS	2	0	0	2

Course Outcomes:

At the end of this course, students will be able to

1. Understand research problem formulation.
2. Analyze research related information.
3. Follow research ethics.
4. Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
5. Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis, the need of information about Intellectual Property Right to be promoted among students in general & Engineering in particular.
6. Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

UNIT I- RESEARCH PROBLEM AND SCOPE FOR SOLUTION

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

UNIT II- FORMAT

Effective literature studies approaches, analysis, Plagiarism, Research ethics. Effective technical writing, how to write report, Paper Developing a Research Proposal, Format ofresearch proposal, a presentation and assessment by a review committee

UNIT III- PROCESS AND DEVELOPMENT

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

UNIT IV- PATENT RIGHTS

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

UNIT V- NEW DEVELOPMENTS IN IPR

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

TEXT BOOKS

1. Stuart Melville and Wayne Goddard, “Research methodology: an introduction for science & engineering students”Juta Publishers,1996.

2. Wayne Goddard and Stuart Melville, “Research Methodology: An Introduction” , Juta Publishers,2004.

3. Ranjit Kumar, 2nd Edition, “Research Methodology: A Step by Step Guide for beginners”

REFERENCES

1. Halbert, “Resisting Intellectual Property”, Taylor & Francis Ltd ,2007.

2. Mayall, “Industrial Design”, McGraw Hill, 1992.

3. Niebel, “Product Design”, McGraw Hill, 1974.

4. Asimov, “Introduction to Design”, Prentice Hall, 1962.

5. Robert P. Merges, Peter S. Menell, Mark A. Lemley, “ Intellectual Property in New Technological Age”, 2016.

6. T. Ramappa, “Intellectual Property Rights Under WTO”, S. Chand, 2008

PROGRAM CORE COURSES

	Construction Materials and Concrete Design	Category	L	T	P	Credit
		CC	3	1	0	4

PREAMBLE

This course familiarize about the various and latest construction materials, and methodology of concrete design.

PREREQUISITE

NIL

COURSE OBJECTIVES

1	Criteria for choice of the appropriate material and the various tests for quality control.
2	Characterization of uses and application of the different construction materials
3	Detail the manufacturing process of the construction and building materials
4	Special Materials and advanced technology in construction fabrication units.
5	Concrete design procedure for desired strength and durability.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1 - Understand the typical and potential applications of basic construction materials	Understand
CO2 - Compare the properties of most common and advanced building materials	Understand
CO3 - Understand the relation between material properties and structural Form	Understand
CO4 - Understand the importance of experimental verification of material properties	Understand
CO5 - Design an appropriate concrete as per the requirements of the project	Understand and Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S	-	L	-	L	-	-	-	-	-	-			
CO2	S	S	M	L	-	-	-	-	-	-	-	-			
CO3	S	M	S	M	-	-	-	-	-	-	-	-			
CO4	S	M	S	M	-	L	-	-	-	-	-	-			
CO5	S	S	L	L	-	-	-	-	-	-	-	-			

S- Strong; M-Medium; L-Low

SYLLABUS

UNIT I SPECIAL CONCRETES

Concretes, Behaviour of concretes – Properties and Advantages of High Strength and High Performance Concrete – Properties and Applications of Fibre Reinforced Concrete, Self-compacting concrete, Alternate Materials to concrete on high performance & high Strength concrete.

UNIT II COMPOSITES

Types of Plastics – Properties & Manufacturing process – Advantages of Reinforced polymers Types of FRP – FRP on different structural elements – Applications of FRP.

UNIT III OTHER MATERIALS

Types and properties of Water Proofing Compounds – Types of Non-weathering Materials and its uses – Types of Flooring and Facade Materials and its application.

UNIT IV SMART AND INTELLIGENT MATERIALS

Types & Differences between Smart and Intelligent Materials – Special features – Case studies showing the applications of smart & Intelligent Materials.

UNIT V CONCRETE MIX DESIGN

Mix Proportioning – Mixes incorporating Fly ash, Silica fume, GGBS – Mixes for High Performance Concrete – High strength concrete – variations in concrete strength.

BOOKS:

1. Ashby, M.F. and Jones.D.R.H.H. "Engineering Materials 1: An introduction to Properties, applications and designs", Elsevier Publications, 2005.
2. Gambhir.M.L., Concrete Technology – Tata McGraw Hill Book Co. Ltd.,Delhi, 2004.

REFERENCES:

1. Deucher, K.N, Korfiatis, G.P and Ezeldin, A.S, Materials for civil and Highway Engineers, Prentice Hall Inc., 1998.
2. Mamlouk, M.S. and Zaniewski, J.P., Materials for Civil and Construction Engineers, Prentice Hall Inc., 1999.

S. No.	Name of the Faculty	Designation	Name of the College	Mail ID
1	Dr.P.S.Aravind Raj	Associate Professor	AVIT	aravindraj.civil@avit.ac.in
2	Mr.M.Senthilkumar	Assistant Professor	Civil / VMKVEC	Senthilkumar@vmkvec.edu.in

	PROJECT FORMULATION AND APPRAISAL	Category	L	T	P	Credit
		CC	3	1	0	4

PREAMBLE

This subject helps the students to understand the complete project formulation, appraisal process from project identification, to project clearance. It also give better exposure to the students in the area of appraisal, finance and PSP process

PREREQUISITE

NIL

COURSE OBJECTIVES

Study and understand the concepts of project formulation

Study the role and methods of project cash flows and project costing.

The students know about International Practice of appraisal.

Expose the student's knowledge of Project Financing.

Acquire the knowledge of Private Sector Participation

COURSE OUTCOMES

On the successful completion of the course, students will be able to

Have wide knowledge in respect of the projects particularly Project Estimates, Techno-Economic Feasibility Report, Detailed Project Report	Understand
Follow the methods of cash flow in the project and also have an idea of the cost of capital	Understand
Understand the project appraisal and implement it in every stage on ongoing work and analysis the risk	Apply
Know about the requirement and source of finance to carried out the project and financial Institutions	Understand
Develop the knowledge in respect of execution of infrastructure development and Scope of Technology Transfer	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	**L**	S	**M**	-	-	**S**	**M**	**L**	**M**	**L**	**S**	-	**L**	-	**L**	-
CO2	**L**	**S**	M	-	-	**S**	**M**	**L**	**M**	**L**	**S**	-	**L**	**L**	**L**	-
CO3	**M**	**S**	**M**	**L**	-	**S**	**L**	**M**	**M**	**L**	**S**	-	**L**	**S**	**L**	-
CO4	**M**	**S**	**S**	**L**	-	**M**	**L**	**M**	**S**	**L**	**S**	-	**L**	**M**	**L**	-
CO5	**M**	**S**	**S**	**L**	-	**M**	**L**	**M**	**M**	**L**	**S**	-	**M**	**M**	**L**	

S- Strong; M-Medium; L-Low

SYLLABUS

PROJECT FORMULATION: 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

PROJECT COSTING- Project Cash Flows – Time Value of Money – Cost of Capital

PROJECT APPRAISAL 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

PROJECT FINANCING Project Financing – Means of Finance – Financial Institutions – Special Schemes – Key Financial Indicators - Ratios

PRIVATE SECTOR PARTICIPATION Private sector participation in Infrastructure Development Projects - BOT, BOLT, BOOT - Technology Transfer and Foreign Collaboration - Scope of Technology Transfer

TEXTBOOKS

1. Prasanna Chandra, "Project-Planning Analysis Selection Implementation & Review 6 th Edition", Tata Mc Graw Mill Publishing Co., Ltd, Newdelhi 2016.
2.Joy.P.K., Total Quality Project Management – The Indian Context, New Delhi, Macmillan India Ltd.,1992.

REFERENCES

1. United Nations Industrial Development Organization (UNIDO) Manual for the Preparation of Industrial feasibility Studies, (IDBI Reproduction) Bombay 1987.
2.Barcus, SW. and Willison., Handbook of Management consulting Services, McGraw Hill, New York,1986.

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	CONSTRUCTION PLANNING, SCHEDULING AND CONTROL	Category	L	T	P	Credit
		CC	3	1	0	4

PREAMBLE

Gain a thorough understanding of the finer points of construction project planning, scheduling, and control

PREREQUISITE

NIL

COURSE OBJECTIVES

1	To familiarise them with project management concepts, from planning to execution.
2	To familiarise them with project feasibility analysis and network analysis tools for cost and time estimation.
3	To equip them with a working knowledge of contract administration, costing, and budgeting.
4	To familiarise students with quality control.
5	To gain an understanding of the various types of project information.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Recognize the characteristics of a project and its various stages.	Understand
CO2. Recognize the conceptual clarity with which projects are organised and feasibility analyses are conducted	Understand
CO3. Analyze and comprehend project planning, scheduling, and execution control techniques.	Analyze
CO4 Utilize the risk management plan and conduct an analysis of the stakeholders' roles.	Apply
CO5. Contract management, project procurement, service level agreements, and productivity all require an understanding.	Understand

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PS O2	PS O3
CO1	**M**	**M**	**L**	M	**L**	**S**	**S**	**L**	**L**	**M**	**M**	**M**	**L**	**L**	**L**
CO2	**S**	**S**	**M**	**L**	**M**	**S**	**M**	**L**	**L**	**S**	**L**	**S**	**S**	**M**	**M**
CO3	**M**	**M**	**M**	**L**	**M**	**M**	**S**	**M**	**M**	**L**	**S**	**L**	**M**	**S**	**S**
CO4	**L**	**L**	**M**	**L**	**M**	**S**	**M**	**M**	**M**	**L**	**S**	**L**	**M**	**L**	**L**
CO5	**M**	**M**	**L**	**M**	**L**	**M**	**S**	**M**	**M**	**M**	**M**	**M**	**S**	**M**	**M**

S- Strong; M-Medium; L-Low

SYLLABUS

UNIT – I CONSTRUCTION PLANNING

Basic Concepts in the Development of Construction Plans - Choice of Technology and Construction Method - Defining Work Tasks - Defining Precedence Relationships among Activities - Estimating Activity Durations - Estimating Resource Requirements for Work Activities - Coding Systems

UNIT - II SCHEDULING PROCEDURES AND TECHNIQUES

Construction Scheduling, Work break down structure, activity cost and time estimation in CPM, PERT, RPM (Repetitive Project Modeling) techniques. LOB technique, Mass haul diagrams. Precedence Network Analysis, software in Construction scheduling (MSP, primavera, Construction manager).

UNIT - III SPECIFICATION OF PROJECT BUDGET

The Cost Control Problem - The Project Budget - Forecasting for Activity Cost Control - Financial Accounting Systems and Cost Accounts - Control of Project Cash Flows - Schedule Control - Schedule and Budget Updates - Relating Cost and Schedule Information.

. **UNIT - IV SAFETY AND QUALITY MANAGEMENT**

Safety and Quality Concerns in Construction - Organizing for Quality and Safety - Work and Material Specifications - Total Quality Control - Quality Control by Statistical Methods - Statistical QualityControl with Sampling by Attributes - Statistical Quality Control with Sampling by Variables – Safety

UNIT - V PROJECT INFORMATION

Types of Project Information - Accuracy and Use of Information - Computerized Organization and Use of Information - Organizing Information in Databases - Relational Model of Databases - Other Conceptual Models of Databases - Centralized Database Management Systems - Databases and Applications Programs - Information Transfer and Flow

BOOKS:

1. Chitkara. K.K. “Construction Project Management: Planning Scheduling and Control”, Tata McGraw Hill Publishing Company, New Delhi, 2008. .
2. Calin M. Popescu, Chotchal Charoenngam, “Project Planning, Scheduling and Control in Construction: An Encyclopedia of terms and Applications”, Wiley, New York, 2005.

REFERENCES:

1. Willis, E. M., “Scheduling Construction Projects”, John Wiley & Sons, 2006.
2. Halpin, D. W. “Financial and Cost Concepts for Construction Management”, John Wiley & Sons. New York, 2005

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	COMPUTER APPLICATIONS IN CONSTRUCTION ENGINEERING AND PLANNING	Category	L	T	P	Credit
		CC	0	0	4	2

PREAMBLE

This helps the students to utilize the optimized computer technology in the field of planning andconstruction. This subject also helps the project planning and scheduling in digitalized approach.

PREREQUISITE

NIL

COURSE OBJECTIVES

1	To study and understand the introduction of system hardware.
2	To study the role and methods of optimization techniques.
3	The students know about inventory models.
4	To Expose the student's knowledge of scheduling application.
5	To learn about project planning and scheduling.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO:1	To understand the about the optimization techniques and practice	Understand
CO:2	To under the about the resource allocation and resource utilization	Understand
CO:3	To utilize the software interface in project planning and scheduling.	Analyze
CO:4	To perceive the Human Resource Management in the Construction Project	Apply
CO:5	To perceive the Material Management in the Construction Project	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
CO:1	**M**	**M**	**L**	M	**L**	**S**	**S**	**L**	**L**	**M**	**M**	**M**	**L**	**L**	**L**
CO:2	**S**	**S**	**M**	**L**	**M**	**S**	**M**	**L**	**L**	**S**	**L**	**S**	**S**	**M**	**M**
CO:3	**M**	**M**	**M**	**L**	**M**	**M**	**S**	**M**	**M**	**L**	**S**	**L**	**M**	**S**	**S**
CO:4	**L**	**L**	**M**	**L**	**M**	**S**	**M**	**M**	**M**	**L**	**S**	**L**	**M**	**L**	**L**
CO:5	**M**	**M**	**L**	**M**	**L**	**M**	**S**	**M**	**M**	**M**	**M**	**M**	**S**	**M**	**M**

S – STRONG, M – MEDIUM and L – LOW

SYLLABUS

INTRODUCTION

LIST OF EXPERIMENTS

1. Planning and Scheduling of Project using Microsoft Project
2. Project and Portfolio Management using Computer Application
3. Resources Management using Computer Application
4. Risk Management using Computer Application
5. Workflow of events and activities in Construction Project
6. Project templates and Web administration in Construction Industry
7. ERP in Construction Industry
8. Material Management in Construction industry using Computer Application

TEXT BOOKS

1. Billy E.Gillet., Introduction to Operations Research – A Computer Oriented Algorithmic Approach, Tata Mc Graw Hill, 1990
2. Paulson, B.R., Computer Applications in Construction, Mc Graw Hill, 1995

REFERENCE BOOKS

1. Feigenbaum,L., Construction Scheduling with Primavera Project PlannerPrentice HallInc., 2002
2. Ming Sun and Rob Howard, "Understanding I.T. in Construction, Spon Press, Taylor and Francis Group, London and New York, 2004.

COURSE DESIGNERS

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	ADVANCED CONCRETE TECHNOLOGY	Category	L	T	P	Credit
		CC	3	1	0	4

PREAMBLE

This course explains about the materials used for various types of concrete, their behaviour and concreting methods.

PREREQUISITE

NIL

COURSE OBJECTIVES

1	To study and understand the concrete ingredients.
2	To study the role of fibre reinforced concrete.
3	The students know about concrete mix design and high strength concrete.
4	To expose the students knowledge of mechanical properties of concrete.
5	To acquire the knowledge of durability of concrete.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1 - Understand the chemical and mechanical properties of cement	Understand and Apply
CO2 - Understand the role of different admixtures in concrete	Apply
CO3 - Design for various concrete grades using codal provisions	Apply
CO4 - Understand the concept on fresh and hardened concrete properties and its testing Procedures	Apply
CO5 - Describe about the special concretes	Understand and Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	L	L	M	-	-	-	-	-	-	-	-			
CO2	S	L	M	L	-	-	-	-	-	-	-	-			
CO3	S	S	M	L	-	-	-	S	-	-	-	-			
CO4	S	M	L	L	-	-	-	-	-	-	-	-			
CO5	M	M	L	M	-	-	-	-	-	-	-	-			

S- Strong; M-Medium; L-Low

SYLLABUS

UNIT I CONCRETE INGREDIENTS

Composition of OPC – Manufacture – Modified Portland Cements – Hydration Process of Portland Cements – Structure of Hydrated Cement Pastes

Mineral Admixtures – Slags – Pozzolanas and Fillers – Chemical Admixtures – Solutes – Retarders – Air Entraining Agents – Water Proofing Compounds – Plasticizers and Super Plasticizers

Aggregates – Properties and testing of fine and course aggregates – combining of aggregates – Substitute material for aggregates – recent advancements.

UNIT II SPECIAL CONCRETES

Fibre Reinforced Concrete – Self Compacting Concrete – Polymer Concrete – Sustainable Concrete – Lightweight concrete.

UNIT – II CONCRETE MIX DESIGN

Mix Proportioning – Mixes incorporating Fly ash, Silica fume, GGBS – Mixes for High Performance Concrete – High strength concrete – variations in concrete strength.

UNIT IV MECHANICAL PROPERTIES OF CONCRETE

Interfacial Transition Zone – Fracture Strength – Compressive strength – Tensile strength - Impact strength - Bond strength.

UNIT V DURABILITY OF CONCRETE

Factors affecting durability – Chemical Attack – Permeability – Sulphate attack - chloride penetration – water absorption – creep – Shrinkage.

BOOKS:

3. Santhakumar.A.R., Concrete Technology, Oxford University press, New Delhi. 2007.
4. Gambhir.M.L., Concrete Technology – Tata McGraw Hill Book Co. Ltd.,Delhi, 2004.

REFERENCES:

1. Neville, A.M., Properties of Concrete, Longman, 1995.
2. Metha P.K. and Montreio P.J.M., Concrete Structure Properties and Materials, Prentice Hall, 1998.

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	MODERNISTIC APPROACHES IN CONSTRUCTION	Category	L	T	P	Credit
		CC	3	1	0	4

PREAMBLE

Study and comprehend the Modernized construction approaches practicing in the field of civil engineering.

PREREQUISITE

NIL

COURSE OBJECTIVES

1	To study and understand the usage of different sustainable materials in construction
2	To study the concept and usage of Nano technology in the field of civil engineering
3	To study the inevitable role of biotechnology in the field of construction
4	To rendering the different automation process involved in modern day of construction
5	To acquire the role of prefab construction

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Investigate and comprehend the use of various sustainable building materials.	Understand
CO2. Analyze the concept of Nanotechnology and its application in the field of civil engineering.	Understand
CO3. To validate the basic knowledge of biotechnology in the construction industry	Analyze
CO4. To clearly elucidate about the various automation processes that are used in today's construction	Apply
CO5. To clearly explicate the equipment's and methods used in modular construction	Understand

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	**L**	**L**	**L**	M	**L**	**S**	**S**	**L**	**L**	**M**	**M**	**M**	**L**	**L**	**L**
CO2	**M**	**M**	**M**	**L**	**M**	**S**	**S**	**-**	**L**	**S**	**L**	**S**	**S**	**M**	**M**
CO3	**M**	**L**	**M**	**L**	**M**	**M**	**-**	**M**	**M**	**-**	**S**	**L**	**M**	**S**	**S**
CO4	**M**	**M**	**M**	**L**	**M**	**S**	**L**	**M**	**M**	**L**	**S**	**L**	**M**	**L**	**L**
CO5	**L**	**L**	**L**	**M**	**L**	**M**	**S**	**M**	**M**	**M**	**M**	**M**	**S**	**M**	**M**

S- Strong; M-Medium; L-Low

SYLLABUS

UNIT - I SUSTAINABLE BUILDING MATERIALS

Special alloys of steel and other metals- glass- polymer- fabric- Construction chemicals- Specialized equipment's-Market survey -collection of information about the materials

UNIT - II NANO CONCRETE

Concept of Nanotechnology- Nano Cement materials- Nanoscale Characterization -Silica Aerogels- Effect of Nano-SiO- Nano Clay- Graphene-Oxide- Electrochemical Injection- Cement Reinforcement by Nanotubes.

UNIT - III CONSTRUCTION BIOTECHNOLOGY

Basics of Biotechnology for Civil Engineering - Biotechnological Admixtures- Biotechnological Plastics- Bio cements- Bio coating of Surfaces- Bio grouts- Bio corrosion- Bio deterioration - Future Developments

UNIT - IV CONSTRUCTION AUTOMATION

Concept- Building Information Model- 3D Printing- Roles of artificial intelligence in construction engineering and management

UNIT - V MODULAR CONSTRUCTION

Modular construction- Types- prefabrication–Principles–Materials–Modular coordination–Standardization–Systems–Production–Transportation–Erection –Construction and erection of roof and floor slabs–Wall panels –Columns–Shear walls

BOOKS:

3. CBRI, Building materials and components, India, 1990
4. Nanotechnology in Construction, Konstantin Sobolev & Surendra P. Shah, Springer International Publishing, Switzerland 2015
5. Construction Biotechnology, Volodymyr & Ivanov Viktor Stabnikov, Green Energy and Technology (GREEN), 2017
6. Construction Automation. In: Castro-Lacouture D. (2009) , Springer Handbook of Automation, 2009

REFERENCES:

3. Henrick Nissen, "Industrial Building and Modular Design",Cement Concrete Association,
4. Roy Chudley& Roger Greeno, "Advanced Construction Techniques", Pearson Prentice Hall

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	AUTOMATION IN CONSTRUCTION MANAGEMENT	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

Having the ability to create unique insights from what is seen or observed, as well as having a strong digital footprint in the field of construction management

PREREQUISITE

NIL

COURSE OBJECTIVES

1	To gain insight into the use of automation and robots in construction management
2	To understand the fundamentals of sensors and inspection
3	To investigate existing and prototype construction equipment.
4	Data networking for prefabrication elements will be investigated.
5	Robotic technologies for prefabrication elements will be investigated.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Understand how building management systems and automation can be used in both on-site and off-site projects.	Understand
CO2. Robotics can be used to solve construction problems.	Apply
CO3. The use of computers in construction The processing of data	Apply
CO4. Learn the fundamentals of communication and office automation.	Understand
CO5. To clearly explicate the Robotics in the Construction Industry	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	**L**	**L**	**L**	M	**L**	**S**	**S**	**L**	**L**	**M**	**M**	**M**	**L**	**L**	**L**
CO2	**M**	**M**	**M**	**L**	**M**	**S**	**S**	**-**	**L**	**S**	**L**	**S**	**S**	**M**	**M**
CO3	**M**	**L**	**M**	**L**	**M**	**M**	**-**	**M**	**M**	**-**	**S**	**L**	**M**	**S**	**S**

CO4	**M**	**M**	**M**	**L**	**M**	**S**	**L**	**M**	**M**	**L**	**S**	**L**	**M**	**L**	**L**
CO5	**L**	**L**	**L**	**M**	**L**	**M**	**S**	**M**	**M**	**M**	**M**	**M**	**S**	**M**	**M**

S- Strong; M-Medium; L-Low

SYLLABUS

UNIT - I FUDAMENTAL OF BMS

Concept and application of Building Management System (BMS) and Automation, requirements and design considerations and its effect on functional efficiency of building automation system, architecture and components of BMS- Review and analysis of state- of –art in construction automation

UNIT-II OFF AND ON-SITE AUTOMATION IN CONSTRUCTION

Field sensors actuators- controllers- non-destructive evaluation- data acquisition- Off site automation in construction Information processing- Materials processing - Case study - Existing and prototype equipment for construction – case study

UNIT - III BUILDING AUTOMATION

Introduction to building automation systems – components– Heating, ventilation, and air Conditioning (HVAC)– Lighting – Electrical systems water supply and sanitary systems– Fire Safety – security -Communication and office automation system -Water pump monitoring & Control - Control of Computerized HVAC Systems

. **UNIT - IV ROBOTICS IN CONSTRUCTION**

Automation and robotic technologies for customized component, module and building Prefabrication- Elementary technologies and single – Task construction robots - Site automation robotic on site factories

UNIT - V DATA NETWORKING CONSTRUCTION AUTOMATION

Data networking– IBMS system and its components – Centralized control equipment's – substation and field controllers – Gamma building control – energy-efficient building and room automation.

BOOKS:

7. Javad Majrouhi Sardroud, (2011),"Automated Management of Construction Projects" LAP Lambert Academic Publishing.
8. Wang Shengwei, (2010), "Intelligent Buildings and Building Automation" Taylor & Francis Group.

REFERENCES:

5. Majrouhi Sardroud Javad, (2014), "Automation in Construction Management" Scholars' Press
6. HongleiXu and Xiangyu Wang, (2014), "Optimization and Control Methods in Industrial Engineering and Construction (Intelligent Systems, Control and Automation: Science and Engineering)" Springer.

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	ADVANCED PROJECT MANAGEMENT CONCEPTS	Category	L	T	P	Credit
		CC	3	1	0	4

PREAMBLE

In this Advanced Project Management Concepts, students delve deeper into project management concepts include task analysis, critical path method, planning, project timelines, and ongoing monitoring.

PREREQUISITE

NIL

COURSE OBJECTIVES

1	To study and understand the project life cycle and types of construction.
2	To study the role of project management, owners perspective.
3	The students know about organizing for project management.
4	To expose the students knowledge of labour material and equipment utilization.
5	To Acquire the Knowledge of Cost Estimation

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Recognize and mitigate the early seeds of failure in the project life cycle	Understand and Apply
CO2. Engage and lead effective project management teams in your Organization	Apply
CO3. Understand project management design, development, and deployment	Apply
CO4. Use project management tools, techniques, and skills	Apply
CO5. Understand how to manage project cost, quality, and delivery	Understand and Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	**L**	M	**L**	**-**	**-**	**-**	**M**	**L**	**L**	**M**	**-**	**M**	**L**	**L**	**L**
CO2	**M**	**S**	**M**	**-**	**M**	**S**	**S**	**L**	**M**	**-**	**S**	**L**	**M**	**M**	**S**
CO3	**L**	**L**	**S**	**L**	**-**	**-**	**M**	**S**	**M**	**L**	**L**	**S**	**M**	**S**	**M**
CO4	**M**	**S**	**S**	**-**	**L**	**-**	**S**	**M**	**S**	**L**	**L**	**S**	**L**	**L**	**M**
CO5	**M**	**M**	**L**	**L**	**M**	**S**	**M**	**S**	**M**	**L**	**M**	**M**	**M**	**M**	**S**

S- Strong; M-Medium; L-Low

SYLLABUS

UNIT I THE OWNER'S PERSPECTIVE

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

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

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, MATERIAL AND EQUIPMENT UTILIZATION

Historical Perspective - Labour Productivity - Factors Affecting Job-Site Productivity - Labour Relations in Construction - Problems in Collective Bargaining - Materials Management - Material Procurement and Delivery - Inventory Control - Tradeoffs of Costs in Materials Management. - Construction Equipment - Choiceof Equipment and Standard Production Rates - Construction Processes Queues and Resource Bottlenecks

UNIT V COST ESTIMATION

Costs Associated with Constructed Facilities - Approaches to Cost Estimation - 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 - Cost Indices - Applications of Cost Indices to Estimating - Estimate Based on Engineer's List of Quantities - Estimation of Operating Costs.

BOOKS:

1. Chris Hendrickson and Tung Au, Project Management for Construction – Fundamental Concepts for Owners, Engineers, Architects and Builders, Prentice Hall, Pittsburgh, 2000.
2. Chitkara, K.K. Construction Project Management: Planning, Scheduling and Control, Tata McGraw-Hill Publishing Company, New Delhi, 1998.

REFERENCES:

1. Frederick E. Gould, Construction Project Management, Wentworth Institute of Technology, Vary E. Joyce, Massachusetts Institute of Technology, 2000.
2. Choudhury, S , Project Management, Tata McGraw-Hill Publishing Company, New Delhi, 1988.
3. George J.Ritz , Total Construction Project Management - McGraw-Hill Inc, 1994.

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	QUALITY AND SAFETY IN CONSTRUCTION	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

The students will be able to gain knowledge about the importance of quality and safety in construction and will be skilled to manage both at work place.

PREREQUISITE

NIL

COURSE OBJECTIVES

1	To understand the elements of quality planning and the implication.
2	To become aware of objectives and advantage of quality assurance and management.
3	To study about safety in construction.
4	To study about various safety operations in construction.
5	To study about accidents and safety measures in construction industry.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Should be exposed to means of quality in construction.	Understand
CO2. Should be able to learn about quality management.	Understand
CO3. Should be able to taken safety measures in construction.	Understand, Apply
CO4. The concept of other various operations with safety.	Understand, Apply
CO5. Know about accidents & measures taken in construction.	Understand , Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	**L**	L	**L**	**-**	**L**	**L**	**-**	**S**	**L**	**-**	**M**	**M**	**M**	**L**	**L**
CO2	**L**	**L**	**M**	**-**	**M**	**L**	**-**	**S**	**L**	**-**	**M**	**L**	**M**	**M**	**M**
CO3	**M**	**M**	**M**	**L**	**M**	**L**	**M**	**M**	**M**	**-**	**L**	**M**	**M**	**S**	**S**
CO4	**S**	**M**	**S**	**M**	**M**	**M**	**M**	**M**	**M**	**M**	**L**	**S**	**S**	**M**	**S**
CO5	**S**	**S**	**S**	**M**	**S**	**M**	**M**	**M**	**M**	**M**	**S**	**S**	**S**	**M**	**S**

S-Strong; M-Medium; L-Low

SYLLABUS

UNIT – I Construction Quality

Construction Quality, Inspection and Testing, Quality control, Quality Assurance, Quality Certification for companies and laboratories (ISO Certification, NABL certification)

UNIT – II Construction Quality Management

Total Quality Management, Critical factors of TQM, TQM in Projects, Benchmarking, concepts of quality policy, standards, manual - Needs Of QA/QC - Different Aspects of Quality-Appraisals, Factors Influencing Construction Quality-Critical, Standardization.

UNIT – III Construction Safety

Construction Safety-meaning and scope, Safety in construction- Roles of different groups in safety - Technological aspects, organizational aspects and behavioural aspects, Safety legislation and Standards, Contract conditions on safety in Civil Engineering projects.

UNIT – IV Safety in Various Construction Operations

Basic terminology in safety, safety pyramid- Safety in Construction: Causes, classification, cost and measurement of an accident, safety programme for construction, protective equipment, accident report, safety measure: (a)For storage and handling of building materials. (b) Construction of elements of a building (c) In demolition of buildings Safety lacuna in Indian scenario - National Building Code Provisions on construction safety, Construction safety manuals. Safety in Vehicles, Cranes, Tower Cranes, Wire Ropes, Pulley blocks, Mixers. SoPs (Safe Operating Procedures) – Construction equipment, materials handling-disposal & hand tools.

UNIT – V Accidents & Safety measures

Types of injuries, Factors affecting safety, Strategic Planning for safety provisions. Personal & Structural safety - Recording injuries and accident indices. Theories and principles of accident –frequency – rate – serviceability rate – incident rate – activity rate, first aid. Other hazards – fire, confined spaces, electrical safety. Method statement, SOPs, PPE, Inspections, Investigations. Site safety programmes - JSA, JHA, Root cause analysis, meetings, safety policy, manuals, training & orientation. Safety legislation regard to violation.

BOOKS:

1. John L. Ashford, The Management of Quality in Construction, E & F.N, Spon. New York, 2009.
2. K.N.Vaid, Construction Safety Management, National Institute of Construction Management and Research, 1988
3. J.B.Fullman, Construction Safety Security & Loss Prevention , John Wiley & Sons Inc
4. Linger.L, Modern Methods of Material Handling
5. Hinze, J.W. (1997) Construction Safety, Prentice Hall.
6. MacCollum, D.V. (1995) Construction Safety Planning, John Wiley & Sons
7. Bhattacharjee, S.K. (2011) Safety Management in Construction, Khanna Publishers

REFERENCES:

1. David Gold Smith, "Safety Management in construction and Industry", Mc Graw Hill
2. K N Vaid, "Construction Safety Management", NICMAR, Bombay
3. D S Rajendra Prasad, "Quality Management System in Civil Engineering", Sapna Book

House, Bangalore
4. "The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996, Universal Law Publishing Co. Pvt. Ltd.
5. James, J.O Brien, Construction Inspection Handbook - Quality Assurance and Quality Control, Van Nostrand, New York, 1989. 11

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	QUANTITATIVE TECHNIQUES IN CONSTRUCTION MANAGEMENT	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

The students will be able to gain knowledge about the importance of quantitative management techniques and management of materials and human resources.

PREREQUISITE

NIL

COURSE OBJECTIVES

1	To study and understand the operation research, linear programming.
2	To study the role of production management.
3	The students know about financial management and capital budgeting.
4	To expose the students knowledge of pricing techniques.
5	To acquire the knowledge of managerial economics.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Should be exposed to means of quantity computation in construction.	Understand
CO2. Should be able to learn about quantity management.	Understand
CO3. Should be able to taken measures in construction to manage resources.	Understand, Apply
CO4. The concept of other various operations with construction activities and events.	Understand, Apply
CO5. Know about measures taken in quantity accretion.	Understand , Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	**L**	L	**L**	**-**	**L**	**L**	**-**	**S**	**L**	**-**	**M**	**M**	**M**	**L**	**L**
CO2	**L**	**L**	**M**	**-**	**M**	**L**	**-**	**S**	**L**	**-**	**M**	**L**	**M**	**M**	**M**
CO3	**M**	**M**	**M**	**L**	**M**	**L**	**M**	**M**	**M**	**-**	**L**	**M**	**M**	**S**	**S**
CO4	**S**	**M**	**S**	**M**	**M**	**M**	**M**	**M**	**M**	**M**	**L**	**S**	**S**	**M**	**S**
CO5	**S**	**S**	**S**	**M**	**S**	**M**	**M**	**M**	**M**	**M**	**S**	**S**	**S**	**M**	**S**

S-Strong; M-Medium; L-Low

SYLLABUS

UNIT I OPERATIONS RESEARCH

Introduction to Operations Research - Linear Programming – Graphical and Simplex Methods, Duality and Post – Optimality Analysis – Transportation and Assignment Problems

UNIT II PRODUCTION MANAGEMENT

Inventory Control - EOQ - Quantity Discounts - Safety Stock – Replacement Theory – PERT and CPM – Simulation Models – Quality Control

UNIT III FINANCIAL MANAGEMENT

Working Capital Management – Compound Interest and Present Value methods – Discounted Cash Flow Techniques – Capital Budgeting

UNIT IV DECISION THEORY

Decision Theory – Decision Rules – Decision making under conditions of certainty, risk and uncertainty – Decision trees – Utility Theory

UNIT V MANAGERIAL ECONOMICS

Cost Concepts – Break-even analysis – Pricing Techniques – Game theory Applications.

BOOKS:

1. Vohra, N.D., Quantitative Techniques in Management, Tata McGraw-HillCompany Ltd, New Delhi, 1990.
2. Schroeder, R.G, Operations Management, McGraw Hill, USA, 1982.
3. Levin, R.I, Rubin,D.S., and Stinson J., Quantitative Approaches to Management, McGraw Hill Book Co., 1988.

REFERENCES:

1. Frank Harrison, E., The Managerial Decision Making Process, Houghton MifflinCo., Boston, 1975.
2. Hamdy A.Taha, Operations Research: An Introduction, Prentice Hall, 2002.

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	QUALITY CONTROL AND ASSURANCE IN CONSTRUCTION	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

To study about quality management, quality planning and its improvement techniques and to study about the quality improvement techniques

PREREQUISITE

NIL

COURSE OBJECTIVES

1	To study and understand the quality management, quality plan.
2	To study the role of quality system and preparing quality system documents.
3	The students know about quality planning
4	To expose the students knowledge of quality assurance and control**.**
5	To acquire the knowledge of quality improvement techniques

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. To Implement quality systems and standards in the preparation of documents and be aware of the different aspects of cost of quality.	Understand and Apply
CO2. To Apply relevant codes and standards, codes of quality, quality policy, methods in construction industry to attain customer satisfaction in projects.	Apply
CO3.. To understand the elements of quality planning and the implication	Apply
CO4. To become aware of objectives and advantage of quality assurance	Apply
CO5. To clearly Identify and solve problems relating to quality improvement on the way and able to take early decisions to achieve the ultimate aim of the organization.	Understand and Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO1	PSO2	PSO3	PSO4
CO1	**L**	S	**L**	**L**	**M**	L	L	**L**	**L**	**M**	**M**	**M**	**L**	**L**	**L**	**L**
CO2	**L**	**L**	**S**	**M**	L	S	**S**	**L**	**M**	**L**	**S**	**S**	**S**	**S**	**S**	**S**

CO3	**L**	**S**	**L**	**L**	**L**	**M**	**M**	**M**	**M**	**L**	**S**	**S**	**M**	**S**	**M**	**L**
CO4	**L**	**S**	**L**	**S**	**L**	**L**	**S**	**M**	**L**	**L**	**S**	**S**	**L**	**S**	**M**	**M**
CO5	**L**	**L**	**M**	**M**	**M**	**S**	**S**	**L**	**M**	**M**	**M**	**M**	**M**	**S**	**S**	**L**

S- Strong; M-Medium; L-Low

SYLLABUS

UNIT - I QUALITY MANAGEMENT

Introduction – Definitions and objectives – Factor influencing construction quality - Responsibilities and authority - Quality plan - Quality Management Guidelines – Quality circles.

UNIT II QUALITY SYSTEMS

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

Quality Policy, Objectives and methods in Construction industry - Consumers satisfaction, Ergonomics - Time of Completion - Statistical tolerance – Taguchi's conceptof 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

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

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.

BOOKS:

1. James, J.O' Brian, Construction Inspection Handbook – Quality Assurance and Quality Control, Van Nostrand, New York, 1989. Clarkson H. Oglesby, Productivity Improvement in Construction, McGraw-Hill, 1989.
2. Kwaku, A., Tena, Jose, M. Guevara, Fundamentals of Construction Management and Organisation, Reston Publishing Co., Inc., Virginia, 1985.
3. Juran Frank, J.M. and Gryna, F.M. Quality Planning and Analysis, Tata McGraw Hill, 1993

REFERENCES:

1. Hutchins.G, ISO 9000, Viva Books, New Delhi, 2000
2. Clarkson H. Oglesby, Productivity Improvement in Construction, McGraw-Hill,1989.

3. John L. Ashford, The Management of Quality in Construction, E & F.N.Spon, New York, 1989
4. Steven McCabe, Quality Improvement Techniques in Construction, AddisonWesley Longman Ltd, England. 1998

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ELECTIVE COURSES

	CONTRACT LAWS AND REGULATIONS	Category	L	T	P	Credit
		EC-PS	3	0	0	3

PREAMBLE

To study contract laws and regulations so that adequate knowledge on formulating and managing construction contracts is gained

PREREQUISITE

NIL

COURSE OBJECTIVES

1	To study the various types of construction contracts and their legal aspects and provisions.
2	To study the tenders, its formation and labour regulations.
3	To study the elements of concluding, and administering contracts.
4	To achieve awareness on arbitrations and legal procedures.
5	To study labour regulations and their impact on managing of contracts.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. To study and understand the Elements of Contracts.	Understand
CO2. To study the role of Contract Formation and Interpretation.	Understand
CO3. To learn about the roles of an arbitrator.	Apply
CO4. To interpret the student knowledge on Tax Laws.	Apply
CO5. To acquire the knowledge of Labour Regulations and Welfare Legislation.	Understand

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	-	L	-	L	L	-	-	M	S	M	L	-	M	M
CO2	M	L	L	-	L	L	-	-	M	S	M	L	-	M	M
CO3	M	M	-	-	M	-	-	M	L	M	M	L	L	L	L
CO4	L	M	M	-	S	S	L	M	-	L	M	M	M	L	M
CO5	L	M	M	-	S	S	L	S	-	L	M	M	M	L	M

S- Strong; M-Medium; L-Low

SYLLABUS

UNIT – I CONSTRUCTION CONTRACTS

Definition of Contract - Indian Contracts Act – Elements of Contracts – Types of Contracts – Features – Suitability – Design of Contract Documents –- Legal Issues in Contract – Standard Forms of Contracts- General and Special Conditions of Contracts - Project Management Consultants and the Contractor

UNIT – II TENDERS

Tendering Process - Tender Documents – Requirements for Tendering –Methods of Inviting Tenders-Evaluationof Tender from Technical, Financial Aspects– Contract Formation and Interpretation – Potential Contractual Problems – World Bank Procedures and Guidelines – Tamil Nadu Transparency in Tenders Act.

UNIT – III ARBITRATION

Earnest Money Deposit (EMD) – Security deposits - Arbitrator– Appointment of Arbitrators – Conditions of Arbitration – Powers and Duties of Arbitrator – Rules of Evidence – Violations –

Certificates, Forms, Schedules

UNIT – IV LEGAL REQUIREMENTS

Insurance and Bonding – Types of Bonds - Laws Governing Sale, Purchase and Use of Urban and Rural Land – Land Revenue Codes – Tax Laws – Income Tax, Sales Tax, Excise and Custom Fine and Liquidated Damages – Insurance Income Tax – Sales Tax – VAT– Legal Requirements for Planning – Property Law – Agency Law – Local Government Laws for Approval

UNIT – V LABOUR REGULATIONS

Social Security – Welfare Legislation – Laws relating to Wages, Bonus and Industrial Disputes, Labour Administration – Insurance and Safety Regulations- Indian Contracts Act - Labour Laws - Minimum Wages Act – Child Labour Act- Industrial Dispute Act- Maternity Benefit Act – Workmen's Compensation Act – Indian Factory Act – Tamil Nadu Factory Act.

TEXT BOOKS:

1. Gajaria G.T., Laws Relating to Building and Engineering Contracts in India, M.M.Tripathi Private Ltd., Bombay, 1982.
2. Joseph T. Bockrath, Contracts and the Legal Environment for Engineers and Architects, McGraw Hill, 2000.
3. Sharma M.R., (2013), Fundamentals of Construction Planning & Management S.K. Kataria& Sons, New Delhi.

REFERNCES:

1. Kwaku, A., Tenah, P.E. Jose M.Guevara, P.E., Fundamentals of Construction Management and Organisation, Printice Hall, 1985.
2. Patil. B.S, Civil Engineering Contracts and Estimates, Universities Press (India) Private Limited, 2006.
3. Martin Brook (2016), Estimating and Tendering for Construction Work, 5th Edition, Routledge, Taylor & Francis.
4. Jimmie Hinze, (2013), Construction Contracts, 3rd Edition, McGraw Hill, New Delhi.

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	SYSTEM INTEGRATION IN CONSTRUCTION	Category	L	T	P	Credit
		EC-PS	3	0	0	3

PREAMBLE

This course consolidates the fundamentals by taking a holistic approach to building technology in the design and construction of structures. The focus of the course is on understanding how systems interact with one another in the context of achieving high performance in various categories of major use. To illustrate the concept and practice, a case study approach will be used.

PREREQUISITE

NIL

COURSE OBJECTIVES

1	To research the integration of various construction systems, environmental factors, services, maintenance, and safety systems
2	To comprehend how the various systems that make up a building design are interwoven in order to achieve a high-performance structure
3	To comprehend how the various systems that make up a building design are integrated in order to achieve a high-performance structure
4	Through case studies, gain an understanding of building systems integration with a focus on sustainable design
5	Through case studies, gain an understanding of building systems integration with a focus on sustainable construction

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. To understand various structural systems requirements in construction after completing this course.	Understand
CO2. To understand various Environmental factor in construction after completing this course.	Understand
CO3. To understand various Service steps requirements in construction after completing this course.	Understand
CO4. To understand various maintenance steps requirements in construction after completing this course.	Understand
CO5. To understand various safety steps requirements in construction after completing this course.	Understand

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	**L**	**L**	**L**	M	**L**	**S**	**S**	**L**	**L**	**M**	**M**	**M**	**L**	**L**	**L**
CO2	**M**	**M**	**M**	**L**	**M**	**S**	**S**	**-**	**L**	**S**	**L**	**S**	**S**	**M**	**M**
CO3	**M**	**L**	**M**	**L**	**M**	**M**	**-**	**M**	**M**	**-**	**S**	**L**	**M**	**S**	**S**

CO4	**M**	**M**	**M**	**L**	**M**	**S**	**L**	**M**	**M**	**L**	**S**	**L**	**M**	**L**	**L**
CO5	**L**	**L**	**L**	**M**	**L**	**M**	**S**	**M**	**M**	**M**	**M**	**M**	**S**	**M**	**M**

S- Strong; M-Medium; L-Low

SYLLABUS

UNIT - I STRUCTURAL INTEGRATION

Structural System, Systems for enclosing Buildings, Functional aesthetic system, Materials, Selection and Specification.

UNIT-II ENVIRONMENTAL FACTORS

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

Plumbing – Electricity – Vertical circulation and their interaction – HVAC

UNIT - IV MAINTENANCE

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

Ability of systems to protect fire – Preventive systems – fire escape system design – Planning for pollution free construction environmental – Hazard free Construction execution

BOOKS:

1. A.J.Elder and Martiz Vinden Barg, "Handbook of Building Enclosure", McGraw-Hill Book Company, 1983.
2. David V.Chadderton, "Building Services Engineering", Taylar and Francis, 2007.

REFERENCES:

1. Jane Taylor and Gordin Cooke, "The Fire Precautions" Act in Practices, 1987.
2. Peter R. Smith and Warren G. Julian, "Building Services", Applied Science Publishers Ltd., London, 1993.
3. William T. Mayer, "Energy Economics and Building Design , McGraw-Hill Book Company, 1983.

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	ENERGY EFFICIENT BUILDINGS	Category	L	T	P	Credit
		EC-PS	3	0	0	3

PREAMBLE

To study the design of energy efficient buildings which balances all aspects of energy, lighting, space conditioning and ventilation by providing a mix of passive solar design strategies and to learn the use of materials with low embodied energy.

PREREQUISITE

NIL

COURSE OBJECTIVES

1	To Study about the energy requirement of the building construction
2	To Study about the key design elements for energy efficient buildings
3	To learn the green buildings concepts applicable to modern buildings.
4	Acquaint students with the principle theories, materials, and construction techniques and to create energy efficient buildings.
5	To learn energy efficiency measures on grounds of engineering and economic feasibility.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. To understand the concept effective utilization of energy in building.	**Understand**
CO2. To learn about energy efficiency through landscaping.	**Understand**
CO3. The learn the methods air regulation in buildings	**Understand**
CO4. To learn about how to develop a heat transfer mechanism in building	**Apply**
CO5. To Integrate the renewable energy systems in the buildings and passive cooling in buildings.	**Apply**

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	M	-	-	-	L	M	-	L	-	L	L	L	-	-
CO2	M	M	L	-	L	-	M	L	M	L	L	L	-	L	-
CO3	L	L	M	-	M	M	S	-	-	L	L	S	M	L	L
CO4	S	-	M	M	S	M	S	-	M	M	M	S	M	M	M
CO5	S	-	M	M	M	M	S	-	M	-	M	S	M	M	M

S- Strong; M-Medium; L-Low

SYLLABUS

UNIT I INTRODUCTION

Conventional versus Energy Efficient buildings – Historical perspective - Water – Energy – IAQ requirement analysis – Energy required for building construction - Heat Transfer Future building design aspects.

UNIT II LANDSCAPE AND BUILDING ENVELOPES

Energy efficient Landscape design - Micro-climates – various methods –Building materials, Envelope heat loss and heat gain and its evaluation, paints, Insulation, Design methods and tools - Air Filtration and odor removal –Heat Recovery in large buildings

UNIT III HEATING, VENTILATION AND AIR CONDITIONING

Natural Ventilation, Passive cooling and heating - Application of wind, water and earth for cooling, evaporative cooling, radiant cooling – Hybrid Methods – Energy Conservation measures, Thermal Storage integration in buildings.

UNIT IV HEAT TRANSMISSION IN BUILDINGS

Surface co-efficient: air cavity, internal and external surfaces, overall thermal transmittance, wall and windows; Heat transfer due to ventilation/infiltration, internal heat transfer; Sol-air temperature; Decrement factor; Phase lag. Design of day lighting; Computer packages for carrying out thermal design of buildings and predicting performance.

UNIT V PASSIVE COOLING & RENEWABLE ENERGY IN BUILDINGS

Passive cooling concepts: Evaporative cooling, radiative cooling; Application of wind, water and earth for cooling; Shading, paints and cavity walls for cooling; Roof radiation traps; Earth air tunnel. Introduction of renewable sources in buildings, solar water heating, small wind turbines, stand-alone PV systems, Hybrid system – Economics.

TEXT BOOKS:

1. Krieder J. and Rabi A., "Heating and Cooling of buildings : Design for Efficiency", Mc Graw Hill, 1994.
2. Ursala Eicker, "Solar Technologies for buildings", Wiley publications, 2003.
3. Moore, F., "Environmental Control System", McGraw Hill Inc. 2002

REFERENCES:

1. Brown, G.Z. and DeKay, M., "Sun, Wind and Light – Architectural Design Strategies", John Wiley and Sons Inc, 2001.
2. Chilogioji, M.H., and Oura, E.N., "Energy Conservation in Commercial and Residential Buildings" - Marcel Dekker Inc., New York and Basel, 2005.
3. Guide book for National Certification Examination for Energy Managers and Energy Auditors (Could be downloaded from www.energymanagertraining.com)
4. Energy Conservation Building Code, Bureau of Energy Efficiency", New Delhi,2007.

S.No	Name of the Faculty	Designation	Name of the College	Mail ID
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	CONSTRUCTION ECONOMICS AND FINANCE MANAGEMENT	Category	L	T	P	Credit
		EC-PS	3	0	0	3

PREAMBLE:

For any construction project to be successful, it must be technically sound and the resulting benefits must exceed the cost associated with the project. This course "Construction Economics and Finance" basically aims at describing various aspects of engineering economics. The field of construction economics and finance deals with the systematic evaluation of cost and benefit associated with different projects. The topics in this course cover principles of engineering economy followed by basic methods for carrying out economic studies considering the time value of money. The other topics include the demonstration of different methods namely present, future and annual worth method, rate of return, break-even comparison, capitalized-cost and cost-benefit analysis for the comparison of alternatives

PREREQUISITE: NIL

COURSE OBJECTIVES:

To study and understand the role of civil engineering industrial development

To study the role of construction economics and transport energy.

The students know about financing instruments..

To Expose the students knowledge of Cash basis of a accounting

To acquire the knowledge of Loans to Contractors

COURSE OUTCOMES:

After successful completion of the course, students will be able to

CO1: Understand the concept of Economy related to Engineering	Understand
CO2: Practice the Construction development in Housing, transport energy and other Infrastructures	Apply
CO3: Analyse the financial statements and Investment and financing decision	Analysing
CO4: Assess the Accounting for tax reporting purposes and financial reporting purposes	Analysing
CO5: Understand the Interim construction financing	Understand

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	M	L	-	-	-	L	L	L	M	L	M	-	-	L
CO2	M	M	L	-	L	L	-	L	M	M	-	L	-	-	-
CO3	L	S	L	S	S	-	-	L	-	L	-	L	M	M	-
CO4	L	M	S	L	M	-	L	-	L	M	L	M	-	M	-
CO5	L	L	M	-	L	M	S	S	M	L	L	M	L	-	M

S- Strong; M-Medium; L-Low

SYLLABUS:

UNIT I ECONOMICS:

Role of Civil Engineering in Industrial Development – Advances in Civil Engineering - Engineering Economics – Support Matters of Economy related to Engineering – Market demand and supply – Choice of Technology – Quality Audit in economic law of returns governing production.

UNIT II CONSTRCUTION ECONOMICS -Construction development in Housing, transport energy and other infrastructures – Economics of ecology, environment, energy resources – Local material selection – Form and functional designs – Construction workers – Urban Problems – Poverty – Migration – Unemployment – Pollution.

UNIT III FINANCING The need for financial management - Types of financing – Financing instruments– short term borrowing – Long term borrowing – Leasing – Equity financing – Internal generation of funds – External commercial borrowings – Assistance from government budgeting support and international finance corporations – Analysis of financial statements – Balance Sheet - Profit and Loss account – Cash flow and Fund flow analysis – Ratio analysis – Investment and financing decision – Financial Control - centralized management

UNIT IV ACCOUNTING METHOD -General Overview – Cash basis of a accounting – Accrual basis of accounting – Percentage completion method – Completed contract method – Accounting for tax reporting purposes and financial reporting purposes – Accounting Standards.

UNIT V LENDING TO CONTRACTORS Loans to Contractors – Interim construction financing – Security and risk aspects.

TEXT BOOKS:

1. Prasanna Chandra, Project Selection, Planning, Analysis, Implementation and Review, Tata McGraw Hill Publishing Company, 1995.
2. Halpin, D.W., Financial and Cost Concepts for Construction Management, John Wiley & Sons, New York, 1985.

REFERENCES:

1. Warneer Z Hirsch, Urban Economics, Macmillan, New York, 1993.
2. Kwaku A, Tenah and Jose M.Guevara, Fundamental of Construction
3. Management and Organisation, Prentice – Hall of India, 1995.
4. Madura, J and Veit, E.T., Introduction to Financial Management, West Publishing Co., St. Paul, 1988.

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CONSTRUCTION PERSONNEL MANAGEMENT	Category	L	T	P	Credit
	EC-PS	3	0	0	3

PREAMBLE

To study and execute the importance of events and activities management in construction projects

PREREQUISITE

Construction Planning, Scheduling and Control

COURSE OBJECTIVES

1	To study the various aspects of manpower management.
2	To study the man power planning management
3	To study the various aspects of organization management
4	To study the human relations management
5	To study the welfare and development methods in construction

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. know various processes in manpowerplanning	Understand and, Apply
CO2. handle organizational and welfare measures.	Apply
CO3. tackle problems in execution.	Apply
CO4. find the route to complete the target when difficulties arise.	Apply
CO5. to know the value of manual power	Understand and Apply

MAPPINGWITHPROGRAMMEOUTCOMESANDPROGRAMMESPECIFICOUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	**L**	M	**L**	**-**	**S**	**S**	**S**	**L**	**L**	**M**	**M**	**M**	**L**	**L**	**L**
CO2	**L**	**L**	**S**	**-**	**S**	**S**	**S**	**L**	**M**	**M**	**S**	**L**	**M**	**M**	**S**
CO3	**M**	**L**	**S**	**L**	**L**	**-**	**M**	**M**	**M**	**L**	**L**	**S**	**M**	**S**	**M**
CO4	**M**	**L**	**S**	**L**	**L**	**-**	**S**	**M**	**S**	**L**	**L**	**S**	**L**	**L**	**M**
CO5	**M**	**M**	**M**	**M**	**M**	**S**	**M**	**M**	**M**	**L**	**M**	**M**	**M**	**M**	**S**

S-Strong;M-Medium;L-Low

SYLLABUS

UNIT I MANPOWER PLANNING

Manpower Planning process , Organising, Staffing, directing, and controlling – Estimation, manpower requirement – Factors influencing supply and demand of human resources – Role of HR manager – Personnel Principles.

UNIT II ORGANISATION

Requirement of Organisation – Organisation structure – Organisation Hierarchical charts – Staffing

Plan - Development and Operation of human resources - Managerial Staffing – Recruitment – Selection strategies – Placement and Training.

UNIT III HUMAN RELATIONS AND ORGANISATIONAL BEHAVIOUR

Basic individual psychology – Approaches to job design and job redesign – Self managing work teams – Intergroup – Conflict in organizations – Leadership-Engineer as Manager – al 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

Compensation – Safety and health – GPF – EPF – Group Insurance – Housing - Pension – Laws related to welfare measures.

UNIT V MANAGEMENT AND DEVELOPMENT METHODS

Wages and Salary, Employee benefits, Employee appraisal and assessment – Employee services-Safety and Health Management – Special Human resource problems – Productivity in human resources – Innovative approach to designing and managing organization – Managing New Technologies – Total Quality Management – Concept of quality of work life – Levels of change in the organizational Development – Requirements of organizational Development – System design and methods for automation and management of operations – Developing policies, practices and establishing process pattern – Competency upgradation and their assessment – New methods of training and development – Performance Management**.**

REEFERENCES:

1. Charles D Pringle, Justin Gooderi Longenecter, Management, CE Merril Publishing Co. 1981.
2. Dwivedi R.S, Human Relations and Organisational Behaviour, Macmillian India Ltd.,2005.
3. Josy.J. Familaro, Handbook of Human Resources Administration, McGraw-Hill International Edition, 1987.
4. Memoria,C.B., Personnel Management, Himalaya Publishing Co., 1997.
5. Carleton Counter II and Jill Justice Coutler, The Complete Standard Handbook of Construction Personnel Management, Prentice-Hall, Inc., 1989.

S.No	NameoftheFaculty	Designation	Name of the College	MailID
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	BUSINESS ECONOMICS AND FINANCE MANAGEMENT	Category	L	T	P	Credit
		EC-PS	3	0	0	3

PREAMBLE

To study about the construction economics and its role and to exposure on financial instrumentation on their cash basis of accounting

PREREQUISITE

NIL

COURSE OBJECTIVES

1	To study and understand the role of civil engineering industrial development. .
2	To study the role of construction economics and transport energy.
3	The students know about financing instruments.
4	To Expose the students knowledge of Cash basis of a accounting.
5	To acquire the knowledge of Loans to Contractors

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. To Evaluate the economic theories, cost concepts and pricing policies	Understand and Apply
CO2. To study the elements of construction economics	Apply
CO3.. To study the need for financial management and means of achieving the same.	Apply
CO4. To study a few accounting methods	Apply
CO5. To study the elements of lending to the contractors	Understand and Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO1	PSO2	PSO3	PSO4
CO1	**L**	S	**L**	**L**	**L**	L	L	**L**	**L**	**M**	**L**	**M**	M	**L**	**S**	**L**
CO2	**S**	**M**	**M**	**S**	L	L	**S**	**S**	**M**	**M**	**S**	**S**	**M**	**S**	**S**	**L**
CO3	**L**	**L**	**L**	**L**	-	**M**	**S**	**S**	**S**	**L**	**S**	**S**	**M**	**S**	**S**	**M**
CO4	**L**	**S**	**S**	**M**	**L**	**M**	**M**	**M**	**L**	**L**	**S**	**S**	**L**	**S**	**S**	**M**

CO5	**L**	**M**	**M**	**M**	**S**	**S**	**S**	**L**	**M**	**S**	**M**	**M**	**L**	**S**	**S**	**L**

S- Strong; M-Medium; L-Low

SYLLABUS

UNIT I ECONOMICS

Role of Civil Engineering in Industrial Development – Advances in Civil Engineering - Engineering Economics – Support Matters of Economy related to Engineering – Market demand and supply – Choice of Technology – Quality Audit in economic law of returns governing production.

UNIT II CONSTRCUTION ECONOMICS

Construction development in Housing, transport energy and other infrastructures –Economics of ecology, environment, energy resources – Local material selection –Form and functional designs – Construction workers – Urban Problems – Poverty –Migration – Unemployment – Pollution.

UNIT III FINANCING

The need for financial management - Types of financing – Financing instruments–short term borrowing – Long term borrowing – Leasing – Equity financing – Internal generation of funds – External commercial borrowings – Assistance from government budgeting support and international financecorporations – Analysis of financial statements – Balance Sheet - Profit and Loss account – Cash flow and Fund flow analysis – Ratio analysis – Investment and financing decision – Financial Control - centralized management.

UNIT IV ACCOUNTING METHOD

General Overview – Cash basis of a accounting – Accrual basis of accounting –Percentage completion method – Completed contract method – Accounting for tax reporting purposes and financial reporting purposes – Accounting Standards

UNIT V LENDING TO CONTRACTORS

Loans to Contractors – Interim construction financing – Security and risk aspects.

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4. Madura, J and Veit, E.T., Introduction to Financial Management, West Publishing Co., St. Paul, 1988

S.No	Name of the Faculty	Designation	Name of the College	Mail ID
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	RESOURCE MANAGEMENT AND CONTROL IN CONSTRUCTION	Category	L	T	P	Credit
		EC-PS	3	0	0	3

PREAMBLE

To study about various aspects of Resource Management and Control in Construction and to aply the techniques of recourse allocation.

PREREQUISITE

NIL

COURSEOBJECTIVES

1	To study and understand the resource planning and types of resources.
2	To study the role of labour management and labour schedule.
3	The students know about materials and equipment.
4	To expose the students knowledge of time management.
5	To acquire the knowledge of resource allocation and leveling

COURSEOUTCOMES

On the successful completion of the course, students will be able to

CO1. To be well versed in resource planning and management in construction	Understandand Apply
CO2. To clearly understand the labour costs and schedule in construction.	Apply
CO3. To be well versed to manage the materials at site	Apply
CO4. To demonstrate the time management for all kind of projects.	Apply
CO5. To incorporate the realities of construction site and respond to changes in project objectives and to track resource utilization.	Understand and Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	**M**	M	**L**	**M**	**S**	**S**	**S**	**M**	**L**	**M**	**M**	**M**	**L**	**L**	**L**
CO2	**M**	**L**	**S**	**M**	**S**	**M**	**M**	**L**	**M**	**M**	**S**	**L**	**M**	**M**	**S**
CO3	**M**	**M**	**S**	**L**	**L**	**M**	**M**	**M**	**M**	**L**	**L**	**S**	**M**	**S**	**M**

CO4	**L**	**L**	**S**	**L**	**L**	**-**	**S**	**M**	**M**	**L**	**L**	**M**	**L**	**L**	**M**
CO5	**M**	**M**	**M**	**M**	**M**	**S**	**M**	**M**	**M**	**L**	**M**	**M**	**M**	**M**	**S**

S-Strong;M-Medium;L-Low

SYLLABUS

UNIT – I RESOURCE PLANNING

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

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

Material: Time of purchase, quantity of material, sources, Transportation, Delivery and Distribution**,** Planning and selecting by optimistic choice with respect to cost, Time, Source and handling

UNIT – IV TIME MANAGEMENT

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

Time-cost trade off, Computer application - resource leveling,resource list, resource allocation, Resource loading, Cumulative cost - Value Management

.

BOOKS:

1 Andrew,D., Szilagg, Hand Book of Engineering Management, 1982.

2. James.A., Adrain, Quantitative Methods in Construction Management, American Elsevier Publishing Co., Inc., 1973.

REFERENCES:

1. Harvey, A., Levine, Project Management using Micro Computers, Obsorne
2. Glenn .A, Sea's and Reichard, Clough .H, “Construction Project Management”, John Wiley and Sons, Inc, 2009.

S.No	Name of the Faculty	Designation	Name of the College	Mail ID
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2	Mr.C.Kathirvel	Associate Professor & Head	Civil / VMKVEC	kathirvel@vmkvec.edu.in

	PROJECT SAFETY MANAGEMENT	Category	L	T	P	Credit
		EC-PS	3	0	0	3

PREAMBLE

PREREQUISITE

NIL

COURSEOBJECTIVES

1	To study and understand the construction accidents and cost of construction injuries.
2	To study the role of safety programmes and elements of effective safety programme.
3	The students know about International Practice of appraisal
4	To Expose the students knowledge of design for safety.
5	To acquire the knowledge of owners' and designers' outlook.

COURSEOUTCOMES

On the successful completion of the course, students will be able to

CO1. To understand the construction accidents and Legal Implications.	Understand and Apply
CO2. To clearly explain the Elements of an Effective Safety Programme	Apply
CO3. To elaborate the concept on Safety in Construction Contracts.	Apply
CO4. To clearly explain the Owners responsibility and safety and role of designers in ensuring safety	Apply
CO5. To understand the Safety Procedures and Workers Compensation	Understand and Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	**M**	M	**L**	**M**	**S**	**S**	**S**	**L**	**L**	**M**	**M**	**M**	**L**	**L**	**M**
CO2	**M**	**L**	**S**	**-**	**S**	**S**	**S**	**L**	**M**	**M**	**S**	**L**	**M**	**M**	**S**
CO3	**M**	**S**	**S**	**L**	**L**	**L**	**M**	**M**	**M**	**M**	**L**	**M**	**M**	**S**	**M**
CO4	**M**	**L**	**S**	**M**	**L**	**-**	**S**	**M**	**S**	**L**	**L**	**S**	**L**	**L**	**M**
CO5	**M**	**M**	**M**	**M**	**M**	**S**	**S**	**M**	**M**	**L**	**M**	**M**	**M**	**M**	**S**

S-Strong;M-Medium;L-Low

SYLLABUS

UNIT – I CONSTRUCTION ACCIDENTS

Accidents and their causes – Human factors in construction safety – costs of construction injuries- occupational and safety hazard assessment- legal implications

UNIT – II SAFETY PROGRAMMES

Problem areas in construction safety- Elements of an Effective Safety Programme-Job –Site safety assessment- Safety Meetings- Safety Incentives

UNIT – III CONTRACTUAL OBLIGATIONS

Safety in construction contracts- Substance Abuse- Safety record keeping

UNIT – IV DESIGNING FOR SAFETY

Forklifts Safety Culture – Safe Workers – Safety and First Line Supervisors – Safety and Middle Managers – Top Management Practices, Company Activities and Safety – Safety Personnel – Sub contractual Obligation – Project Coordination and Safety Procedures – Workers Compensation

UNIT- V OWNERS' AND DESIGNERS' OUTLOOK

Study of various case studies.

BOOKS:

1. Jimmy W. Hinze, Construction Safety, Prentice Hall Inc., 1997.
2. Richard J. Coble, Jimmie Hinze and Theo C. Haupt, Construction Safety and Health Management, Prentice Hall Inc., 2001.

REFERENCES:

1. Tamilnadu Factory Act, Department of Inspectorate of factories, Tamil nadu.

S.No	Name of the Faculty	Designation	Name of the College	Mail ID
1	Ms.S.Monisha	Assistant Professor - I	AVIT	monisha.civil@avit.ac.in
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	MAINTENANCE AND REHABILITATION OF STRUCTURES	Category	L	T	P	Credit
		EC-PS	3	0	0	3

PREAMBLE

To study the damages, repair and rehabilitation of structures

PREREQUISITE

NIL

COURSE OBJECTIVES

1	To study and understand the maintenance repair and rehabilitation.
2	To study the role of serviceability and durability of concrete
3	The students know about materials and techniques for repair.
4	To Expose the students knowledge of repair to structures.
5	To acquire the knowledge of demolition of structures.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Describe various phases of maintenance and be able to evaluate damaged structures	Understand
CO2. Analyze the influence of different environmental elements, fire and pollution on buildings.	Understand and apply
CO3. Identify and describe material used in repair work.	Understand and apply
CO4. Describe various procedures and techniques in strengthening measures	Understand and apply
CO5. Explain demolition techniques for existing buildings	Understand and apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	**M**	M	**L**	**-**	**S**	**L**	**S**	**L**	**M**	**-**	**M**	**M**	**L**	**L**	**L**
CO2	**L**	**L**	**-**	**M**	**-**	**-**	**M**	**L**	**M**	**-**	**S**	**L**	**M**	**L**	**S**
CO3	**M**	**L**	**-**	**L**	**-**	**-**	**-**	**-**	**M**	**-**	**L**	**S**	**L**	**S**	**M**
CO4	**S**	**L**	**S**	**-**	**M**	**-**	**-**	**-**	**S**	**L**	**L**	**S**	**L**	**L**	**M**
CO5	**M**	**S**	**M**	**-**	**M**	**-**	**-**	**-**	**M**	**L**	**M**	**M**	**S**	**L**	**L**

S- Strong; M-Medium; L-Low

SYLLABUS

UNIT I MAINTENANCE AND REPAIR STRATEGIES

Maintenance, repair and rehabilitation, Facets of Maintenance, importance of Maintenance various aspects of Inspection, Assessment procedure for evaluating a damaged structure, causes of deterioration-

UNIT II SERVICEABILITY AND DURABILITY OF CONCRETE

Quality assurance for concrete construction concrete properties- strength, permeability, thermal properties and cracking. - Effects due to climate, temperature, chemicals, corrosion - design and construction errors - Effects of cover thickness and cracking- Impact of Pollution on Buildings.

UNIT III MATERIALS AND TECHNIQUES FOR REPAIR

Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, Ferro cement and polymers coating for rebars loadings from concrete, mortar and dry pack, vacuum concrete, Gunite and Shotcrete, Epoxy injection, Mortar repair for cracks, shoring and underpinning. Methods of corrosion protection, corrosion inhibitors, corrosion resistant steels and cathodic protection.

UNIT IV REPAIRS TO STRUCTURES

Strengthening Measures - Repair of structures distressed due to earthquake – Strengthening using FRP Strengthening and stabilization techniques for repair.

UNIT V DEMOLITION OF STRUCTURES

Planning, Precautions and Protective Measures In Demolition Work-Sequence Of Operations Demolition Of Structural Elements. Engineered Demolition techniques for dilapidated structures - Case studies.

BOOKS:

Denison Campbell, Allen and Harold Roper, “Concrete Structures, Materials, Maintenance and Repair”, Longman Scientific and Technical UK, 1991.

Allen R.T and Edwards S.C, “Repair of Concrete Structures”, Blakie and Sons, UK, 1987.

REFERENCES:

M.S. Shetty, "Concrete Technology - Theory and Practice ", S. Chand and Company, New Delhi, 6th Edition, 2005.

N.Palaniappan, "Estate Management, Anna Institute of Management ", Chennai, 1992.

Lakshmipathy, Metal Lecture notes of Workshop on "Repairs and Rehabilitation of Structures", 29 - 30th October 1999.

Raikar, R.N., “Learning from failures - Deficiencies in Design, Construction and Service” - R&D Centre (SDCPL), Raikar Bhavan, Bombay, 1987.

Santhakumar A.R., “Concrete Technology” Oxford University Press, Printed in India by Radha Press, New Delhi, 2007.

Peter H.Emmons, “Concrete Repair and Maintenance Illustrated”, Galgotia Publications pvt. Ltd., 2001.

S.No	Name of the Faculty	Designation	Name of the College	Mail ID
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OPEN ELECTIVES ON EMERGING AREAS

	METAL ADDITIVE MANUFACTURING	Category	L	T	P	Credit
		OE--EA	3	0	0	3

Prerequisite:-Nil

Course Objective

1	Understand the basic principles, methods, areas of usage, possibilities and limitations and the environmental effects of the metal additive manufacturing
2	Select suitable materials for development of parts using additive manufacturing with sound mechanical properties
3	Select suitable processes from various metal additive manufacturing processes as per the product requirement
4	Develop and select suitable parameter for manufacturing and post processing techniques for metal additive manufacturing parts
5	Design the parts for metal additive manufacturing

Course Outcomes: On the successful completion of the course, students will be able to

CO1.	Understand the basic principles, applications and limitations metal additive manufacturing system	Understand
CO2.	Understand how to select suitable materials from the existing or develop new materials for additive manufacturing	Understand
CO3.	Understand the working principle of various methods in MAM and their applications and limitation	Understand
CO4.	Produce a defect free MAM parts with suitable material selection and post processing techniques	Apply
CO5.	Understand the design and optimization techniques to design and develop parts using MAM techniques	Apply

Mapping with Programme Outcomes and Programme Specific Outcomes

CO	PO1	PO	PO	PO	PO	PO	PO	PO	PO	PO 1	PO 1	PO 1	PS O	PS O	PS O
CO1	M	-	-	-	M	-	M	-	-	-	-	L	L	-	-
CO2	M	-	-	-	M	-	M	-	-	-	-	L	L	-	-
CO3	M	-	-	-	M	-	M	-	-	-	-	L	L	-	M
CO4	M	-	-	-	M	-	M	-	-	-	-	L	L	-	M
CO5	M	-	-	-	M	-	M	-	-	-	-	L	L	-	M

S-Strong;M-Medium;L-Low

Syllabus

Module 1	**Introduction**	9
Introduction to metal additive manufacturing – classification and challenges – applications- CAD for additive manufacturing – file formats, CAD CAM software, modelling and data processing – STL format – slicing – design consideration- machine set up		
Module 2	**Materials and properties of AM printed parts**	9
Manufacturing of metallic materials - Conventional vs AM process - Solidification of Metals Equilibrium and Non-equilibrium phases for solidification for AM Phase diagrams - Iron-Carbon - Aluminum alloy - Titanium alloy - Nickel alloy Methods of Powder Particles Production and Powder Properties - Wire Properties for Direct Energy Deposition - Mechanical properties of AM printed parts		
Module 3	**Basic processes in metal additive manufacturing**	9
Powder bed fusion – direct energy deposition – binder jetting – metal extrusion – material jetting - sheet lamination Laser theory - Continuous vs pulsed laser - Laser types - Laser beam properties Basics of electron beam - Electron beam powder bed fusion and mechanism Powder feeders and their classification - Delivery Nozzles - Powder bed delivery and spreading system Wire Fed Systems - Positioning Devices - Print-heads		
Module 4	**AM process parameters**	9
Beam Scanning Strategies and Parameters for PBF and DED - Powder Properties for PBF, DED, and BJ - Ambient Parameters for PBF and DED - Geometry-Specific Parameters, Support Structures (PBF) Defects in AM Printed Parts - Need of Post Processing - Need for Surface Finishing Common Post Processing for MAM - Potential Hazards of Additive Manufacturing – economics of MAM		
Module 5	**Design for Additive Manufacturing**	9
Fundamentals and principle -design techniques and steps - design optimization, material selection and consideration in application field - Part decomposition and Decomposition methods Topology optimization techniques - Overhangs, and Bridging and cavities in design Key characteristics and considerations in topology optimization - Topology optimization under material uncertainty and manufacturability - Industry 4.0 future with AM		

Text Books	
1	Milewski, J.O., 2017. Additive manufacturing of metals. Cham: Springer International Publishing.
2	Balasubramanian, K.R. and Senthilkumar, V. eds., 2020. Additive Manufacturing Applications for Metals and Composites. IGI Global.
Reference Books	
1	Leach, R. and Carmignato, S. eds., 2020. Precision Metal Additive Manufacturing. CRC Press.
2	Gebhardt, A., “Rapid prototyping”, Hanser Gardener Publications, 2003

3	Gibson, I., Rosen, D.W. and Stucker, B., "Additive Manufacturing Methodologies: Rapid Prototyping to Direct Digital Manufacturing", Springer, 2010
4	Kamrani, A.K. and Nasr, E.A., "Rapid Prototyping: Theory and practice", Springer, 2006.

CourseDesigners

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1	Mr.A.Elanthirayan	Asst. Prof. G-II	AVIT	aleanthirayan@avit.ac.in

	WASTE TO ENERGY	Category	L	T	P	Credit
		OE-EA	3	0	0	3

PREAMBLE

This course is to provide insights into waste management options by reducing the waste destined for disposal and encouraging the use of waste as a resource for alternate energy production.

PREREQUISITE – Nil

COURSE OBJECTIVES

1	To enable students to understand of the concept of Waste to Energy.
2	To link legal, technical and management principles for production of energy form waste.
3	To learn about the best available technologies for waste to energy.
4	To analyze of case studies for understanding success and failures.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

O1: Understand the knowledge about the operations of Waste to Energy Plants.	Understand
O2: Analyse the various aspects of Waste to Energy Management Systems.	Analyze
O3: Carry out Techno-economic feasibility for Waste to Energy Plants	Apply
O4: Evaluate planning and operations of Waste to Energy plants.	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO1 1	PO1 2	PSO 1	PS O2	PSO3
CO1	M	-	-	L	-	-	-	-	-	-	-	-	L	-	-
CO2	M	M	L	L	-	M	-	-	-	-	-	-	L	-	-
CO3	S	M	S	M	-	L	-	M	-	-	-	-	M	L	-
CO4	S	M	S	-	L	-	-	-	-	-	-	-	M	L	-
CO5	L	L	-	L	-	-	-	-	-	-	-	-	L	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION

The Principles of Waste Management and Waste Utilization. Waste Management Hierarchy and 3R Principle of Reduce, Reuse and Recycle. Waste as a Resource and Alternate Energy source.

WASTE SOURCES & CHARACTERIZATION

Waste production in different sectors such as domestic, industrial, agriculture, postconsumer, waste etc. Classification of waste – agro based, forest residues, domestic waste, industrial waste (hazardous and non-hazardous). Characterization of waste for energy utilization. Waste Selection criteria.

TECHNOLOGIES FOR WASTE TO ENERGY

Biochemical Conversion – Energy production from organic waste through anaerobic digestion and fermentation. Thermo-chemical Conversion – Combustion, Incineration and heat recovery, Pyrolysis, Gasification; Plasma Arc Technology and other newer technologies.

WASTE TO ENERGY OPTIONS

Landfill gas, collection and recovery. Refuse Derived Fuel (RDF) – fluff, briquettes, pellets. Alternate Fuel Resource (AFR) – production and use in Cement plants, Thermal power plants and Industrial boilers. Conversion of wastes to

fuel resources for other useful energy applications Energy from Plastic Wastes – Non-recyclable plastic wastes for energy recovery. Energy Recovery from wastes and optimization of its use, benchmarking and standardization. Energy Analysis.

CASE STUDIES - WASTE TO ENERGY PLANTS

Success/failures of waste to energy Global Best Practices in Waste to energy production distribution and use. Indian Scenario on Waste to Energy production distribution and use in India. Success and Failures of Indian Waste to Energy plants. Role of the Government in promoting 'Waste to Energy'. Waste activities – collection, segregation, transportation and storage requirements. Location and Siting of 'Waste to Energy' plants. Industry Specific Applications – In-house use – sugar, distillery, pharmaceuticals, Pulp and paper, refinery and petrochemical industry and any other industry. Centralized and Decentralized Energy production, distribution and use. Comparison of Centralized and decentralized systems and its operations.

EFERENCES

1. Lee, James M., "Biochemical Engineering." PHI, 1st Edition, 1992. Yeh W.K., Yang H.C., James R.M., "Enzyme Technologies: Metagenomics, Biocatalysis and Biosynsthesis", Wiley- Blackwell, 1st Edition, 2010. Blanch H.W., Clark D. S., "Biochemical Engineering", Marcel Dekker, Inc. 2nd Edition, 1997.
2. Palmer, Trevor. "Enzymes: Biochemistry, Biotechnology, Clinical Chemistry." 2nd Edition, East West Press, 2008.

Course Designers

S.No.	Name of the faculty	Designation	Department	Mail ID
1.	Dr.R. Kirubakaran	Assistant Professor	Department of Biotechnology	kirubakaran@vmkvec.edu.in
2	Dr.M.Sridevi	Professor	Biotechnology	hodbte@vmkvec.edu.in

	BIOMEDICAL PRODUCT DESIGN AND DEVELOPMENT	Category	L	T	P	Credit
		OE-EA	3	0	0	3

PREAMBLE

The course aims at providing the basic concepts of product design, product features and its architecture so that student can have a basic knowledge in the common features a product has and how to incorporate them suitably in product.

PREREQUISITE – Nil

COURSE OBJECTIVES

1	To understand the global trends and development methodologies of various types of products and services.
2	To conceptualize, prototype and develop product management plan for a new product based on the type of the new product and development methodology integrating the hardware, software, controls, electronics and mechanical systems.
3	To understand requirement engineering and know how to collect, analyze and arrive at requirements for new product development and convert them in to design specification.
4	To understand system modeling for system, sub-system and their interfaces and arrive at the optimum system specification and characteristics.
5	To develop documentation, test specifications and coordinate with various teams to validate and sustain up to the EoL (End of Life) support activities for engineering customer.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Define, formulate and analyze a problem for the product design.	Apply
CO2 Obtain the domain knowledge of product development and regulatory requirements for the design of prototype.	Apply
CO3. Explain the process of manufacturing, testing and validation for scalable product development.	Apply
CO4 Gain knowledge of the Innovation & Product Development process in the Business Context.	Apply
CO5 Discuss the economics in product development and business strategies for turnover from commercialization.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S	M	L	--	--	--	M	--	--	--	M	S	L	M
CO2	S	S	M	L	--	--	--	M	--	--	--	M	S	L	M
CO3	S	S	M	L	--	--	--	M	--	--	--	M	S	L	M
CO4	S	S	S	L	--	--	--	M	--	--	--	M	S	L	M
CO5	S	S	S	L	--	--	--	M	--	--	--	M	S	L	M

S- Strong; M-Medium; L-Low

SYLLABUS

PRODUCT DESIGN

Definition, History and Modern Practice – Designs; Design and Product Life Cycle; Design Process; What is a medical device, Challenges in medical device, Understanding the innovation cycle, Good Design Practice.

Understanding, analyzing and validating user needs, Screening Needs, Technical Requirements, Concept Generation – Innovation Survey Questionnaire, Morphological Matrix, QFD, Concept Analysis and validation, Concept Modelling, Concept Screening & Validation.

PRODUCT DEVELOPMENT AND REGULATORY

Breakthrough Products, Platform Products, Front End of Innovations / Fuzzy Front End, Generic Product Development Process (Concept Development, System Design, Detailed Design, Test & Refinement, Production Ramp-up), Variants of Development Processes (Market Pull, Technology Push, Platform, Process-Intensive, Customized, High-Risk, Quick Build, Complex Systems), Good Documentation Practice, Prototyping Specifications, Prototyping, Medical Device standards, Quality management systems, Medical Device Classification, Design of Clinical Trials, Design Control & Regulatory Requirements, Documentation in Medical Devices, Regulatory pathways.

CALABLE PRODUCT DEVELOPMENT

Design for manufacturing, Design for assembly, Design for Serviceability, Design for usability, Medical Device Verification & Validation, Product Testing & Regulatory compliance, Clinical trial & validation, Device Certification.

MANUFACTURING AND BUSINESS STRATEGIES

Lean Manufacturing – Toyota Production System, Good Manufacturing Practices, Framework for Product Strategy – Core Strategic Vision (CSV), Characteristics of good CSV, Opportunity Identification Process & Generating Opportunities, Quality of Opportunities – Real-Win-Worth It (3M RWW), Product Planning Process, Technology S-Curve, Evaluating and Prioritizing Projects, Product-Process Change Matrix, Resource Planning, Total Available Market (Segmentation, Targeting & Positioning), Served Available Market, Product Platform Strategy, Market Platform Plan (Product Platform Management, Product Line Strategy).

PRODUCT ECONOMICS AND MARKET INFUSIONS

Economics/Finance in Product Development (Sales Forecasting – ATAR Model/ Bases Model, Pricing the product, Cash flow in Product Development, Categorizing the costs, Structuring Manufacturing Costs, Prototyping Costs, Development Costs, Cost Volume Profit Analysis, Breakeven Analysis, Common Return Metrics – Payback/ NPV/ IRR, Common Comparison Metrics – WACC/ RRR/ MARR). Business Model Canvas, Marketing Channels, Sales Models, Post Commercialization Surveillance, End of Life support.

REFERENCES:

1. Jones, J.C., Design Methods, John Wiley, 1981.
2. Cross, N., Engineering Design Methods, John Wiley, 1994.
3. Pahl, G., and Beitz, W., Engineering Design, Design Council, 1984.
4. Michael E. McGrath, Product Strategy for High-Technology Companies, 2nd Edition, McGraw Hill.
5. Ulrich, K.T., and Eppinger, S.D., Product Design and Development, Tata McGraw Hill, India.
6. Ehrelspiel. K, and Lindemann U Cost Efficient Design, Springer, 2007.
7. Paul H king, Richard C. Fries, Arthur T. Johnson, Design of Biomedical Devices and Systems. Third edition, ISBN 9781466569133.
8. Peter J. Ogrodnik, Medical Device Design: Innovation from Concept to Market, Academic Press Inc; Edition (2012), ISBN- 10:0123919428.
9. Stefanos Zenios, Josh Makower, Paul Yock, Todd J. Brinton, Uday N. Kumar, Lyn Denend, Thomas M. Krummel, Biodesign: the Process of Innovating Medical Technologies, Cambridbge University press; Edition (2009), ISBN- 10:0521517427.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID

1	Dr.L.K.Hema	Professor & Head	BME & ECE	hodbme@avit.ac.in
2	Dr.N.Babu	Professor	BME	babu@vmkvec.edu.in
3	Dr.R.Ezhilan	Assistant Professor	BME	ezhilan@vmkvec.edu.in

	ADVANCED CYBER SECURITY	Category	L	T	P	Credit
		OE-EA	3	0	0	3

PREAMBLE

To understand the need for Cyber Security in real time and to study techniques involved in it.

PREREQUISITE : NIL

COURSE OBJECTIVES

1.	To understand the basic terminologies related to cyber security and current cyber security threat landscape.
2.	To unserstand the cyberattacks that target computers, mobiles and persons
3.	To understand the legal framework that exist in India for cyber crimes and penalties and punishments for such crimes
4.	To study the data privacy and security issues related to Social media platforms.
5.	To understand the main components of cyber security plan

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1: able to understand the basic terminologies related to cyber security and current cybe security threat landscape.	Understand
CO2: Able to complete u n d e r s t a n d i n g of the cyberattacks that target computers, mobiles and persons	Apply
CO3: able to understand the legal framework that exist in India for cyber crimes and penalties and punishments for such crimes, It will also expose students to limitations of existing IT Act,2000 legal framework that is followed in other countries and legal and ethical aspects related to new technologies.	Apply
CO4: Able to get insight into the Data Protection Bill,2019 and data privacy and security issues related to Social media platforms.	Apply
CO5:Able to understand the main components of cyber security plan.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	M	M	M	M	-	-	-	-	-	-	-	-	M	M	M
CO 2	M	M	M	M	M	-	-	-	-	-	-	-	M	M	M
CO 3	M	M	S	M	M	-	-	-	-	-	-	-	M	M	M
CO 4	S	M	M	M		-	-	-	-	-	-	-	M	M	S
CO 5	S	M	M	M	S	-	-	-	-	-	-	-	M	M	S

S- Strong; M-Medium; L-Low

SYLLABUS:

Overview of Cyber security	**9 hours**
Cyber security increasing threat landscape, Cyber security terminologies- Cyberspace, attack, attack vector, attack surface, threat, risk, vulnerability, exploit, exploitation, hacker., Non-state actors, Cyber terrorism, Protection of end user machine, Critical IT and National Critical Infrastructure, Cyberwarfare, Case Studies.	
Cyber crimes	**9 hours**
Cyber crimes targeting Computer systems and Mobiles- data diddling attacks, spyware, logic bombs, DoS, DDoS, APTs, virus, Trojans, ransomware, data breach., Online scams and frauds- email scams, Phishing, Vishing, Smishing, Online job fraud, Online sextortion, Debit/ credit card fraud, Online payment fraud, Cyberbullying, website defacement, Cybersquatting, Pharming, Cyber espionage, Cryptojacking, Darknet- illegal trades, drug trafficking, human trafficking., Social Media Scams & Frauds- impersonation, identity theft, job scams, misinformation, fake newscyber crime against persons - cyber grooming, child pornography, cyber stalking., Social Engineering attacks, Cyber Police stations, Crime reporting procedure, Case studies.	
Cyber Law	**9 hours**
Cyber crime and legal landscape around the world, IT Act,2000 and its amendments. Limitations of IT Act, 2000. Cyber crime and punishments, Cyber Laws and Legal and ethical aspects related to new technologies- AI/ML, IoT, Blockchain, Darknet and Social media, Cyber Laws of other countries, Case Studies.	
Data Privacy and Data Security	**9 hours**
Defining data, meta-data, big data, nonpersonal data. Data protection, Data privacy and data security, Personal Data Protection Bill and its compliance, Data protection principles, Big data security issues and challenges, Data protection regulations of other countries- General Data Protection Regulations(GDPR),2016 Personal Information Protection and Electronic Documents Act (PIPEDA)., Social media- data privacy and security issues.	
Cyber security M a n a g e m e n t , Compliance and Governance	**9 hours**
Cyber security Plan- cyber security policy, cyber crises management plan., Business continuity, Risk assessment, Types of security controls and their goals, Cyber security audit and compliance, National cyber security policy and strategy.	
REFERENCES	
1. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd. 2. Information Warfare and Security by Dorothy F. Denning, Addison Wesley. 3. Security in the Digital Age: Social Media Security Threats and Vulnerabilities by Henry A. Oliver, Create Space Independent Publishing Platform. 4. Data Privacy Principles and Practice by Natraj Venkataramanan and Ashwin Shriram, CRC Press. 5. Information Security Governance, Guidance for Information Security Managers by W. KragBrothy, 1st Edition, Wiley Publication. 6. Auditing IT Infrastructures for Compliance By Martin Weiss, Michael G. Solomon, 2nd Edition, Jones Bartlett Learning.	

COURSE DESIGNERS

S. No.	Name of the Faculty	Designation	Department	Mail ID
1.	Dr.R.Jaichandran	Assistant professor G-II	CSE	rjaichandran@avit.ac.in
2.	Mr. B. Sundharamurthy	Assistant Professor	CSE	sundharamurthy@vmkvec.edu.in

	BIO MEMS	Category	L	T	P	Credit
		OE-EA	3	0	0	3

PREAMBLE

The rapid development of the integrated circuit (IC) industry has led to the emergence of micro electronics process engineering as a new advanced discipline. The combination of MEMS and integrated intelligence has been put forward as a disruptive technology.Gives brief knowledge about applications of Bio-MEMS technology for therapeutics and diagnostics.

PREREQUISITE

Nil

COURSE OBJECTIVES

1	To train the students in the design aspects of Bio MEMS devices and Systems.
2	To learn the basic principles of BioMEMS/Microfluidic device manufacturing.
3	To make the students aware of applications in various medical specialists especially the Comparison of conventions methods and Bio MEMS usage.
4	To Classify the different mechanisms of micro sensors and actuators.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Understand the Micro fluidic Principles and study its applications.	Understand
CO2. Explain the principles and applications of Micro Total Analysis.	Understand
CO3. Discuss and realize the MEMS applications in Bio Medical Engineering	Understand
CO4. Classifying the principles of Micro Actuators and Drug Delivery system	Apply
CO5.Utilizing the concept of MEMS with biological applications	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	L	L	L	L	-	-	-	-	-	-	-	-	-	-
CO2	S	L	L	L	M	-	-	-	-	-	-	-	-	-	-
CO3	S	L	M	L	M	-	-	-	-	-	-	-	-	L	-
CO4	S	M	M	L	M	-	-	-	-	-	-	L	L	L	-
CO5	S	S	M	L	M	-	-	-	-	-	-	L	L	L	-

S- Strong; M-Medium; L-Low

SYLLABUS

Unit I

Introduction-The driving force behind Biomedical Applications – Biocompatibility - Reliability Considerations-Regularity Considerations – Organizations - Education of Bio MEMS-Silicon Micro fabrication-Soft Fabrication techniques

Unit II

Micro fluidic Principles- Introduction-Transport Processes- Electro kinetic Phenomena-Micro valves –Micro mixers-Micro pumps.

Unit III

SENSOR PRINCIPLES and MICRO SENSORS: Introduction-Fabrication-Basic Sensors-Optical fibers-Piezo electricity and SAW devices-Electrochemical detection-Applications in Medicine

Unit IV

MICRO ACTUATORS and DRUG DELIVERY: Introduction-Activation Methods-Micro actuators for Micro fluidics-equivalent circuit representation-Drug Delivery

Unit V

MICRO TOTAL ANALYSIS: Lab on Chip-Capillary Electrophoresis Arrays-cell, molecule and Particle Handling-Surface Modification-Microsphere-Cell based Bioassay Systems Detection and Measurement Methods-Emerging Bio MEMS Technology-Packaging, Power, Data and RF Safety-Biocompatibility, Standards

Text Books/ References Books :

1. Steven S. Saliterman, Fundamentals of Bio MEMS and Medical Micro devices, Wiley Interscience, 2006.
2. Albert Folch , Introduction to Bio MEMS, CRC Press, 2012
3. Gerald A. Urban, Bio MEMS, Springer, 2006
4. Wanjun wang, steven A. Soper, Bio MEMS, 2006.
5. M. J. Madou, “Fundamentals of Micro fabrication”,2002.
6. G.T. A. Kovacs, “Micro machined Transducers Sourcebook”, 1998.

COURSE DESIGNERS				
S.No	**Name of the Faculty**	**Designation**	**Department**	**Mail ID**
1	Mrs.A.Malarvizhi	Assistant Professor	ECE	malarvizhi@vmkvec.edu.in
2	Dr.T.Muthumanickam	Professor & Head	ECE	muthumanickam@vmkvec.edu.in

	SOLAR AND ENERGY STORAGE SYSTEMS	Category	L	T	P	C
		OE-EA	3	0	0	3

PREAMBLE

This subject deals with the general concept of Solar and Energy Storage Systems, and improvement.

PREREQUISITE: Nil

COURSE OBJECTIVE

1.	To explain basics of solar photovoltaic systems and energy storage system
2.	To understand the concepts and various components of stand-alone system
3.	To gain the sound knowledge about grid connected PV system
4.	To know the design of various PV-interconnected systems.
5.	To provide the knowledge about the various applications of solar system

COURSE OUTCOMES

On the successful completion of the course, students will be able to	Understand
CO1: Describe the basics of solar system.	Understand
CO2:Recognize the concepts of standalone PV system.	Analysis
CO3: Design the grid connected system for various applications.	Analysis
CO4: Select the suitable storage system for particular applications.	Analysis
CO5: Recognize the various applications of solar system.	Create

Mapping with programme outcomes and programme specific outcomes

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	-	-	M	S	S	M	-	-	L	-	M	-	M
CO2	S	S	-	-	M	S	S	M	-	-	L	-	L	-	L
CO3	S	S	L	-	S	S	S	M	-	-	M	-	M	L	L
CO4	S	M	L	M	S	S	M	M	-	-	M	-	M	-	-
CO5	S	M	L	M	S	S	M	L	L	-	M	-	M	-	M

S-STRONG ,M-MEDIUM,L-LOW

Introduction
Characteristics of sunlight: the sun and its radiation, Solar radiation, Direct and diffusion radiation, greenhouse effect, solar isolation data and estimation-semiconductors and P-N junctions: semiconductors and types, absorption of light, recombination and PN junctions –behavior of solar cells – cell properties: efficiency and losses, Top contact design, Laser grooved, Buried contact solar cell – PV cell interconnection: Module and circuit design, Environmental and thermal protection.

Stand-alone PV System
Solar modules – storage systems: Types, applications, requirements, efficiency, Lead acid batteries – power conditioning and regulation: Diodes, Regulators, Inverters- Balance of system components - protection – standalone PV systems design – sizing: Reliability maps, sizing for high reliability, existing methods.

Grid Connected PV Systems
PV systems in buildings – Utility applications for photo voltaic – design issues for central power stations – safety– Economic aspect – Efficiency and performance - International PV programs – Integration of PV and Wind –Indian Specific Standard for Integration.

Energy Storage Systems
Impact of intermittent generation: Wind, gas and coal integration, impacts of cycling, PSCO case studies – Battery energy storage – solar thermal energy storage – pumped hydroelectric energy storage.

Applications
Water pumping – battery chargers – solar car – direct-drive applications –Space – Telecommunications.1

Total Hours = 45

Text book(s):
1. Solar Energy – S.P. Sukhatme, Tata McGraw Hill, 2017.
2. Stuart R.Wenham, Martin A.Green, Muriel E. Watt and Richard Corkish, “Applied Photovoltaics”, 2011.

Reference(s):
1. Frank S. Barnes & Jonah G. Levine, “Large Energy storage Systems Handbook”, CRC Press, 2017.
2. S. Sumathi, “Solar PV and Wind Energy Conversion Systems (Green Energy and Technology)”, L. Ashok Kumar , P. Surekha, 2015.
3 https://nptel.ac.in/courses/112/105/112105051/
4 https://nptel.ac.in/content/storage2/courses/108103009/download/M9.pdf

COURSE DESIGNERS

S.No	Name of the faculty	Designation	Department	Mail-id
1.	Mr.A.Balamurugan	AP	EEE	balamurugan@vmkvec.edu.in
2.	Mr.V.Rattan Kumar	AP(Gr-II)	EEE	rattankumar@avit.ac.in

Employability Enhancement Courses

	TECHNICAL SEMINAR	Category	L	T	P	Credit
		EE-S	0	0	2	1

COURSE OBJECTIVES

- To work on a specific technical topic in advanced topics in Civil Engineering in order to acquire the skills of oral presentation and to acquire technical writing abilities for seminars and conferences.

COURSE OUTCOMES

On completion of the course, the student is expected to be able to acquire the skills of oral presentation and to acquire technical writing abilities for seminars and conferences.

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	S	-	M	M	-	S	S	-	-	M	-	M	S	-	S

S- Strong	M-Medium	L-Low

SYLLABUS

The students will work for two hours per week guided by a group of staff members. They will be asked to talk on any topic of their choice related to advanced topics in Civil Engineering and to engage in dialogue with the audience. A brief copy of their talk also should be submitted. Similarly, the students will have to present a seminar of not less than fifteen minutes and not more than thirty minutes on the technical topic. They will also answer the queries on the topic. The students as audience also should interact. Evaluation will be based on the technical presentation and report submitted.

TOTAL : 30 PERIODS

AUDIT COURSES

	ENGLISH FOR RESEARCH PAPER WRITING	Category	L	T	P	Credit
		AC	0	0	2	0

PREAMBLE

This course is designed to improve the writing skills, level of readability of the learner and skills for writing the title.

PREREQUISITE

Nil

COURSE OBJECTIVES

1	Understand that how to improve your writing skills and level of readability
2	Learn about what to write in each section
3	Understand the skills needed when writing a Title
4	Ensure the good quality of paper at very first-time submission

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Understand how to improve your writing skills with conciseness so as to and removing redundancy	Understand
CO2. Classify the sections involved in research paper writing	Understand
CO3. Interpret the sequence of research findings with results	Apply
CO4. Use various paraphrasing method to provide good quality paper at very first-time submission	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES															
COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	M	-	-	-	-	-	-	M	-	-	M	-	-	S
CO2	L	M	-	-	M	-	-	-	M	-	-	M	-	-	S
CO3	L	M	-	-	M	-	-	-	M	-	-	M	-	-	S
CO4	L	M	-	-	M	-	-	-	M	-	-	M	-	-	S

S- Strong; M-Medium; L-Low

SYLLABUS

Unit I

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

Unit II

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

Unit III

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check, 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

Unit IV

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

Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

Text Books/ References Books :

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book
4. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

COURSE DESIGNERS

S.No	Name of the Faculty	Designation	Department	Mail ID
1.	Dr.Jennifer G Joseph	HoD-H&S	AVIT	Jennifer@avit.a.cin
2.	Mr. Tyndale Cicil	Assistant Professor	AVIT	tyndale.english@avit.ac.in

	VALUE EDUCATION	Category	L	T	P	Credit
		AC	0	0	2	0

PREAMBLE

The course highlights the importance of values and ethics for human life and organization.

PREREQUISITE

Nil

COURSE OBJECTIVES

1	To understand value of education and self- development
2	To inculcate good values in students to make them patriotic with humanity
3	To groom the personality with positive thinking with universal brotherhood and religious tolerance.
4	To impart the value of true friendship and happiness
5	To enhance the character and competence for developing into self-control person

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1. Identify the value of education and self- development with work ethics	Remember
CO2. Interpret sense of duties with good values in students to make them patriotic with humanity	Understand
CO3. Explain the integration, scientific attitude, overall personality with labor dignity	Understand
CO4. Discuss the value of true friendship and happiness	Understand
CO5. Paraphrase the character and competence for developing into self-control person	Understand

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	L	-	-	-	-	-	S	-	L	-	-	-	-	-
CO2	L	L	-	-	-	-	-	M	-	-	-	-	-	-	-
CO3	L	L	M	-	-	-	-	M	-	-	-	L	L	L	-
CO4	L	S	-	-	-	-	-	M	-	-	-	-	-	-	-
CO5	L	S	M	-	-	-	-	M	-	L	-	-	L	L	-

S- Strong; M-Medium; L-Low

SYLLABUS

Unit I

Values and self-development –Social values and individual attitudes, Work ethics, Indian vision of humanism, Moral and non- moral valuation. Standards and principles, value judgements

Unit II

Importance of cultivation of values, Sense of duty. Devotion, Self-reliance. Confidence, Concentration, Truthfulness, Cleanliness, Honesty, Humanity. Power of faith, National Unity, Patriotism, Love for nature, Discipline

Unit III

Personality and Behavior Development - Soul and Scientific attitude, Positive Thinking. Integrity and discipline., Punctuality, Love and Kindness, avoid fault Thinking, Free from anger, Dignity of labor, Universal brotherhood and religious tolerance

Unit IV

True friendship, Happiness Vs suffering, love for truth, Aware of self-destructive habits, Association and Cooperation, doing best for saving nature

Unit V

Character and Competence –Holy books vs Blind faith, Self-management and good health, Science of reincarnation, Equality, Nonviolence, Humility, Role of Women, all religions and same message, mind your Mind, Self-control, Honesty, Studying effectively

Text Books/ References Books :

1. Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford UniversityPress, New Delhi

Course Code	Course Title	category	L	T	P	C
	CONSTITUTION OF INDIA	**AC**	0	0	2	0

Course Objectives:
On completion of this course, the students will be able:

1 To understand the nature and the Philosophy of the Constitution.

2 To understand the outstanding Features of the Indian Constitution and Nature of the Federal system.

3 To Analyse Panchayat Raj institutions as a tool of decentralization.

4 To Understand and analyse the three wings of the state in the contemporary scenario.

5 To Analyse Role of Adjudicatory Process.

5 To Understand and Evaluate the recent trends in the Indian Judiciary.

Course Content

UNIT I

The Constitution - Introduction

The Historical background and making of the Indian Constitution –Features of the Indian Constitution- Preamble and the Basic Structure - Fundamental Rights and Fundamental Duties –Directive Principles State Policy

UNIT II –Government of the Union

The Union Executive-Powers and duties of President –Prime Minister and Council of Ministers - Lok Sabha and Rajya Sabha

UNIT III –Government of the States

The Governor –Role and Powers - Cheif Minister and Council of Ministers- State Legislature

UNIT IV – Local Government

The New system of Panchayats ,Municipalities and Co-Operative Societies

UNIT V – Elections

Powers of Legislature -Role of Chief Election Commissioner-State Election Commission

TEXTBOOKS AND REFERENCE BOOKS:

1 Ethics and Politics of the Indian Constitution Rajeev Bhargava Oxford University Press, New Delhi, 2008

2 The Constitution of India B.L. Fadia Sahitya Bhawan; New edition (2017)

3 Introduction to the Constitution of India DD Basu Lexis Nexis; Twenty-Fourth 2020 edition Suggested

Total Hours:30 hours

Software/Learning Websites:

1. https://www.constitution.org/cons/india/const.html

2. http://www.legislative.gov.in/constitution-of-india

3. https://www.sci.gov.in/constitution

4. https://www.toppr.com/guides/civics/the-indian-constitution/the-constitution-ofindia/

Alternative NPTEL/SWAYAM Course:

S.NO	NPTEL ID	NPTEL Course Title	Course Instructor
1	12910600	CONSTITUTION OF INDIA AND ENVIRONMENTAL GOVERNANCE: ADMINISTRATIVE AND ADJUDICATORY PROCESS	PROF. M. K. RAMESH NATIONAL LAW SCHOOL OF INDIA UNIVERSITY

COURSE DESIGNER

S.NO	NAME OF THE FACULTY	DESIGNATION	NAME OF THE INSTITUTION	MAIL ID
1	Dr.Sudheer	Principal	AV School of Law	Sudheersurya18@gmail.com

	PEDAGOGY STUDIES	Category	L	T	P	Credit
		AC	0	0	2	0

PREAMBLE

The course is designed to provide pedagogical practices towards academic, research activities and professional developments.

PREREQUISITE

Nil

COURSE OBJECTIVES

1	To provide theories and methodologies related to curriculum development and research framework
2	To familiarize with pedagogical practices in formaland informal classrooms in developing countries
3	To identify evidence on the effectiveness of the pedagogical practices for enhancing teaching and learning Methods
4	To understand the learning and resource barriers while handling large classes
5	To identify critical evidence gaps to guide the development

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO1.Identify theories and methodologies related to curriculum development and research framework	Remember
CO2.Interpret pedagogical practices in formaland informal classrooms in developing countries	Understand
CO3.Draw a chart on the effectiveness of the pedagogical practices for enhancing teaching and learning methods	Apply
CO4.Explore the learning and resource barriers while handling large classes	Analyze
CO5.Examine critical evidence gaps to guide the development	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	L	-	-	-	-	-	-	-	L	-	-	-	-	-
CO2	L	L	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	L	L	M	-	-	-	-	-	-	-	-	L	L	L	-
CO4	L	S	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	L	S	M	-	-	-	-	-	-	L	-	-	L	L	-

S- Strong; M-Medium; L-Low

SYLLABUS

Unit I

Introduction and Methodology,Aims and rationale, Policy background, Conceptual framework andterminology, Theories of learning, Curriculum, Teacher education, Conceptual framework, Research questions, Overview of methodology and searching.

Unit II

Thematic overview: Pedagogical practices are being used by teachers in formaland informal classrooms in developing countries, Curriculum, Teacher education.

Unit III

Evidence on the effectiveness of pedagogical practices, Methodology for the in depth stage: quality assessment of included studies, How can teacher education (curriculum and practicum) and the schoolcurriculum and guidance materials best support effective pedagogy, Theory of change, Strength and nature of the body of evidence for effective pedagogicalpractices, Pedagogic theory and pedagogical approaches, Teachers' attitudes and beliefs and Pedagogic strategies.

Unit IV

Professional development: alignment with classroom practices and followupsupport, Peer support, Support from the head teacher and the community, Curriculum and assessment, Barriers to learning: limited resources and large class sizes.

Unit V

Research gaps and future directions, Research design, Contexts, Pedagogy, Teacher education, Curriculum and assessment, Dissemination and research impact.

Text Books/ References Books :

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2):245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal ofCurriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher educationresearch project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning ofbasicmaths and reading in Africa: Does teacher preparation count? International JournalEducational Development, 33 (3): 272–282.

Course Code	Course Title	Category	L	T	P	C
	Personality Development Through Life Enlighten Skills	**AC**	0	0	2	0

Course Objectives:

1. To help the learner understand the basics of Personality and its correlation to society.
2. To understand the role of Attitude and motivation in the enhancement of personality.
3. To apply the concepts learnt in heightening the self esteem.
4. To analyse the most efficient method to develop the personality and prepare for employment.

UNIT I- Introduction to Personality Development

The concept of personality - Dimensions of personality – Theories of Freud & Erickson- Significance of personality development. The concept of success and failure: What is success? - Hurdles in achieving success - Overcoming hurdles -Factors responsible for success – What is failure - Causes of failure. SWOT analysis.

UNIT II Attitude & Motivation

Attitude - Concept - Significance - Factors affecting attitudes - Positive attitude – Advantages –Negative attitude- Disadvantages - Ways to develop positive attitude - Differences between personalities having positive and negative attitude. Concept of motivation - Significance – Internal and external motives - Importance of self- motivation- Factors leading to de-motivation

UNIT III Self-esteem

Term self-esteem - Symptoms - Advantages - Do's and Don'ts to develop positive self-esteem – Low self-esteem - Symptoms - Personality having low self esteem - Positive and negative self esteem. Interpersonal Relationships – Defining the difference between aggressive, submissive and assertive behaviours - Lateral thinking.

UNIT IV Other Aspects of Personality Development

Body language - Problem-solving - Conflict and Stress Management - Decision-making skills - Leadership and qualities of a successful leader – Character building -Team-work – Time management - Work ethics –Good manners and etiquette.**UNIT V Employability Quotient**

Resume building- The art of participating in Group Discussion – Facing the Personal (HR & Technical) Interview - Frequently Asked Questions - Psychometric Analysis - Mock Interview Sessions.

Total: 45 Periods

Text Books: 1. Hurlock, E.B (2006). Personality Development, 28th Reprint. New Delhi: Tata McGraw Hill. 2. Stephen P.Robbins and Timothy A. Judge(2014), Organizational Behavior 16th Edition: Prentice Hall.

COURSE DESIGNERS			
COURSE INSTRUCTOR	**DESIGNATION**	**NAME OF THE INSTITUTION**	**MAIL ID**

Dr.Jennifer G Joseph	HoD-H&S	AVIT	Jennifer@avit.a.cin
Mr. Tyndale Cicil	Assistant Professor	AVIT	tyndale.english@avit.ac.in