KUMARAGURU COLLEGE OF TECHNOLOGY,

An autonomous Institution affiliated to Anna University, Chennai

COIMBATORE – 641 049.

B.E., MECHANICAL ENGINEERING

REGULATIONS 2017

CURRICULUM AND SYLLABI

III to VIII Semesters

Department of Mechanical Engineering

C. Velmurugan

Approved by BoS Chairman

VISION

To emerge as a center that imparts quality higher education through its program in the domain of Mechanical Engineering to meet the changing needs of the society.

MISSION

Bring about supremacy in curricular and co-curricular sustained activities with competent faculty through teaching and research, that generates technically capable mechanical engineering professionals to serve the society with delight and gratification.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

The Program Educational Objectives of Mechanical Engineering Undergraduate Program are to prepare the students:

I.Graduates will take up careers in manufacturing and design related sectors.

II. Graduates will be involved in the execution of mechanical engineering projects.

III. Graduates will take up educational programmes in mastering Mechanical Engineering Science and Management.

PROGRAM OUTCOMES (POs)

Graduates of the Mechanical Engineering Undergraduate Program should have the ability to:

PO 1: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO 2: 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 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: 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: 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.

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PO 6: 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: 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: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO 9: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10: 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.

PO 11: 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.

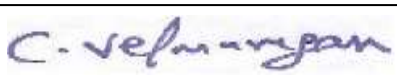
PO 12: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

Graduates of the Mechanical Engineering Undergraduate Program will have the ability to:

PSO 1: Apply the fundamentals of science and mathematics to solve complex problems in the field of design and thermal sciences.

PSO 2: Apply the concepts of production planning and industrial engineering techniques in the field of manufacturing engineering.



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REGULATIONS 2017

B.E. MECHANICAL ENGINEERING

CURRICULUM

Semester III										
S. No	**Course code**	**Course Title**	**Course Mode**	**CT**	**L**	**T**	**P**	**J**	**C**	**Pre-requisite**
1	U17MAT3101	Partial differential equations and Transforms	Theory	BS	3	1	0	0	4	--
2	U17MEI3201	Metal Cutting and Computer Aided Manufacturing	Embedded-Theory & Lab	PC	3	0	2	0	4	--
3	U17MEI3202	Mechatronics	Embedded - Theory & Lab	ES	2	0	2	0	3	--
4	U17MET3003	Product Design and Development	Theory	ES	3	0	0	0	3	--
5	U17MET3004	Engineering Thermodynamics	Theory	PC	3	0	0	0	3	--
6	U17INI3600	Engineering Clinic I	Project based course	ES	0	0	4	2	3	--
7	U17VEP3503	FAMILY VALUES (Mandatory)	Practical course	HS	0	0	2	0	0	U17VEP2502
Total Credits									**20**	
Total Contact Hours/week									**25**	

Semester IV										
S. No	**Course code**	**Course Title**	**Course Mode**	**CT**	**L**	**T**	**P**	**J**	**C**	**Pre-requisite**
1	U17MAT4101	Numerical Methods and Probability	Theory	BS	3	1	0	0	4	--
2	U17MEI4201	Strength of Materials	Embedded - Theory & Lab	PC	3	0	2	0	4	U17MET2102
3	U17MEI4202	Fluid Mechanics and Machinery	Embedded - Theory & Lab	PC	3	0	2	0	4	--
4	U17MEI4203	Geometric Modeling and CAD	Embedded-Theory & Lab	PC	3	0	2	0	4	--
5	U17MET4004	Applied Materials Engineering	Theory	PC	3	0	0	0	3	--
6	U17CHT4003	Environmental Science and Engineering	Theory	MC	3	0	0	0	0	--
7	U17VEP4504	PROFESSIONAL VALUES (Mandatory)	Practical course	HS	0	0	2	0	0	U17VEP3503
8	U17INI4600	Engineering Clinic II	Project based course	ES	0	0	4	2	3	U17INI3600
Total Credits									**22**	
Total Contact Hours/week									**31**	

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Semester V										Pre-requisite
S. No	**Course code**	**Course Title**	**Course Mode**	**CT**	**L**	**T**	**P**	**J**	**C**	
1	U17MEI5201	Thermal Engineering	Embedded - Theory & Lab	PC	3	0	2	0	4	U17MET3004
2	U17MEI5202	Engineering Metrology and Quality Control	Embedded - Theory & Lab	PC	3	0	2	0	4	--
3	U17MET5003	Machine Design	Theory	PC	3	0	0	0	3	U17MEI4201
4	U17MET5004	Kinematics of Machinery	Theory	PC	3	0	0	0	3	U17MET2102
5	U17MEI5205	Finite element analysis	Embedded - Theory & Lab	PC	3	0	2	0	4	--
6	U17VEP5505	SOCIAL VALUES (Mandatory)	Practical course	HS	0	0	2	0	0	U17VEP4504
7	U17-------	Open Elective - I	Theory	OE	3	0	0	0	3	--
8	U17INI5600	Engineering Clinic III	Project based course	ES	0	0	4	2	3	U17INI4600
Total Credits									24	
Total Contact Hours/week									30	

Semester VI										Pre-requisite
S. No	**Course code**	**Course Title**	**Course Mode**	**CT**	**L**	**T**	**P**	**J**	**C**	
1	U17MEI6201	Heat and Mass Transfer	Embedded - Theory & Lab	PC	3	0	2	0	4	--
2	U17MEI6202	Dynamics of Machinery	Embedded - Theory & Lab	PC	3	0	2	0	4	U17MET5004
3	U17MET6003	Operations Research	Theory	PC	3	0	0	0	3	--
4	U17-------	Open Elective - II	Theory	OE	3	0	0	0	3	--
5	U17MEE----	Programme Elective – 1	Theory	PE	3	0	0	0	3	--
6	U17VEP6506	NATIONAL VALUES (Mandatory)	Practical course	HS	0	0	2	0	0	U17VEP5505
7	U17INI6600	Engineering Clinic IV	Project based course	ES	0	0	4	2	3	U17INI5600
Total Credits									20	
Total Contact Hours/week									25	

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Semester VII										Pre-requisite
S.No	**Course code**	**Course Title**	**Course Mode**	**CT**	**L**	**T**	**P**	**J**	**C**	
1	U17MET7001	Engineering Economics and Financial Management	Theory	Mgmt	3	0	0	0	3	--
2	U17MET7002	Design of Transmission systems	Theory	PC	3	0	0	0	3	U17MET5003
3	U17MEE----	Programme Elective II	Theory	EEC	3	0	0	0	3	--
4	U17MEE----	Programme Elective III	Theory	PE	3	0	0	0	3	--
5	U17MEE----	Programme Elective IV	Theory	PE	3	0	0	0	3	--
6	U17MEP7703	Mini Project/ Phase I Project	Project only Course	PW	0	0	0	6	3	--
7	U17VEP7507	GLOBAL VALUES (Mandatory)	Practical course	HS	0	0	2	0	0	U17VEP6506
Total Credits									18	
Total Contact Hours/week									21	

Semester VIII									
S.No	**Course code**	**Course Title**	**Course Mode**	**CT**	**L**	**T**	**P**	**J**	**C**
1	U17MEP8701	Capstone Project/Internship/Phase II project	Project only Course	PW	0	0	0	24	12
Total Credits									12
Total Contact Hours/week									24

Total Credits	**160**

List of mandatory courses

S.No	Couse Code	Course Title	Course Mode	CT	Sem
1	U17VEP3503	Human Excellence-Family Values	Lab	HS	3
2	U17VEP4504	Human Excellence-Professional Values	Lab	HS	4
3	U17INT6000	Constitution of India	Theory	MC	5
4	U17CHT4000	Environmental Science and Engineering	Theory	MC	4
5	U17VEP5505	Human Excellence-Social Values	Lab	HS	5
6	U17VEP6506	Human Excellence-National Values	Lab	HS	6
7	U17VEP7507	Human Excellence-Global Values	Lab	HS	7

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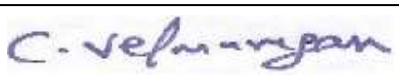
Programme Electives									
S.No	**Course code**	**Course Title**	**Course Mode**	**CT**	**L**	**T**	**P**	**J**	**C**
Design Engineering									
1	U17MEE0001	Design of Jigs, Fixtures and Press Tools	Theory	PE	3	0	0	0	3
2	U17MEE0002	Vibration and Noise Control	Theory	PE	3	0	0	0	3
3	U17MEE0003	Composite Materials	Theory	PE	3	0	0	0	3
4	U17MEE0004	Design for Manufacturing and Environment	Theory	PE	3	0	0	0	3
Thermal Engineering									
1	U17MEE0005	Refrigeration and Air Conditioning	Theory	PE	3	0	0	0	3
2	U17MEE0006	Computational Fluid Dynamics	Theory	PE	3	0	0	0	3
3	U17MEE0007	Design of Thermal Systems	Theory	PE	3	0	0	0	3
4	U17MEE0008	Design of Heat Exchangers	Theory	PE	3	0	0	0	3
5	U17MEE0017	Gas Dynamics and Jet Propulsion	Theory	PE	3	0	0	0	3
6	U17MEE0018	Automobile Engineering	Theory	PE	3	0	0	0	3
Manufacturing Engineering									
1	U17MEE0009	Additive Manufacturing	Theory	PE	3	0	0	0	3
2	U17MEE0010	Modern Machining Processes	Theory	PE	3	0	0	0	3
3	U17MEE0011	Welding and Allied Processes	Theory	PE	3	0	0	0	3
4	U17MEE0012	Lean Manufacturing	Theory	PE	3	0	0	0	3
Industrial Engineering									
1	U17MEE0013	Plant Layout and Process Design	Theory	PE	3	0	0	0	3
2	U17MEE0014	Logistics and Supply Chain Networks	Theory	PE	3	0	0	0	3
3	U17MEE0015	Industrial Safety	Theory	PE	3	0	0	0	3
4	U17MEE0016	Industrial Marketing	Theory	PE	3	0	0	0	3



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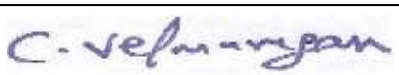
SEMESTER – III

L	T	P	J	C



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3	1	0	0	4

U17MA*T*3101 PARTIAL DIFFERENTIAL EQUATIONS AND FOURIER ANALYSIS

Course Outcomes (COs):

CO1: Form partial differential equations and solve certain types of partial differential equations.

CO2: Determine the Fourier Series and half range Fourier Series of a function given explicitly or to find Fourier Series of numerical data using harmonic analysis

CO3: Solve one dimensional wave equation and one-dimensional heat equation in steady state using Fourier series.

CO4: Apply Fourier Series to solve the steady state equation of two-dimensional heat equation in Cartesian coordinates.

CO5: Use Fourier series to solve the steady state equation of Circular and Semi-circular disks.

CO6: Apply Fourier transform, sine and cosine transform to certain functions and use Parseval's identity to evaluate integrals.

Pre-requisite:

1. U17MAT2101-Advanced calculus and Laplace transforms

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak														
COs	Programme Outcomes (POs)													
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO 1	S	S							M	M				
CO 2	S	S							M	M				
CO 3	S	S							M	M				
CO 4	S	S							M	M				
CO 5	S	S							M	M				
CO 6	S	S							M	M				

Course Assessment methods:

Direct	Indirect
1. Internal Test I 2. Internal Test II 3. Assignment 4. Group presentation 5. Tutorial 6. End semester exam	Course end survey

PARTIAL DIFFERENTIAL EQUATIONS **9+3 Hours**

Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions - Solution of PDE by variable separable method – Solution of standard types of first

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order partial differential equations (excluding reducible to standard types) – Lagrange's linear equation – Linear Homogeneous partial differential equations of second and higher order with constant coefficients.

FOURIER SERIES **9+3 Hours**

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Parseval's identity – Harmonic Analysis.

BOUNDARY VALUE PROBLEMS – ONE DIMENSIONAL EQUATIONS 9+3 Hours

Classification of second order quasi linear partial differential equations – Fourier series solutions of one-dimensional wave equation – One dimensional heat equation: Problems with temperature and temperature gradients.

BOUNDARY VALUE PROBLEMS – TWO DIMENSIONAL EQUATIONS 9+3 Hours

Steady state solution of two-dimensional heat equation in Cartesian coordinates: Infinite and finite plates – Steady state solution of two-dimensional heat equation in Polar coordinates: Circular and Semicircular disks – Fourier series solutions.

FOURIER TRANSFORM **9+3 Hours**

Infinite Fourier transform pair – Infinite Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

Theory: 45	**Tutorial: 15**	**Practical: 0**	**Project: 0**	**Total: 60 Hours**

References:

1. Grewal B.S., "Higher Engineering Mathematics", Thirty Sixth Edition, Khanna Publishers, Delhi, 2001.
2. Veerarajan T., "Engineering Mathematics", Tata McGraw Hill, New Delhi (2001)
3. Kandasamy P., Thilagavathy K. and Gunavathy K., "Engineering Mathematics Volume III", S.Chand& Company ltd., New Delhi, 1996.
4. Ian Sneddon., "Elements of partial differential equations" , McGraw – Hill, New Delhi, 2003.
5. Arunachalam T., "Engineering Mathematics III", Sri Vignesh Publications, Coimbatore 2009.
6. Erwin Kreyszig, "Advanced Engineering Mathematics", 9th Edition, Wiley India, 2013.

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U17MEI3201 METAL CUTTING AND COMPUTER AIDED MANUFACTURING

L	T	P	J	C
3	0	2	0	4

Course outcomes

After successful completion of the course, the student would be able to

CO 1: Apply the fundamentals of metal cutting and cutting tool materials

CO 2: Study the types of machine tools and working principles of machine tools

CO 3: Apply principles of surface integrity in finishing processes and study gear manufacturing techniques

CO 4: Apply the manufacturing activities inter relation with computers for plant operations

CO 5: Apply the concept of Group Technology in computer aided manufacturing.

CO 6: Apply system modeling tools in CIM and the fundamental concepts of data communications

Pre-requisite: Nil

CO/PO Mapping
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes (POs)													
	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
CO 1	S	S							S	S				S
CO 2	M								S	S				S
CO 3	S								S	S				S
CO 4	M						M							S
CO 5	M						M		M	M				S
CO 6	M				M		M		M	M				S

Course Assessment methods:

DIRECT
1. Continuous Assessment Test I, II (Theory component) 2. Assignment; Group Presentation, Project 3. Demonstration etc (as applicable) (Theory component) 4. Pre/Post - Experiment Test/Viva; Experimental Report for each Experiment (lab Component) 5. Model Examination (lab component) 6.End Semester Examination (Theory and lab components)
INDIRECT

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1. Course-end survey

THEORY OF METAL CUTTING 8 Hours

Introduction to Metal Cutting Methods – Mechanics of Metal Cutting – Orthogonal – Oblique – Merchants' Circle Diagram – Details of Derivation – Chip Details – Heat Generation – Cutting Tool Life – Cutting Tool Nomenclature – Economics of tool life – Optimal cutting speed for productivity - Cutting tool Materials - Cutting fluids – Recent Developments and Applications - Dry Machining and High-Speed Machining

MACHINE TOOLS 7 Hours

Introduction to Lathe – Shaper – Planning – Milling – Drilling – Boring – Grinding – Honing – Working Principles – Operations – Working Holding Devices.

SURFACE FINISHING PROCESSES AND GEAR MANUFACTURING 8 Hours

Grinding Machines – Grinding wheel Specifications – Honing – Lapping – Tapping – Burnishing – Super Finishing – Surface Integrity concepts – Gear Manufacturing Processes – Gear cutting – Gear Hobbing – Gear Shaping Machines – Manufacture of Spur – Helical – Bevel – Worm and Worm Wheel – Gear Finishing, Honing.

INTRODUCTION TO COMPUTER INTEGRATED MANUFACTURING 7 Hours

The meaning and origin of CIM- the changing manufacturing and management scene - External communication - islands of automation and software-dedicated and open systems-product related activities of a company- marketing engineering - production planning - plant operations - physical distribution- business and financial management.

GROUP TECHNOLOGY AND COMPUTER AIDED PROCESS PLANNING 7 Hours

Role of Group Technology in CAD/CAM integration - part families - classification and coding – DCLASS, MICLASS and OPITZ coding systems-benefits of Group Technology Process planning - role of process planning in CAD/CAM integration - approaches to computer aided process planning -variant approach and generative approaches.

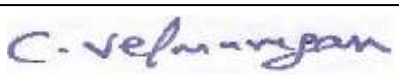
CIM IMPLEMENTATION AND DATA COMMUNICATION 8 Hours

System modeling tools -IDEF models - activity cycle diagram - CIM open system architecture (CIMOSA)- CIM architecture - Product data management-CIM implementation software-Open systems- manufacturing automation protocol and technical office protocol (MAP /TOP)
Development of databases -database terminology- architecture of database systems-data modeling and data associations -relational data bases - database operators - advantages of data base and relational database.

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

REFERENCES:

1. Jain, R.K., and Gupta, S.C., "Production Technology", Khanna Publishers, New Delhi, 2004.
2. Sharma P.C., "A Text Book of Production Technology", S.Chand& Company Ltd., New Delhi,2010.



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3. HajraChoudhry, S.K., and Bose, S.K., “Workshop Technology”, Media Promoters and Publishers Pvt. Ltd., Bombay, 2004.
4. Mikell.P.Groover,“Automation,Production Systems and computer integrated manufacturing”, Pearson Education,2007.
5. Radhakrishnan P, SubramanyanS.andRaju V., “CAD/CAM/CIM”,New Age International (P) Ltd, New Delhi,. 2004.
6. Ranky, Paul G.,“Computer Integrated Manufacturing”, Prentice Hall International, 2003.
7. David D.Bedworth, Mark R.Hendersan, Phillip M.Wolfe “Computer Integrated Design and Manufacturing”, McGraw-Hill Inc, 2004.

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U17MEI3202MECHATRONICS

L	T	P	J	C
2	0	2	0	3

Course outcomes

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

CO 1: Explain mechatronics design process and adaptive control systems

CO 2: Discuss the working of various actuators

CO 3: Discuss the architecture of microprocessors.

CO 4: Discuss the architecture of PLC.

CO 5: Discuss the various case studies.

CO 6: Simulate Hydraulic and Pneumatic using software tool and trainer kit.

Pre-requisite: Nil

CO/PO Mapping
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes (POs)													
	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
CO 1			M											
CO 2			M											
CO 3	M													
CO 4	M				M									
CO 5			M											
CO 6					S									

Course Assessment methods:

DIRECT
1. Continuous Assessment Test I, II (Theory component) 2. Assignment; Group Presentation, Project 3. Demonstration etc (as applicable) (Theory component) 4. Pre/Post - Experiment Test/Viva; Experimental Report for each Experiment (lab Component) 5. Model Examination (lab component) 6.End Semester Examination (Theory and lab components)
INDIRECT
1. Course-end survey

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INTRODUCTION TO MECHATRONICS **9 Hours**

Introduction to Mechatronics – Conventional and Mechatronics approach in designing products – Mechatronics design process - Mechatronics in Manufacturing – Adaptive and distributed control systems – Modelling and simulation of mechatronics systems.

SENSORS AND ACTUATORS **9 Hours**

Overview of sensors and transducers – Microsensors - Signal conditioning – Operational amplifiers – Protection – Filtering - Analog and Digital converters.

Solenoids – Direct Current motors –Servomotors – Stepper motors – BLDC Selection and application.

MICROPROCESSSOR BASED CONTROLLERS **9 Hours**

Architecture of microprocessor and microcontroller– Pin Configuration – Addressing Modes – Instruction set, Timing diagram of 8085.

PROGRAMMING LOGIC CONTROLLERS **9 Hours**

Programmable Logic Controllers – Basic Structure – Input / Output Processing – Programming – Mnemonics – Timers, Internal relays and counters – Shift Registers – Master and Jump Controls – Data Handling – Analogs Input / Output – Selection of a PLC Problem – Application of PLCs for control.

CASE STUDIES **9 Hours**

Pick and place robot – Automatic Car Park Systems – Automatic Camera – Automatic WashingMachine - Engine Management Systems.

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

REFERENCES

1. Bolton, W. “Mechatronics”, Pearson Education,2011.
2. 'Mechatronics”,HMT Ltd.,Tata McGraw Hill Publication Co. Ltd., New Delhi,2000.
3. Michael B. Histand and David G. Alciatore, “Introduction to Mechatronics and Measurement Systems”, McGraw-Hill International Editions, 2011.
4. Ramachandran, K.P., Vijayaraghavan, G.K.and Bala Sundaram, M.S. “Mechatronics: Integrated Mechanical Electronic System”,Wiley India Pvt Ltd,2008.
5. Bradley D. A., Dawson D., Buru N.C. and. Loader A.J, “Mechatronics”, Chapman and Hall,2004.
6. Dan Necsulesu, “Mechatronics”, Pearson Education,Asia, 2002.
7. Lawrence J. Kamm, “Understanding Electro-Mechanical Engineering”, An Introduction to Mechatronics, Prentice Hall of India Pvt Ltd,2000.
8. NitaigourPremchandMahadik, “Mechatronics”, Tata McGraw-Hill publishing Company Ltd, 2003.
9. B.P. Singh, “Advanced Microprocessor and Microcontrollers”, New Age InternationalPublisher,2008.

LIST OF EXPERIMENTS:

1. Simulation of basic Hydraulic, Pneumatic and Electric circuits using software.
2. Design and testing of circuits using basic pneumatic trainer kits.
3. Design and testing of circuits with logic sequence using Electro pneumatic trainer kits
4. Design and testing of sequential circuits in Electro pneumatic kit using PLC.

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Theory: 0	Tutorial: 0	Practical: 30	Project: 0	Total: 30 Hours

U17MET3003PRODUCT DESIGN AND DEVELOPMENT

L	T	P	J	C
3	0	0	0	3

Course outcomes:

CO1: Apply concepts of product development and outline product planning process
CO2: Apply relative importance of customer needs in establishing product specifications
CO3: Identify concept generation activities and summarize the methodology involved in concept selection and testing
CO4: Outline supply chain considerations in product architecture and understand the industrial design process
CO5: Apply design for manufacturing concepts in estimating manufacturing costs
CO6: Apply principles of prototyping in product development economics and highlight importance of managing projects

Pre-requisite: Nil

CO/PO Mapping
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	ProgrammeOutcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M		M		M					W			M	
CO2			M										M	
CO3	M		M										S	
CO4			S			W				M	M		M	
CO5			S		M	M								S
CO6					M				M		S			S

Course Assessment methods:

Direct	Indirect
1. Internal Test I 2. Internal Test II 3. Assignment 4. Group presentation 5. End semester exam	Course end survey

INTRODUCTION - DEVELOPMENT PROCESSES AND ORGANIZATIONS – PRODUCT PLANNING **9 Hours**

Characteristics of successful product development to Design and develop products, duration and cost of product development, the challenges of product development.A generic

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development process, concept development: the front-end process, adapting the generic product development process, the AMF development process, product development organizations, the AMF organization. The product planning process, identify opportunities. Evaluate and prioritize projects, allocate resources and plan timing, complete pre project planning, reflect all the results and the process.

IDENTIFYING CUSTOMER NEEDS - PRODUCT SPECIFICATIONS 9 Hours

Gathering raw data from customers, interpreting raw data in terms of customer needs, organizing the needs into a hierarchy, establishing the relative importance of the needs and reflecting on the results and the process. Specifications, establish specifications, establishing target specifications setting the final specifications.

CONCEPT GENERATION - CONCEPT SELECTION - CONCEPT TESTING 9 Hours

The activity of concept generation clarify the problem search externally, search internally, explore systematically, reflect on the results and the process, Overview of methodology, concept screening, concept scoring, caveats. Purpose of concept test, choosing a survey population and a survey format, communicate the concept, measuring customer response, interpreting the result, reflecting on the results and the process.

PRODUCT ARCHITECTURE - INDUSTRIAL DESIGN - DESIGN FOR MANUFACTURING 9 Hours

Meaning of product architecture, implications of the architecture, establishing the architecture, variety and supply chain considerations, platform planning, related system level design issues. Assessing the need for industrial design, the impact of industrial design, industrial design process, managing the industrial design process, is assessing the quality of industrial design. Definition, estimation of manufacturing cost, reducing the cost of components, assembly, supporting production, impact of DFM on other factors.

PROTOTYPING PRODUCT DEVELOPMENT ECONOMICS MANAGING PROJECTS 9 Hours

Prototyping basics, principles of prototyping, technologies, planning for prototypes, Elements of economic analysis, base case financial mode,. Sensitive analysis, project trade-offs, influence of qualitative factors on project success, qualitative analysis. Understanding and representing task, baseline project planning, accelerating projects, project execution, postmortem project evaluation.

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

REFERENCES:

1.Karl Ulrich,T, Steven Eppinger, D, “Product Design and Development”, McGrawHill, 2015.
2.Chitale, AK, Gupta, RC, “Product Design and Manufacturing” PHI, 2013.
3.Timjones, “New Product Development:An Introduction to a multifunctional process”, Butterworth-Heinemann, 1997.
4.Geoffery Boothroyd, Peter Dewhurst and Winston Knight,A, “Product Design for Manufacture and Assembly”, CRC Press, 2011.

Approved by BoS Chairman

U17MET3004 ENGINEERING THERMODYNAMICS

L	T	P	J	C
3	1	0	0	4

(Use of standard Steam table and Mollier diagram, Psychrometric Chart and Gas Tables are permitted)

Course outcomes

After successful completion of the course, the student would be able to

CO 1: Demonstrate basic concepts in open and closed system.
CO 2: Apply second law concepts to heat engine and heat pumps
CO 3: Apply concepts of entropy.
CO 4: Interpret the performance of various vapor power cycles
CO 5: Analyze the thermodynamic relations and air standard cycles
CO 6: Solve problems in various psychrometric processes

Pre-requisite: Nil

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak														
COs	Programme Outcomes (POs)													
	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
CO 1	M								S	M		W	M	
CO 2	S	W							S	S		M	M	
CO 3	S	W							M	M			M	
CO 4	S	M							S	S		W	S	
CO 5	M									S			M	
CO 6	M								M	M			M	

Course Assessment methods:

Direct	Indirect
1. Internal Test I 2. Internal Test II 3. Assignment 4. Group presentation 5. Tutorial 6. End semester exam	Course end survey

BASIC CONCEPTS AND FIRST LAW **12 Hours**

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Basic concepts - concept of continuum, macroscopic approach: thermodynamic systems - closed, open and isolated: Property, state, path and process, quasi-static process, work, modes of work, Zeroth law of thermodynamics – concept of temperature and heat. Concept of ideal and real gases. First law of thermodynamics – SFEE - Application to closed and open systems

SECOND LAW AND ENTROPY **12 Hours**

Second law of thermodynamics – Kelvin's and Clausius statements of second law, Heat Engines, Refrigerator and Heat Pump, Coefficient of Performance, Reversibility Carnot cycle - reversed Carnot cycle, efficiency, Carnot theorem, Thermodynamic temperature scale. Clausius theorem, Clausius inequality, concept of entropy, entropy of ideal gas, change of entropy for different non-flow processes, principle of increase of entropy – absolute entropy, Availability and irreversibility

STEAM AND VAPOUR CYCLES **9 Hours**

Formation of steam at constant pressure, types of steam, steam tables and uses, external work done during evaporation, internal energy of Steam, dryness fraction of steam, entropy of steam – Mollier diagram steam power cycles, standard Rankine cycle, modified Rankine cycle. Reheat and regenerative cycle.

IDEAL AND REAL GASES, THERMODYNAMIC RELATIONS AND AIR STANDARD CYCLES
8 Hours

Properties ideal and real gases, equation state, VanderWall's equation of state, compressibility factor, compressibility chart- Dalton's law of partial pressure, exact differentials, T-D relations, Maxwell's relations, Clausius Clapeyron equations, Joule-Thomson coefficient. Air standard otto cycle, Process making of the cycle, Cycle thermal efficiency, Compression expansion ratio and cycle efficiency, Deviation of real spark ignition engine from ideal cycle engines.

PSYCHROMETRY **4 Hours**

Avagadro's Law, equation state, Gas mixtures, Dalton's law, Psychrometry and psychrometric charts, property calculations of air vapour mixtures.

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

REFERENCES:

1. Nag, P.K., "Engineering Thermodynamics", Tata McGraw-Hill, New Delhi, 2008.
2. Cengel Y., "Thermodynamics An Engineering Approach", Tata McGraw-Hill, NewDelhi, 2008.
3. Holman.J.P. "Thermodynamics",Tata MC Graw Hill, 2006.
4. Arora, C.P, "Thermodynamics", Tata McGraw-Hill, New Delhi, 2004.
5. Merala, C. Pother, Craig, W., Somerton, "Thermodynamics for Engineers", Schaum Outline Series, McGraw-Hill, 2008.
6. Rogers and Mayhew, "Engineering Thermodynamics", Work and Heat Transfer, Pearson education, 1992.

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17INI3600 ENGINEERING CLINIC - I

L	T	P	J	C
0	0	4	2	3

Course objectives

- To help the students look into the functioning of simple to complex devices and systems
- To enable the students to design and build simple systems on their own
- To help experiment with innovative ideas in design and team work
- To create an engaging and challenging environment in the engineering lab

Course Outcomes

After successful completion of this course, the students should be able to:

CO1: Identify a practical problem and find a solution
CO2: Understand the project management techniques
CO3: Demonstrate their technical report writing and presentation skills

Pre-requisite:

Nil

CO/PO Mapping
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S	S	S	S	S	M	W		S			S		
CO2											S			
CO3										S				

Course Assessment methods:

Direct	Indirect
1. Project reviews 50%	1. Course Exit Survey
2. Workbook report 10%	
3. Demonstration & Viva-voce 40%	

Content:

The course will offer the students with an opportunity to gain a basic understanding of computer controlled electronic devices and apply the concepts to design and build simple to complex devices. As a practical project based embedded course, the students will be taught the concepts using a variety of reference material available in the public domain. While the course will start with formal instruction on hardware, programming and applications, the major portion of the course will provide the students with ample opportunity to be innovative in designing and building a range of products from toys to robots and flying machines.
In the Third semester, students will focus primarily on IOT with C programming using Audino

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GUIDELINES:

1. Practical based learning carrying credits.
2. Multi-disciplinary/ Multi-focus group of 5-6 students.
3. Groups can select to work on a specific tasks, or projects related to real world problems.
4. Each group has a faculty coordinator/Instructor who will guide/evaluate the overall group as well as individual students.
5. The students have to display their model in the 'Engineering Clinics Expo' at the end of semester.
6. The progress of the course is evaluated based on reviews and final demonstration of prototype.

Total Hours: 90

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U17VEP3503 **FAMILY VALUES**
(Mandatory)

L	T	P	J	C
0	0	2	0	0

Course Outcomes

After successful completion of this course, the students should be able to

CO 1: Develop skills in maintaining the harmony in the family.
CO 2: Create impulsive activities for healthy family
CO 3: Be receptive to troubled Individuals
CO 4: Gain healthy life by practicing Kundalini Yoga &Kayakalpa
CO 5: Possess Empathy among family members.
CO 6: Reason the life and its significance

Pre-requisites:

1. U17VEP1501 / PERSONAL VALUES
2. U17VEP2502 / INTERPERSONAL VALUES

CO/PO Mapping
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1									S					
CO2							M							
CO3										M				
CO4												S		
CO5						S								
CO6								M						

Course Assessment methods

Direct
1.Group Activity / Individual performance and assignment 2.Assessment on Value work sheet / Test
Indirect
1. Mini project on values / Goodwill Recognition

Values through Practical activities:

1. Family system: Introduction to Family Values – elements of family values - Adjustment, Tolerance, Sacrifice - Family structure in different society – work life balance.
2. Peace in Family: Family members and their responsibility - Roles of parents, children, grant parents -. Respectable women hood
3. Core value: Empathy: Unconditional love - Respect - Compassion - sacrifice–Care &share - helping – emotional support- hospitality – cleanliness
4. Blessing: Blessing - methods - Vibration effect - Benefits - Reason for misunderstanding in the Family and resolution through blessings.
5. Healthy Family: Good relationship with neighbors - Counseling - Simplified Kundalini Yoga - Kaya Kalpa Yoga

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Workshop mode

REFERENCES

1. FAMILY - www.download.nos.org/331courseE/L-13%20FAMILY.pdf

2. FRAMEWORK FOR ACTION ON VALUES EDUCATION IN EARLY CHILDHOOD – UNESCO – PDF – www.unesdoc.unesco.org/images/0012/001287/128712e.pdf

3. TRUE FAMILY VALUES Third Edition - Tparents Home www.tparents.org/Library/Unification/Books/TFV3/_TFV3.pdf

4. FAMILY VALUES IN A HISTORICAL PERSPECTIVE - The Tanner Lectures on www.tannerlectures.utah.edu/_documents/a-to-z/s/Stone95.pdf

5. PROBLEMS OF INDIA'S CHANGING FAMILY AND STATE ... - the United Nations - www.un.org/esa/socdev/family/docs/egm09/Singh.pdf

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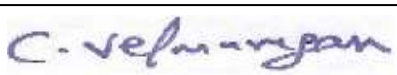
SEMESTER – IV



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U17MAT4101 **NUMERICAL METHODS AND PROBABILITY**

L	T	P	J	C
3	1	0	0	4

(Common to AE/AUE/CE/ME/MCE/EEE)

COURSE OUTCOMES

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

- **CO1:** Apply various numerical techniques for solving non-linear equations and sysems of linear equations.
- **CO2:** Analyze and apply the knowledge of interpolation and determine the integration and differentiation of the functions by using the numerical data.
- **CO3:** Predict the dynamic behavior of the system through solution of ordinary differential equations by using numerical methods.
- **CO4:** Apply the concepts of probability, conditional probability and total probability.
- **CO5:** Analyze random or unpredictable experiments and investigate important features of random experiments.
- **CO6:** Construct probabilistic models for observed phenomena through distributions which play an important role in many engineering applications.

Pre-requisite:

System of equations, Frequency distribution, mean, median, mode.

CO/PO Mapping
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S	S												
CO2	S	S												
CO3	S	S							M					
CO4	S	S												
CO5	S	S							M					
CO6	S	S												

DIRECT
1. Continuous Assessment Test I, II (Theory component)
2. Assignment; Group Presentation, Project
3. Demonstration etc (as applicable) (Theory component)
4. Pre/Post - Experiment Test/Viva; Experimental Report for each Experiment (lab Component)
5. Model Examination (lab component)
6.End Semester Examination (Theory and lab components)
INDIRECT
1. Course-end survey

SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS **9+3 Hours**

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Linear interpolation method – Iteration method – Newton's method – Solution of linear system by Gaussian elimination and Gauss-Jordan methods - Iterative methods: Gauss Jacobi and Gauss – Seidelmethods – Inverse of matrix by Gauss – Jordan method – Eigenvalues of a matrix by Power method.

INTERPOLATION, NUMERICAL DIFFERENTIATION AND INTEGRATION
9+3 Hours

Lagrange's and Newton's divided difference interpolation – Newton's forward and backward difference interpolation – Approximation of derivatives using interpolation polynomials – Numerical integration using Trapezoidal and Simpson's rules.

NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS 9+3 Hours

Single step methods: Taylor's series method – Euler and Improved Euler methods for solving a first order equations – Fourth order Runge – Kutta method for solving first and second order equations – Multistep method: Milne's predictor and corrector method.

PROBABILITY **3+1 Hours**

Axioms of probability - Conditional probability – Total probability – Bayes' theorem

RANDOM VARIABLES **6+2 Hours**

Random variable – Distribution function – properties – Probability mass function-
Probability density function – moments and moment generating function – properties.

STANDARD DISTRIBUTIONS9+3 Hours

Binomial, Poisson and Normal distributions – Moments, Moment Generating functions and properties for the above distributions - Fitting of Binomial and Poisson distributions.

Theory: 45 Hours **Tutorials: 15 Hours** **Total: 60 Hours**

REFERENCES

1. Grewal, B.S. and Grewal,J.S., " Numerical methods in Engineering and Science", 9th Edition, Khanna Publishers, New Delhi, 2007.
2. Gerald, C. F. and Wheatley, P. O., "Applied Numerical Analysis", 7th Edition, Pearson Education Asia, New Delhi, 2007.
3. Chapra, S. C and Canale, R. P. "Numerical Methods for Engineers", 7th Edition, Tata McGraw-Hill, New Delhi, 2016.
4. R.A. Johnson and C.B. Gupta, "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 9th Edition, 2016.
5. R.E. Walpole, R.H. Myers, S.L. Myers, and K Ye, "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 9th edition, 2017.

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U17MEI4201 **STRENGTH OF MATERIALS**

L	T	P	J	C
3	0	2	0	4

Course Outcomes
After successful completion of the course, the student would be able to

CO 1: Apply fundamental concepts and compute simple stresses and deformations in structuralmembers.
CO 2: Construct shear force and bending moment diagrams for statically determinate beams and determine stress distribution.
CO 3: Compute slope and deflection in statically determinate beams.
CO 4: Examine the buckling failure in columns and calculate strain energy under varying load conditions.
CO 5: Solve problems on shafts and springs subjected to twisting moment.
CO 6: Apply the concepts of complex stress system in 2D systems and in thin walled containers.

Pre-requisite: U17MET2102 - Engineering Mechanics

CO/PO Mapping
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S	M		M									M	
CO2	S	M											M	
CO3	M	W		M									M	
CO4	M	W		M									M	
CO5	S	M		M									M	
CO6	M	W											M	

Course Assessment methods:

DIRECT
1. Continuous Assessment Test I, II (Theory component)
2. Assignment; Group Presentation, Project
3. Demonstration etc (as applicable) (Theory component)
4. Pre/Post - Experiment Test/Viva; Experimental Report for each Experiment (lab Component)
5. Model Examination (lab component)
6.End Semester Examination (Theory and lab components)
INDIRECT
2. Course-end survey

STRESSES AND STRAINS **9 Hours**

Stress and strain - Elastic limit - Hooke's law - Stress-strain diagrams - Ultimate stress-Yield Stress-Factor of safety – Stresses and strains in stepped bars and uniformly varying sections – Stresses in composite bars due to axial loads and temperature. Elastic constants and their relationship - Stresses due to impact and suddenly applied load.

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COMPLEX STRESSES AND THIN CYLINDERS **9 Hours**

State of stress at a point - Normal and Shear stresses on any plane - Principal stresses and strains in two dimensions – Analytical method, Mohr's circle method. Hoop and longitudinal stresses in thin cylinders and shells.

SHEAR AND BENDING IN BEAMS **9 Hours**

Shear force and bending moment diagrams for statically determinate beams.
Theory of simple bending - Stress distribution along length and in beam section – Shear stresses in beams.

DEFLECTION OF BEAMS AND COLUMNS **9 Hours**

Slope and deflection in determinate beams - Double integration method, Macaulay's methods, Area moment method. Columns – End conditions – Euler's formula – Rankine's formula.

TORSION **9 Hours**

Torsion of circular and hollow shafts - Elastic theory of torsion - Stresses and Deflection in Circular solid and hollow shafts - stepped shaft - Power transmitted by a shaft- Shaft in series and parallel. Strain energy due to axial force - Resilience – Springs - closed and open coiled helical springs.

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

REFERENCES:

1. Popov E. P, "Engineering Mechanics of Solids", Prentice-Hall of India, New Delhi, 2007.
2. Rajput R. K, "A Textbook of Strength of Materials", S. Chand, 2007.
3. Subramanian R., "Strength of materials", Oxford University Press, New Delhi, 2005
4. Premalatha J, "Mechanics of solids", Vignesh Publications, Coimbatore, 2009.
5. Bansal R. K, "Strength of materials", Laxmi Publications, New Delhi, 2007.
6. William A.Nash, "Theory and Problems of Strength of materials, Schaum's Outline series", Tata McGraw-Hill, New Delhi, 2007.

Lab Experiments

1. Tension test on a mild steel rod
2. Shear test on a mild steel rod
3. Torsion test on mild steel rod
4. Hardness test on metals - Brinell and Rockwell Hardness
5. Deflection test on beams
6. Compression test on helical springs
7. Tensile test on helical springs
8. Impact Test.

Theory: 0	**Tutorial: 0**	**Practical: 30**	**Project: 0**	**Total: 30 Hours**

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U17MEI4202 FLUID MECHANICS AND MACHINERY

L	T	P	J	C
3	0	2	0	4

Course outcomes

After successful completion of the course, the student would be able to

CO 1: State and explain various fluid properties.

CO 2: Apply the knowledge of fluid statics for solving the problems in buoyancy and manometers

CO 3: Solve problems in mass, momentum and energy balance equations in fluid dynamics

CO 4: Determine the flow rate through Venturimeter and orifice meter.

CO 5: Analyze the performance of turbines and pumps

CO 6: Illustrate the various tools for solving fluid dynamic problems

Pre-requisite: Nil

CO/PO Mapping
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S	M										M	S	
CO2	S	M							M	M			M	
CO3	S	S							S	S			M	
CO4	S	M		S					M	M		M	M	
CO5	S	S		S					M	M		M	M	
CO6	W					M							W	

Course Assessment methods:

DIRECT
1. Continuous Assessment Test I, II (Theory component)
2. Assignment; Group Presentation, Project
3. Demonstration etc (as applicable) (Theory component)
4. Pre/Post - Experiment Test/Viva; Experimental Report for each Experiment (lab Component)
5. Model Examination (lab component)
6.End Semester Examination (Theory and lab components)
INDIRECT
1. Course-end survey

FLUID PROPERTIES, STATICS AND KINEMATICS **10 Hours**

Fluid Properties: Importance & applications of fluid mechanics. Solid vs Fluid - Units and Dimensions – Properties of fluids (Definition only)-Mass density – Specific weight – Specific volume – Specific gravity – Viscosity – Compressibility – Surface tension – Capillarity – Vapor pressure.

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Fluid Statics: Hydrostatic equation –Forces on plane and curved surfaces- Buoyancy – Metacentre – Simple and differential manometers. Fluid Kinematics: Path line – Stream line – Streak line – Stream and Potential functions – Flownets.

FLUID DYNAMICS **10 Hours**

Fluid Element and properties - Lagrangian vs Eulerian description – Governing equations: Mass balance (Continuity equation) – Newton's second law (momentum equation- statement only) – First law of thermodynamics (Energy equation-statement only). Non-viscous flows (Euler's equation) – Frictionless flows (Bernoulli's equation), Introduction to CFD.

Case study (not for exam): Demonstration of solving Euler's and Navier-Stokes equation using analysis tools like ANSYS, HyperWorks etc.

FLUID FLOW AND DIMENSIONAL ANALYSIS **10 Hours**

Laminar and turbulent flows through pipe – Hagen-Poiseuille equation – Darcy-Weishbach equation – Major and Minor losses.

Dimensional Analysis- Buckingham's π theorem- Discharge and velocity measurements- venture meter and pitot tube.

HYDRAULIC TURBINES **8 Hours**

Force exerted on moving plate/ vanes- Definition and classifications- Pelton, Francis, Propeller and Kaplan turbine: Working principles- Velocity triangle – Work done – specific speed – efficiencies – Performance curve for turbines.

HYDRAULIC PUMPS **7 Hours**

Definition and classifications- Centrifugal and Reciprocating Pumps: Working principles- Indicator diagram – Specific speed – efficiency and performance curves - Cavitations in pumps.

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

REFERENCES:

1. P.N. Modi & S.M. Seth, "Hydraulics and fluid mechanics including hydraulic machines", Standard book house, 2005.
2. R.K. Bansal,"Fluid mechanics and hydraulic machines", Laxmi Publications (P) Ltd, 2006.
3. K.L. Kumar,"Engineering fluid mechanics", Eurasia publishing house, 2001.
4. V.L. Streeter – "Fluid mechanics", McGraw-Hill, 2002.
5. White, F.M., "Fluid Mechanics", Tata McGraw-Hill, New Delhi, 2003.
6. Versteeg, H.K, and Malalasekera, W., "An Introduction to Computational Fluid Dynamics: The Finite Volume Method", Pearsons, 2007.

LIST OF EXPERIMENTS

1. Determination of the Coefficient of discharge of a given Orifice meter.
2. Determination of the Coefficient of discharge of a given Venturi meter.
3. Characteristic curves of centrifugal / reciprocating pump.
4. Performance characteristics of Pelton wheel.
5. Performance characteristics of Francis turbine.

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Theory: 0	Tutorial: 0	Practical: 30	Project: 0	Total: 30 Hours

U17MEI4203 GEOMETRIC MODELLING AND CAD

L	T	P	J	C
3	0	2	0	4

Course Outcomes (COs)

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

CO1: Apply the concepts of computer graphics and graphics systems
CO2: Apply transformations and graphics pipeline procedure
CO3: Apply the concepts of various types of curves and surfaces.
CO4: Practice the solid modeling features
CO5: Apply various Graphic file standards with their importance
CO6: Apply Interactive Computer Programming techniques

Pre-requisite: Nil

CO/PO Mapping
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes (POs)													
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO 1			M		S									
CO 2		M												
CO 3	M		M										M	
CO 4					S								M	
CO 5					M									
CO 6					M									

Course Assessment methods:

DIRECT
1. Continuous Assessment Test I, II (Theory component)
2. Assignment; Group Presentation, Project
3. Demonstration etc (as applicable) (Theory component)
4. Pre/Post - Experiment Test/Viva; Experimental Report for each Experiment (lab Component)
5. Model Examination (lab component)
6.End Semester Examination (Theory and lab components)
INDIRECT
1. Course-end survey

COMPUTER GRAPHICS AND GRAPHICS SYSTEMS 9 Hours

Origin, history, goals and applications. 3D graph essentials, 3D world, Graphics API's and software, graphics input and output devices, Raster devices. Output primitives and attributes:

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DDA, Bresenham algorithm for straight lines, Midpoint algorithm for conics and curves, Filled area – scan line, boundary and flood fill. Primitive attributes.

TRANSFORMATIONS AND GRAPHICS PIPELINE **9 Hours**

Coordinate system, Graphics pipeline, Translation, scaling, rotation, reflection and shear transformations. Combined, modeling and co-ordinate transformation. Viewing and clipping: 3D viewing pipeline, Co-ordinates and volume, Parallel and perspective projections, Projection and view-port transformation, clipping. Camera, normalized view volume.

CURVES AND SURFACES **9 Hours**

Lagrange, hermite and spline interpolation, cubic, Bezier and b-spline curves, composite curves and geometric continuity, non-linear splines, curve fairing, recursive subdivision of curves. Surfaces: Implicit and quadric surfaces, surface of revolution, sweep, ruled, bilinear and coons surfaces. Bicubic patch. Bezier, b-spline and cycloid surfaces.

SOLID MODELING **9 Hours**

Solid Modeling and their representation, assembly drawing of various machine components, analysis of simple components, complex components in orthographic and isometric views.

GRAPHICS FILE STANDARDS AND ICP **9 Hours**

Data exchange format shake based format, product-based format, GKS, PHIGS, IGES, PDES, DXF, CGM, STL, VRML, XML files. Interactive Computer Programming: Introduction to elementary level - on screen menu - high level - database level - device level and object-oriented programming

REFERENCES:

1. Donald Hearn and Pauline Baker, "Computer Graphics C Version", Pearson Education, 2004.
2. Michael E Mortenson, "Geometric Modeling", John Wiley and Sons, Inc., 2004.
3. David F Rogers and Alan Adams J, "Mathematical Elements in Computer Graphics", Tata McGraw Hill, 2002.
4. James D Foley, Andries Van Dam, Steven K Feiner and John F Hughes, "Computer Graphics Principles and Practice", AddisonWesley Publishing Company, 2000.
5. MarttiMantyla, "An Introduction to Solid Modeling", Springer Verlag, 1987.

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

List of Experiments

1. Development of Lagrange, hermite and spline interpolation
2. Development of cubic, Bezier and b-spline curves,
3. Development of composite curves and geometric continuity, non-linear splines,
4. Development of Implicit and quadric surfaces
5. Development of ruled, bilinear and coons surfaces.
6. Development of Bicubic patch. Bezier, b-spline and cycloid surfaces.
7. 3D part modeling - Protrusion, Extrude cut,
8. 3D part modeling – Blend
9. 3D part modeling – Sweep
10. 3D part modeling – Draft, Loft, Rib

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11. Preparation of Assembled Drawing - Plummer block bearing
12. Preparation of Assembled Drawing - Universal joint
13. Preparation of Assembled Drawing - Knuckle joint

Theory: 0	**Tutorial: 0**	**Practical: 30**	**Project: 0**	**Total: 75 Hours**

U17MET4004 APPLIED MATERIALS ENGINEERING

L	T	P	J	C
3	0	0	0	3

Course outcomes

After successful completion of the course, the student would be able to

CO 1: Apply the knowledge of plastic deformation and strengthening mechanisms in engineering applications

CO 2: Apply the knowledge of failure mechanisms in failure analysis of metallic materials.

CO 3: Identify and select materials for engineering applications based on various mechanical properties.

CO 4: Selection of special steels for a given application based on its properties.

CO 5: Select materials for design by evaluating the linkages between material properties, micro-structures and processing

CO 6: Explain properties, structure and applications of composites, ceramics and nano-materials

Pre-requisite: Nil

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak														
COs	**Programme Outcomes (POs)**													
	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**
CO 1	**S**								**S**	**M**				**M**
CO 2	**S**								**S**					**M**
CO 3	**S**								**S**					**M**
CO 4	**S**								**S**					**M**
CO 5	**S**								**S**					**M**
CO 6	**S**									**M**				**M**

Course Assessment methods:

Direct	**Indirect**
1. Internal Test I 2. Internal Test II 3. Assignment 4. Group presentation 5. End semester exam	Course end survey

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UNIT I ELASTIC AND PLASTIC BEHAVIOUR **8 hours**

Mechanism of Elastic deformation, Stress- Strain behavior, Modulus of Elasticity-Shear modulus and poison ratio, Plastic deformation, Stress strain behavior, ductility, Resilience, toughness, elastic recovery after plastic deformations, True Stress and Strain, Plastic deformation of crystalline Materials – Strengthening mechanism, Grain size reduction, solid solution, Strain hardening, Recovery Recrystallization and Grain growth and aging.

FAILURES OF METALS **8 hours**

Fracture mechanisms -Griffith's theory - stress intensity factor, Ductile and brittle Fracture, Ductile to brittle transition, significance and fracture toughness- Environment sensitive fracture, Fatigue –Cyclic stress, S-N curve, crack initiation and propagation mechanisms, factors affecting fatigue life, Environment effects on fatigue, high temperature fracture – creep, procedure of failure analysis.

SELECTION OF MATERIALS **8 hours**

Motivation, cost basis and service requirements, selection for mechanical properties, strength, toughness, fatigue and creep, Selection for surface durability, corrosion and wear resistance – Relationship between materials selection and processing.

MATERIAL PROCESSING **9 hours**

Processing of engineering materials, primary and secondary manufacturing processes –Criteria for selection of materials for casting, welding, forging, rolling, extrusion, drawing, forming and machining, process induced defects – Monitoring and control.

MODERN MATERIALS **12 hours**

Properties and applications of dual phase steels, high strength low alloy steel, Maraging steel, Special purpose steels – introduction to smart materials, engineering plastics and composites materials – properties and applications of ceramics – WC, TiC, TaC, CBN – types and applications of nanomaterials.

TOTAL: 45 PERIODS

REFERENCES:

1. Dieter, G.E., "Mechanical Metallurgy", McGraw Hill, 1988.
2. Charles, J.A., Crane, F.A.A and Furness, J.A.G., "Selection and use of engineering Materials", (3 rd Edition, Butterworth – Heiremann, 1977.
3. James, K.W., Wiley, Intersam, John, "The Hand book of Advance Materials", Wilson Publishers., 2004.
4. Burakonsa, T.Z. and Wierzchan. T.,"Surface Engg of Meterials"- Principles of Equipment, Techniques.
5. Courtney, T.H.,"Mechanical Behavior of Materials" ,(2nd edition), McGraw Hill, 2000.
6. Flinn,R.A.and Trojan ,P.K.., "Engineering Materials and their Applications" (4th Edition), Jaico, 1999.
7. Metals hand book, vol. 10, "Failure Analysis and Prevention", (10th edition), 1994.

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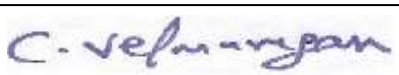
WEB REFERENCES:

www.astm.org/labs/pages/131350.htm



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U17EST4003 ENVIRONMENTAL SCIENCE AND ENGINEERING

L	T	P	J	C
3	0	0	0	0

(Common to Automobile/Aeronautical/Mechanical/Mechatronics Engineering)

Course Outcomes

After successful completion of the course, the student would be able to

CO 1: Analyze the impact of engineering solutions in a global and societal context

CO 2: Discuss contemporary issues that results in environmental degradation and would attempt to provide solutions to overcome those problems

CO 3: Highlight the importance of ecosystem and biodiversity

CO 4: Ability to consider issues of environment and sustainable development in his personal and professional undertakings

CO 5: Paraphrase the importance of conservation of resources.

CO 6: Play an important role in transferring a healthy environment for future generations

Pre-requisite: Nil

CO/PO Mapping
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes (POs)													
	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
CO 1		M					S		M					M
CO 2						M				M				
CO 3							M							
CO 4						M	S							
CO 5							S							
CO 6			W				S					M		

Course Assessment methods:

Direct	Indirect
1. Internal Test I 2. Internal Test II 3. Assignment 4. Group presentation 5. End semester exam	Course end survey

Course Content

OBJECTIVES

At the end of this course the student is expected to understand what constitutes the environment, what are precious resources in the environment, how to conserve these resources, what is the role of a human being in maintaining a clean environment and useful

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environment for the future generations and how to maintain ecological balance and preserve bio-diversity.

INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES **14 Hours**

Definition, scope and importance – Need for public awareness – Forest resources: Use and overexploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people

Water resources: Use and overutilization of surface and ground water, conflicts over water, dams benefits and problems - Water conservation, rain water harvesting, watershed management Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies

Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, case studies

Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies

Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification, Wasteland reclamation – Role of an individual in conservation of natural resources

ECOSYSTEMS AND BIODIVERSITY **9 Hours**

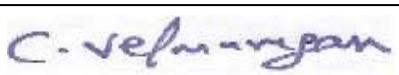
ECOSYSTEM: Concept of an ecosystem – Structure and function of an ecosystem: Producers, consumers and decomposers, Food chain, Food web, Energy flow in the ecosystem and Ecological pyramids - Ecological succession – Introduction, types, characteristic features, structure and function of the (a) Forest ecosystem (b) Grassland ecosystem (c) Desert ecosystem (d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

BIODIVERSITY : Introduction to Biodiversity – Definition: genetic, species and ecosystem diversity – Biogeographical classification of India – Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic values – India as a mega-diversity nation – Hot-spots of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

ENVIRONMENTAL POLLUTION **10 Hours**

Definition – Causes, effects and control measures of: (a) Air pollution - Organic and inorganic pollution - cyclone separator, electrostatic precipitator(b) Water pollution (c) Heavy metal pollution (d) Noise pollution (e) Thermal pollution (f) Nuclear hazards - Role of an individual in prevention of pollution – Pollution case studies – Solid waste and hazardous Management: Causes, effects and control measures from factories, small scale and large scale industries - waste minimization – Disaster management: floods, earthquake, cyclone and landslides.

SOCIAL ISSUES AND THE ENVIRONMENT **7 Hours**



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From Unsustainable to Sustainable development – Urban problems related to energy – Resettlement and rehabilitation of people; its problems and concerns, case studies – Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion – Environment Protection Act – Air (Prevention and Control of Pollution) Act – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Human Rights

HUMAN POPULATION AND THE ENVIRONMENT 5 Hours

Population growth and explosion – Welfare Programme- Environment and human health – Communicable disease – Role of Information Technology in Environment and human health – Case studies.

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

REFERENCES:

1. Miller T.G, "Environmental Science", Wadsworth Publishing Co, 2013.
2. Masters G.M., and Ela W.P., "Introduction to Environmental Engineering and Science", Pearson Education Pvt., Ltd.
3. BharuchaErach, "The Biodiversity of India", Mapin Publishing Pvt. Ltd., Ahmedabad India, 2002.
4. Trivedi R.K and Goel P.K., "Introduction to Air pollution". Techno-science Publications. 2003.
5. Trivedi R.K., "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", Enviro Media, 1996.
6. Cunningham, W.P., Cooper, T.H.., &Gorhani E., "Environmental Encyclopedia", Jaico Publication House, Mumbai, 2001
7. Wager K.D., "Environmental Management", W.B. Saunders Co., USA, 1998
8. Townsend C., Harper J and Michael Begon, "Essentials of Ecology", Blackwell
science Publishing Co., 2003
9. Syed Shabudeen, P.S. "Environmental chemistry", Inder Publishers, Coimbatore, 2013

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U17INI4600 ENGINEERING CLINIC - II

L	T	P	J	C
0	0	4	2	3

Course objectives

- To help the students look into the functioning of simple to complex devices and systems
- To enable the students to design and build simple systems on their own
- To help experiment with innovative ideas in design and team work
- To create an engaging and challenging environment in the engineering lab

Course Outcomes

After successful completion of this course, the students should be able to:

CO1: Identify a practical problem and find a solution
CO2: Understand the project management techniques
CO3: Demonstrate their technical report writing and presentation skills

Pre-requisite:

1. U17INI3600 Engineering Clinic – I

CO/PO Mapping
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	ProgrammeOutcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S	S	S	S	S	M	W		S			S		
CO2											S			
CO3										S				

Course Assessment methods:

Direct	Indirect
1. Project reviews 50%	1. Course Exit Survey
2. Workbook report 10%	
3. Demonstration & Viva-voce 40%	

Content:

The course will offer the students with an opportunity to gain a basic understanding of computer controlled electronic devices and apply the concepts to design and build simple to complex devices. As a practical project based embedded course, the students will be taught the concepts using a variety of reference material available in the public domain. While the course will start with formal instruction on hardware, programming and applications, the major portion of the course will provide the students with ample opportunity to be innovative in designing and building a range of products from toys to robots and flying machines.

In the Fourth semester, students will focus primarily on Raspberry pi based controllers with Python programming

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GUIDELINES:

1. Practical based learning carrying credits.
2. Multi-disciplinary/ Multi-focus group of 5-6 students.
3. Groups can select to work on a specific tasks, or projects related to real world problems.
4. Each group has a faculty coordinator/Instructor who will guide/evaluate the overall group as well as individual students.
5. The students have to display their model in the 'Engineering Clinics Expo' at the end of semester.
6. The progress of the course is evaluated based on reviews and final demonstration of prototype.

Total Hours: 90

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U17VEP4504 **PROFESSIONAL VALUES**
(Mandatory)

L	T	P	J	C
0	0	2	0	0

Course Outcomes

After successful completion of this course, the students should be able to

CO 1: Develop the ethical values in both professional and personal life
CO 2: Develop ability to take decision to reinforce professional life
CO 3: Rational in professional skills required for diverse society
CO 4: Excel in ingenious attitude to congregate professional life
CO 5: Research into the professional stand
CO 6: Spruce an Individual with decorum to achieve professional life

Pre-requisites :

1. U17VEP1501 / PERSONAL VALUES
2. U17VEP2502 / INTERPERSONAL VALUES
3. U17VEP3503 / FAMILY VALUES

CO/PO Mapping
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1								S						
CO2				M										
CO3			S											
CO4												S		
CO5								M						
CO6										M				

Course Assessment methods

Direct
1.Group Activity / Individual performance and assignment 2.Assessment on Value work sheet / Test
Indirect
1. Mini project on values / Goodwill Recognition

Values through Practical activities:

1.Professional skills With Values: Positive Attitude, Adaptability, Responsibility, Honesty and Integrity, Self Esteem, & Self Confidence

2.Building Innovative work cultures: Creative thinking, Critical thinking, Conflict Resolution, Problem Solving, & Decision making

3.Professional Work Ethics: Types of Ethics, Etiquette, personality Grooming, Emotional quotient, Human Dignity, Safety & Role of Professional in Social Responsibility

4.Engineering Ethics: Engineering Council of India - Objectives - Code of Ethics - Social responsibility -Professional Quality - Ethical issues - Effects - Strategy – Corruption, Consequences, Cures

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5.Case studies in engineering ethics: Discussion of case studies relating to Public safety, health, welfare, Quality of product, Improper conduct by management, Product responsibility, Intellectual property

Workshop mode

REFERENCES

1. LEARNING TO DO SOURCEBOOK 3 - UNESCO-UNEVOC -PDF
www.unevoc.unesco.org/fileadmin/user_upload/pubs/LearningToDo.pdf

2. DECLARATION OF PROFESSIONAL VALUES AND ETHICAL STANDARDS
www.garda.ie/Documents/User/declarationvalues.pdf

3. KARMA YOGA - SWAMI VIVEKANANDA
www.vivekananda.net/PDFBooks/KarmaYoga.pdf

4. PROFESSIONAL ETHICS IN ENGINEERING - Sasurie College of Engineering
www.sasurieengg.com/.../GE2025%20Professional%20Ethics%20in%20Engineering.

5. ENGINEERING ETHICS CASE STUDY; Challenger
www.ucc.ie/en/processeng/staff/academic/ebyrne/.../PE1006PptNotesLect7.pdf

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Semester V

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U17MET5201	THERMALENGINEERING	L	T	P	J	C
		3	0	2	0	4

(Use of standard thermodynamic tables, Mollier diagram, Psychometric chart and Refrigerant property tables are permitted in the examination)

Course outcomes

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

CO 1: Explain the working principle and combustion characteristics of IC Engines.

CO 2: Calculate the performance parameters of Gas power cycles, IC Engines and estimate the fuel properties

CO 3: Explain the performance characteristics of steam nozzles.

CO 4: Discuss the importance of velocity diagrams and compounding in Turbines

CO 5: Calculate the various efficiencies of the air compressors.

CO 6: Explain the working principle of VCR & VAR systems.

Pre-requisite:1. U17MET3004- Engineering Thermodynamics

CO/PO Mapping (S/M/W indicates strengthofcorrelation)S-Strong, M-Medium, W-Weak														
COs	Programme Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S			M					M	M			S	
CO2	S	M		M		W	W		M	M			S	
CO3	S								M	M			M	
CO4	S			M					M	M			M	
CO5	S			M			W		M	M			S	
CO6	S								M	M			S	

Course Assessment methods:

DIRECT
1. Continuous Assessment Test I, II (Theory) 2. Assignments 3. Experimental results analysis/viva 4. Model Examination (lab) 5.End Semester Examination (Theory and lab components)
INDIRECT
1. Course-end survey

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INTERNALCOMBUSTIONENGINES **9 Hours**

Engine components and functions - timing diagram. Fuel supply systems- CRDI, MPFI, Ignition Systems - Combustion phenomenon – Knocking and Detonation – Octane, Cetane numbers- Air-fuel ratio calculation, Lubrication system and cooling system.

GAS POWER CYCLES &ENGINE PERFORMANCE **9 Hours**

Otto, Diesel, Dual, Brayton cycles (Air standard efficiency derivation only), Calculation of mean effective pressure and air standard efficiency, Actual and theoretical PV diagram of Four stroke engines, Actual and theoretical PV diagram of two stroke engines. Exhaust gas analysis - Recent trends in pollution control norms

STEAM NOZZLESANDTURBINES **9 Hours**

Flow of steam through nozzles, shapes of nozzles, effect of friction – Nozzle efficiency- General relationship between area, velocity and pressure in nozzle flow. Critical pressure ratio - Impulse and reaction principles, compounding, and velocity diagrams for simple turbines, speed regulations – governors. Reheating the steam- Bleeding.

AIRCOMPRESSOR **9 Hours**

Classification - Reciprocating Air Compressor - working principle, work of compression with and without clearance. Multistage air compressor and inter cooling (Descriptive treatment only), Rotary Compressors – Centrifugal Compressor and axial flow compressor (Descriptive treatment only), Screw Compressors.

REFRIGERATION ANDAIR CONDITIONING **9 Hours**

Fundamentals of refrigeration and air conditioning - Vapour compression refrigeration cycle- super heat, sub cooling- Performance calculations- working principle of vapour absorption system, Ammonia-Water, Lithium boride- water systems (Description only) – Alternate refrigerants- Air conditioning systems: types, working principles- Psychrometry - Cooling Load calculations – Concept of RSHF, GSHF, ESHF.

LIST OF EXPERIMENTS:

1. Valve Timing and Port Timing Diagrams.
2. Performance Test on Multi Cylinder Diesel Engine by Hydraulic loading.
3. Heat Balance Test on Diesel Engine by Electrical loading.
4. Morse Test on Multi cylinder Petrol Engine.
5. Performance and emission Test on single cylinder petrol engine.
6. Determination of Frictional Power by retardation test.
7. Determination of Viscosity of given oil.

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8. Determination of Flash Point and Fire Point.
9. Performance test on reciprocating air compressor.
10. Study on CRDI and MPFI engines.
11. Study of data acquisition system for engine experiments.

Theory: 45 Tutorial: 0 Practical: 30 Project: 0 Total: 75 Hours

REFERENCES:

1. Sarkar, B.K, "Thermal Engineering", Tata McGraw-Hill Publishers,2007.
2. Kothandaraman.C.P., Domkundwar.S, Domkundwar.A.V., "A course inthermal Engineering", DhanpatRai&sons,2002.
3. Arora, C.P., "Refrigeration and Air conditioning", Tata McGraw-HillPublishers,2007.
4. Ganesan.V., "Internal Combustion Engines",TataMcGraw-Hill,2007.

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U17MEI 5202 ENGINEERING METROLOGY AND QUALITY CONTROL

L	T	P	J	C
3	0	2	0	4

Course Outcomes:

After successful of the course, the student would be able to:

CO 1: Apply knowledge of linear and angular measurements and effective communication for engineering practice.

CO 2: Apply knowledge of form measurements with effective communication for engineering application.

CO 3: Explain the working principles of advanced instruments/equipments used in metrology.

CO 4: Construct various control charts for the variables and attributes.

CO 5: Apply knowledge of various sampling methods, concepts and reliability.

Pre-requisite: Nil

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak														
COs	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	S													M
CO2	S													M
CO3	M													M
CO4	S			M										
CO5	S			M										

Course Assessment methods:

DIRECT
1. Continuous Assessment Test I, II (Theory) 2. Assignments 3. Experimental results analysis/viva 4. Model Examination (lab) 5.End Semester Examination (Theory and lab components)
INDIRECT
1. Course-end survey

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LINEAR AND ANGULAR MEASUREMENTS **9 hours**

Length Standards - Length Measuring instruments - Vernier instruments - micrometer, height gauge, dial indicators, Bore gauges, Slip gauges, Comparators - Mechanical, Electrical, Optical and Pneumatic, Optical Projector. Angle measuring instruments - Bevel protractor, Spirit level, Sine bar, Autocollimator, Angle Decker.

FORM MEASUREMENT **9 hours**

Screw thread terminology- Measurement of effective diameter by two wire and three wire methods - errors in threads- Measurement of pitch, profile errors and total composite errors, Gear tooth terminology-Methods of measurements of run out, pitch, profile, lead, backlash, tooth thickness-composite method of inspection - Parkinson gear tester - Measurement of surface finish - Stylus probe instruments - Tomlinson and Talysurf instrument-Straightness, Flatness and Roundness measurement.

ADVANCES IN METROLOGY **9 hours**

Precision instruments based on Laser- laser interferometer – Universal Measuring Machine- Tool maker's microscope - Coordinate Measuring Machine (CMM): need, construction, types, applications-Computer Aided Inspection, Machine Vision - Introduction to Nanometrology

PROCESS CONTROL FOR VARIABLES AND ATTRIBUTES **9 hours**

Definition and concept of quality - significance of SQC - benefits and limitations of SQC - Quality assurance - Quality cost - Process capability – process capability studies – Construction and uses of control chart – Control chart for variables – X bar chart, R- chart, S-chart- Control chart for attributes – c- chart, u- chart, p- charts.

ACCEPTANCE SAMPLING **9 hours**

Lot by lot sampling - probability of acceptance in single, double, multiple sampling techniques – OC curves – producers' risk and consumers risk. AQL, LTPD, AOQL concepts-standard sampling plans for AQL and LTPD.

LIST OF EXPERIMENTS:

1. Study of linear measuring instruments.
2. Linear Measurement using vernier height gauge and slip gauge.
3. Angular measurement using sine bar and bevel protector.
4. Measurements of gear tooth dimensions using gear tooth vernier and error of composite gear tooth using gear roll tester.
5. Measurement of screw thread parameters using Tool Makers Microscope and Profile Projector.
6. Measurement of surface roughness of machined components.

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7. A study of co-ordinate measuring machine.
8. Process capability study

Theory :45 hours **Practicals : 15 hours** **Total: 60hours**

REFERENCES:

1. Jain R.K., "Engineering Metrology", Khanna Publishers,2005.
2. Gupta S.C, "Engineering Metrology", Dhanpat rai Publications, 2005.
3. Beckwith, Marangoni, Lienhard, "Mechanical Measurements", Pearson Education, 2006.
4. Anthony, D.M. Engineering Metrology, Pergamon Press, First Edition, 1986.
5. Shotbolt, C.S. and Galyer. J. Metrology for Engineers, Cassell Publ., Fifth Edition, 1990.
6. Douglas C. Montgomery, "Introduction to Statistical Quality Control", John wiley& sons, 2005.

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U17MET5003	MACHINE DESIGN	L	T	P	J	C
	(Use of approved Design Data Book is permitted in the Examination)	3	0	0	0	3

Course outcomes

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

CO 1: Apply the concept of steady stresses in design of machine elements subjected to steady loads.

CO 2: Solve problems in machine elements subjected to varying loads

CO 3: Design shafts and couplings for various applications

CO 4: Select bearings for specific applications.

CO 5: Design temporary and permanent joints.

CO 6: Design energy storing springs and flywheel.

Pre-requisite:1.U17MEI4201- Strength of Materials

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak														
COs	Programme Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		M					W						S	
CO2		M					W						S	
CO3	S						W						M	
CO4	S						W						W	
CO5	S						W						M	
CO6	S						W						W	

Course Assessment methods:

Direct	Indirect
1. Internal Test I 2. Internal Test II 3. Assignment 4. End semester exam	Course end survey

STEADY STRESSES IN MACHINE MEMBERS **7 hours**

Introduction to the design process – Product development cycle- factors influencing machine design, selection of materials based on mechanical properties - Preferred numbers – Direct, Bending and Torsional stress – Impact and shock loading, eccentric loading – Design of curved beams - Theories of failure

STRESS CONCENTRATION AND VARIABLE STRESSES IN MACHINE MEMBERS

5 hours

Stress concentration – Design for variable loading – Soderberg, Goodman and Gerber relations

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DESIGN OF SHAFTS AND COUPLINGS **9 hours**

Design of shafts based on strength, rigidity and critical speed – Design of keys, key ways and splines - Design of rigid and flexible couplings

DESIGN OF BEARINGS **8 hours**

Sliding contact and rolling contract bearings – Design of hydrodynamics journal bearings – selection of rolling contact bearings.

DESIGN OF TEMPORARY AND PERMANENT JOINTS **9 hours**

Threaded fasteners - Design of bolted joints including eccentric loading, Knuckle joints, Cotter joints – Design of welded joints - Design of riveted joints.

DESIGN OF ENERGY STORING ELEMENTS **7 hours**

Design of various types of springs, helical springs, leaf springs - Design of flywheels considering stresses in rims and arms

Theory :45hours **Total: 45 hours**

REFERENCES:

1. Shigley J.E and MischkeC.R.,"Mechanical Engineering Design",Tata McGraw-Hill , 2003.
2. Bhandari V.B, "Design of Machine Elements",Tata McGraw-Hill Book Co, 2007.
3. Sundararajamoorthy T. V, Shanmugam .N, "Machine Design", Anuradha Publications, Chennai, 2003.
4. Orthwein W, "Machine Component Design", Jaico Publishing Co, 2003.
5. Ugural A.C, "Mechanical Design – An Integral Approach", McGraw-Hill Book Co, 2004.

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U17MET5004 **KINEMATICS OF MACHINERY** **L T P J C**

3 0 0 0 3

After successful completion of the course, the student would be able to

CO 1: Apply the fundamental concepts in developing various mechanisms
CO 2: Analyze velocity and acceleration in planar mechanisms
CO 3: Synthesise simple mechanisms such as 4-bar and slider crank mechanisms
CO 4: Construct the cam profile for specific follower motion.
CO 5: Determine appropriate gears for requirements.
CO 6: Compute the parameters in gear trains and determine the speeds in gear boxes.

Pre-requisite: U17MET2102 - Engineering Mechanics

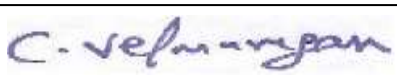
CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak														
COs	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	W												W	
CO2	S	M		W					W				M	
CO3	M												M	
CO4	M	M		W									M	
CO5	M								W				M	
CO6	S			W					W				M	

Course Assessment methods:

Direct	**Indirect**
1. Internal Test I 2. Internal Test II 3. Assignment 4. End semester exam	Course end survey

BASICS OF MECHANISMS **6 Hours**

Terminology and Definitions- Degree of freedom, mobility-Kutzbach criterion- Grashoff's law-Gruebler's criterion - Mechanical Advantage -Transmission angle – Coupler curves - Kinematic Inversions of 4- bar chain and slider crank chains - Description of common mechanisms -- Ratchets and pawl mechanisms- Indexing mechanisms - Rocking mechanisms - Straight line generators – Steering mechanisms



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KINEMATICS OF PLANE MECHANISMS **11 Hours**

General plane motion - Relative velocity method – Displacement, velocity and acceleration analysis in simple mechanisms - Instantaneous center method, Kennedy theorem – Coincident points – Coriolis component of acceleration - Analytical method of kinematic analysis

SYNTHESIS OF MECHANISMS **7 Hours**

Mechanism synthesis – Motion generation, path generation and function generation – Chebychev's spacing of accuracy points – Graphical and algebraic methods of synthesis of simple mechanisms such as 4 bar and slider crank mechanisms.

KINEMATICS OF CAM **8 Hours**

Classifications - Displacement diagrams - Uniform velocity, simple harmonic, uniform acceleration and retardation and cycloidal motions – Graphical layout of plate cam profiles - Derivatives of follower motion – High speed cams – Cams with specified contours - unbalance and wind up - Pressure angle and undercutting – spring surge, jump speed - Analysis of cam.

GEARS **6 Hours**

Introduction – Types – Terminology – Law of toothed gearing – Velocity of sliding – Involute and cycloidal tooth profiles – Interchangeable gears – Length of path and arc of contact – contact ratio – Interference and under cutting – Minimum number of teeth to avoid interference in pinion and gear – Non-standard gear teeth.

GEAR TRAINS AND GEAR BOXES **7 Hours**

Gear trains –Simple, compound, reverted and epicyclic gear trains – Differentials.

Multi speed gear boxes – Speed ratio - Kinematic arrangement – Ray diagram.

Total:45Hours

REFERENCES:

1. Rattan, S.S.,"Theory of Machines", Tata McGraw-Hill Publishing Company Ltd.,New Delhi, 2009.
2. Uicker, J.J., Pennock, G.R and Shigley, J.E., "Theory of Machines and Mechanisms", Oxford University Press,New Delhi, 2009.
3. Thomas Bevan, "Theory of Machines",CBS Publishers and Distributors, 2005.
4. Ghosh, A., and Mallick, A.K., "Theory of Mechanisms and Machines", Affiliated EastWestPvt. Ltd., New Delhi, 2006.
5. Rao, J.S., and Dukkipati, R.V, "Mechanism and Machine Theory", New Age International (P) Ltd Publishers. New Delhi, 2007.
6. Khurmi, R.S., and Gupta, J.K., "Theory of Machines", S.Chand& Company, 2009.
7. Norton L Robert, "Kinematics and Dynamics of Machinery",Tata McGraw Hill, Higher Education, 2008.

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U17MEI5205	FINITE ELEMENT ANALYSIS	L	T	P	J	C
		3	0	2	0	4

Course outcomes

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

CO 1: Solve problems by applying standard finite element techniques.
CO 2: Analyze 1-D finite elements and to build the stiffness matrix.
CO 3: Examine 2-D finite element continuum for structural applications.
CO 4: Solve 1-D and 2-D heat transfer problems using finite element approach.
CO 5: Applyaxisymmetric formulation for specific applications.
CO 6: Make use of finite element principles in iso-parametric applications.

Pre-requisite: Nil

CO/PO Mapping
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes (POs)													
	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
CO 1	S												W	
CO 2	M				M				W				M	
CO 3	M	M	M						W				W	
CO 4	S	M			M				W				M	
CO 5	M	M			M								M	
CO 6	S												W	

Course Assessment methods:

Direct	Indirect
1. Internal Test I 2. Internal Test II 3. Assignment 4.Group Presentation 5. End semester exam	Course end survey

INTRODUCTION **9 Hours**

Historical background– Matrix approach – Application to the continuum – Discretisation – Matrix algebra – Gaussian elimination – Governing equations for continuum – Classical Techniques in FEM – Weighted residual method – Rayleigh Ritz method

ONE DIMENSIONAL PROBLEMS **9 Hours**

Finite element modeling – Coordinates and shape functions- Potential energy approach – Galarkin approach – Assembly of stiffness matrix and load vector – Finite element equations –

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Quadratic shapefunctions – Applications to plane trusses- One dimensional steady state conduction and convective heat transfer problems.

TWO-DIMENSIONAL CONTINUUM 9 Hours

Introduction – Finite element modeling – Scalar valued problem – Poisson's equation –Laplace equation –Triangular elements – Element stiffness matrix – Force vector – Galarkin approach - Stress calculation.

AXISYMMETRIC CONTINUUM 9 Hours

Axisymmetric formulation – Element stiffness matrix and force vector – Galarkin approach – Body forces – Stress calculations – Boundary conditions.

ISOPARAMETRIC ELEMENTS FOR TWO DIMENSIONAL CONTINUUM9 Hours

The four-node quadrilateral – Shape functions – Element stiffness matrix and force vector – Numerical integration – Stiffness– Stress calculations – Four node quadrilateral for axisymmetric problems.

Theory :45Hours Practical :30Hours Total:75Hours

Practical :

1. Stress analysis of a plate with a circular hole.
2. Stress analysis of rectangular L bracket
3. Stress analysis of an axi-symmetric component
4. Stress analysis of beams (Cantilever, Simply supported, Fixed ends)
5. Mode frequency analysis of a 2 D component
6. Mode frequency analysis of beams (Cantilever, Simply supported, Fixed ends)
7. Harmonic analysis of a 2D component
8. Thermal stress analysis of a 2D component
9. Conductive heat transfer analysis of a 2D component
10. Convective heat transfer analysis of a 2D component

REFERENCES:

1. Chandrupatla T.R., and Belegundu A.D., "Introduction to Finite Elements in Engineering",Prentice Hall, 2011.
2. David V Hutton "Fundamentals of Finite Element Analysis" McGraw-Hill Int. Edition, 2005.
3. Rao S.S., "The Finite Element Method in Engineering", Pergammon Press, 2005.

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4. Reddy J.N.,“Finite Element: An Introduction to Finite Element Method”, McGraw-Hill education,2005.
5. O.C.Zienkiewicz and R.L.Taylor, “The Finite Element Methods”,Butterworth Heineman,2005.
6. Logan D.L, “A first course in the Finite Element Method”,Thomson Learning, 2010

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7. .

U17VEP5505 **SOCIAL VALUES**
(Mandatory)

L	T	P	J	C
0	0	2	0	0

Course Outcomes

After successful completion of this course, the students should be able to

CO 1: Understand the transformation from self to society
CO 2: Acquire knowledge about disparity among Human Beings
CO 3: Realize the new ethics in creating a more sustainable Society
CO 4: Develop skills to manage challenges in social issues
CO 5: Acquire the skills for Management of Social work & HolisticSociety
CO 6: Validate the social liabilities at dissimilar situations

Pre-requisites:

1. U17VEP1501 / PERSONAL VALUES
2. U17VEP2502 / INTERPERSONAL VALUES
3. U17VEP3503 / FAMILY VALUES
4. U17VEP4504 / PROFESSIONAL VALUES

CO/PO Mapping
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						S								
CO2							S							
CO3								M						
CO4											S			
CO5												S		
CO6									M					

Course Assessment methods

Direct
1.Group Activity / Individual performance and assignment 2.Assessment on Value work sheet / Test
Indirect
1. Mini project on values / Goodwill Recognition

Values through Practical activities:

1. Self and Society: Relation between self and society – Different forms of society - Elements of Social structures – Realization of Duties and Responsibilities of Individual in the Society

2. Social Values: Tolerance – Responsibility – Sacrifice – Sympathy - Service – peace-nonviolence - right conduct- Unity – forgive – dedication – Honest

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3. Social issues: Disparity among Human beings- Poverty-Sanitation -corruption- un employment-superstition – religious intolerance & castes – terrorism.

4. Emerging Ethics for Sustainable Society: Unison of Men in Society - Positive Social Ethics - Cause and Effect - Ensuring an Equitable Society- Effect of Social Media in society - development of Education and Science in the Society

5. Social Welfare:Social welfare Organization - Programme by Government and NGO's - Benefits of Social Service - Balancing the Family and Social Life – Development of Holistic Society

Workshop mode

REFERENCES

1. SOCIAL PROBLEMS IN INDIA - ForumIAS.com – PDF discuss.forumias.com/uploads/File upload/.../711b18f321d406be9c79980b179932.pd...

2. INVESTING IN CULTURAL DIVERSITY AND INTERCULTURAL DIALOGUE: UNESCO ... www.un.org/en/events/culturaldiversityday/pdf/Investing_in_cultural_diversity.pdf

3. INDIAN SOCIETY AND SOCIAL CHANGE - University of Calicut www.universityofcalicut.info/SDE/BA_sociology_indian_society.pdf

4. CULTURE, SOCIETY AND THE MEDIA - E-classwww.eclass.uoa.gr/.../MEDIA164/.../%5BTony_Bennett,_James_Curran,_Michael_G

5. SOCIAL WELFARE ADMINISTRATION - IGNOU www.ignou.ac.in/upload/Bswe-003%20Block-2-UNIT-6-small%20size.pdf

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U17INI5600 ENGINEERING CLINIC – III

L	T	P	J	C
0	0	4	2	3

Course objectives

- To help the students look into the functioning of simple to complex devices and systems
- To enable the students to design and build simple systems on their own
- To help experiment with innovative ideas in design and team work
- To create an engaging and challenging environment in the engineering lab

Course Outcomes

After successful completion of this course, the students should be able to:

CO1: Identify a practical problems and find a solution
CO2: Understand the project management techniques
CO3: Demonstrate their technical report writing and presentation skills

Pre-requisite:

1. U17INI4600 Engineering Clinic II

CO/PO Mapping
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	ProgrammeOutcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S	S	S	S	S	M	W		S			S		
CO2											S			
CO3										S				

Course Assessment methods:

Direct	Indirect
1. Project reviews 50%	1. Course Exit Survey
2. Workbook report 10%	
3. Demonstration & Viva-voce 40%	

Content:

The course will offer the students with an opportunity to gain a basic understanding of computer controlled electronic devices and apply the concepts to design and build simple to complex devices. As a practical project based embedded course, the students will be taught the concepts using a variety of reference material available in the public domain. While the course will start with formal instruction on hardware, programming and applications, the major portion of the course will provide the students with ample opportunity to be innovative in designing and building a range of products from toys to robots and flying machines.

In the Fifth semester, students will focus primarily on Design project combining concepts learnt in Engineering clinics I and II

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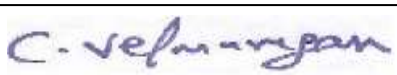
GUIDELINES:

1. Practical based learning carrying credits.
2. Multi-disciplinary/ Multi-focus group of 5-6 students.
3. Groups can select to work on a specific tasks, or projects related to real world problems.
4. Each group has a faculty coordinator/Instructor who will guide/evaluate the overall group as well as individual students.
5. The students have to display their model in the 'Engineering Clinics Expo' at the end of semester.
6. The progress of the course is evaluated based on reviews and final demonstration of prototype.

Total Hours: 90



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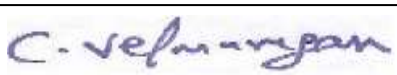
Semester VI



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U17MEI6201	HEAT AND MASS TRANSFER	L	T	P	J	C
	(Use of Standard Heat and Mass Transfer Data Book is permitted)	3	0	2	0	4

Course outcomes

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

CO 1: Apply steady state heat conduction problems for composite systems and fins.
CO 2: Solve transient heat conduction problems.
CO 3: Solve problems in natural and forced convection for internal and external flows.
CO 4: Calculate the effectiveness of heat exchanger using LMTD and NTU methods.
CO 5: Illustrate radiation shape factors for various geometries.
CO 6: Explain the phenomenon of diffusion and convective mass transfer.

Pre-requisite:1. U17MET3004 – Engineering Thermodynamics

CO/PO Mapping
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S			M					M	M			S	
CO2	S			M					M	M			S	
CO3	S	M		M					M	M			M	
CO4	S	S		M					M	M			S	
CO5	M			M					W	W			W	
CO6	M								W	W			W	

Course Assessment methods:

DIRECT
1. Continuous Assessment Test I, II (Theory component)
2. Assignment; Group Presentation, Project
3. Demonstration etc (as applicable) (Theory component)
4. Pre/Post - Experiment Test/Viva; Experimental Report for each Experiment (lab Component)
5. Model Examination (lab component)
6.End Semester Examination (Theory and lab components)
INDIRECT
2. Course-end survey

CONDUCTION **9 hours**

Basic Concepts – Mechanism of Heat Transfer – Conduction, Convection and Radiation – Fourier Law of Conduction - General Differential Conduction equation inCartesian andCylindrical Coordinate systems – One Dimensional Steady State Heat Conduction through Plane Wall, Cylindrical and Spherical systems – Composite Systems – Critical thickness of

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insulation - Conduction with Internal Heat Generation – Extended Surfaces – Numerical Methods of One dimensional Heat conduction- Unsteady Heat Conduction – Lumped Analysis, Infinite and semi Infinite solids using Heislers Chart.

CONVECTION **9 hours**

Basic Concepts – Convective Heat Transfer Coefficients – Boundary Layer Concept – Types of Convection – Forced Convection – Dimensional Analysis – External Flow – Flow over Plates, Cylinders and Spheres – Internal Flow – Laminar, Turbulent and Combined flows – Flow over Bank of tubes – Free Convection – Dimensional Analysis – Flow over Vertical, Horizontal and Inclined Plates, Cylinders and Spheres.

HEAT EXCHANGERS **9 hours**

Nusselts theory of condensation - Regimes in boiling - Correlations in condensation and boiling - Types of Heat Exchangers- compact heat exchanger – Overall Heat Transfer Coefficient – Fouling Factors - LMTD and Effectiveness – NTU methods of Heat Exchanger Analysis.

RADIATION **9 hours**

Basic Concepts, Laws of Radiation – Black Body Radiation – Grey body radiation –radiation shield - Shape Factor Algebra (Plates, parallel, perpendicular, parallel circular disc) – Gas radiations (qualitative study).

MASS TRANSFER **9 hours**

Basic Concepts – Diffusion Mass Transfer – Fick's Law of Diffusion – Steady state Molecular Diffusion – Convective Mass Transfer – Momentum, Heat and Mass Transfer Analogy – Convective Mass Transfer Correlations.

Theory :45 hoursTotal: 45 hours

LIST OF EXPERIMENTS:

1.Thermal conductivity measurement using a two-slab guarded hot plate apparatus

2. Thermal conductivity measurement of an insulation using lagged pipe apparatus.

3. Determination of convective heat transfer coefficient and rate of Heat transfer - free and forced convection.

4. Determination of rate of Heat transfer from pin-fin - natural and forced convection mode.

5. Estimation of effectiveness of tube – in – tube parallel flow and counter flow heat exchanger mode by using LMDT and NTU method.

6. Determination of emissivity and radiation factor for the given test specimen using Stefan- Boltzman emissivity apparatus.

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7. Determination of COP of the given VCR test rig.
8. Determination of COP of the given air conditioning test rig.

REFERENCES:

1. Sachdeva R C, “Fundamentals of Engineering Heat and Mass Transfer”, New Age International,2008.
2. YunusCengal, “Heat and Mass Transfer”, Tata McGraw Hill,2008.
3. Holman J.P, “Heat Transfer” Tata Mc Graw Hill,2007.
4. Ozisik M.N, “Heat Transfer”, McGraw-Hill Book Co,2001.
5. Nag P.K, “Heat Transfer”, Tata McGraw-Hill, New Delhi, 2002.
6. Eckert, E.R.G, ‘Heat and mass transfer “ Mc Graw hill, 1959.
7. Frank P. Incropera and David P. DeWitt, “Fundamentals of Heat and Mass Transfer”, John Wiley and Sons, March 2006.:

Theory: 45 hours **Practical: 30 hours** **Total: 75 Hours**

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U17MEI6202	DYNAMICS OF MACHINERY	L	T	P	J	C
		3	0	2	0	4

Course outcomes

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

CO 1: Analyze the static and dynamic force in mechanical systems. Evaluate the fluctuation of energy stored in flywheel.

CO 2: Determine the unbalanced force in reciprocating and rotating mass

CO 3: Apply the fundamental concepts of vibrating system to predict the natural frequency.

CO 4: Estimate the frequency of damped and forced vibrating systems

CO 5: Calculate the speed range of governors.

CO 6: Determine the gyroscopic couple.

Pre-requisite:1. U17MET5004 Kinematics of Machinery

CO/PO Mapping
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S	M							W				M	
CO2	S	M		M					W				M	
CO3	M			M					W				M	
CO4	M			M					W				M	
CO5	M			M					W				M	
CO6	M			M					W				M	

Course Assessment methods:

Direct	Indirect
1. Internal Test I 2. Internal Test II 3. Assignment 4. End semester exam	Course end survey

FORCE ANALYSIS AND FLYWHEELS **10 Hours**

Static force analysis of mechanisms - Inertia force and Inertia torque – Dynamic force analysis - Dynamic Analysis in Reciprocating Engines – Gas Forces - Equivalent masses - Crank shaft torque. Turning moment diagrams – Fluctuation of energy, speed - Flywheels of engines and punching press

BALANCING **8 Hours**

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Static and dynamic balancing – Balancing of rotating masses - Balancing of reciprocating masses in a single cylinder engine - Balancing in multi-cylinder engines – Firing order – Balancing of linkages.

FREE VIBRATION **9 Hours**

Basic features of vibratory systems - Basic elements and lumping of parameters - Degrees of freedom - Single degree of freedom - Free vibration - Equations of motion - Natural frequency - Whirling of shafts and critical speed - Torsional vibration of two and three rotor systems.

DAMPED AND FORCED VIBRATIONS **8 Hours**

Damped vibration - Types of damping - Response to periodic forcing - Harmonic Forcing – Forced vibration caused by unbalance – Force transmissibility and amplitude transmissibility - Vibration isolation.

GOVERNORS **5 Hours**

Governors - Types - Centrifugal governors – Porter, Proell and Hartnell governors – Controlling force - Characteristics.

GYROSCOPES **5 Hours**

Gyroscopes - Gyroscopic couple - Gyroscopic stabilization - Gyroscopic effects in aeroplanes, ships and automobiles.

INTEGRATED LABORATORY EXPERIMENTS

1. Characteristic cures of Porter and Hartnell governors
2. Motorized gyroscope
3. Damped vibration
4. Balancing of reciprocating masses
5. Balancing of rotating masses
6. (a) Longitudinal vibration in helical spring (b) Verification of Dunkerley's rule
7. (a) Single rotor system (b) Vibrating table
8. Critical speed of whirling of shaft

Theory:45 Hours **Practical:30Hours** **Total:75Hours**

REFERENCES:

1. Rattan S.S., "Theory of Machines",Tata McGraw-Hill Publishing Company, New Delhi, 2009.
2. Thomas Bevan, "Theory of Machines", CBS Publishers and Distributors, 2005.

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3. Ghosh A. and MallickA.K.,“Theory of Mechanisms and Machines”, Affiliated East-West Press Pvt. Ltd., New Delhi, 2006.
4. Shigley J.E. and Uicker J.J., "Theory of Machines and Mechanisms", Oxford University Press,New Delhi, 2009.
5. Rao J.S. and DukkipatiR.V.,“Mechanism and Machine Theory”, New International Limited Publishers, New Delhi, 2007.
6. John Hannah and Stephens R.C.,“Mechanics of Machines”, Viva low-Priced Student Edition, 2006.
7. Sadhu Singh “Theory of Machines” Pearson Education India, 2006.

STANDARDS:

1. IS 11717: 2000, Vocabulary on Vibration and Shock
2. IS 13301: 1992, Guidelines for vibration isolation for machine foundations
3. IS 10000: Part 7: 1980, Methods of tests for internal combustion engines: Part 7 Governing tests for constant speed engines and selection of engines for use with electrical generators
4. IS 13274: 1992, Mechanical vibration - Balancing – Vocabulary
5. IS 13277: 1992, Balancing machine - Description and evaluation

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U17MET6003 **OPERATIONS RESEARCH**

L	T	P	J	C
3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to:

CO1: Apply linear programming model and assignment model to domain specific situations

CO2: Analyze the various methods under transportation model and apply the model for testing the closeness of their results to optimal results

CO3: Apply the concepts of PERT and CPM for decision making and optimally managing projects

CO4: Analyze the various replacement and sequencing models and apply them for arriving at optimal decisions

CO5: Analyze and apply appropriate inventory techniques in domain specific situations.

CO6: Analyze and apply appropriate queuing theories in domain specific situations

Pre-requisite: Nil

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak														
COs	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	S	S		S										
CO2	S	S		S										
CO3	S	S		S										
CO4	S	S		S										
CO5	S	S		S										
CO6	S	S		S										

Course Assessment methods:

Direct	Indirect
1. Internal Test I 2. Internal Test II 3. Assignment 4. Group presentation 5. End semester exam	Course end survey

LINEAR MODEL **9 hours**

The phases of OR study – formation of an L.P model – graphical solution – simplex algorithm – artificial variables technique (Big M method, two phase method), duality in simplex

TRANSPORTATION AND ASSIGNMENT PROBLEM **9 hours**

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Transportation model – Initial solution by North West corner method – least Cost method – VAM. Optimality test – MODI method and stepping stone method. Assignment model – formulation – balanced and unbalanced assignment problems

PROJECT MANAGEMENT BY PERT & CPM **9 hours**

Basic terminologies – Constructing a project network – Scheduling computations – PERT - CPM – Resource smoothening, Resource leveling, PERT Cost

REPLACEMENT AND SEQUENCING MODELS **9 hours**

Replacement policies - Replacement of items that deteriorate with time (value of money not changing with time) – Replacement of items that deteriorate with time (Value of money changing with time) – Replacement of items that fail suddenly (individual and group replacement policies).

Sequencing models- n job on 2 machines – n jobs on 3 machines – n jobs on m machines, Traveling salesman problem

INVENTORY AND QUEUING THEORY **9 hours**

Variables in inventory problems, EOQ, deterministic inventory models, order quantity with price break, techniques in inventory management.

Queuing system and its structure – Kendall's notation – Common queuing models - M/M/1: FCFS/∞/∞ - M/M/1: FCFS/n/∞ - M/M/C: FCFS/∞/∞ - M/M/1: FCFS/n/m

Theory :45 hours **Total: 45 hours**

REFERENCES:

1. Taha H.A., "Operation Research", Pearson Education,2011.
2. Hira and Gupta "Introduction to Operations Research", S.Chand and Co.2007.
3. Hira and Gupta "Problems in Operations Research", S.Chand and Co.2008
4. Wagner, "Operations Research", Prentice Hall of India, 2000.
5. Bhaskar, S., "Operations Research", Anuradha Agencies,2015.

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U17VEP6506 **NATIONAL VALUES**
(Mandatory)

L	T	P	J	C
0	0	2	0	0

Course Outcomes

After successful completion of this course, the students should be able to

CO 1: Acquire knowledge on the Essence of Indian Knowledge Tradition

CO 2: Know the great Indian personalities and follow their trail

CO 3: Understand the specialty of democracy

CO 4: Disseminate our Nation and its values to propagate peace

CO 5: Contribute with their energy and effort for a prosperous India

CO 6: Propagate the youth and the contribution for development of our Nation

Pre-requisites :

1. U17VEP1501 / PERSONAL VALUES
2. U17VEP2502 / INTERPERSONAL VALUES
3. U17VEP3503 / FAMILY VALUES
4. U17VEP4504 / PROFESSIONAL VALUES
5. U17VEP5505 / SOCIAL VALUES

CO/PO Mapping
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						S								
CO2									M					
CO3							M							
CO4								S						
CO5											S			
CO6												M		

Course Assessment methods

Direct
1.Group Activity / Individual performance and assignment 2.Assessment on Value work sheet / Test
Indirect
1. Mini project on values / Goodwill Recognition

Values through Practical activities:

1. Essence of Indian Knowledge Tradition:

Basic structure of Indian Knowledge System - Modern Science and Indian Knowledge System - Yoga and Holistic Health care - Case studies - Philosophical Tradition -

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Indian Linguistic Tradition - Indian Artistic Tradition.

2. Great Indian Leaders: Ancient rulers - Freedom fighters - Social reformers -Religious and Spiritual leaders - Noble laureates -Scientists – Statesman.

3. Largest Democracy: Socialist -Secular - Democratic and Republic – special features of Indian constitution – Three pillar of Indian democracy - Fundamental rights – Duties of a citizen – centre state relationship.

4. India's Contribution to World peace: Nonaligned Nation – Principle of Pancha Sheela – Mutual respect, non-aggression, non-interference, Equality and cooperation – Role of India in UNO -Yoga India's gift to the world.

5. Emerging India: World's largest young work force - Stable Economic development - Labor market & Achievement in space technology – Value based Social structure. Emerging economic superpower.

Workshop mode

REFERENCES

1. KNOWLEDGE TRADITIONS AND PRACTICES OF INDIA, *CBSE Publication* *cbseacademic.nic.in/web_material/Circulars/2012/68_KTPI/Module_6_2.pdf*

2. CULTURAL HERITAGE OF INDIA - SCERT Kerala
www.scert.kerala.gov.in/images/2014/HSC.../35_Gandhian_Studies_unit-01.pdf

3. LEARNING TO DO: VALUES FOR LEARNING AND WORKING TOGETHER - UNESCO
www.unesdoc.unesco.org/images/0014/001480/148021e.pdf

4. INDIA AFTER GANDHI.pdf - Ramachandra Guha - University of Warwick
www2.warwick.ac.uk/fac/arts/history/students/modules/hi297/.../week1.pdf

5. INDIA'S CONTRIBUTION TO THE REST OF THE WORLD - YouSigma
www.yousigma.com/interesting facts/indiasgifttotheworld.pdf

6. INDIA AS AN EMERGING POWER - International Studies Association
web.isanet.org/Web/Conferences/.../11353cac-9e9b-434f-a25b-a2b51dc4af78.pdf

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U17INI6600 ENGINEERING CLINIC - IV

L	T	P	J	C
0	0	4	2	3

Course objectives

- To help the students look into the functioning of simple to complex devices and systems
- To enable the students to design and build simple systems on their own
- To help experiment with innovative ideas in design and team work
- To create an engaging and challenging environment in the engineering lab

Course Outcomes

After successful completion of this course, the students should be able to:

CO1: Identify a practical problems and find a solution
CO2: Understand the project management techniques
CO3: Demonstrate their technical report writing and presentation skills

Pre-requisite:

1. U17INI5600 Engineering Clinic III

CO/PO Mapping
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S	S	S	S	S	M	W		S			S		
CO2											S			
CO3										S				

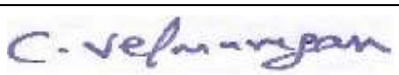
Course Assessment methods:

Direct	Indirect
1. Project reviews 50%	1. Course Exit Survey
2. Workbook report 10%	
3. Demonstration & Viva-voce 40%	

Content:

The course will offer the students with an opportunity to gain a basic understanding of computer controlled electronic devices and apply the concepts to design and build simple to complex devices. As a practical project based embedded course, the students will be taught the concepts using a variety of reference material available in the public domain. While the course will start with formal instruction on hardware, programming and applications, the major portion of the course will provide the students with ample opportunity to be innovative in designing and building a range of products from toys to robots and flying machines.

In the Sixth semester, students will focus primarily on Reverse engineering project to improve performance of a product and Design and developing a prototype



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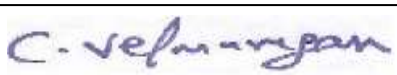
GUIDELINES:

1. Practical based learning carrying credits.
2. Multi-disciplinary/ Multi-focus group of 5-6 students.
3. Groups can select to work on a specific task, or projects related to real world problems.
4. Each group has a faculty coordinator/Instructor who will guide/evaluate the overall group as well as individual students.
5. The students have to display their model in the 'Engineering Clinics Expo' at the end of semester.
6. The progress of the course is evaluated based on reviews and final demonstration of prototype.

Total Hours: 90



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Semester VII

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U17MET7001	ENGINEERING ECONOMICS AND FINANCIAL MANAGEMENT	L	T	P	J	C
		3	0	0	0	3

Course outcomes

After successful of the course, the student would be able to:

CO1: Evaluate the economic theories, cost concepts and pricing policies

CO2: Analyze the market structures and integration concepts

CO3: Apply the concepts of national income and understand the functions of banks and concepts of globalization

CO4: Apply the concepts of financial management for project appraisal and working capital management

CO5: Understand accounting systems

CO6: Analyse financial statements using ratio analysis

Pre-requisite: Nil

CO/PO Mapping
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

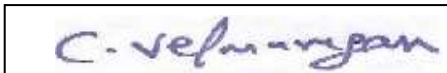
COs	Programme Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		M				M					M			M
CO2				M		M					M			M
CO3						M					M			M
CO4				M							S			M
CO5											S			M
CO6		M		M							S			M

Course Assessment methods:

Direct	Indirect
1. Internal Test I 2. Internal Test II 3. Assignment 4.Group Presentation 5. End semester exam	Course end survey

ECONOMICS, COST AND PRICING CONCEPTS **9 hours**

Economic theories – Demand analysis – Determinants of demand – Demand forecasting – Supply – Actual Cost and opportunity Cost – Incremental Cost and sunk Cost – Fixed and variable Cost – Marginal Costing – Total Cost – Elements of Cost – Cost curves – Breakeven point and breakeven chart – Limitations of break-even chart



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– Interpretation of break-even chart – Contribution – P/V-ratio, profit-volume ratio or relationship – Price fixation – Pricing policies – Pricing methods.

CONCEPTS ON FIRMS AND MANUFACTURING PRACTICES 9 hours

Firm – Industry – Market – Market structure – Diversification – Vertical integration – Merger – Horizontal integration.

NATIONAL INCOME, MONEY AND BANKING, ECONOMIC ENVIRONMENT 9 hours

National income concepts – GNP – NNP – Methods of measuring national income – Inflation – Deflation – Kinds of money – Value of money – Functions of bank – Types of bank – Economic liberalization – Privatization – Globalization

CONCEPTS OF FINANCIAL MANAGEMENT 9 hours

Financial management – Scope – Objectives – Time value of money – Methods of appraising project profitability – Sources of finance – Working capital and management of working capital

ACCOUNTING SYSTEM, STATEMENT AND FINANCIAL ANALYSIS 9 hours

Accounting system – Systems of book-keeping – Journal – Ledger – Trail balance – Financial statements – Ratio analysis – Types of ratios – Significance – Limitations

Theory :45 hours **Total: 45 hours**

References:

1. Prasanna Chandra, “Financial Management (Theory & Practice)”,Tata Mcgraw Hill Publishing Co Ltd, 2016.
2. Weston & Brigham, “Essentials of Managerial Finance”, The Dryden Press; Fifth Edition edition (1974)
3. Pandey, I. M., “Financial Management”
4. Fundamentals of Financial Management- James C. Van Horne.
5. Bhaskar S. “Engineering Economics and Financial Accounting”, (2003) Anuradha Agencies, Chennai
6. Financial Management & Policy -James C. Van Horne

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7. Management Accounting & Financial Management- M. Y. Khan & P. K. Jain
8. Management Accounting Principles & Practice -P. Saravanavel
9. Ramachandra Aryasri.A., and Ramana Murthy V.V.,"Engineering Economics & Financial Accounting"-Tata McGraw Hill, New Delhi, 2006.
10. Varshney R.L., and MaheswariK.L.,"Managerial Economics" – Sultan Chand & Sons, New Delhi, 2001
11. Samvelson and Nordhaus,"Economics"-Tata McGraw Hill, New Delhi, 2002

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U17MET7002 DESIGN OF TRANSMISSION SYSTEMS

L	T	P	J	C
3	0	0	0	3

Course outcomes

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

CO 1: Choose suitable flexible drive for specific application.

CO 2: Design spur and helical gear by considering strength and life.

CO 3: Estimate the dimensions of bevel and worm gears

CO 4: Construct the gear box for suitable application.

CO 5: Design braking system for various applications.

CO 6: Apply the concepts of pressure and wear theories to design clutches.

Pre-requisite: U17ME5003 –Machine Design

CO/PO Mapping **(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak**														
COs	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	S	M	W						W				S	
CO2	S	M	W						W				S	
CO3	S	M	W						W				S	
CO4	S	M	W						W				S	
CO5	S	M	W						W				S	
CO6	S	M	W						W				S	

Course Assessment methods:

Direct	Indirect
1. Internal Test I 2. Internal Test II 3. Assignment 4.Group Presentation 5. Tutorial 6. End semester exam	Course end survey

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DESIGN OF FLEXIBLE ELEMENTS **8 Hours**

Dynamic aspects of belt drives – ratio of driving tensions - Maximum power transmitted by a belt drive. Selection of Flat belts and V belts – pulleys -Wire ropes and pulleys – Selection of Transmission chains and Sprockets. Design of pulleys and sprockets.

SPUR GEARS AND HELICAL GEARS **8 Hours**

Force analysis -Tooth stresses - Dynamic effects - Fatigue strength - Gear materials – Module and Face width-power rating calculations based on strength and wear considerations - Helical Gears – Pressure angle in the normal and transverse plane- Equivalent number of teeth-forces and stresses. Estimating the size of the spur and helical gears.

BEVEL AND WORM GEARS **8 Hours**

Straight bevel gear: Tooth terminology, tooth forces and stresses, equivalent number of teeth. Estimating the dimensions of pair of straight bevel gears. Worm Gear: terminology, Merits and demerits. Thermal capacity, materials-forces and stresses, efficiency, estimating the size of the worm gear pair.

DESIGN OF GEAR BOXES **6 Hours**

Geometric progression - Standard step ratio - Design of sliding mesh gear box - Constant mesh gear box. – Design of multi speed gear box.

DESIGN OF BRAKES **8 Hours**

Dynamic aspects of braking – Braking Torque in block, band and internal expanding shoe brake - Design brakes

DESIGN OF CLUTCHES **7 Hours**

Dynamic aspects of clutches – Torque transmitted in plate clutches, cone clutches and jaw clutches - Design of clutches

Theory :45 Hrs **Total:60Hrs**

REFERENCES:

1.Rattan, S.S.,"Theory of Machines", Tata McGraw-Hill Publishing Company Ltd.,New Delhi, 2009.

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2.Shigley J.E and Mischke C.R., “Mechanical Engineering Design”, Tata McGraw-Hill Education, 2014.

3.Sundararajamoorthy T.V., Shanmugam N., "Machine Design", Anuradha Publications, Chennai, 2015.

4.Maitra G.M., Prasad L.V., “Hand book of Mechanical Design”, Tata McGraw-Hill, 1995.

5.Bhandari, V.B., “Design of Machine Elements”, Tata McGraw-Hill Education, 2010.

6.Prabhu. T.J., “Design of Transmission Elements”, Mani Offset, Chennai, 2000.

7.Hamrock B.J., Jacobson B., Schmid S.R., “Fundamentals of Machine Elements”, McGraw-Hill Book Co., 2013.

8.UguralA.C,"Mechanical Design, An Integrated Approach", McGraw Hill Education, 2003.

9.Khurmi, R.S., and Gupta, J.K., “Theory of Machines”, S.Chand& Company, 2009.

STANDARDS:

1.IS 4460: Parts 1 to 3: 1995, Gears – Spur and Helical Gears – Calculation of Load Capacity.

2.IS 7443 : 2002, Methods of Load Rating of Worm Gears

3.IS 15151: 2002, Belt Drives – Pulleys and V-Ribbed belts for Industrial applications – PH, PJ, PK, Pl and PM Profiles : Dimensions

4.IS 2122: Part 1: 1973, Code of practice for selection, storage, installation and maintenance of belting for power transmission: Part 1 Flat Belt Drives.

5.IS 2122: Part 2: 1991, Code of practice for selection, storage, installation and maintenance of belting for power transmission: Part 2 V-Belt Drives.

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U17MEP7703 Mini Project / Phase I Project

L	T	P	J	C
0	0	0	6	3

Course outcomes

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

CO 1: Identify a problem in mechanical engineering field through survey.

CO 2: Develop methodology to find the solution for the problem.

CO 3: Perform methodology using appropriate tools for the problem

CO 4: Learn suitable modern tools.

CO 5: Analyze data and interpret the results obtained.

CO 6: Prepare a Consolidated report details the various stages of the Project

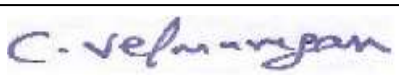
CO/PO Mapping

(S / M / W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S	M	W						M				S	
CO2	S	M	W						M				S	
CO3	S	M	W						M				S	
CO4	S	M	W						M				S	
CO5	S	M	W						M				S	
CO6	S	M	W						M				S	

Course Content

- The objective of Project Work–Phase I is to enable students to identify a problem in mechanical engineering field using literature or industry survey. The work can be an innovative improvement of existing system in the mechanical engineering/interdisciplinary areas and shall include modeling, design, experimentation, evaluation, fabrication or analysis.
- The aim of the project work is to deepen comprehension of principles by applying them to a new problem which may be the design, manufacture of a device, experimentation, simulation of mechanical systems.
- Suitable methodology to be arrived by evaluating existing solutions. Suitable modern tools shall be used to find the solution.
- Every project work shall have a guide who is the member of the faculty of the



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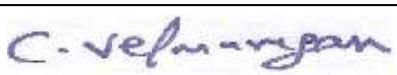
institution.

- For industrial projects, supervisor from the organization will be a co-guide.
- Each project work will be carried out by a batch of maximum three students.
- The project period allotted shall be utilized by the students to receive directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present periodical seminars on the progress made in the project.
- The continuous assessment shall be made as prescribed in the regulations.
- The review committee will be constituted by the Head of the Department.
- The progress of the project is evaluated based on a minimum of three reviews.
- Each student shall finally submit a report covering background information, literature survey, problem statement, methodology and use of modern tools with in stipulated date.



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U17VEP7507 **GLOBAL VALUES**
(Mandatory)

L	T	P	J	C
0	0	2	0	0

Course Outcomes

After successful completion of this course, the students should be able to:

CO 1: Aware of the concept of Universal Brotherhood and support the organizations which are working for it

CO 2: Follow the path of Ahimsa in every aspect of their life

CO 3: Uphold the Universal declaration of Human Rights

CO 4: Understand the unequal distribution of wealth in the World and bestow their Effort towards inclusive growth

CO 5: Sensitize the environmental degradation and work for the sustainable development

CO 6: Amalgamate harmony through Non-violence and edify the nation headed for Upholding development

Pre-requisites:

1. U17VEP1501 / PERSONAL VALUES
2. U17VEP2502 / INTERPERSONAL VALUES
3. U17VEP3503 / FAMILY VALUES
4. U17VEP4504 / PROFESSIONAL VALUES
5. U17VEP5505 / SOCIAL VALUES
6. U17VEP6506 / NATIONAL VALUES

CO/PO Mapping
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1							M					
CO2								S				
CO3									M			
CO4						S						
CO5											M	
CO6												S

Course Assessment methods

Direct
1.Group Activity / Individual performance and assignment 2.Assessment on Value work sheet / Test
Indirect
1. Mini project on values / Goodwill Recognition

Values through Practical activities:

1. Universal Brotherhood: Meaning of Universal Brotherhood- Functioning of Various organization for Universal human beings -Red Cross, UN Office for Humanitarian Affairs – Case study on humanitarian problems and intervention - Active role of

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Students/Individual on Universal Brotherhood.

2. Global Peace, Harmony and Unity: Functions of UNO - Principal Organizations - Special organization – Case study relating to disturbance of world peace and role of UNO – Participatory role of Students/Individual in attaining the Global peace and Unity.

3. Non-Violence: Philosophy of nonviolence- Nonviolence practiced by Mahatma Gandhi – Global recognition for nonviolence - Forms of nonviolence - Case study on the success story of nonviolence– Practicing nonviolence in everyday life.

4. Humanity and Justice: Universal declaration of Human Rights - Broad classification - Relevant Constitutional Provisions– Judicial activism on human rights violation - Case study on Human rights violation– Adherence to human rights by Students/Individuals.

5. Inclusive growth and sustainable development: Goals to transform our World: No Poverty - Good Health - Education – Equality - Economic Growth - Reduced Inequality – Protection of environment – Case study on inequality and environmental degradation and remedial measures.

Workshop mode

REFERENCES

1. TEACHING ASIA-PACIFIC CORE VALUES OF PEACE AND HARMONY – UNICEF www.unicef.org/.../pdf/Teaching%20Asia-Pacific%20core%20values.pdf

2. THREE-DIMENSIONAL ACTION FOR WORLD PROSPERITY AND PEACE- IIM Indore - www.iimidr.ac.in/.../Three-Dimensional-Action-for-World-Prosperity-and-Peace-Glo...

3. MY NON-VIOLENCE - MAHATMA GANDHI
www.mkgandhi.org/ebks/my_nonviolence.pdf

4. HUMAN RIGHTS AND THE CONSTITUTION OF INDIA 8th ... - India Juris
www.indiajuris.com/uploads/.../pdf/l1410776927qHuman%20Rights%20080914.pdf

5. THE ETHICS OF SUSTAINABILITY – Research Gate
www.researchgate.net/file.PostFileLoader.html?id...assetKey..

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Semester VIII

Approved by BoS Chairman

U17MEP8701	Capstone Project / Internship / Phase II project	L	T	P	J	C
		0	0	0	24	12

Course outcomes

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

CO 1: Identify a problem in mechanical engineering field through survey.

CO 2: Develop methodology to find the solution for the problem.

CO 3: Perform methodology using appropriate tools for the problem

CO 4: Learn suitable modern tools.

CO 5: Analyze data and interpret the results obtained.

CO 6: Prepare a Consolidated report details the various stages of the Project

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S	M	W						M				S	
CO2	S	M	W						M				S	
CO3	S	M	W						M				S	
CO4	S	M	W						M				S	
CO5	S	M	W						M				S	
CO6	S	M	W						M				S	

Course Content

- Create a model/fabricate a model/conduct experiment/simulate mechanical system/implement improved ideas for the project work carried in Phase-I. Analyze data, evaluate the results and conclude the appropriate solution, suggestion for feature work.
- The continuous assessment shall be made as prescribed in the regulations.
- The review committee may be constituted by the Head of the Department.
- The progress of the project is evaluated based on a minimum of three reviews.
- Each student shall finally produce a comprehensive report covering background information, literature survey, problem statement, project work details and conclusion.
- This final report shall be typewritten form as specified in the guidelines.

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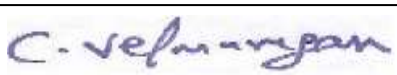
Programme Electives

Design Engineering



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U17MEE0001	Design of Jigs, Fixtures and Press Tools	L	T	P	J	C
	(Use of P S G Design Data Book is permitted in the University examination)	3	0	0	0	3

Course outcomes

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

CO1: Summarize the different methods of Locating Jigs and Fixtures and Clampingprinciples

CO2: Design and develop jigs and fixtures for given component

CO3: Discuss the press working terminologies and elements of cutting dies

CO4: Distinguish between Bending and Drawing dies.

CO5: Discuss the different types of forming techniques

CO6: Discuss the computer aids for the design of sheet metal dies

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													
COs	**Programme Outcomes (POs)**												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	M						M		M	M			M	
CO2	M								M	M			M	
CO3	M								M	M			M	
CO4	M								M	M			M	
CO5	W								M	M			M	
CO6	M					W	W		M	M			M	

LOCATING AND CLAMPING PRINCIPLES **9 hours**

Objectives of tool design- Function and advantages of Jigs and fixtures – Basic elements – principles of location – Locating methods and devices – Redundant Location – Principles of clamping – Mechanical actuation – pneumatic and hydraulic actuation Standard parts – Drill bushes and Jig buttons – Tolerances and materials used.

JIGS AND FIXTURES **9 hours**

Design and development of jigs and fixtures for given component- Types of Jigs – Post, Turnover, Channel, latch, box, pot, angular post jigs – Indexing jigs – General principles of milling, Lathe, boring, broaching and grinding fixtures – Assembly, Inspection and Welding fixtures – Modular fixturing systems- Quick change fixtures.

PRESS WORKING TERMINOLOGIES AND ELEMENTS OF CUTTING DIES **9 hours**

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Press Working Terminologies - operations – Types of presses – press accessories – Computation of press capacity – Strip layout – Material Utilization – Shearing action – Clearances – Press Work Materials – Center of pressure- Design of various elements of dies – Die Block – Punch holder, Die set, guide plates – Stops – Strippers – Pilots – Selection of Standard parts – Design and preparation of four standard views of simple blanking, piercing, compound and progressive dies.

BENDING AND DRAWING DIES **9 hours**

Difference between bending and drawing – Blank development for above operations – Types of Bending dies – Press capacity – Spring back – knockouts – direct and indirect – pressure pads – Ejectors – Variables affecting Metal flow in drawing operations – draw die inserts – draw beads- ironing – Design and development of bending, forming, drawing, reverse redrawing and combination dies – Blank development for axisymmetric, rectangular and elliptic parts – Single and double action dies.

FORMING TECHNIQUES AND EVALUATION **9 hours**

Bulging, Swaging, Embossing, coining, curling, hole flanging, shaving and sizing, assembly, fine Blanking dies – recent trends in tool design- computer Aids for sheet metal forming Analysis – basic introduction - tooling for numerically controlled machines- setup reduction for work holding – Single minute exchange of dies – Poka Yoke.

TOTAL: 45 hours

REFERENCES:

1. ASTME Fundamentals of Tool Design Prentice Hall of India.
2. Design Data Hand Book, PSG College of Technology, Coimbatore.
3. Donaldson, Lecain and Goold “Tool Design”, 5th Edition, Tata McGraw Hill, 2017.
4. Hoffman “Jigs and Fixture Design”, Thomson Delmar Learning, Singapore, 2004.
5. Kempster, “Jigs and Fixture Design”, Third Edition, Hoddes and Stoughton, 1974.
6. Venkataraman. K., “Design of Jigs Fixtures & Press Tools”, Tata McGraw Hill, New Delhi, 2005
7. Joshi, P.H. “Jigs and Fixtures”, Second Edition, Tata McGraw Hill Publishing Co., Ltd., New Delhi, 2010.
8. Joshi P.H “Press tools - Design and Construction”, wheels publishing, 1996

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U17MEE0002 Vibration and Noise Control

L	T	P	J	C
3	0	0	0	3

Course outcomes

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

CO 1: Develop the mathematical models for vibrating systems.
CO 2: Solve problems in vibrating systems with single degree of freedom.
CO 3: Explain two degree of freedom vibrating systems and solve simple problems.
CO 4: Examine the multi degree of freedom systems.
CO 5: Make use of proper instruments for vibration measurement.
CO 6: Explain about engineering noise and control.

Pre-requisite: 1. U17MET5004 Kinematics of Machinery
2. U17MEI6202 Dynamics of Machinery

CO/PO Mapping
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	ProgrammeOutcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S												S	
CO2	M	S		S									S	
CO3	M	S		M									M	
CO4		S		S									S	
CO5	S		W			M	M		M	M			M	
CO6	S		W			M	M		M	M			S	

Course Assessment methods:

Direct	Indirect
1. Internal Test I 2. Internal Test II 3. Assignment 4.Group Presentation 5. End semester exam	Course end survey

FUNDAMENTALS OF VIBRATION **9 hours**

Introduction -Sources of vibration-Mathematical models-Types of vibration. Review of Single degree freedom systems with and without damping –Types of Damping- Dynamics of rotating and reciprocating engines– Critical speed of industrial rotors with specific reference to rigid and flexible rotors – Influence of type of bearings – Vibration isolation – Nonmetallic isolators.

TWO DEGREE FREEDOM SYSTEM **9 hours**

Introduction- Free vibration of Undamped and damped system. Torsional system-Spring coupled system – mass coupled system – Vibration of two-degree freedom system – Forced

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vibration with harmonic Excitation – Dynamic Vibration Absorber – Torsional Vibration Absorber-Vibration control.

MULTI-DEGREE FREEDOM SYSTEM **9 hours**

Longitudinal, Transverse, Torsional systems, Geared systems Complexities – Normal mode of vibration – Flexibility Matrix and Stiffness matrix – Eigen values and eigen vectors – Orthogonal properties – Energy methods of Rayleigh, Ritz and Drunkenly

EXPERIMENTAL VIBRATION ANALYSIS **9 hours**

Need for the experimental methods in Vibration analysis. Vibration Measuring Devices: seismometer, accelerometer and velometers-Vibration exciters: mechanical, hydraulic, electromagnetic and electrodynamic –Frequency measuring instruments: single reed, multi reed and stroboscope. Vibration meters and sound level meter. Signal conditioning devices: Filters, Amplifiers, Modulators/Demodulators, ADC/DAC. Signal analysis devices. Vibration recording and display devices.Experimental modal analysis. System Identification from frequency response

ENGINEERING NOISE AND ITS CONTROL **9 hours**

Introduction-Sound Power, Sound Intensity and Sound pressure level. Sound spectra.The decibel scale-Decibel addition, subtraction and averaging- Loudness, Weighting networks, Equivalent sound level. Noise: Effects, Ratings and Regulations. Noise: Sources, Isolation and control-Industrial noise sources-Industrial noise control strategies-Noise control at the source, along the path and at the receiver.

Theory :45 hours **Total :45hours**

REFERENCES:

1. Ambekar.A.G. “Mechanical Vibrations and Noise Engineering”, Prentice Hall of India, New Delhi, 2006
2. Thomson, W.T, “Theory of Vibration with Applications”, Nelson Thomas Ltd,1998.
3. Rao, S.S.,” Mechanical Vibrations,” Printice hall,2011.
4. Den Hartog, J.P, “Mechanical Vibrations,” Read books, 2008.
5. Ramamurti. V, “Mechanical Vibration Practice with Basic Theory”, Narosa, New Delhi, 2000.
6. William.w.Seto, “Theory and problems of Mechanical Vibrations,”Schaum Outline Series, Mc Graw Hill Inc., Newyork,1990.

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U17MEE0003 Composite Materials

L	T	P	J	C
3	0	0	0	3

Course outcomes

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

CO 1: Identify the various matrices, reinforcements and their combinations in composite materials.

CO 2: Select composite materials for suitable applications.

CO 3: Develop suitable Metal Matrix Composites.

CO 4: Identify perfect Ceramic Matrix Composites for high temperature applications.

CO 5: Choose various combinations of fibres and resins.

CO 6: Select an appropriate manufacturing technique for composite materials.

Pre-requisite: Nil

CO/PO Mapping
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	ProgrammeOutcomes(POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1							S						W	
CO2	S						M	W		M			M	
CO3	M											M	W	
CO4	M							W				M	W	
CO5	M									W		M	W	
CO6	S						S	W						S

Course Assessment methods:

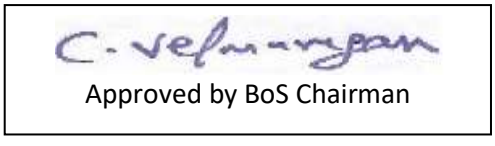
Direct	Indirect
1. Internal Test I 2. Internal Test II 3. Assignment 4.Group Presentation 5. End semester exam	Course end survey

INTRODUCTION TO COMPOSITES **12 hours**

Fundamentals of composites - need for composites – Enhancement of properties - classification of composites – Matrix and their role- Metal matrix composites (MMC), Ceramic matrix composites (CMC), Polymer matrix composites (PMC)-Reinforcement – Particle reinforced composites-Fibre reinforced composites- Rule of mixtures- Applications of various types of composites- Introduction to nano materials.

METAL MATRIX COMPOSITES **11hours**

Metal Matrix, Reinforcements – particles – fibres, Effect of reinforcement - Volume fraction. Various types of Metal Matrix Composites, Characteristics of MMC, Alloy vs. MMC,



Advantages and limitations of MMC –Processing of MMC – Powder metallurgy process - diffusion bonding – stir casting – squeeze casting.

CERAMIC MATRIX COMPOSITES **11hours**

Engineering ceramic materials – Properties – Advantages – Limitations – Monolithic ceramics - Need for CMCs – Ceramic matrix - Various types of Ceramic Matrix composites- oxide ceramics – Non oxide Ceramics – Aluminium oxide – Silicon nitride – Reinforcements – particles- fibres- whiskers. Sintering - Hot pressing – Cold isostatic pressing (CIPing) – Hot isostatic pressing (HIPing).

POLYMER MATRIX COMPOSITES **11 hours**

Polymer matrix resins – Thermosetting resins, thermoplastic resins – Reinforcement fibres – Rovings – Woven fabrics – Non-woven random mats – Various types of fibres. Methods for producing PMC - Hand layup processes – Spray up processes – Compression moulding – Reinforced reaction injection moulding - Resin transfer moulding – Pultrusion – Filament winding – Injection moulding. Fibre Reinforced Plastics (FRP), Glass fibre Reinforced Plastics (GRP).

Theory :45 hours **Total:45hours**

REFERENCES:

1. Mathews F.L. and Rawlings R.D., "Composite materials: Engineering and Science", Chapman and Hall, London, England, 2006.
2. Chawla K.K., "Composite materials",Springer –Verlag, 2012.
3. Clyne T.W. and Withers P.J., "Introduction to Metal Matrix Composites", Cambridge University Press, 2003.
4. Strong A.B., "Fundamentals of Composite Manufacturing", SME, 2008.
5. Sharma S.C., "Composite materials", Narosa Publications, 2004.
6. "Short Term Course on Advances in Composite Materials, Composite Technology Centre, Department of Metallurgy", IIT- Madras, December 2001.
7. Autar.K.Kaw, "Mechanics of Composite Materials", CRC Press, 2006.

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U17MEE0004 **Design for Manufacturing and Environment**

L	T	P	J	C
3	0	0	0	3

Course outcomes

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

CO 1: Illustrate the basic of design for manufacture.

CO 2: Outline casting, weldment, forming, nonmetallic and machined component design for manufacture.

CO 3: Understand and explain the design considerations for formed metal components

CO 4: Discuss the considerations for the design of machine components

CO 5: Model the design for assembly.

CO 6: Apply concepts of Design for Environment

Pre-requisite: 1. U17MET2001 Manufacturing Technology
2. U17MEP2501 Manufacturing Technology and Metallurgy laboratory
3. U17MEI3201 Metal Cutting and Computer Aided Manufacturing

CO / PO Mapping
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M	M	S				M		M					M
CO2	M	M	S				M		M					M
CO3	M	M	S				M		M					M
CO4	M	M	S				M		M					M
CO5	M	M	S				S		M					M
CO6	M	M	S				M		M					M

Course Assessment methods:

Direct	Indirect
1. Internal Test I 2. Internal Test II 3. Assignment 4.Group Presentation 5. End semester exam	Course end survey

INTRODUCTION **10hours**

Economics of Process selection, process capability and process capability metrics – General design principles of manufacturability – Proper material selection – Strength and Mechanical factors- geometric tolerances, surface finish, cumulative effect of tolerances - Worst case method, Root sum square method.

FACTORS INFLUENCING FORM DESIGN **10hours**

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Working principle, Material, Manufacture, Design-, Production method, size, surface property Influence of materials on form design - castings, aluminium casting, pressure die casting, Plastic molding, form design of welded members

COMPONENT DESIGN – MACHINING AND CASTING CONSIDERATION

10 hours

Design features to facilitate machining –Twist drill –Drill entry and run out counter sunk head screws-Redesign of casting based on parting line consideration-pattern, mould, parting line, cast holes-cored holes, machined holes, identify the possible and probable parting line, special sand core.

DESIGN FOR THE ENVIRONMENT **10 hours**

Introduction to Environmental objectives – Global issues – Regional and local issues – Basic DFE methods – Design guide lines – Lifecycle assessment – Basic method – AT&T's environmentally responsible product assessment - Weighted sum assessment method – Lifecycle assessment method – Techniques to reduce environmental impact – Design to minimize material usage – Design for disassembly – Design for recyclability – Design for remanufacture – Design for energy efficiency – Design to regulations and standards.

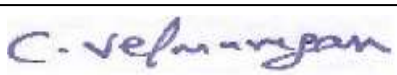
CASE STUDIES **5 hours**

Application concepts of design for manufacture in real time conditions- Exposure on DFM software.

Theory:45 hours **Total:45 hours**

REFERENCES:

1. James G. Bralla,"Design for Manufacturability handbook", McGraw Hill Book Co.,1990
2. Henry Peck,"Design for manufacture", Pitman Publishers., 1983.
3. Matousek "Engineering Design", Blackie & sons, 1974.



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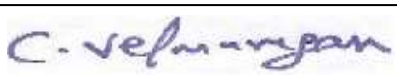
Programme Electives

Thermal Engineering



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U17MEE0005	REFRIGERATION AND AIRCONDITIONING	L	T	P	J	C
	(Use of Psychrometric chart and Refrigeration Table is permitted.)	3	0	0	0	3

Course outcomes

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

CO 1: Explain the working of variousrefrigeration systems and System components.

CO 2: Estimate the performance of VCR system and illustrate the working of different VCR systems.

CO 3: Explain the working principle of different VAR systems and estimate the performance of the system.

CO 4: Illustrate the various non-conventional refrigeration methods.

CO 5: Explain the various air conditioning system components and classify the air conditioning system.

CO 6: Estimate the cooling load for various conditions considering the different heat sources.

Pre-requisite: Thermal Engineering

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S						W			W			M	
CO2	S	S					W			W			S	
CO3	S	S					W			W			S	
CO4	S									W			M	
CO5	S									W			M	
CO6	S	M								M			S	

Course Assessment methods:

Direct	Indirect
1. Internal Test I 2. Internal Test II 3. Assignment 4.Group Presentation 5. End semester exam	Course end survey

INTRODUCTION TO REFRIGERATION **9 hours**

Refrigeration and second law of thermodynamics-Engine, refrigerator and heat pump-Methods of Refrigeration- Evaporative refrigeration, Refrigeration by expansion of air, Refrigeration by throttling of gas, Ice refrigeration, Steam jet refrigeration, Dry ice refrigeration, Refrigeration by using liquid gases- Refrigerants- Properties & selection-

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Environmental impact of refrigerants- System components- Compressors Evaporators- Condensers- Thermostatic Expansion devices- Cooling towers.

VAPOUR COMPRESSOR REFRIGERATION SYSTEM 9 hours

Simple vapour compression refrigeration cycle- T-S, and p-h charts for VCR system- presentation of different process on p-h chart- COP from T-S chart- Advantages and Disadvantages of VCR over air compression refrigeration- Methods for improving COP – Single load and multi load systems. Methods for Defrosting- air refrigeration- Bell Coleman Air refrigerator- Simple cooling and simple evaporative type- Boot strap and boot strap evaporative type.

ABSORPTION REFRIGERATION SYSTEM 9 hours

Introduction- Basic absorption system- Actual ammonia absorption system- Lithium Bromide absorption refrigeration system- Electrolux refrigerator – Actual Electrolux refrigerator- COP of absorption refrigeration system.

Non-conventional refrigeration – Vortex tube – Thermo Electric refrigeration- Pulse tube refrigeration- Cooling by adiabatic demagnetization.

AIRCONDITIONING SYSTEM 9 hours

Methods of air conditioning – Direct expansion- All water systems- All air systems- Combined systems- Heat pump systems- Air conditioning equipments – Air filters – Humidifiers- Dehumidifiers- fans and blowers- cooling towers and spray ponds- Air distribution system. Types of air conditioners- Window, split type and central air conditioning – Applications- Automotive air conditioning.

COOLING LOAD CALCULATIONS 9 hours

Different heat sources- Types of load- Conduction heat load, radiation heat load, radiation load of sun, Occupants load, Equipment load, Infiltration load, Fresh air load- By pass factor- Effective room sensible heat factor- Design of space cooling load- Basics of Air duct design.

Heat pump – Types-Working fluids for heat pumps- Heat pump circuit- Performance of Heat pump.

Theory :45 hours **Total:45 hours**

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REFERENCES:

1. Manohar Prasad, "Refrigeration and Air Conditioning", New Age International (P) Ltd, 2015.
2. Arora. C.P., "Refrigeration and Air Conditioning", Tata McGraw-Hill New Delhi,2007.
3. Roy.JDossat, “Principles of Refrigeration”, Prentice Hall, 2001
4. Stoecker N.F and Jones, "Refrigeration and Air Conditioning", MCG raw Hill Education, Asia,2001.
5. Manohar Prasad, "Refrigeration and Air Conditioning", New Age International (P) Ltd, 2013.

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U17MEE0006	Computational Fluid Dynamics	L	T	P	J	C
	(Use of Psychrometric chart and Refrigeration Table is permitted.)	3	0	0	0	3

Course outcomes

After successful completion of the course, the student would be able to

CO 1: Understand the governing equations of fluid dynamics and boundary conditions

CO 2: Understand the Discretization techniques

CO 3: Apply the knowledge of finite difference discretization methods for solving one dimensional heat conduction equation

CO 4: Apply finite volume techniques for different schemes for solving one dimensional heat conduction equation.

CO 5: Understand various grid generation methods.

Pre-requisite: Fluid Mechanics, Heat and Mass Transfer.

CO/PO Mapping
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M	M							M	M		M	M	
CO2	S	M							M	M			M	
CO3	M	M							M	M			M	
CO4	S	M							M	M		M	M	
CO5	M	M							M	M		M	M	

Course Assessment methods:

Direct	Indirect
1. Internal Test I 2. Internal Test II 3. Assignment 4. Group presentation 5. Tutorial 6. End semester exam	Course end survey

INTRODUCTION AND GOVERNING EQUATIONS **9 hours**

Introduction - Impact and applications of CFD in diverse fields - Governing equations of fluid dynamics – Continuity - Momentum and energy - Generic integral form for governing equations - Initial and Boundary conditions - Classification of partial differential equations – Hyperbolic - Parabolic - Elliptic and Mixed types - Applications and relevance.

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DISCRETIZATION BASIC ASPECTS OF DISCRETIZATION 10 hours

Discretization techniques – Introduction to Finite difference - Finite volume method–-– central, forward and backward difference expression for uniform grid-central difference expression for Non-uniform grid- Difference equations - Numerical Error- Grid independence test.

FINITE DIFFERENCE METHODS FOR CONDUCTION HEAT TRANSFER

10 hours

One–dimensional and two-dimensional steady state heat conduction-Transient one-dimensional heat conduction –Methods of solutions- Explicit - Implicit - Crank-Nicolson– Stability criterion.

FINITE VOLUME METHODS FOR CONVECTION – DIFFUSION 8 hours

Steady one-dimensional convection and diffusion - Central difference, upwind, quick, exponential, hybrid and power law schemes. Numerical procedure for SIMPLE algorithm.

INTRODUCTION TO GRID GENERATION8 hours

Choice of grid, grid-oriented velocity components, Cartesian velocity components, staggered and collocated arrangements, adaptive grids.

Theory : 45 hours **Total : 45 hours**

REFERENCES:

1. K.A. Hoffman, (2000), Computational Fluid Dynamics for Engineering, Vol I - III Engineering Education System, Austin, Texas.
2. J.D. Anderson, Jr., (2000), Computational Fluid Dynamics – The basics with applications, McGraw-Hill, Incs.
3. K. Muralidhar, T. Sundarajan, (2001), Computational Fluid Flow and Heat Transfer,Narosa Publishing House, New Delhi.
4. S.V. Patankar, (1999), Numerical Heat Transfer and Fluid Flow, Hemisphere, New York.
5. V.V. Ranade, (2002), Computational Flow Modeling for Chemical Reactor Engineering,Academic Press

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U17MEE0007	Design of Thermal Systems	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

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

CO1: To understand various optimization techniques and apply them to thermal design

CO2: To expose mathematical tools for characterization of performance of energy equipment

CO3: To learn basic principles underlying pumping, heat exchangers modeling and optimization in design of thermal systems

CO4: To study modelling methods for thermal equipment's and learn simulation techniques

CO5: To optimization concerning design of thermal systems

CO6: To develop representational modes of real processes and systems

Pre-requisites:

1. U17MET3004 Thermodynamics
2. U17MEI4202 Fluid Mechanicsand Machinery
3. U17MEI6201 Heat and Mass Transfer

CO/PO Mapping
(S/M/W indicates strength of correlation) S- Strong, M- Medium, W- Weak.

COs	Programme Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S	M		M							S		M	
CO2	S	W		S	S						M		W	
CO3	S	S	S		M	M			S	M			S	
CO4	S	S	S						S				S	
CO5	M	M	M	S									M	S
CO6	S	S	M	S	S				M				S	M

Course Assessment Methods:

Direct	Indirect
1. Internal Test I 2. Internal Test II 3. Assignment 4. Group Presentation 5. Tutorial 6. End Semester exam	Course end survey

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DESIGN CONCEPTS **9 hours**

Design Principles, Workable Systems, Optimal Systems, Matching of System Components, Economic Analysis, Depreciation, Gradient Present Worth factor

MATHEMATICAL MODELLING **10hours**

Equation Fitting, Nomography, Empirical Equation, Regression Analysis, Different Modes of Mathematical Models, Selection.

MODELLING THERMAL EQUIPMENTS **11 hours**

Estimation of thermodynamic properties: T-C-P characteristics of binary solutions, Developing T-X diagram, Modelling Heat Exchangers, Evaporators, Condensers, Compressors, and Pumps.

OPTIMIZATION **10 hours**

System simulation: Successive substitution, Newton-Raphson method with one variable.Optimization: Lagrange multiplier, Test for minimum and Maximum,

DYNAMIC BEHAVIOUR OF THERMAL SYSTEM **5 hours**

Steady state Simulation, Laplace Transformation, Feedback Control Loops, Stability Analysis.

Theory: 45 hours **Total Hours: 45 hours**

Reference Books

1. W.F. Stoecker Design of Thermal Systems, 3 rd Edition, McGraw-Hill, 1989.
2. A.Bejan, G.Tsatsaronis and M.Moran ,Thermal Design and Optimization, John Wiley & Sons. 1996.,
3. Kapur J. N., Mathematical Modelling , Wiley Eastern Ltd , New York , 1989
4. Yogesh Jaluria , Design and Optimization of Thermal Systems , CRC Press , 2007.
5. R.F.Boehm Design Analysis of Thermal Systems, John Wiley & Sons, 1987.
6. B.K. Hodge, Analysis and Design of Energy systems, Prentice-Hall Inc, 1988,
7. Rao S. S., Engineering Optimization Theory and Practice, New Age Publishers, 2005

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U17MEE0008	Design of Heat Exchangers	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

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

CO1: Discuss the components of heat exchanger

CO2: Analyze the heat exchanger for flow

CO3: Appraise the design aspects of heat exchangers

CO4: Design and develop a solution for compact and plate heat exchanger

CO5: Predict the performance characteristics for shell and tube condensers

CO6: Analyze heat exchanger using LMTD and NTU methods

Pre-requisites:

1. U17MEI6201 Heat and mass transfer

CO/PO Mapping (S/M/W indicates strength of correlation) S- Strong, M- Medium, W- Weak.														
COs	**Programme Outcomes (POs)**													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S	M	W						M	M			M	
CO2	M	W	W						M	M			W	
CO3	S	S	M			W			S	S		M	S	
CO4	S	S	M			W			S	S		M	S	
CO5	M	M	M						M	M		M	M	
CO6	S	S	W						M	M			S	

Course Assessment Methods:

Direct	Indirect
1. Internal Test I 2. Internal Test II 3. Assignment 4. Group Presentation 5. Tutorial 6. End Semester exam	Course end survey

CONSTRUCTIONAL DETAILS AND HEAT TRANSFER **8 hours**

Types – Shell and Tube Heat exchangers- Regenerators and Recuperators- Industrial Applications of Heat exchangers- Temperature Distribution and its Implications- Analysis of Heat Exchanger – LMTD and effective method (€-NTU method), fouling factor.

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FLOW ANALYSIS **4 hours**

Tube side pressure drop for circular cross section tubes, pressure drop in tube bundles in cross flow.

DESIGN ASPECTS **13 hours**

Heat exchanger design methodology, Basic logic structure of process heat exchanger design, Rating of the preliminary design of heat exchanger. Baffle type and geometry, TEMA standards, Design of Shell and Tube Heat exchangers (Bell-Delaware Method).

COMPACT AND PLATE HEAT EXCHANGERS **13 hours**

Design of Compact Heat exchangers and Plate Heat Exchangers (Kakac method).

STEAM CONDENSERS **7 hours**

Thermal design of shell and tube condensers (Kakac method)

Note: The fluid for heat exchangers is considered to be air, water, oil. Chemicals are not been considered and S.I units are to be followed.

Theory: 45 hours **Total Hours: 45 hours**

References:

1. SadikKakac, Hongtan Liu and AnchasaPramuanjaroenkij, Heat Exchangers, selection, Rating and Thermal Design, CRC press, 2002.
2. D.Q Kern, Process Heat Transfer, McGraw-Hill Book Company, Japan, 21st Printing 1983.
3. Taborek, T.Hewitt G.F and Afgan.N, Heat Exchangers, Theory and Practice, McGraw-Hill Book Co. 1980.
4. Ramesh K.. Shah and Dusan P. Sekulic, Fundamentals of Heat Exchanger Design, John Wiley and Sons, 2003.
5. Design Data Hand Book for Design of Heat Exchangers – Compiled from Kumaraguru College of Technology, Coimbatore.

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U17MEE0017	GAS DYNAMICS AND JET PROPULSION	L	T	P	J	C
	(Use of approved gas tables is permitted in the examination)	3	0	0	0	3

Course outcomes

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

CO 1: Explain the effect of Mach Number on compressibility.

CO 2: Solve the area ratio for nozzle and diffuser for subsonic and supersonic flow conditions.

CO 3: Solve the problems in Rayleigh and Fanno flow for constant area sections.

CO 4: Explain the concept of normal shock for an isentropic flow.

CO 5: Discuss the performance of turbo jet, ram jet and pulse jet engines.

CO 6: Calculate the performance of rocket propulsion systems.

Pre-requisite:

1. U17MET3004Fluid Mechanics and Machinery
2. U17MEI4202Engineering Thermodynamics

CO/PO Mapping (S/M/W indicates strength of correlation)S-Strong, M-Medium, W-Weak													
COs	**Programme Outcomes (POs)**												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	S	M							M	M			S	
CO2	S	M							M	M			S	
CO3	S	M							M	M			S	
CO4	S	M		W					M	M			S	
CO5	M	M							M	M			M	
CO6	M	M							M	M			M	

Direct	Indirect
1. Internal Test I 2. Internal Test II 3. Assignment 4.Group Presentation 5.Tutorial 6. End semester exam	Course end survey

Course Assessment methods:

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COMPRESSIBLE FLOW – FUNDAMENTALS **9 hours**

Energy and momentum equations for compressible fluid flows, various regions of flows, reference velocities, stagnation state, velocity of sound, critical states, Mach number, critical Mach number, types of waves, Mach cone, Mach angle, effect of Mach number on compressibility- Use of Gas tables.

FLOW THROUGH VARIABLE AREA DUCTS **9 hours**

Isentropic flow through variable area ducts, T-s and h-s diagrams for nozzle and diffuser flows, area ratio as a function of Mach number, mass flow rate through nozzles and diffusers, effect of friction in flow through nozzles- Phenomenon of chocking

FLOW THROUGH CONSTANT AREA DUCTS **9hours**

Flow in constant area ducts with friction (Fanno flow) - Fanno curves and Fanno flow equation, variation of flow properties, variation of Mach number with duct length.

Flow in constant area ducts with heat transfer (Rayleigh flow), Rayleigh line and Rayleigh flow equation, variation of flow properties, maximum heat transfer- Applications.

NORMAL SHOCK **9hours**

Governing equations, variation of flow parameters like static pressure, static temperature, density, stagnation pressure and entropy across the normal shock, Prandtl – Meyer equation, impossibility of shock in subsonic flows, flow in convergent and divergent nozzle with shock- Use of tables and charts.

PROPULSION **9 hours**

Aircraft propulsion – types of jet engines – study of turbojet engine components – diffuser, compressor, combustion chamber, turbine and exhaust systems, performance of turbo jet engines – thrust, thrust power, propulsive and overall efficiencies

Rocket propulsion – rocket engines thrust equation – effective jet velocity specific impulse – rocket engine performance, solid and liquid propellants-

Theory :45 hours **Total:45hours**

REFERENCES:

1. Yahya. S.M., “Fundamental of compressible flow with Aircraft and Rocket propulsion”, New Age International (p) Ltd., New Delhi, 2009.
2. Patrich.H. Oosthvizen, William E.Carscallen, “Compressible fluid flow”, McGraw-Hill, 2006.
3. Cohen.H., Rogers R.E.C and Sravanamutoo, “Gas turbine theory”, Addison Wesley Ltd., 2005.
4. Ganesan. V., “Gas Turbines”, Tata McGraw-Hill, New Delhi, 2003
5. Rathakrishnan. E., “Gas Dynamics”, Prentice Hall of India, New Delhi, 2001.

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6. Babu.V. “Fundamentals of Gas Dynamics”, ANE Books India, 2008.
7. Somasundaram Pr.S.L,“Gas Dynamics and Jet Propulsions” New age International Publishers, 1996.

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U17MEE0018 **AUTOMOBILE ENGINEERING**

L	T	P	J	C
3	0	0	0	3

Course outcomes

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

CO 1: Explain the vehicle structures, lubrication, cooling and emission control systems.

CO 2: Summarize the various fuel injection, ignition and electrical systems of an automobile.

CO 3: Describe the working principle of various components in transmission systems.

CO 4: Discuss the various steering mechanisms and suspension systems.

CO 5: Compare the conventional and antilock braking systems.

CO 6: Discuss the usage of various alternate energy sources in automobiles.

Pre-requisite: Nil

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M						M		M	M			M	
CO2	M								M	M			M	
CO3	M								M	M			M	
CO4	M								M	M			M	
CO5	W								M	M			M	
CO6	M					W	W		M	M			M	

Course Assessment methods:

Direct	Indirect
1. Internal Test I 2. Internal Test II 3. Assignment 4.Group Presentation 5. End semester exam	Course end survey

VEHICLE STRUCTURE AND ENGINES **9 hours**

Types of Automobiles - Vehicle Construction – Chassis – Frame and Body – Aerodynamic forces.Engine components, Materials and functions - Cooling and Lubrication systems in

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engines – Turbo Chargers – Engine Emission Control by three way Catalytic converter – Electronic Engine Management System.

ENGINE AUXILIARY SYSTEMS **9 hours**

Carburetor–working principle - Electronic fuel injection system – Mono-point and Multi - Point Injection Systems – Construction, Operation and Maintenance of Lead Acid Battery - Electrical systems – Battery generator – Starting Motor and Drives – Lighting and Ignition (Battery, Magneto Coil and Electronic Type) - Regulators-cut outs.

TRANSMISSION SYSTEMS **10 hours**

Clutch – Types and Construction – Gear Boxes, Manual and Automatic – Floor Mounted Shift Mechanism – Over Drives – Fluid flywheel - Torque converters– Propeller shaft – Slip Joint – Universal Joints – Differential and Rear Axle – Hotchkiss Drive and Torque Tube Drive – Introduction to rear wheel drive.

STEERING, BRAKES AND SUSPENSION **9 hours**

Wheels and Tyres – Wheel Alignment Parameters - Steering Geometry and Types of steering gear box– Power Steering – Types of Front Axle – Suspension systems – Braking Systems – Types and Construction – Diagonal Braking System – Antilock Braking System.

ALTERNATIVE ENERGY SOURCES **8 hours**

Use of Natural Gas, LPG, Biodiesel, Alcohol and Hydrogen in Automobiles - Electric and Hybrid Vehicles, Fuel Cells – Introduction to off road vehicles.

Theory :45 hours **Total:45 hours**

REFERENCES:

1. Ed May, “Automotive Mechanics”, Tata McGraw-Hill,2003

2. Kirpal Singh “Automobile Engineering”, Standard Publishers, New Delhi, 2009.

3. William H.Crouse and Donald L.Angline “Automotive Mechanics”, Tata McGraw-Hill, 2007.

4. Srinivasan, “Automotive Mechanics”,Tata McGraw-Hill, 2003.

5. Joseph Heitner, “Automotive Mechanics”,East-West Press, 1999.

6. Halderman, “Automotive Engines:Theory and Servicing”,Pearson, 2009.

7. Ramalingam, K.K, “Automobile Engineering”, Scitech publications, 2008

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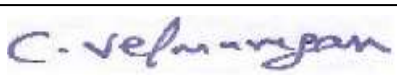
Programme Electives

Manufacturing& Industrial Engineering



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U17MEE0009 **ADDITIVE MANUFACTURING**

L	T	P	J	C
3	0	0	0	3

Course outcomes:

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

CO1: Apply the basics of additive manufacturing techniques in manufacturing

CO2: Apply the liquid and solid based rapid prototyping system in suitable applications

CO3: Apply powder based rapid prototyping system in suitable applications

CO4: Apply the different materials for rapid prototyping system

CO5:Apply the concepts of modelling, data processing and reverse engineering in rapid prototyping

CO6: Apply the new technologies in rapid prototyping for various applications

Pre-requisite: Nil

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak														
COs	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	S	M			M				M	S		M	S	S
CO2	S									S			S	S
CO3	S									S			S	S
CO4	S			M			M		S	S	M		S	S
CO5	S	S	S	M					S	S		S	S	S
CO6	S								S	S			S	S

Course Assessment methods:

Direct	Indirect
1. Internal Test I 2. Internal Test II 3. Assignment 4.Group Presentation 5.Tutorial 6. End semester exam	Course end survey

INTRODUCTION **9 hours**

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History – Development of RP systems – Applications in Product Development, Reverse Engineering, Rapid Tooling, Rapid Manufacturing- Principle –Fundamental – File format – Other translators – medical applications of RP – On demand manufacturing – Direct material

LIQUID BASED AND SOLID BASED RAPID PROTOTYPING SYSTEM 9 hours

Classification – Liquid based system - Stereo Lithography Apparatus (SLA), de- tails of SL process, products, Advantages, Limitations, Applications and Uses. Solid based system - Fused Deposition Modelling, principle, process, products, advantages, applications and uses - Laminated Object Manufacturing

POWDER BASED RAPID PROTOTYPING SYSTEMS 9 hours

Selective Laser Sintering – principles of SLS process, principle of sinter bonding process, Laser sintering materials, products, advantages, limitations, ap- plications and uses. Three-Dimensional Printing – process, major applications, research and development. Direct shell production casting – key strengths, process, applications and uses, case studies, research and development. Laser Sintering System, e-manufacturing using Laser sintering, customized plastic parts, customized metal parts, e-manufacturing - Laser Engineered Net Shaping (LENS).

MATERIALS FOR RAPID PROTOTYPING SYSTEMS 9 hours

Nature of material – type of material – commercial shapes – selection of material and applications - polymers, metals, ceramics and composites liquid based materials, photo polymer development – solid based materials, powder-based materials – case study.

REVERSE ENGINEERING AND NEW TECHNOLOGIES 9 hours

Introduction, measuring device- contact type and non-contact type, CAD model creation from point clouds-pre-processing, point clouds to surface model creation, medical data processing - types of medical imaging, software for making medical models, medical materials, other applications - Case study.

Theory:45 hours Total:45 hours

REFERENCES:

1. Dongdong Gu, “Laser Additive Manufacturing of High-Performance Materials”, Springer-Verlag Berlin Heidelberg, 2015.
2. Chee Kai Chua, “Lasers in 3D Printing and Manufacturing, World Scientific, 2016.
3. Rafiq I.Noorani, “Rapid Prototyping: Principles and Applications”, Wiley & Sons, 2006.
4. Chua C.K, Leong K.F and Lim C.S, “Rapid Prototyping: Principles and Applications”, World Scientific, 2003.
5. N.Hopkinson, r.j.m, hauge, p m, dickens, “Rapid Manufacturing: AnIndustrial revolution for the digital age”, Wiley, 2006

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6. IAN GIBSON, “Advanced Manufacturing Technology for Medical ap- plications: Reverse Engineering,Software conversion and Rapid Proto- tying”, Wiley, 2006
7. Paul F.Jacobs, Rapid Prototyping and Manufacturing, “Fundamentals of Stereolithography”, McGraw Hill, 2002.
8. D.T.Pham and S.S.Dimov, “Rapid Manufacturing”, Springer Verlog,2001.

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U17MEE0010	MODERNMACHINING PROCESSES	L	T	P	J	C
		3	0	0	0	3

Course outcomes

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

CO 1: Apply the appropriate advanced machining components recognizing the industrial requirements

CO 2: Apply the knowledge of advanced machining process using mechanical energy

CO 3: Apply the principle of material removal by electrical discharge machining

CO 4: Apply the principle of material removal by Chemical and electro chemical energy-based processes

CO 5: Apply the fundamentals of radian energy processes

CO 6: Apply the knowledge and concepts in micro machining process

Pre-requisite: Nil

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													
COs	**ProgrammeOutcomes(POs)**												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1		M												
CO2	S								M			M		M
CO3	S								M			M		M
CO4	S								M			M		M
CO5	S								M			M		M
CO6	M								W			W		W

Course Assessment methods:

Direct	Indirect
1. Internal Test I 2. Internal Test II 3. Assignment 4.Group Presentation 5. End semester exam	Course end survey

INTRODUCTION **9 hours**

Need for Modern Advanced Machining Processes - Classification based on Materials – Machining Methods – Energy – Processes Selection – Physical Parameters – Cost of

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Production – Volume of Production – Shapes of Product – Process Capability – Economical Production

MECHANICAL ENERGY BASED PROCESSES 9hours

Ultrasonic Machining – Principles – Transducer Type – Concentrators – Abrasive Slurry – Process Parameters – Tool Feed Mechanisms – Advantages – Limitations – Applications – Abrasive Jet Machining – Process – Principle – Process Variables – Material Removal Rate – Advantages and Disadvantages – Applications – Water Jet Machining – Principle Process Variables – Advantages and Disadvantages – Applications.

ELECTRICAL DISCHARGE MACHINING AND ELECTRICAL DISCHARGE WIRE CUT MACHINING 9 hours

Electrical Discharge Machining – Mechanism of Material Removal – Dielectric Fluid – Electrodes Materials – Spark Erosion Generators – Electrode Feed System – Material Removal Rate – Process Parameters – Tool Electrodes Design – Characteristics of Spark Eroded Surfaces – Advantages and Disadvantages – Applications – Electrical Discharge Wire Cut and Grinding – Principle – Wire Feed System – Advantages and Disadvantages – Applications.

CHEMICAL AND ELECTRO-CHEMICAL ENERGY BASED PROCESSES 9 hours

Chemical Machining – Fundamentals – Principle – Classification – Selection of Etchant – Chemical Milling – Engraving – Blanking – Drilling – Trepanning - Advantages – Disadvantages – Applications – Electro Chemical Machining – Electro Chemistry Process – Electrolytes – Properties – Material Removal Rate – Tool Materials – Tool Feed Systems – Design of Electrolyte Flow – Process Variables – Advantages – Disadvantages – Applications – Electro Chemical Grinding – Honing – Cutting Off – De burring – Turning.

ELECTRON BEAM – LASER BEAM – ION BEAM PLASMA ARC MACHINING AND MICRO MACHINING 9 hours

Electron Beam Machining – Principle – Generation – Control of Electron Beam – Advantages – Disadvantages – Applications – Laser Beam Machining – Principle – Solid – Gas – Laser Methods – Applications – Thermal Features – LBM – Advantages – Disadvantages – Applications – Ion Beam Machining – Equipment – Process Characteristics – Advantages – Disadvantage – Applications – Plasma Arc Machining – Principle – Gas Mixture – Types of Torches – Process Parameters – Advantages – Disadvantages – Applications – Introduction – Definition – Micro Machining – Classification of Micro Machining – Nano Machining – Nano Finishing - Mechanical – Thermal Micro Machining –Electro Discharge – Electron Beam – Laser Beam –Electro Chemical – Nano Finishing

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Theory :45 hours **Total:45hours**

REFERENCES:

1. Vijay.K. Jain “Advanced Machining Processes”, Allied Publishers Pvt. Ltd., New Delhi, 2002.
2. Pandey P.C., and Shan H.S. “Modern Machining Processes” Tata McGraw-Hill, New Delhi, 2001.
3. Mc Geough, “Advanced Methods of Machining” Chapman and Hall, London, 2002.
4. Paul De Garmo, Black, J.T.andRonald.A.Kohser, “Material and Processes in Manufacturing” Prentice Hall of India Pvt. Ltd., New Delhi, 2001.
5. Benedict. G.F.,“Nontraditional Manufacturing Processes”, Marcel Dekker Inc., New York, 2003.
6. Amitadha Bhattacharyya, “New Technology”, The Institution of Engineers,India.
7. “Production Technology” HMT Bengaluru, Tata McGraw Hill Publishing company Limited, New Delhi, 2006

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U17MEE0011 **WELDING AND ALLIED PROCESSES**

L	T	P	J	C
3	0	0	0	3

CO1: Provide the relationship between process parameters and their influence on GMAW and GTAW weld Quality.

CO2: Find power requirement, weld deposition rate and percent dilution calculations for Submerged Arc Welding and Discuss Process characteristics of Plasma Arc Welding processes.

CO3: Obtain the weldability of Resistance Welding process and Welding current and Electrode feed rate calculation for Electroslag Welding Processes

CO4: Deliberate on Operation, Process Characteristics and Applications of Electron and Laser beam welding processes.

CO5: Distinguish the applications of various allied joining processes and also provide the economics analysis of a welding process

CO6: Design a weld joints based on weld stress and also suggest suitable weld quality test for a given applications

Pre-requisite: Nil

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak														
COs	**Programme Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1		M												
CO2	S								M			M		M
CO3	S								M			M		M
CO4	S								M			M		M
CO5	S								M			M		M
CO6	M								W			W		W

CLASSIFICATION OF ARC WELDING PROCESSES **9 hours**

Heat Sources, Power Sources, Arc Phenomena, Arc Blow, Power Source Characteristics, V-I, Relationship, Flux Covering, Different Types of Electrodes and Their Applications, Gas Welding and Cutting, Flame Characteristics, Gas Tungsten Arc Welding**,** Electrode Polarity, ShieldingGas,Use of Pulsed Arc and GTA Spot Welding;

Gas Metal Arc Welding**,** Nature and Conditions of Spray Transfer, Dip Transfer and CO_2 Welding, Flux Cored and Pulsed and Synergic MIG Welding, Welding Current, Heat input Calculation,Arc Efficiency for GMAW and GTA processes

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Submerged Arc Welding, Advantages and Limitations, Process Variables and Their Effects, Plasma Arc Welding Processs Special Features of Plasma-Arc, Transferred and Non-Transferred Arc, Keyhole and Puddle-In Mode of Operation, Process Characteristics and Applications, Advantages and limitations. Welding Power and Weld Metal Deposition rate calculations for SAW. Weld Dilution calculations

RESISTANCE WELDING **9 hours**

Spot, Seam, Projection, Stud, Upset and Flash Butt Welding, Electro Slag and Electro Gas Welding. Solid State Welding: Friction Welding, Friction Stir and Induction Pressure Welding, Process Characteristics and Applications, Explosive, Diffusion and Ultrasonic Welding, Principles of Operation, Process Characteristics and Applications Weldability of Resistance Welding process calculations. Welding current and Electrode feed rate calculation for Electroslag Welding

ELECTRON BEAM WELDING **9 hours**

Electron Beam Welding in Different Degrees of Vacuum, LBW: Physics of Lasers, Types of Lasers, Operation, Process Characteristics and Applications, Advantages and Limitations.

Brazing: Soldering: Adhesive Bonding, Thermal Cutting Processes, Metal Surfacing and Spraying Processes, Automation in Welding, Specific Welding Applications and Innovations, Economics of Welding, Safety in Welding, Standard Time and Cost Calculation.

TESTING AND DESIGN OF WELD JOINTS **9 hours**

Design Criteria and Quality Control of Welds. Edge preparation Types of Joints, Weld Symbols. Stresses in Butt and Fillet Welds – Weld Size Calculations, Design for Fatigue. Testing of Welds – Tensile, Bend, Hardness, Impact, Notch and Fatigue Tests, Life Assessment of Weldment

References

1. Robert W. Mesler Jr. Principles of Welding: Processes, Physics, Chemistry, and Metallurgy, John Wiley& Sons. Inc, 2007.

2. Parmer R. S., 'Welding Processes and Technology', Khanna Publishers, 2003.

3.Kearns W. H, 'Welding Hand Book (Welding Processes)', Volume II and III, 7th Edition, AWS, 1984

4. Parmer R. S., 'Welding Engineering and Technology', Khanna Publishers, 2004.

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5. Nadkarni S.V., 'Modern Arc Welding Technology', Oxford and IBH Publishing, 1996.

6. H.S.Bawa " Manufacturing Technology-I" Tata Mc Graw Hill Publishers New Delhi 2007.

U17MEE0012 **LEAN MANUFACTURING**

L	T	P	J	C
3	0	0	0	3

Course outcomes

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

CO 1: Apply the basic concepts of lean manufacturing

CO 2: Applyforecasting systems and supply chain management concept for effective operational decision making

CO 3: Apply capacity planning for managing multistage production system

CO 4: Apply the concepts of pull production systems for better manufacturing performance

CO 5: ApplyJIT philosophy to improve product flow

CO 6: Apply theory of constraints for shop scheduling and shop floor control

Pre-requisite: Nil

CO/PO Mapping
(S/M/W indicates strength of correlation)S-Strong, M-Medium, W-Weak

COs	Programme Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M						M							M
CO2	M								M	M				S
CO3	M					M				M				S
CO4	M									M				S
CO5	M				M				M	M				S
CO6	M									M				S

Course Assessment methods:

Direct	Indirect
1. Internal Test I 2. Internal Test II 3. Assignment 4.Group Presentation 5. End semester exam	Course end survey

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LEAN MANUFACTURING - OVERVIEW **9 hours**

Measures of competitiveness, Functional areas of firm, Product design, manufacture, delivery, Principles of Production system –Learning curves- Product demand life cycle-Capacity balancing, Role of inventory and information.

MANUFACTURING STRATEGY AND SUPPLY CHAIN **9 hours**

Forecasting systems – Purposes and uses of forecasts, manufacturing strategy – Dimensions, Aggregate planning – Planning tradeoffs.

Supply chain management concepts –Logistic information systems-Product design and customization-Vendor selection and contracting-Operational decisions in distribution systems.

MULTI STAGE PRODUCTION SYSTEMS **9 hours**

Materials requirement planning, Capacity Planning-Rough cut capacity planning-Capacity requirement planning-Load Reports-Incorporating Stochastic behavior, Lot sizing decisions, Managing change, Limitations of MRP, Introduction to multi stage product structures, Types of inventory, Inventory costs.

DECENTRALIZED PULL SYSTEMS& JIT PHILOSOPHY **9 hours**

Kanban systems –Single and dual systems-Scheduling rules, Environmental regulations, Constant work in process pull alternative (CONWIP)-Performance

JIT production systems, Improving the production environment towards JIT– Improving product flow– The transition to lean

SHOP SCHEDULING & SHOP FLOOR CONTROL **9 hours**

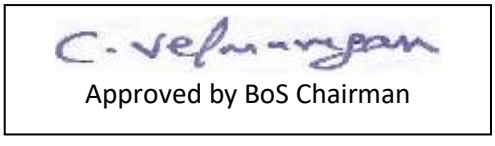
Scheduling system requirements, goals and measures of performance – Theory of constraints-Flowshop scheduling

Shop FloorControl system architecture – Manufacturing execution system – Toolmanagement system – Flexible manufacturing systems.

Theory :45 hours **Total:45hours**

REFERENCES:

1. Michael L George, David T Rowlands, Bill Kastle, “What is Lean Six Sigma”, McGraw-Hill, New York, 2007.
2. Askin R G and Goldberg J B, “Design and Analysis of Lean Production Systems”, John Wiley and Sons Inc., 2003.
3. Micheal Wader, “Lean Tools: A Pocket guide to Implementing Lean Practices”,



Productivity and Quality Publishing Pvt Ltd, 2002.

4. Kenichi Sekine, “One-piece flow”, Productivity Press, Portland, Oregon, 2005.
5. Joseph A De Feo, William W Bearnard “Juran Institute’s Six Sigma Break Through and Beyond”, Tata McGraw-Hill Edition, New Delhi, 2004.
6. Richard B ChaseF. Robert Jacobs and Nicholas J Aquilano, “Operations Management for Competitive Advantage”, McGraw Hill, 2006.
7. Poka - Yoke, "Improving Product Quality by Preventing Defects", Productivity Press, 2004.
8. Alan Robinson “Continuous Improvement in Operations”, Productivity Press, Portland, Oregon, 2003.

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U17MEE0013 **PLANT LAYOUT AND PROCESS DESIGN**

L	T	P	J	C
3	0	0	0	3

Course outcomes

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

CO 1: Outline the importance of plant location analysis.
CO 2: Extend types of layout and infer steps in layout design.
CO 3: Apply production planning techniques in product design and development.
CO 4: Outline process flow tasks and measures for managing flow variability.
CO 5: Analyze the importance of process design.
CO 6: Classify the various techniques of inventory management.

Pre-requisite:

1. NIL

CO/PO Mapping

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													
COs	**Programme Outcomes (POs)**												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	S								S	S				S
CO2	S								S	S				S
CO3	S	M	M						M	M				S
CO4	S		M						M					S
CO5	S	M							M	M				S

Course Assessment methods:

Direct	Indirect
1. Internal Test I 2. Internal Test II 3. Assignment 4.Group Presentation 5. End semester exam	Course end survey

PLANT LOCATION **9 Hours**

Plant Location analysis – Importance – Location Decisions – Classifications of location decisions- Location decision factors- Process of selecting a new plant – Comparisons between Service and Manufacturing Locations -Globalization and MNC's - Location and layout.

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PLANT LAYOUT **9 Hours**

Need for a layout study- Generic steps involved- Types of layout-Product, Process, Fixed Position, Combined layouts- Factors Influencing layout- Objectives of layout problems- Steps in layout design - Plant layout Procedure – Steps and Approaches.

PRODUCTION PLANNING AND CONTROL **9 Hours**

Introduction and Evolution – Objectives – Benefits – Functions – Types of Production – Product Design and Development-Product Analysis–Profit considerations - Standardization, Simplification, Specialization - Break even analysis.

PROCESS DESIGN **9 Hours**

Process flow and tasks - Process flow diagram and Flow Charts –Process performance measures –Littles law – Flow time measurement-Starvation and blocking- Process flow structures- Managing flow variability- Process Design - Process improvement.

INVENTORY CONTROL **9 Hours**

Inventory Analysis – Objectives and Purpose of holding stock - Costs and risks associated with inventory-Techniques of Inventory Management-ABC,EOQ,EPQ,Order Point Problems, Two bin technique,VED,HML,FSN, JIT.

Theory: 45 Hours **Total:45 Hours**

REFERENCES:

1. Fred E Meyers, "Plant Layout and Material Handling", Prentice Hall, 1999.
2. James A. Tompkins , John A. White, Yavuz A. Bozer and J. M. A. Tanchoco "Facilities Planning", John Wiley & Sons, 2003.
3. Khanna, O. P., "Industrial Engineering and Management", Dhanpatrai and Sons, 2003.
4. MartandTelsang, "Industrial Engineering and Production Management", S. Chand and Company, Second Edition, 2006.
5. Samson Eilon, "Elements of production planning and control", Universal Book Corpn.2001
6. Richard Francis, L. Leon McGinnis, F. Jr., John White, A., "Facility Layout and Location – an Analytical Approach", Prentice Hall of India., 2nd Ed.
7. G.Halevi and R.D.Weill, "Principles of Process Plannning" Chappman and Hall, Madras 1995.

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U17MEE0014	LOGISTICS AND SUPPLY CHAIN NETWORKS	L	T	P	J	C
		3	0	0	0	3

Course outcomes

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

CO 1: Justify significance of a logistics and its relationship to supply chain management.

CO 2: Identify and resolve contemporary issues in a logistic environment

CO 3: Understand basics of supply chain and its overview

CO 4: Analyze impact of sourcing decision in supply chain performance

CO 5: Build distribution network design by analyzing its influencing factors

Pre-requisite: NIL

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak														
COs	Programme Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M							M	M	M				M
CO2	M								M	M				M
CO3	M							M	M	M				M
CO4	M								M	M				M
CO5	M							M	M	M				M
CO6														

Course Assessment methods:

Direct	Indirect
1. Internal Test I 2. Internal Test II 3. Assignment 4.Group Presentation 5. End semester exam	Course end survey

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LOGISTICS **15 hours**

Evolution – Significance of Logistics- Progression of competitive advantage – Value chain- Key activities and processes – Logistic strategy – Hierarchy of logistic management decisions – Relationship of Logistics to Marketing and Production -Logistics Integration – Nodes and links in logistic networks –- Logistic Environment – Cost tradeoff in Logistics - Contemporary issues in logistics – Logistics versus supply chain management - Key to fast cycle logistics.

SUPPLY CHAIN BASICS **10 hours**

Introduction - Traditional scope of the supply chain- Evolution of supply chain – Supply chain overview and Objectives – Flow in supply chain- Decision phases of a supply chain- Process view of a supply chain- Cycle view and Push/Pull view - Supply chain Macro process - Case studies of successful supply chains.

SOURCING DECISIONS AND SUPPLY CHAIN PERFORMANCE **10 hours**

Role of sourcing and benefits of effective sourcing decisions- Supplier scoring and assessment factors - Supplier selection - Contracts and supply chain performance- Design collaboration- The Procurement Process - Product Categorization-Sourcing planning and analysis- Framework of the drivers of Supply Chain performance - Achieving a strategic fit.

DISTRIBUTION AND SUPPLY CHAIN NETWORK DESIGN **10 hours**

Introduction to distribution channels - Role of distribution in a supply chain- Factors Influencing distribution network design- Design options for a distribution network- Distribution Networks in Practice - Network design decisions-Factors influencing network design decisions- Framework for global site location-Conventional networks and tailored networks.

Theory :45hours **Total:45hours**

REFERENCES:

1. Sunil chopra Peter meindl, D.V. Kalra,“ Supply chain management”, Pearson Education, Prentice Hall of India, 2010.
2. Rahul. V. Altekar, “Supply Chain Management, Concept and cases”, PHI, 2009.
3. V. Sople “Logistics Management” Pearson India, 2012.

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U17MEE0015	INDUSTRIAL SAFETY	L	T	P	J	C
		3	0	0	0	3

Course outcomes

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

CO 1: Understand the industrial safety, health standards and safety measures
CO 2: Illustrate the philosophies behind industrial accidents and hazards
CO 3: Analyze about Industrial fatigue, Environmental factors and Industrial waste
CO 4: Discuss about human side of safety
CO 5: Illustrate human welfare and discuss about handling emergencies
CO 6: Study the different types safety organization and acts

Pre-requisite: Nil

CO/PO Mapping
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1			M								M	M		
CO2			M			M					M			
CO3			M				M				M			
CO4			M								M			M
CO5			M								M			M
CO6			M								M			

Course Assessment methods:

Direct	Indirect
1. Internal Test I 2. Internal Test II 3. Assignment 4.Group Presentation 5. End semester exam	Course end survey

INTRODUCTION - SAFETY **8 hours**

Definition-Milestones in industrial safety movement-safety responsibility and organization – Occupational safety and health administration (OSHA) –safety measures in planning, production and inspection – safety and productivity

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INDUSTRIAL ACCIDENTS AND HAZARDS **8hours**

Introduction- types of accidents in industry – Causes and prevention of accidents –accident reporting – accident reporting and analysis –Classification of hazards – Hazard management program- Major Industrial hazards – safety audit

INDUSTRIAL FATIGUE, ENVIRONMENTAL FACTORS AND INDUSTRIAL WASTE

7 hours

Fatigue – types, factors contributing to fatigue, Environment – Temperature, noise, illumination, vibration, heat, ventilation and air-conditioning - Waste – classification – harmful effect – primary and secondary treatment- waste disposal

HUMAN SIDE OF SAFETY **8 hours**

Personal protective equipment – Need,choice, respiratory and non-respiratory protective equipment, Training and maintenance- Occupational health problems – diseases and first aid - Fire hazards and prevention, Electrical hazard prevention and safety

WELFARE AND HANDLING EMERGENCIES **7hours**

Employee welfare-Statutory welfare schemes, Health hazards-Control strategies- Non-statutory schemes - Emergencies – need, objectives and emergency planning process- Safety symbols – signs, colors and categories -

SAFETY ORGANIZATION AND ACTS **7 hours**

Purpose of a safety organization-Safety policy- Safety committee- types- Role of safety coordinator- Responsibilities, Interferences and Sufferings of safety supervisor-Safety publicity-ISO14000 – Environmental management systems – ISO 9000 – Factories act 1948.

Theory :45 hours **Total:45hours**

REFERENCES:

1. Krishnan N.V., “Safety in Industry", Jaico Publisher House, 2005.
2. Singh, U.K. and Dewan, J.M., "Safety, Security and risk management", APH Publishing Company, New Delhi, 2005.
3. C. Ray Asfahl, David W. Rieske“ Industrial Safety and health management”, Prentice Hall,2009.
4. R.K. Mishra,“Safety Management”, AITBS publishers, 2012.
5. Krishnan N.V., “Safety in Industry", Jaico Publisher House, 2005.
6. Singh, U.K. and Dewan, J.M., "Safety, Security and risk management", APH Publishing Company, New Delhi, 2005.

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7. C. Ray Asfahl, David W. Rieske “Industrial Safety and health management”, Prentice Hall,2009.
8. R.K. Mishra,“Safety Management”, AITBS publishers, 2012.

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Course outcomes

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

CO 1: Understand and explain industrial marketing system and concepts.

CO 2: Classify industrial markets and list models of organizational buying behaviour.

CO 3: Analyse importance of marketing information systems and marketing research processes.

CO 4: Define industrial products and recall the factors influencing its pricing decisions.

CO 5: Dissect channel design process and appraise industrial communication programs.

Prerequisities : NIL

CO/PO Mapping (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													
COs	Programme Outcomes (POs)												
	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
CO 1			M				M				M			S
CO 2			M								M			S
CO 3			M						W		M			S
CO 4			M								M			S
CO 5			M				S		W	S	M			S
CO 6			M				M				M			S

Course Assessment methods

Direct	Indirect
1. Internal Test I 2. Internal Test II 3. Assignment 4.Group Presentation 5. End semester exam	Course end survey

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INTRODUCTION **9 Hours**

Introduction to Industrial Markets - Industrial Marketing System - Concepts - Characteristics – Definition – Exchange processes – Characteristics of Industrial and Consumer markets – Industrial Market demand – Cross elasticity of demand.

INDUSTRIAL PURCHASING **9 Hours**

Types of Industrial Customers - Purchasing practices - Industrial Buyer Behaviour – Industrial buying situation – Decision Making Units – Models of Organizational buying behavior- Modern Purchasing terminologies.

MARKETING PLANNING AND RESEARCH **9 Hours**

Business Marketing – Marketing Planning – Corporate Strategic Planning – Target Marketing - Marketing Information Systems – Market Evaluation - Role of IT in Marketing Information Systems - Definition and Process of Marketing Research - Research Instruments.

PRODUCT DEVELOPMENT AND PRICING **9 Hours**

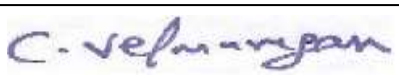
Industrial Products and Services definition - New Industrial Product Development – Product Life Cycle - Marketing strategies - Industrial Pricing Characteristics- Influencing factors in pricing decisions of Industrial Markets-Classification of costs-Pricing Strategies.

CHANNEL DESIGN **9 Hours**

Channel Design Process - Economic performances and channel management decisions- Industrial Logistics system- Role and Characteristics of Industrial Distributors- Sales Promotion – Personal Selling - Sales Force Management – Advertising in Industrial Marketing – Industrial Communication programs.

REFERENCES

1. Hawaldar, K. Krishna, INDUSTRIAL MARKETING, TATA McGraw-Hill Publishing Company Limited, New Delhi. 2008.
2. Milind T. Phadtare, INDUSTRIAL MARKETING, Prentice Hall of India Pvt. Ltd, New delhi,2008
3. Philip Kotler and Gary Armstrong “Principles of Marketing”, Prentice Hall of India, 2008.
4. Michael D Hautt and Thomas W Speh, INDUSTRIAL MARKETING MANAGEMENT, TheDyden Press.
5. Peter M. Chisnall, STRATEGIC INDUSTRIAL MARKETING; Prentice-Hall International
6. Robert R. Reeder, Briety& Betty H. reeder, INDUSTRIAL MARKETING, Prentice Hall of India Pvt. Ltd, New delhi,2008.



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