KUMARAGURU COLLEGE OF TECHNOLOGY
COIMBATORE – 641 049
(An Autonomous Institution Affiliated to Anna University, Chennai)

Department of Mechanical Engineering

REGULATIONS – 2017

(CBCS)

SYLLABUS FOR THIRD SEMESTER MECHANICAL ENGINEERING

From Academic year 2017-2018

B.E - MECHANICAL ENGINEERING

SEMESTER – III

U17MA*T*3101 PARTIAL DIFFERENTIAL EQUATIONS AND FOURIER ANALYSIS

L	T	P	J	C
3	1	0	0	4

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)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S	S							M	M				
CO2	S	S							M	M				
CO3	S	S							M	M				
CO4	S	S							M	M				
CO5	S	S							M	M				
CO6	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 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.

L	T	P	J	C
3	0	2	0	4

U17MEI3201 METAL CUTTING AND COMPUTER AIDED MANUFACTURING

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)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	S	S							S	S				S
CO2	M								S	S				S
CO3	S								S	S				S
CO4	M						M							S
CO5	M						M		M	M				S
CO6	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
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.
3. Hajra Choudhry, 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, Subramanyan S.and Raju 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.

LIST OF EXPERIMENTS:

1. Spur Gear cutting using Milling machine
2. Dove tail machining using shaper machine
3. Internal keyway machining using vertical slotting machine
4. Drilling, reaming and tapping for a given dimension of hole
5. Cylindrical grinding and Surface grinding on given workpiece
6. Facing, plain and step turning and taper turning.
7. Single start V-Thread cutting and knurling.
8. Boring and internal thread cutting.
9. Study on electrical discharge machine.
10. Manual part programming (using G and M codes) in CNC Lathe. Machining operations include turning, facing, taper turning, and step turning (any two operations).
11. Machining operations include Linear and Circular interpolation, chamfering and grooving (any two operations).
12. Manual part programming (using G and M codes) in CNC Milling. Machining operations include Linear and Circular interpolation (contour motions).
13. Machining operations include Drilling, peck drilling and boring (using any of the CAM software).

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

L	**T**	**P**	**J**	**C**
2	**0**	**2**	**0**	**3**

U17MEI3202 MECHATRONICS

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

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 Washing Machine - 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. Nitaigour Premchand Mahadik, "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.

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

U17MET3003 PRODUCT 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	Programme Outcomes(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 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.

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

Course Assessment methods:

Direct	Indirect
1. Internal Test I 2. Internal Test II	Course end survey

3. Assignment 4. Group presentation 5. Tutorial 6. End semester exam	

BASIC CONCEPTS AND FIRST LAW **12 Hours**

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.