M.KUMARASAMY COLLEGE OF ENGINEERING, KARUR.

(Autonomous)

AFFILIATED TO ANNA UNIVERSITY, CHENNAI

Department of Mechanical Engineering

REGULATIONS 2019

M.E. MANUFACTURING ENGINEERING

I TO IV SEMESTERS (FULL TIME) CURRICULUM AND SYLLABUS

SEMESTER I

S. No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	19PMAB101T	Applied Probability and Statistics	3	1	0	4
2	19PMEC101T	Advanced Materials Technology	3	0	0	3
3	19PMEC102T	Automated Computer Integrated Manufacturing Systems	3	0	0	3
4	19PMEC103T	Modern Manufacturing Processes	3	0	0	3
5	19PMEC104T	Robot Design and Programming	3	0	0	3
6	E1	Elective I	3	0	0	3
7	19PATM101	Research Methodology and IPR	2	0	0	2
PRACTICAL						
8	19PMEC105L	CAD/CAM Laboratory	0	0	4	2
		TOTAL	20	1	4	23

SEMESTER II

S. No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	19PMEC106T	Optimization Techniques in Manufacturing	3	0	0	3
2	19PMEC107T	Manufacturing Metrology and Quality Engineering	3	0	0	3
3	19PMEC108T	Theory of Metal Forming	3	0	0	3
4	19PMEC109T	Material Testing and Characterization Techniques	3	0	0	3
5	E2	Elective II	3	0	0	3
6	E3	Elective III	3	0	0	3
7	19PATM102	English for Research Paper Writing	1	0	0	0
PRACTICAL						
8	19PMEC110L	Automation and Metal Forming Laboratory	0	0	4	2
		TOTAL	19	0	4	20

SEMESTER III

S. No	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	E4	Elective IV	3	0	0	3
2	E5	Elective V	3	0	0	3
3	19PATM103	Pedagogy Studies	1	0	0	0
PRACTICAL						
4	19PMEP201L	Project Work (Phase I)	0	0	12	6
		TOTAL	7	0	12	12

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SEMESTER IV

S. No	COURSE CODE	COURSE TITLE	L	T	P	C
1	19PMEP202L	Project Work (Phase II)	0	0	24	12
		TOTAL	**0**	**0**	**24**	**12**

TOTAL CREDITS TO BE EARNED FOR THE AWARD OF THE DEGREE = 67

LIST OF ELECTIVES FOR M.E. MANUFACTURING ENGINEERING

SEMESTER I (Elective I)

S. NO	COURSE CODE	COURSE TITLE	L	T	P	C
1.	19PMEE001T	Fluid Power Automation	3	0	0	3
2.	19PMEE002T	Design for Manufacture and Assembly	3	0	0	3
3.	19PMEE003T	Advances in Casting and Welding	3	0	0	3
4.	19PMEE004T	Metal Cutting Theory and Practice	3	0	0	3
5.	19PMEE005T	Manufacturing of Automotive Parts	3	0	0	3

SEMESTER II (Elective II & III)

S. NO	COURSE CODE	COURSE TITLE	L	T	P	C
1.	19PMEE006T	Finite Element Methods for Manufacturing Engineering	3	0	0	3
2.	19PMEE007T	Materials Management	3	0	0	3
3.	19PMEE008T	Industrial Ergonomics	3	0	0	3
4.	19PMEE009T	Polymers and Composite Materials	3	0	0	3
5.	19PMEE010T	Non-Destructive Evaluation	3	0	0	3
6.	19PMEE011T	Lean Manufacturing	3	0	0	3
7.	19PMEE012T	Quality and Reliability Engineering	3	0	0	3
8.	19PMEE013T	MEMS and Nanotechnology	3	0	0	3
9.	19PMEE014T	Surface Engineering	3	0	0	3

SEMESTER III (Elective IV & V)

S. NO	COURSE CODE	COURSE TITLE	L	T	P	C
1.	19PMEE015T	Micro Manufacturing	3	0	0	3
2.	19PMEE016T	Computer Aided Product Design	3	0	0	3
3.	19PMEE017T	Financial Management	3	0	0	3
4.	19PMEE018T	Manufacturing Management	3	0	0	3
5.	19PMEE019T	Concepts of Green Manufacturing	3	0	0	3
6.	19PMEE020T	Nanotechnology	3	0	0	3
7.	19PMEE021T	Mechatronics	3	0	0	3
8.	19PMEE022T	Manufacturing Techniques	3	0	0	3
9.	19PMEE023T	Production and Operation Management	3	0	0	3

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Department	MECHANICAL ENGINEERING					Semester		I
Course Code	Course Name	Hours / Week			Total Hours	Credit	Maximum Marks	
		L	T	P		C	CA	ES	Total
19PMAB101T	APPLIED PROBABILITY AND STATISTICS	3	1	0	60	4	50	50	100

Course Objective (s):

- To train the students so that students will be able to design experimental designs and use these concepts for research design.
- To introduce the concept of probability so that they can be used for industrial applications.
- To stress upon the importance of the sampling theory and its usefulness in industrial quality control.
- To make students familiarize with the concepts of estimation theory and its applications.
- To help students the usefulness of test of significance and its applications in industry and research.

Course Outcomes:

CO1 : Apply the concepts of probability to industrial and research problems.
CO2 : Apply the concept of sampling techniques, so that they can be used for industrial applications.
CO3 : To use estimation theory and its usefulness in industrial quality control.
CO4 : Apply the concepts of testing of hypothesis to industrial problems.
CO5 : Apply techniques of ANNOVA to industry and research.

Unit I	PROBABILITY THEORY	13

Random variables – probability density and distribution functions-moment generating and characteristic functions – Binomial, Poisson, Normal distributions and their applications.

Unit II	SAMPLING THEORY	13

Sampling distributions – Standard error – t, F, Chi square distributions – applications.

Unit III	ESTIMATION THEORY	6

Interval estimation for population mean, standard deviation, difference in means, preparation ratio of standard deviations and variances.

Unit IV	TESTING OF HYPOTHESIS AND ANOVA	8

Hypothesis testing – Small samples – Tests concerning proportion, means, standard deviations – Tests based on chi square – and Redistribution - test One, two factor models-Design of experiments.

Unit V	ANOVA	5

Design of experiments – One, Two factor Models

REFERENCES:

1. Morris H Dcrort and Mark J Schervish, Probability and Statistics, Pearson Education, 2018.
2. Vijay K Rohatgi and Md.Ehsanes A K Saleh, An Introduction to Probability and Statistics, Wiley, 3rd Edition.2015.
3. Gupta S.C and Kapoor V.K, Fundamentals of Applied Statistics, Sultan Chand, 2014.
4. John.E Freunds, Mathematical statistics with applications, Pearson Education, India, 8th Edition, 2013
5. Levin I. and Rubin S, Statistics for Management, Pearson Education India, 7th Edition, 2012.

Department	MECHANICAL ENGINEERING					Semester		I
Course Code	Course Name	Hours / Week			Total Hours	Credit	Maximum Marks	
		L	T	P		C	CA	ES	Total
19PMEC101T	ADVANCED MATERIALS TECHNOLOGY	3	0	0	45	3	50	50	100

Course Objective (s):

- To make the students to understand on elastic, plastic and fractured behavior of engineering materials.
- To train the students in selection of metallic and non-metallic materials for the various engineering applications.

Course Outcomes:

- To impart knowledge on the advanced concepts of material technology

Unit I	ELASTIC AND PLASTIC BEHAVIOR	10

Elasticity in metals and polymers Anelastic and visco-elastic behaviour – Mechanism of plastic deformation and non metallic shear strength of perfect and real crystals – Strengthening mechanisms, work hardening, solid solutioning, grain boundary strengthening, poly phase mixture, precipitation, particle, fibre and dispersion strengthening. Effect of temperature, strain and strain rate on plastic behaviour – Super plasticity – Deformation of non crystalline materials.

Unit II	FRACTURE BEHAVIOUR	10

Griffith's theory, stress intensity factor and fracture toughness – Toughening mechanisms – Ductile, brittle transition in steel – High temperature fracture, creep – Larson Miller parameter – Deformation and fracture mechanism maps – Fatigue, low and high cycle fatigue test, crack initiation and propagation mechanisms and Paris law. Effect of surface and metallurgical parameters on fatigue – Fracture of non metallic materials – Failure analysis, sources of failure, procedure of failure analysis.

Unit III	SELECTION OF MATERIALS	10

Motivation for selection, 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 – Case studies in materials selection with relevance to aero, auto, marine, machinery and nuclear applications – Computer aided materials selection.

Unit IV	MODERN METALLIC MATERIALS	8

Dual phase steels, High strength low alloy (HSLA) steel, Transformation induced plasticity (TRIP) Steel, Maraging steel, Nitrogen steel – Intermetallics, Ni and Ti aluminides – smart materials, shape memory alloys – Metallic glass and nano crystalline materials.

Unit V	NON METALLIC MATERIALS	7

Polymeric materials – Formation of polymer structure – Production techniques of fibers, foams, adhesives and coating – structure, properties and applications of engineering polymers – Advanced structural ceramics, WC, TIC, TaC, Al_2O3, SiC, Si_3N_4 CBN and diamond – properties, processing and applications.

REFERENCES:

1. Ashby M.F., Material Selection in Mechanical Design, 3rd Edition, Butter Worth 2005.
2. ASM Hand book, Vol.11, Failure Analysis and Prevention, (10th Edition), ASM, 2002.
3. Charles, J.A., Crane, F.A.A. and Fumess, J.A.G., Selection and use of engineering materials, (3rd
4. edition), Butterworth-Heiremann, 2001.
5. Thomas H. Courtney, Mechanical Behaviour of Materials, (2nd edition), McGraw Hill, 2000
6. George E.Dieter, Mechanical Metallurgy, McGraw Hill, 1988

Department	MECHANICAL ENGINEERING					Semester			I
Course Code	Course Name	Hours / Week			Total Hours	Credit	Maximum Marks		
		L	T	P		C	CA	ES	Total
19PMEC102T	AUTOMATED COMPUTER INTEGRATED MANUFACTURING L SYSTEM	3	0	0	45	3	50	50	100

Course Objective (s):

- To teach the role of computers in processing of information knowing across the various stages and various departments in a manufacturing industries
- To train them in process planning.

Course Outcomes:

- To expose the students on the need of automation and integration

Unit I	INTRODUCTION	6

Introduction to CAD, CAM, CAD/CAM and CIM - Evolution of CIM – CIM wheel and cycle – Production concepts and mathematical models – Simple problems in production models – CIM hardware and software – Major elements of CIM system – Three step process for implementation of CIM – Computers in CIM – Computer networks for manufacturing – The future automated factory – Management of CIM – Impact of CIM on personnel – CIM status.

Unit II	AUTOMATED MANUFACTURING SYSTEMS	10

Automated production line – system configurations, work part transfer mechanisms – Fundamentals of Automated assembly system – System configuration, Part delivery at workstations – Design for automated assembly – Overview of material handling equipments – Consideration in material handling system design – The 10 principles of Material handling. Conveyor systems – Types of conveyors – Operations and features.

Automated Guided Vehicle system – Types of vehicles and AGVs applications – Vehicle guidance technology – Vehicle management and safety.

Storage system performance – storage location strategies – Conventional storage methods and equipments – Automated storage/Retrieval system and Carousel storage system Deadlocks in Automated manufacturing systems – Petrinet models – Applications in Dead lock avoidance.

Unit III	GROUP TECHNOLOGY AND FMS	10

Part families – Visual – Parts classification and coding – Production flow analysis – Grouping of parts and Machines by rank order clustering method – Benefits of GT – Case studies.

FMS – Components – workstations – FMS layout configurations – Computer control systems – FMS planning and implementation issues – Architecture of FMS – flow chart showing various operations in FMS – Machine cell design – Composite part concept, Holier method, Key machine concept – Quantitative analysis of FMS – Bottleneck model – Simple and complicated problems – Extended Bottleneck model - sizing the FMS – FMS applications, Benefits.

Unit IV	PROCESS PLANNING	10

Process planning – Activities in process planning, Informations required. From design to process planning – classification of manufacturing processes Selection of primary manufacturing processes – selecting among casting process, forming process and machining process. Sequencing of operations according to Anteriorities – various examples – forming of Matrix of Anteriorities – case study. Typical process sheet – case studies in Manual process planning.

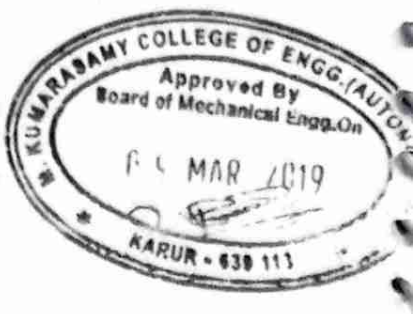
Computer Aided Process Planning – Process planning module and data base – Variant process planning – Two stages in VPP – Generative process planning – Flow chart showing various activities in generative PP – Semi generative process planning.

Unit V	TYPES OF PROCESS CONTROL AND AUTOMATIC DATA CAPTURE	9

Introduction to process model formulation – linear feed back control systems – Optimal control – Adaptive control –Sequence control and PLC. Computer process control – Computer process interface – Interface hardware – Computer process monitoring – Direct digital control and Supervisory computer control.

Overview of Automatic identification methods – Bar code technology – Other Automatic data capture technologies.

REFERENCES:	
1	Alavudeen and Venkateshwaran, -Computer Integrated Manufacturingl, PHI Learning Pvt. Ltd., New Delhi, 2008.
2	Mikell P.Groover, -Automation, Production system and Computer integrated Manufacturingl, Prentice Hall of India Pvt. Ltd., 2008.
3	Kant Vajpayee,S., -Computer Integrated Manufacturingl, Prentice Hall of India, New Delhi, 2007
4	James A.Retrg, Herry W.Kraebber, -Computer Integrated Manufacturingl, Pearson Education, Asia, 2001.
5	Viswanathan,N., and Narahari,Y., -Performance Modeling and Automated Manufacturing Systemsl, Prentice Hall of India Pvt. Ltd., 2000.
6	Radhakrishnan,P., Subramanian,S., and Raju,V., -CAD/CAM/CIMl New Age International Publishers, 2000.



Department	MECHANICAL ENGINEERING					Semester			I
Course Code	Course Name	Hours / Week			Total Hours	Credit	Maximum Marks		
		L	T	P		C	CA	ES	Total
19PMEC103T	MODERN MANUFACTURING PROCESSES	3	0	0	45	3	50	50	100

Course Objective (s):

- To create awareness on Abrasive aided machining
- To understand electrical and electrochemical machining processes.
- To analyse the principles of high energy aided machining.
- To study the surface and bulk machining processes of silicon wafer.
- To introduce students to the major manufacture steps in electronic circuit boards.

Course Outcomes:

CO1 : Understand and grasp the significance of modern machining process and its applications.
CO2 : Identify the selection of machining process and its parameters.
CO3 : Express and appreciate the cutting edge technologies and apply the same for research purposes.
CO4 : Measure the stages involved in fabrication of micro devices.
CO5 : Create new devices involved in micro fabrication and recent technology.

Unit I	ABRASIVE AIDED MACHINING PROCESSES	9

Abrasive machining – water jet machining - ultrasonic machining –Abrasive flow machining- Magneto rheological Abrasive flow machining- construction working principle – steps - types – process parameters – derivations – problems, merits, demerits and applications .

Unit II	ELECTRICAL AND CHEMICAL AIDED MACHINING PROCESSES	9

Wire cut EDM - Electric discharge machining – Electrochemical machining – chemical machining – Maskants - Electrochemical grinding - construction – principle – types – control - circuits – tool design – merits, demerits and applications. Hybrid Machining.

Unit III	HIGH ENERGY AIDED MACHINING PROCESSES	9

Laser beam machining – Electron beam machining – Plasma arc machining – Ion beam machining – construction working principle types – process parameter – derivations – problems, merits, demerits and applications.

Unit IV	FABRICATION OF MICRO DEVICES	9

Semiconductors – Si wafer - planarization – Oxidation - diffusion – ion implantation – etching – metallization – bonding – surface and bulk machining – LIGA Process

Unit V	MICROFABRICATION TECHNOLOGY	9

Moulding – PCB board hybrid and MCM technology – programmable devices and ASIC – electronic material and processing– stereolithography – Solid free form fabrication -SAW devices, Surface Mount Technology.

TOTAL: 45 HOURS

REFERENCES:

1. Brahem T. Smith, Advanced Machining I.F.S. UK 2016.
2. Jaeger R.C., Introduction to Microelectronic Fabrication Addison Wesley, 2nd Edition,1998.
3. Jain V K, Micromanufacturing Processes, CRC Press, 2012.
4. Julian W. Gardner, Vijay K Varadan and Osama O Awadelkarim, Microsensors MEMS and Smart devices, John Willey, 2013.
5. Pandey P.C. and Shan HS Modern Machining Processes, Standard Publishing Co., 1st Edition,1980.
6. Serope Kalpakjian and Steven R. Schmid- Manufacturing Process for Engineering Material – Pearson Education, 6th Edition, 2018

Regulation 2019		Semester I	Total Hours			30
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
M	19PATM101	Research Methodology and IPR	2	0	0	2

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is to:

1	Understand and analyse the fundamental of research problem
2	Understand the Research Ethics
3	Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity
4	Understand Intellectual Property Rights
5	Understand Patents Rights

Course Outcome (s) (COs):

At the end of this course, learners will be able to:

CO1	Understand research problem formulation
CO2	Analyze research related information
CO3	Follow research ethics
CO4	Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular
CO5	Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits

UNIT I	INTRODUCTION	6

Meaning of research problem- Sources of research problem-Criteria Characteristics of a good research problem- Errors in selecting a research problem- Scope and objectives of research problem.

UNIT II	ANALYSIS OF REARCH	6

Approaches of investigation of solutions for research problem- data collection- analysis- interpretation- Necessary instrumentations Effective literature studies approaches- analysis Plagiarism,- Research ethics.

UNIT III	RESEACRH PRPOSAL AND TECHNICAL WRITING	6

Effective technical writing - how to write report-Paper Developing a Research Proposal- Format of research proposal- a presentation and assessment by a review committee.

UNIT IV	INTELLECTUAL PROPERTY	6

Nature of Intellectual Property: Patents Designs - Trade and Copyright- Process of Patenting and

Development: technological research- innovation- patenting- And development. International Scenario: International cooperation on Intellectual Property- Procedure for grants of patents- Patenting under PCT.		
UNIT V	**PATENTS RIGHTS**	**6**
Patent Rights: Scope of Patent Rights- Licensing and transfer of technology -Patent information and databases- Geographical Indications.		
Text Book (s)		
1	Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students".	
2	Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007	
Reference (s)		
1	Ranjit Kumar, 2 nd Edition , "Research Methodology: A Step by Step Guide for beginners"	
2	T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008	
3	Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.	
4	Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"	

Department	MECHANICAL ENGINEERING					Semester			I
Course Code	Course Name	Hours / Week			Total Hours	Credit	Maximum Marks		
		L	T	P		C	CA	ES	Total
19PMEC104T	ROBOT DESIGN & PROGRAMMING	3	0	0	45	3	50	50	100

Course Objective (s):

- To teach the students about the kinematic arrangement of robots and its applications in the area of manufacturing sectors
- To expose the students to build a robot for any type of application

Course Outcomes:

- To impart knowledge in the area of Robot designing and programming in Robotic languages.

Unit I	INTRODUCTION	9

Definition, Need Application, Types of robots – Classifications – Configuration, work volume, control loops, controls and intelligence, specifications of robot, degrees of freedoms, end effectors – types, selection applications.

Unit II	ROBOT KINEMATICS	9

Introduction – Matrix representation Homogeneous transformation, forward and inverse – Kinematic equations, Denvit – Hartenbers representations – Inverse Kinematic relations. Fundamental problems with D-H representation, differential motion and velocity of frames – Jacobian, Differential Charges between frames:

Unit III	ROBOT DYNAMICS AND TRAJECTORY PLANNING	9

Lagrangeon mechanics, dynamic equations for sing, double and multiple DOF robots – static force analysis of robots, Trajectory planning – joint space, Cartesian space description and trajectory planning – third order, fifth order - Polynomial trajectory planning

Unit IV	ROBOT PROGRAMMING & AI TECHNIQUES	9

Types of Programming – Teach Pendant programming – Basic concepts in A1 techniques – Concept of knowledge representations – Expert system and its components.

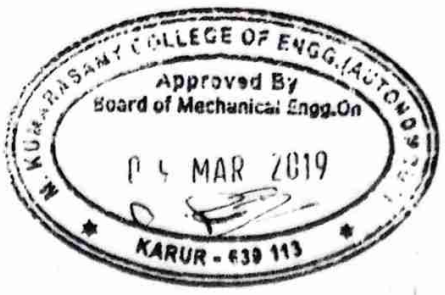
Unit V	ROBOT SENSORS AND ACTUATORS	9

Design of Robots – characteristics of actuating systems, comparison, microprocessors control of electric motors, magnetostrictive actuators, shape memory type metals, sensors, position, velocity, force, temperature, pressure sensors – Contact and non contact sensors, infrared sensors, RCC, vision sensors.

TOTAL: 45 HOURS

REFERENCES:

1	Saeed.B.Niku, 'Introduction to Robotics, Analysis, system, Applications', Pearson educations, 2010.
2	Groover.M.P. Industrial Robotics, McGraw – Hill International edition, 1996.
3	Wesley E Snyder R, 'Industrial Robots, Computer Interfacing and Control', Prentice Hall International Edition, 2013.
4	Gordon Mair, 'Industrial Robotics', Prentice Hall (U.K.) 1988
	John J. Craig, Introduction to Robotics: Mechanics and Control, Pearson, 3rd edition, 2004.
	Fu K S, Gonzalez, Lee C S G, Robotics: Control, Sensing, Vision and Intelligence, McGraw-Hill *Book* Company, 1987.



Department	MECHANICAL ENGINEERING					Semester			I
Course Code	Course Name	Hours / Week			Total Hours	Credit	Maximum Marks		
		L	T	P		C	CA	ES	Total
19PMEC105L	CAD / CAM LABORATORY	0	0	4	60	2	70	30	100

Course Objective (s):

- To teach the students about the drafting of 3D components and analyzing the same using various CAD packages and programming of CNC machines
- To train them to use the various sensors

Course Outcomes:

- To impart the knowledge on training the students in the area of CAD/CAM

CAM LABORATORY — 30

1. Exercise on CNC Lathe: Plain Turning, Step turning, Taper turning, Threading, Grooving & canned cycle
2. Exercise on CNC Milling Machine: Profile Milling, Mirroring, Scaling & canned cycle.
3. Study of Sensors, Transducers & PLC: Hall-effect sensor, Pressure sensors, Strain gauge, PLC, LVDT, Load cell, Angular potentiometer, Torque, Temperature & Optical Transducers.

CAD LABORATORY — 30

2D modeling and 3D modeling of components such as

1. Bearing
2. Couplings
3. Gears
4. Sheet metal components
5. Jigs, Fixtures and Die assemblies.

Department	MECHANICAL ENGINEERING					Semester			II
Course Code	Course Name	Hours / Week			Total Hours	Credit	Maximum Marks		
		L	T	P		C	CA	ES	Total
19PMEC106T	OPTIMIZATION TECHNIQUES IN MANUFACTURING	3	0	0	45	3	50	50	100

Course Objective (s):

- To make use of the above techniques while modeling and solving the engineering problems of different fields.

Course Outcomes:

- To introduce the various optimization techniques and their advancements.

Unit I	INTRODUCTION	5

Optimization – Historical Development – Engineering applications of optimization – Statement of an Optimization problem – classification of optimization problems.

Unit II	CLASSIC OPTIMIZATION TECHNIQUES	10

Linear programming - Graphical method – simplex method – dual simplex method – revised simplex method – duality in LP – Parametric Linear programming – Goal Programming.

Unit III	NON-LINEAR PROGRAMMING	9

Introduction – Lagrangeon Method – Kuhn-Tucker conditions – Quadratic programming – Separable programming – Stochastic programming – Geometric programming.

Unit IV	INTEGER PROGRAMMING AND DYNAMIC PROGRAMMING AND NETWORK TECHNIQUES	12

Integer programming - Cutting plane algorithm, Branch and bound technique, Zero-one implicit enumeration – Dynamic Programming – Formulation, Various applications using Dynamic Programming. Network Techniques – Shortest Path Model – Minimum Spanning Tree Problem – Maximal flow problem.

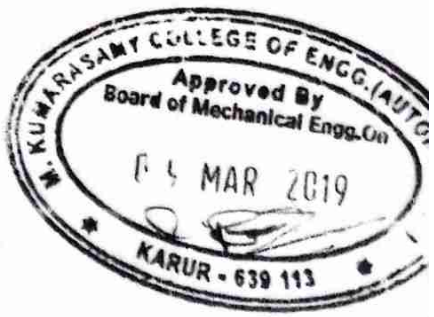
Unit V	ADVANCES IN SIMULATION	9

Genetic algorithms – simulated annealing – Neural Network and Fuzzy systems

TOTAL: 45 HOURS

REFERENCES:

1	R. Panneerselvam, -Operations Researchl, Prentice Hall of India Private Limited, New Delhi 1 2005.
2	J.K.Sharma, Operations Research – Theory and Applications – Macmillan India Ltd., 1997
3	Hamdy A. Taha, Operations Research – An Introduction, Prentice Hall of India, 1997
4	P.K. Guptha and Man-Mohan, Problems in Operations Research – Sultan chand & Sons, 1994
5	Ravindran, Philips and Solberg, Operations Research Principles and Practice, John Wiley & Sons, Singapore, 1992



Department	MECHANICAL ENGINEERING					Semester		II
Course Code	Course Name	Hours / Week			Total Hours	Credit	Maximum Marks	
		L	T	P		C	CA	ES	Total
19PMEC107T	MANUFACTURING METROLOGY AND QUALITY ENGINEERING	3	0	0	45	3	50	50	100

Course Objective (s):

- To impart through knowledge in various latest measurement systems such as laser metrology, coordinate measuring machines and electro-optical devices.
- To train them in the area of precision and quality manufacturing

Course Outcomes:

- To expose the students, the importance of measurement and the various latest measuring techniques using Laser, Coordinate measuring machines and Opto-electronics devices. Also to stress upon the Importance of quality in manufacturing.

Unit I	LASER METROLOGY AND PRECISION INSTRUMENTS	9

Introduction – types of lasers – laser in engineering metrology – metrological laser methods for applications in machine systems – Interferometry applications – speckle interferometry – laser interferometers in manufacturing and machine tool alignment testing – laser Doppler technique – laser Doppler anemometry - Laser telemetric systems – detection of microscopic imperfections on high quality surface Pitter NPL gauge interferometer – classification of optical scanning systems – high inertia laser scan technique – rotating mirror technique vibrational deflectors – refractive and diffractive scanners. – laser gauging – bar coding – laser dimensional measurement system.

Unit II	CO-ORDINATE MEASURING SYSTEM	9

Co-ordinate metrology – CMM configurations – hardware components – software – Probe sensors – Displacement devices – performance evaluations – software – hardware – dynamic errors – thermal effects diagram – temperature variations - environment control – applications – Roll of CMM in reverse engineering.

Unit III	OPTO ELECTRONICS AND VISION SYSTEM	9

Opto electronic devices – CCD – On-line and in-process monitoring in production - applications - image analysis and computer vision – Image analysis techniques – spatical feature – Image extraction – segmentation – digital image processing – Vision system for measurement – Comparison laser scanning with vision system.

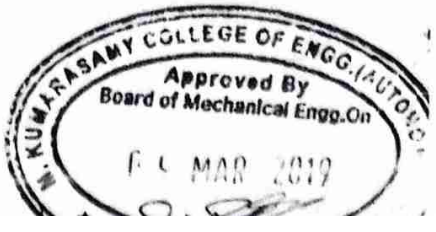
Unit IV	QUALITY IN MANUFACTURING AND DESIGN ENGINEERING	9

Importance of manufacturing planning for quality – initial planning and concept of quality – self controls – defining quality responsibilities on the factory flow – automated manufacturing – overall view of manufacturing planning – process quality audits – Opportunities for improvement in product design – early warning concepts and design assurance – design for basic functional requirements – design for reliability – availability – designing for manufacturability and safety – cost of quality – design review - concurrent engineering – improving the effectiveness of product development.

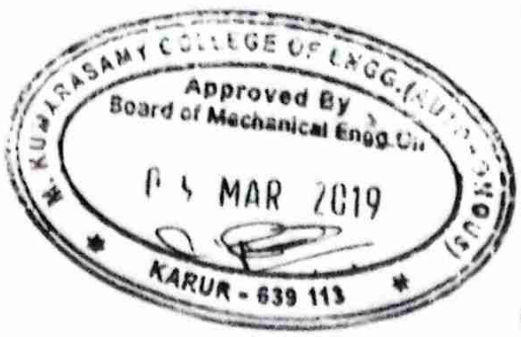
Unit V	QUALITY MANAGEMENT SYSTEM AND CONTINUOUS IMPROVEMENT	9

Need for quality management system – design of quality management system – quality management system requirements – ISO 9001 and other management system and models – basic quality engineering tools - statistical process control – techniques for process design and improvement – Taguchi methods for process improvement – six sigma.

TOTAL: 45 HOURS



REFERENCES:	
1	Oakland J.S. Total Quality Management – Text with cases, Butter worth – Heinemann – An imprint of Elseiver, First Indian Print, New Delhi 2005.
2	Elanchezhian.C, Vijaya Ramnath.B and Sunder Selwyn, T., Engineering Metrology, Eswar Press, Chennai, 2004.
3	Zuech Nello, Understanding and Applying Machine Vision, Marcel Dekker, Inc, 2000
4	John A. Bosch, Giddings and Lewis Dayton, Co-ordinate Measuring Machines and Systems, Marcel Dekker, Inc, 1999.
5	Juran J.M. and Gyna F.M., Quality Planning and Analysis, Tata-McGraw Hill, New Delhi, 1995. Awcock, G.J. and Thomas R, Applied Image Processing, Mc.Graw Hill, Inc. 1996.



Department	MECHANICAL ENGINEERING					Semester			II
Course Code	Course Name	Hours / Week			Total Hours	Credit	Maximum Marks		
		L	T	P		C	CA	ES	Total
19PMEC108T	THEORY OF METAL FORMING	3	0	0	45	3	50	50	100

Course Objective (s):

- To study the basic concepts of metal forming techniques and to develop force calculation in metal forming process.
- To study the thermo mechanical regimes and its requirements of metal forming.

Course Outcomes:

- To impart knowledge on plasticity, surface treatment for forming of various types of metal forming process.

Unit I **THEORY OF PLASTICITY** 9

Theory of plastic deformation – Yield criteria – Tresca and Von-mises – Distortion energy – Stress- strain relation – Mohr's circle representation of a state of stress – cylindrical and spherical co-ordinate system – upper and lower bound solution methods – Overview of FEM applications in Metal Forming analysis.

Unit II **THEORY AND PRACTICE OF BULK FORMING PROCESSES** 9

Analysis of plastic deformation in Forging, Rolling, Extrusion, rod/wire drawing and tube drawing – Effect of friction – calculation of forces, work done – Process parameters, equipment used – Defects – applications – Recent advances in Forging, Rolling, Extrusion and Drawing processes – Design consideration in forming.

Unit III **SHEET METAL FORMING** 9

Formability studies – Conventional processes – H E R F techniques – Superplastic forming techniques – Hydro forming – Stretch forming – Water hammer forming – Principles and process parameters – Advantage, Limitations and application.

Unit IV **POWDER METALLURGY AND SPECIAL FORMING PROCESSES** 9

Overview of P/M technique – Advantages – applications – Powder preform forging – powder rolling – Tooling, process parameters and applications. - Orbital forging – Isothermal forging – Hot and cold isostatic pressing – High speed extrusion – Rubber pad forming – Fine blanking – LASER beam forming.

Unit V **SURFACE TREATMENT AND METAL FORMING APPLICATIONS** 9

Experiment techniques of evaluation of friction in metal forming selection – influence of temperature and gliding velocity – Friction heat generation – Friction between metallic layers – Lubrication carrier layer – Surface treatment for drawing, sheet metal forming, Extrusion, hot and cold forging.Processing of thin Al tapes – Cladding of Al alloys – Duplex and triplex steel rolling – Thermo mechanical regimes of Ti and Al alloys during deformation – Formability of welded blank sheet – Laser structured steel sheet - Formability of laminated sheet.

TOTAL: 45 HOURS

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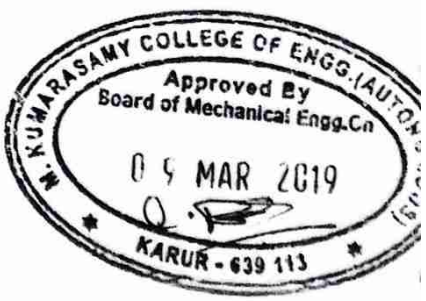
REFERENCES:	
1	Helmi A Youssef, Hassan A. El-Hofy, Manufacturing Technology: Materials, Processes and Equipment, CRC publication press, 2012.
2	SAE Transactions, Journal of Materials and Manufacturing Section 5, 1993-2007
3	Surender kumar, Technology of Metal Forming Processes, Prentice Hall India Publishers,2010
4	Marciniak,Z., Duncan J.L., Hu S.J., ‚Mechanics of Sheet Metal Forming', Butterworth-Heinemann An Imprint of Elesevier, 2006
5	Nagpal G.R., Metal Forming Processes- Khanna publishers, 2005.
6	Altan T., Metal forming – Fundamentals and applications – American Society of Metals, Metals park, 2003



Department	MECHANICAL ENGINEERING					Semester			II
Course Code	Course Name	Hours / Week			Total Hours	Credit	Maximum Marks		
		L	T	P		C	CA	ES	Total
19PMEC109T	MATERIAL TESTING AND CHARACTERIZATION TECHNIQUES	3	0	0	45	3	50	50	100

Course Objective (s):

On completion of the course the students are expected to be knowledgeable in microstructure evaluation, crystal structure analysis, electron microscopy, Chemical Thermal Analysis, static and dynamic mechanical testing methods.

Course Outcomes:

This course aims to impart knowledge on various techniques of material characterization.

Unit I	MICRO AND CRYSTAL STRUCTURE ANALYSIS	10

Principles of Optical Microscopy – Specimen Preparation Techniques – Polishing and Etching – Polarization Techniques – Quantitative Metallography – Estimation of grain size – ASTM grain size numbers – Microstructure of Engineering Materials - Elements of Crystallography – X- ray Diffraction – Bragg's law – Techniques of X-ray Crystallography – Debye – Scherer camera – Geiger Diffractometer – analysis of Diffraction patterns – Inter planer spacing – Identification of Crystal Structure, Elements of Electron Diffraction.

Unit II	ELECTRON MICROSCOPY	9

Interaction of Electron Beam with Materials – Transmission Electron Microscopy – Specimen Preparation – Imaging Techniques – BF & DF – SAD – Electron Probe Microanalysis – Scanning Electron Microscopy – Construction & working of SEM – various Imaging Techniques – Applications- Atomic Force Microscopy- Construction & working of AFM - Applications .

Unit III	CHEMICAL AND THERMAL ANALYSIS	10

Basic Principles, Practice and Applications of X-Ray Spectrometry, Wave Dispersive X-Ray Spectrometry, Auger Spectroscopy, Secondary Ion Mass Spectroscopy, Fourier Transform Infra Red Spectroscopy (FTIR)- Proton Induced X-Ray Emission Spectroscopy, Differential Thermal Analysis, Differential Scanning Calorimetry (DSC) And Thermo Gravitymetric Analysis (TGA).

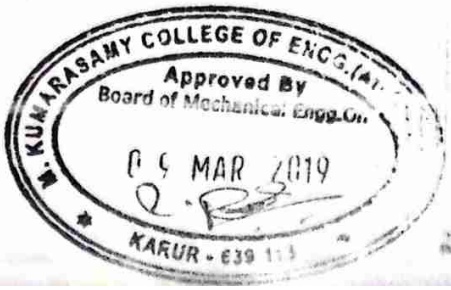
Unit IV	MECHANICAL TESTING – STATIC TESTS	8

Hardness – Brinell, Vickers, Rockwell and Micro Hardness Test – Tensile Test – Stress – Strain plot – Proof Stress – Torsion Test - Ductility Measurement – Impact Test – Charpy & Izod – DWTT - Fracture Toughness Test, Codes and standards for testing metallic and composite materials.

Unit V	MECHANICAL TESTING – DYNAMIC TESTS	9

Fatigue – Low & High Cycle Fatigues – Rotating Beam & Plate Bending HCF tests – S-N curve – LCF tests – Crack Growth studies – Creep Tests – LM parameters – AE Tests-modal analysis - Applications of Dynamic Tests.

TOTAL: 45 HOURS



Regulation 2019		Semester II	Total Hours			15
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
M	19PATM102	English For Research Paper Writing	1	0	0	0

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is to:

1	Understand that how to improve your writing skills and level of readability
2	Learn about what to write in each section
3	Understand the skills needed when writing a Title

Course Outcome (s) (COs):

At the end of this course, learners will be able to:

CO1	Understand the basics of writing skills
CO2	Illustrate the level of readability
CO3	Explain about what to write in each section
CO4	Summarize the skills needed to form a title

UNIT I	3

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

UNIT II	3

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

UNIT III	3

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

UNIT IV	3

Key skills are needed when writing a title, Key skills are needed when writing an abstract, Key skills are needed when writing an introduction, Skills needed when writing a review of the literature

UNIT V	3

Skills are needed when writing the methods, Skills needed when writing the results, Skills are needed when writing the discussion, Skills are needed when writing the conclusions, Useful Phrases, How to ensure paper is as good as it could possibly be the first- Time Submission

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

Department	MECHANICAL ENGINEERING					Semester			II
Course Code	Course Name	Hours / Week			Total Hours	Credit	Maximum Marks		
		L	T	P		C	CA	ES	Total
19PMEC110L	AUTOMATION AND METAL FORMING LABORATORY	0	0	4	60	2	70	30	100

Course Objective (s):

- To train the students to have an hands on having the basic concepts of metal forming processes and to determine some metal forming parameters for a given shape.

Course Outcomes:

To impart practical knowledge on bulk metal forming and sheet metal forming processes.

EXPERIMENTS	30

1. Determination of strain hardening exponent
2. Determination of strain rate sensitivity index
3. Construction of formability limit diagram
4. Determination of efficiency in water hammer forming
5. Determination of interface friction factor
6. Determination of extrusion load
7. Study on two high rolling process

AUTOMATION LAB	30

1. Simulation of single and double acting cylinder circuits
2. Simulation of Hydraulic circuits
3. Simulation of electro pneumatic circuits
4. Simulation of electro hydraulic circuits
5. Simulation of PLC circuits
6. Software simulation of fluid power circuits using Automation studio.

TOTAL: 45 HOURS

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Regulation 2019		Semester II	Total Hours			15
Category	Course Code	Course Name	Hours / Week			C
			L	T	P	
M	19PATM103	Pedagogy Studies	1	0	0	0

Prerequisite Course (s)

Nil

Course Objective (s):

The purpose of learning this course is to:

1	Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.
2	Identify critical evidence gaps to guide the development.

Course Outcome (s) (COs):

At the end of this course, learners will be able to:

CO1	Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
CO2	Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
CO3	Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
CO4	Discuss the passage of the Hindu Code Bill of 1956.

UNIT I	INTRODUCTION AND METHODOLOGY	3

Aims and rationale, Policy background, Conceptual framework and terminology, Theories of learning, Curriculum, Teacher education, Conceptual framework, Research questions, Overview of methodology and Searching

UNIT II	THEMATIC OVERVIEW	3

Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries, Curriculum, Teacher education

UNIT III	PEDAGOGIC STRATEGIES	3

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

UNIT IV	PROFESSIONAL DEVELOPMENT	3

Alignment with classroom practices and follow-up support ,Peer support, Support from the head teacher and the community, Curriculum and assessment, Barriers to learning: limited resources and large class sizes

UNIT V	RESEARCH GAPS AND FUTURE DIRECTIONS	3
Research design , Contexts, Pedagogy, Teacher education, Curriculum and assessment, Dissemination and research impact		
Text Book (s)		
1	Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.	
2	Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.	
Reference (s)		
1	Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.	
2	Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.	
3	Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.	

Department	MECHANICAL ENGINEERING					Semester			I
Course Code	Course Name	Hours / Week			Total Hours	Credit	Maximum Marks		
		L	T	P		C	CA	ES	Total
19PMEE001T	FLUID POWER AUTOMATION	3	0	0	45	3	50	50	100

Course Objective (s):

- To impart knowledge in the area of hydraulic, pneumatic and fluid power components and its functions.

Course Outcomes:

- To make the students to learn the basic concepts of hydraulics and pneumatics and their controlling elements in the area of manufacturing process.
- To train the students in designing the hydraulics and pneumatic circuits using various design procedures.

Unit I	INTRODUCTION	8

Need for Automation, Hydraulic & Pneumatic Comparison – ISO symbols for fluid power elements, Hydraulic, pneumatics – Selection criteria.

Unit II	FLUID POWER GENERATING/UTILIZING ELEMENTS	9

Hydraulic pumps and motor gears, vane, piston pumps-motors-selection and specification-Drive characteristics – Linear actuator – Types, mounting details, cushioning – power packs – construction. Reservoir capacity, heat dissipation, accumulators – standard circuit symbols, circuit (flow) analysis.

Unit III	CONTROL AND REGULATION ELEMENTS	9

Direction flow and pressure control valves-Methods of actuation, types, sizing of ports-pressure and temperature compensation, overlapped and underlapped spool valves-operating characteristics- electro hydraulic servo valves-Different types-characteristics and performance.

Unit IV	CIRCUIT DESIGN	10

Typical industrial hydraulic circuits-Design methodology – Ladder diagram-cascade, method-truth table-Karnaugh map method-sequencing circuits-combinational and logic circuit.

Unit V	ELECTRO PNEUMATICS & ELECTRONIC CONTROL OF HYDRAULIC AND PNEUMATIC CIRCUITS	9

Electrical control of pneumatic and hydraulic circuits-use of relays, timers, counters, Ladder diagram. Programmable logic control of Hydraulics Pneumatics circuits, PLC ladder diagram for various circuits, motion controllers, use of field busses in circuits. Electronic drive circuits for various Motors.

TOTAL: 45 HOURS

REFERENCES:

1. W.Bolton, Mechatronics, Electronic control systems in Mechanical and Electrical Engineering Pearson Education, 2003.
2. Peter Rohner, Fluid Power Logic Circuit Design, Memelan Prem, 1994.
3. Antony Esposito, Fluid Power Systems and control Prentice-Hall, 1988
4. E.C.Fitch and J.B.Suryaatmadyn. Introduction to fluid logic, McGraw Hill, 1978
5. Peter Rohner, Fluid Power logic circuit design, The Macmillan Press Ltd.,London, 1979

Department	MECHANICAL ENGINEERING					Semester			I
Course Code	Course Name	Hours / Week			Total Hours	Credit	Maximum Marks		
		L	T	P		C	CA	ES	Total
19PMEE002T	DESIGN FOR MANUFACTURE AND ASSEMBLY	3	0	0	45	3	50	50	100

Course Objective (s):

- To impart the knowledge about the significance of design for manufacturing and assembly

Course Outcomes:

- To make the students learn about tolerance analysis, allocation and geometrical tolerances.
- Guidelines for design for manufacturing and assembly with examples.

Unit I	TOLERANCE ANALYSIS	8

Introduction – Concepts, definitions and relationships of tolerancing – Matching design tolerances with appropriate manufacturing process – manufacturing process capability metrics – Worst care, statistical tolerance Analysis – Linear and Non-Linear Analysis – Sensitivity Analysis – Taguchi's Approach to tolerance design.

Unit II	TOLERANCE ALLOCATION	8

Tolerance synthesis – Computer Aided tolerancing – Traditional cost based analysis – Taguchi's quality loss function – Application of the Quadratic loss function to Tolerancing – Principles of selective Assembly – Problems.

Unit III	GD&T	10

Fundamentals of geometric dimensioning and tolerancing – Rules and concepts of GD&T – Form controls – Datum systems – Orientation controls – Tolerance of position – Concentricity and symmetry controls – Run out controls – Profile controls.

Unit IV	TOLERANCE CHARTING	9

Nature of the tolerance buildup – structure and setup of the tolerance chart – piece part sketches for tolerance charts – Arithmetic ground rules for tolerance charts – Determination of Required balance dimensions – Determination of Mean working Dimensions – Automatic tolerance charting – Tolerance charting of Angular surfaces.

Unit V	MANUFACTURING GUIDELINES	10

DFM guidelines for casting, weldment design – Formed metal components – Turned parts – Milled, Drilled parts – Non metallic parts – Computer Aided DFM software – Boothroyd and Dewhurst method of DFMA – DCS – Vis/VSA – 3D Dimensional control – Statistical tolerance Analysis Software – Applications.

TOTAL: 45 HOURS

REFERENCES:

1. C.M. Creveling, -Tolerance Design – A handbook for Developing Optimal Specificationsl, Addison – Wesley, 1997.
2. James D. Meadows, ‚Geometric Dimensioning and Tolerancingl, Marcel Dekker Inc., 1995.
3. Alex Krulikowski, -Fundamentals GD&Tl, Delmar Thomson Learning, 1997.
4. Oliver R. Wade, -Tolerance Control in Design and Manufacturingl, Industrial Press, NY, 1967.
5. James G. Bralla, -Handbook of Product Design for Manufacturingl, McGraw Hill, 1983.

Department	MECHANICAL ENGINEERING					Semester			I
Course Code	Course Name	Hours / Week			Total Hours	Credit	Maximum Marks		
		L	T	P		C	CA	ES	Total
19PMEE003T	ADVANCES IN CASTING AND WELDING	3	0	0	45	3	50	50	100

Course Objective (s):

- To refresh the knowledge on basic concepts and to impart knowledge on advances in casting and welding processes.

Course Outcomes:

- To study the metallurgical concepts and applications of casting and welding process.
- To acquire knowledge in CAD of casting and automation of welding process.

Unit I	**CASTING DESIGN**	**8**

Heat transfer between metal and mould — Design considerations in casting – Designing for directional solidification and minimum stresses - principles and design of gating and risering

Unit II	**CASTING METALLURGY**	**8**

Solidification of pure metal and alloys – shrinkage in cast metals – progressive and directional solidification — Degasification of the melt-casting defects – Castability of steel , Cast Iron, Al alloys , Babbit alloy and Cu alloy.

Unit III	**RECENT TRENDS IN CASTING AND FOUNDRY LAYOUT**	**8**

Heat affected Zone and its characteristics – Weldability of steels, cast iron, stainless steel, aluminum, Mg , Cu , Zirconium and titanium alloys – Carbon Equivalent of Plain and alloy steels Hydrogen embrittlement – Lamellar tearing – Residual stress – Distortion and its control . Heat transfer and solidification - Analysis of stresses in welded structures – pre and post welding heat treatments – weld joint design – welding defects – Testing of weldment.

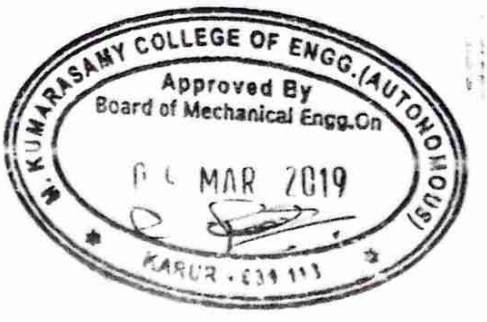
Unit IV	**WELDING METALLURGY AND DESIGN**	**10**

Nature of the tolerance buildup – structure and setup of the tolerance chart – piece part sketches for tolerance charts – Arithmetic ground rules for tolerance charts – Determination of Required balance dimensions – Determination of Mean working Dimensions – Automatic tolerance charting – Tolerance charting of Angular surfaces.

Unit V	**RECENT TRENDS IN WELDING**	**11**

Friction welding, friction stir welding – explosive welding – diffusion bonding – high frequency induction welding – ultrasonic welding – electron beam welding – Laser beam welding –Plasma welding – Electroslag welding- narrow gap, hybrid twin wire active TIG – Tandem MIG- modern brazing and soldering techniques – induction, dip resistance, diffusion processes – Hot gas, wave and vapour phase soldering. Overview of automation of welding in aerospace, nuclear, surface transport vehicles and under water welding.

TOTAL: 45 HOURS



REFERENCES:	
1.	ASM Handbook, Vol 15, Casting, 2004
2.	ASM Handbook vol.6, welding Brazing & Soldering, 2003
3.	Alex Krulikowski, -Fundamentals GD&Tl, Delmar Thomson Learning, 1997.
4.	Oliver R. Wade, -Tolerance Control in Design and Manufacturingl, Industrial Press, NY, 1967.
5.	James G. Bralla, -Handbook of Product Design for Manufacturingl, McGraw Hill, 1986.

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Department	MECHANICAL ENGINEERING					Semester			I
Course Code	Course Name	Hours / Week			Total Hours	Credit	Maximum Marks		
		L	T	P		C	CA	ES	Total
19PMEE004T	METAL CUTTING THEORY AND PRACTICE	3	0	0	45	3	50	50	100

Course Objective (s):

- To impart the knowledge and train the students in the area of metal cutting theory and its importance.

Course Outcomes:

- To make the students familiar with the various principles of metal cutting, cutting tool materials and its wear mechanisms during the machining operation.

Unit I	INTRODUCTION	9

Need for rational approach to the problem of cutting materials-observation made in the cutting of metals-basic mechanism of chip formation-thin and thick zone modes-types of chips-chip breaker- orthogonal Vs oblique cutting-force velocity relationship for shear plane angle in orthogonal cutting- energy consideration in machining-review of Merchant, Lee and Shafter theories-critical comparison.

Unit II	SYSTEM OF TOOL NOMENCLATURE	9

Nomenclature of single point cutting tool-System of tool nomenclature and conversion of rake angles-nomenclature of multi point tools like drills, milling-conventional Vs climb milling, mean cross sectional area of chip in milling-specific cutting pressure.

Unit III	THERMAL ASPECTS OF MACHINING	9

Heat distribution in machining-effects of various parameters on temperature-methods of temperature measurement in machining-hot machining-cutting fluids.

Unit IV	TOOL MATERIALS, TOOL LIFE AND TOOL WEAR	9

Essential requirements of tool materials-development in tool materials-ISO specification for inserts and tool holders-tool life-conventional and accelerated tool life tests-concept of mach inability index-economics of machining.

Unit V	WEAR MECHANISMS AND CHATTER IN MACHINING	9

Processing and Machining – Measuring Techniques – Reasons for failure of cutting tools and forms of wear-mechanisms of wear-chatter in machining-factors effecting chatter in machining-types of chatter-mechanism of chatter.

TOTAL: 45 HOURS

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REFERENCES:	
1.	Boothroid D.G. & Knight W.A., Fundamentals of machining and machine tools, Marcel Dekker, Newyork, 1989.
2.	Shaw.M.C.Metal cutting principles, oxford Clare don press, 1984.
3.	Bhattacharya.A., Metal Cutting Theory and practice, Central Book Publishers, India, 1984.

Department	MECHANICAL ENGINEERING					Semester			I
Course Code	Course Name	Hours / Week			Total Hours	Credit	Maximum Marks		
		L	T	P		C	CA	ES	Total
19PMEE005T	MANUFACTURING OF AUTOMOTIVE PARTS	3	0	0	45	3	50	50	100

Course Objective (s):

- To introduce the students about the requirement of materials for automobile components
- To familiarize students on typical materials used in manufacturing of automobile components
- To impart knowledge on material and manufacturing techniques of piston, valves and battery parts
- To impart knowledge on material and manufacturing techniques of engine blocks, cables and locks in automobile.
- To impart knowledge on material and manufacturing techniques of general transmission parts of automobile

Course Outcomes:

CO1 : have the knowledge about material requirements, its recycling and life cycle aspects.
CO2 : gain an insight over the latest materials adopted in automobile manufacture.
CO3 : have the knowledge of methods adopted in manufacture of piston, valves and battery parts.
CO4 : Know the methods of manufacturing engine block, cables and locks in automobile.
CO5 : have the idea of various manufacturing methods of automobile structure, transmission parts.

Unit I	MATERIAL NEEDS IN AUTOMOBILE	9

Requirements of materials in automotive tests – recycling and life cycle consideration. Current materials in use and their future. Advanced in manufacturing and joining techniques. Technical problems and solutions for use of magnesium alloys in automotive industry. Most commonly used composite moulding processes. Renewable materials, barriers and incentives in use of bio-composites - composite materials and their automotive applications

Unit II	MATERIALS AND TECHNOLOGIES FOR AUTOMOBILE	8

Introduction – steel sheets – high strength steel sheet – "Nano-Hilen" – "BHT" – high strength galvannealed steel sheets – development of inorganic type high lubrication galvannealed steel sheets – organic solid lubricant technology – uses of aluminium in automobiles – uses of plastics in automobiles.

Unit III	MANUFACTURING OF PISTON, VALVES AND BATTERY PARTS	10

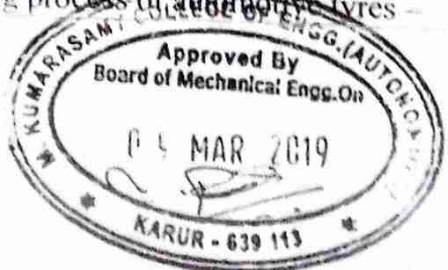
Introduction – manufacturing of auto piston – manufacturing of pins for automobiles – manufacturing of piston rings – manufacturing of lead storage battery. Manufacturing of valve and valve set – manufacturing of automobile silencer.

Unit IV	MANUFACTURING OF ENGINE BLOCK, CABLES AND LOCKS	8

Manufacturing of automobile chain – manufacturing of cylindrical block. Manufacturing of cylinder liner – manufacturing of automobile control cable – manufacturing of engine moulding pad – manufacturing of auto locks.

Unit V	MANUFACTURING OF TRANSMISSION PARTS	10

Manufacturing of automobile chassis and other technologies. Manufacturing of automobile body – Manufacturing of disc brake – Manufacturing of brake drum – Manufacturing of gear blank – Manufacturing of gear – casting method – forming method – powder metallurgy – Manufacturing of gear box housing – Manufacturing process of leaf spring – Manufacturing process of automotive tyres –



Manufacturing of auto tubes and flaps. Heat treatment of automobile components – forging technologies of automobile parts – Manufacturing of Torque Converters- painting technology of automobiles - Role of Nanotechnology in Automotive Industries.

TOTAL: 45 HOURS

REFERENCES:

1.	Ahmed Elmarkkbi, Advanced Composite Materials for Automotive Applications, Wiley publications, 2014.
2.	Brian Cartor, Patric Grant, Automotive Engineering Light Weight, Functional and Novel materials, Taylor and Francis, CRC Press, 2008.
3.	Gupta K.M, Automobile Engineering Vol.I and II, Umesh Publishers, 2000.
4.	Joao Paulo Carmo, New Advances in Vehicular Technology and Automotive Engineering, JanezaTrdine publisher, 2012.
5.	Kirpal Singh, Automobile Engineering, Vol.I and II, Standard Publishers, New Delhi, 1997.

Department	MECHANICAL ENGINEERING					Semester			II
Course Code	Course Name	Hours / Week			Total Hours	Credit	Maximum Marks		
		L	T	P		C	CA	ES	Total
19PMEE006T	FINITE ELEMENT METHODS FOR MANUFACTURING ENGINEERING	3	0	0	45	3	50	50	100

Course Objective (s):

- To study the fundamentals of one dimensional and two dimensional problems using FEA in manufacturing

Course Outcomes:

- To impart knowledge in the area of finite element methods and its application in manufacturing.

Unit I	INTRODUCTION	9

Fundamentals – Initial, boundary and eigen value problems – weighted residual, Galerkin and Rayleigh Ritz methods - Integration by parts – Basics of variational formulation – Polynomial and Nodal approximation

Unit II	ONE DIMENSIONAL ANALYSIS	9

Steps in FEM – Discretization. Interpolation, derivation of elements characteristic matrix, shape function, assembly and imposition of boundary conditions-solution and post processing – One dimensional analysis in solid mechanics and heat transfer

Unit III	SHAPE FUNCTIONS AND HIGHER ORDER FORMULATIONS	9

Shape functions for one and two dimensional elements- Three noded triangular and four nodded quadrilateral element Global and natural co-ordinates—Non linear analysis – Isoparametric elements – Jacobian matrices and transformations – Basics of two dimensional, plane stress, plane strain and axisymmetric analysis

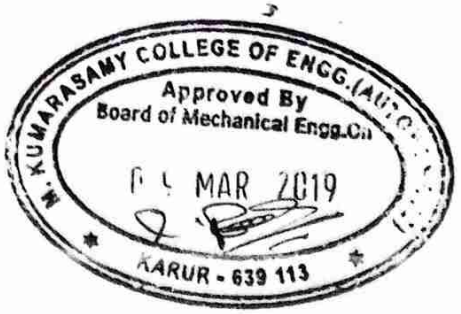
Unit IV	COMPUTER IMPLEMENTATION	9

Pre Processing, mesh generation, elements connecting, boundary conditions, input of material and processing characteristics – Solution and post processing – Overview of application packages – Development of code for one dimensional analysis and validation.

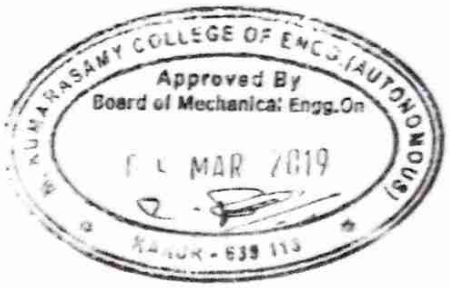
Unit V	ANALYSIS OF PRODUCTION PROCESSES	9

FE analysis of metal casting – special considerations, latent heat incorporation, gap element – Time stepping procedures – Crank – Nicholson algorithm – Prediction of grain structure – Basic concepts of plasticity and fracture – Solid and flow formulation – small incremental deformation formulation – Fracture criteria – FE analysis of metal cutting, chip separation criteria, incorporation of strain rate dependency – FE analysis of welding

TOTAL: 45 HOURS



REFERENCES:	
1.	Reddy, J.N. An Introduction to the Finite Element Method, McGraw Hill,2005.
2.	Rao, S.S., Finite Element method in engineering, Pergammon press, 2005.
3.	Seshu P., Textbook of Finite Element Analysis, PHI Learning Pvt. Ltd, Lewis R.W. Morgan, K, Thomas, H.R. and Seetharaman, K.N. The Finite Element Method in Heat Transfer Analysis, John Wiley, 1994.
4.	Bathe, K.J., Finite Element procedures in Engineering Analysis, 1990
5.	Kobayashi,S, Soo-ik-Oh and Altan,T, Metal Forming and the Finite Element Methods, Oxford



Department	MECHANICAL ENGINEERING					Semester		II
Course Code	Course Name	Hours / Week			Total Hours	Credit	Maximum Marks	
		L	T	P		C	CA	ES	Total
19PMEE007T	MATERIALS MANAGEMENT	3	0	0	45	3	50	50	100

Course Objective (s):

- To make the students familiar with the various concepts and functions of material management, so that the students will be in a position to manage the materials management department independently

Course Outcomes:

CO1 : To introduce to the students the various functions of materials management

Unit I	INTRODUCTION	9

Introduction to materials management – Objectives – Functions – Operating Cycle – Value analysis – Make or buy decisions

Unit II	MANAGEMENT OF PURCHASE	9

Purchasing policies and procedures – Selection of sources of supply – Vendor development – Vendor evaluation and rating – Methods of purchasing – Imports – Buyer – Seller relationship – Negotiations.

Unit III	MANAGEMENT OF STORES AND LOGISTICS	9

Stores function – Location – Layout – Stock taking – Materials handling – Transportation – Insurance – Codification – Inventory pricing – stores management – safety – warehousing – Distribution linear programming – Traveling Salesman problems – Network analysis – Logistics Management.

Unit IV	MATERIALS PLANNING	9

Forecasting – Materials requirements planning – Quantity – Periodic – Deterministic models – Finite production.

Unit V	INVENTORY MANAGEMENT	9

ABC analysis – Aggregate planning – Lot size under constraints – Just in Time (JIT) system

TOTAL: 45 HOURS

REFERENCES:

1. Dr.R. Kesavan, C.Elanchezian and B.Vijaya Ramnath, Production Planning and Control, Anuratha Publications, Chennai, 2008. .P, Handbook of Materials Management, Prentice Hall of India, 2005.
2. Guptha P.K. and Heera, Operations Research, Suttan Chand & Sons, 2007.
3. Lamer Lee and Donald W.Dobler, Purchasing and Material Management, Text and cases, Tata McGraw Hill, Gopalakrishnan
4. G. Reghuram, N. Rangaraj, Logistics and supply chain management – cases and concepts, Macmillan India Ltd., 2006.
5. Dr. R. Kesavan, C.Elanchezian and T.SundarSelwyn, Engineering Manufacturing, Press – 2005

Department	MECHANICAL ENGINEERING					Semester			II
Course Code	Course Name	Hours / Week			Total Hours	Credit	Maximum Marks		
		L	T	P		C	CA	ES	Total
19PMEE008T	INDUSTRIAL ERGONOMICS	3	0	0	45	3	50	50	100

Course Objective (s):

- To make the students familiarize with various concepts of Ergonomics, so that students will able to apply the concepts of ergonomics to Design of man – machine system.

Course Outcomes:

- To introduce the concepts of Ergonomics and to indicate the areas of Applications

Unit I	INTRODUCTION	9

Concepts of human factors engineering and ergonomics – Man – machine system and design philosophy – Physical work – Heat stress – manual lifting – work posture – repetitive motion.

Unit II	II ANTHROPOMETRY	9

Physical dimensions of the human body as a working machine – Motion size relationships – Static and dynamic anthropometry – Anthropometric aids – Design principles – Using anthropometric measures for industrial design – Procedure for anthropometric design.

Unit III	DESIGN OF SYSTEMS	9

Displays – Controls – Workplace – Seating – Work process – Duration and rest periods – Hand tool design – Design of visual displays – Design for shift work.

Unit IV	ENVIRONMENTAL FACTORS IN DESIGN	9

Temperature – Humidity – Noise – Illumination –Vibration – Measurement of illumination and contrast – use of photometers – Recommended illumination levels . The ageing eye – Use of indirect (reflected) lighting – cost efficiency of illumination – special purpose lighting for inspection and quality control – Measurement of sound – Noise exposure and hearing loss – Hearing protectors – analysis and reduction of noise – Effects of Noise on performance – annoyance of noise and interference with communication – sources of vibration discomfort

Unit V	WORK PHYSIOLOGY	9

Provision of energy for muscular work – Role of oxygen physical exertion – Measurement of energy expenditure Respiration – Pulse rate and blood pressure during physical work Physical work capacity and its evaluation.

TOTAL: 45 HOURS

REFERENCES:

1. 1. Martin Helander, A guide to the ergonomics of manufacturing, East West press, 2007
2. 2. E.J. McCormic & Mark S. Sangers, Human factors in engineering design, McGraw Hill 2007
3. 3. R.S. Bridger Introduction to Ergonomics, McGraw Hill, 1995.

Department	MECHANICAL ENGINEERING					Semester			II
Course Code	Course Name	Hours / Week			Total Hours	Credit	Maximum Marks		
		L	T	P		C	CA	ES	Total
19PMEE009T	POLYMERS AND COMPOSITE MATERIALS	3	0	0	45	3	50	50	100

Course Objective (s):

- To study matrix material, reinforcements of polymer matrix composites, MMC and ceramic matrix composites.
- To develop knowledge on processing, interfacial properties and application of composites

Course Outcomes:

- To impart knowledge on types, physical properties and processing of polymer matrix composites, metal matrix composites and ceramics matrix composite.

Unit I | **PROCESSING OF POLYMERS** | **9**

Chemistry and Classification of Polymers – Properties of Thermo plastics – Properties of Thermosetting Plastics - Extrusion – Injection Moulding – Blow Moulding – Compression and Transfer Moulding – Casting – Thermo Forming. General Machining properties of Plastics – Machining Parameters and their effect – Joining of Plastics – Thermal bonding – Applications.

Unit II | **FIBERS AND MATRIX MATERIALS** | **9**

Fibers – Fabrication, Structure, properties and applications – Glass fiber, Boron fiber, carbon fiber, organic fiber, ceramic and metallic fibers - whiskers–Fabrication of Matrix materials – polymers, metals and ceramics and their properties – interfaces – Wettability – Types of bonding at the interface – Tests for measuring interfacial strength - Physical and chemical properties.

Unit III | **PROCESSING OF POLYMER MATRIX COMPOSITES** | **9**

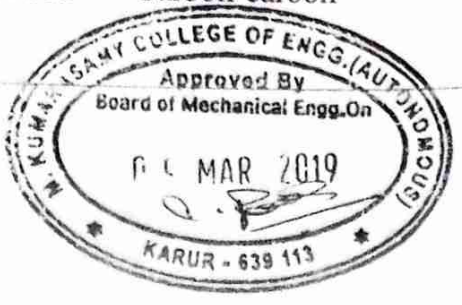
Thermoset matrix composites: hand layup, spray, filament winding, Pultrusion, resin transfer moulding, autoclave moulding - bag moulding, compression moulding with Bulk Moulding Compound and sheet Moulding Compound – thermoplastic matrix composites – film stacking, diaphragm forming, thermoplastic tape laying, injection moulding – interfaces in PMCs - structure, properties and application of PMCs –recycling of PMCs.

Unit IV | **PROCESSING OF METAL MATRIX COMPOSITES** | **9**

Metallic matrices: aluminium, titanium, magnesium, copper alloys – processing of MMCs: liquid state, Solid state, in situ fabrication techniques – diffusion bonding – powder metallurgy techniques- interfaces in MMCs – mechanical properties – machining of MMCs – Applications.

Unit V | **PROCESSING OF CERAMIC MATRIX COMPOSITES AND CARBON-CARBON COMPOSITES** | **9**

Processing of CMCs: cold pressing, sintering, reaction bonding, liquid infiltration, lanxide process – in situ chemical reaction techniques chemical vapour deposition, chemical vapour impregnation, sol-gel – interfaces in CMCs – mechanical properties and applications of CMCs – Carbon-carbon Composites – applications



REFERENCES:

1.	Krishnan K Chawla, Composite Materials: Science and Engineering, International Edition, Springer,2012, ISBN:978-0-387-74364-6.
2.	Mallick P.K., Fiber Reinforced Composites: Materials, Manufacturing and Design, CRC press, New Delhi, 2010, ISBN:0849342058.
3.	Jamal Y. Sheikh-Ahmad, Machining of Polymer Composites, Springer, USA, 2009. ISBN: 978-0- 387-35539-9.
4.	Mallick, P.K. and Newman.S., Composite Materials Technology, Hanser Publishers, 2003. Harold Belofsky, Plastics, Product Design and Process Engineering, Hanser Publishers, 2002.
5.	Seamour, E.B. Modern Plastics Technology, Prentice Hall, 2002 Said Jahanmir, Ramulu M. and Philp Koshy, Machining of Ceramics and Composites, Marcel Dekker Inc., New York, 1999, ISBN: 0-8247-0178-x. ASM Handbook – Composites, Vol-21, 2001, ISBN: 978-0-87170-703-1.

Department	MECHANICAL ENGINEERING					Semester			II
Course Code	Course Name	Hours / Week			Total Hours	Credit	Maximum Marks		
		L	T	P		C	CA	ES	Total
19PMEE010T	NON-DESTRUCTIVE EVALUATION	3	0	0	45	3	50	50	100

Course Objective (s):

- To introduce all types of NDT and their applications in Engineering.

Course Outcomes:

- To stress the importance of NDT in engineering

Unit I	NON-DESTRUCTIVE TESTING AND PRODUCTION, VISUAL INSPECTION & LIQUID PENETRANT TESTING.	9

Introduction to various non-destructive methods, Comparison of Destructive and Non destructive Tests, Visual Inspection, Optical aids used for visual inspection, Applications. Physical principles, procedure for penetrant testing, Penetrant testing materials, Penetrant testing methods-water washable, Post – Emulsification methods, Applications

Unit II	EDDY CURRENT TESTING & ACOUSTIC EMISSION	9

Principles, Instrumentation for ECT, Absolute, differential probes, Techniques – High sensitivity techniques, Multi frequency, Phased array ECT, Applications.

Principle of AET, Instrumentation, Applications - testing of metal pressure vessels, Fatigue crack detection in aerospace structures

Unit III	MAGNETIC PARTICLE TESTING & THERMOGRAPHY	9

Principle of MPT, procedure used for testing a component, Equipment used for MPT, Magnetizing techniques, Applications.

Principle of Thermography, Infrared Radiometry, Active thermography measurements, Applications – Imaging entrapped water under an epoxy coating, Detection of carbon fiber contaminants.

Unit IV	ULTRASONIC TESTING	9

Principle, Ultrasonic transducers, Ultrasonic Flaw detection Equipment, Modes of display A- scan, B-Scan, C- Scan, Applications, Inspection Methods- Normal Incident Pulse-Echo Inspection, Normal Incident Through-transmission Testing, Angle Beam Pulse-Echo testing, TOFD Technique, Applications of Normal Beam Inspection in detecting fatigue cracks, Inclusions, Slag, Porosity and Intergranular cracks - Codes, standards, specification and procedures and case studies in ultrasonics test.

Unit V	RADIOGRAPHY	9

Principle of Radiography, x-ray and gamma ray sources- safety procedures and standards, Effect of radiation on Film, Radiographic imaging, Inspection Techniques – Single wall single image, Double wall Penetration, Multiwall Penetration technique, Real Time Radiography - Codes, standards, specification and procedures and case studies in Radiography test.

Case studies on defects in cast, rolled, extruded, welded and heat treated components - Comparison and selection of various NDT techniques

TOTAL: 45 HOURS

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REFERENCES:	
1.	Baldev Raj, Jeyakumar,T., Thavasimuthu,M., -Practical Non Destructive Testingl Narosa publishing house, New Delhi, 2002
2.	Peter J. Shull -Non Destructive Evaluation: Theory, Techniques and Applicationl Marcel ekker,
3.	Inc., New York, 2002 Krautkramer. J., -Ultra Sonic Testing of Materialsl, 1st Edition, Springer – Verlag Publication, New York, 1996. www.ndt.net

Department	MECHANICAL ENGINEERING					Semester		II
Course Code	Course Name	Hours / Week			Total Hours	Credit	Maximum Marks	
		L	T	P		C	CA	ES	Total
19PMEE011T	LEAN MANUFACTURING	3	0	0	45	3	50	50	100

Course Objective (s):

- To study the various tools for lean manufacturing (LM).
- To apply the above tools to implement LM system in an organization.

Course Outcomes:

- To introduce the concepts of lean manufacturing system.

Unit I	INTRODUCTION TO LEAN MANUFACTURING	9

Conventional Manufacturing versus Lean Manufacturing – Principles of Lean Manufacturing – Basic elements of lean manufacturing – Introduction to LM Tools.

Unit II	UNIT II CELLULAR MANUFACTURING, JIT, TPM	9

Cellular Manufacturing – Types of Layout, Principles of Cell layout, Implementation. JIT – Principles of JIT and Implementation of Kanban. TPM – Pillars of TPM, Principles and implementation of TPM.

Unit III	UNIT III SET UP TIME REDUCTION, TQM, 5S, VSM	9

Set up time reduction – Definition, philosophies and reduction approaches. TQM – Principles and implementation. 5S Principles and implementation - Value stream mapping - Procedure and principles

Unit IV	UNIT IV SIX SIGMA	9

Six Sigma – Definition, statistical considerations, variability reduction, design of experiments – Six Sigma implementation

Unit V	CASE STUDIES	9

Various case studies of implementation of lean manufacturing at industries.

TOTAL: 45 HOURS

REFERENCES:

1. Design and Analysis of Lean Production Systems, Ronald G. Askin & Jeffrey B. Goldberg, John Wiley & Sons, 2003
2. Mikell P. Groover (2002) ,Automation, Production Systems and CIM.
3. Rother M. and Shook J, 1999 ,Learning to See: Value Stream Mapping to Add Value and Eliminate Mudu' , Lean Enterprise Institute, Brookline, MA.

Department	MECHANICAL ENGINEERING					Semester			II
Course Code	Course Name	Hours / Week			Total Hours	Credit	Maximum Marks		
		L	T	P		C	CA	ES	Total
19PMEE012T	QUALITY AND RELIABILITY ENGINEERING	3	0	0	45	3	50	50	100

Course Objective (s):

- To make the students to understand the various quality control techniques and to construct the various quality control charts for variables and attributes and also the design concepts for reliable system and maintenance aspects in industries.

Course Outcomes:

- To expose the students to the various quality control techniques and also to understand the importance and concept of reliability and maintainability in industries.

Unit I	QUALITY & STATISTICAL PROCESS CONTROL	9

Quality – Definition – Quality Assurance – Variation in process – Factors – process capability – control charts – variables X, R and X, - Attributes P, C and U-Chart tolerance design. Establishing and interpreting control charts – charts for variables – Quality rating – Short run SPC.

Unit II	ACCEPTANCE SAMPLING	9

Lot by lot sampling – types – probability of acceptance in single, double, multiple sampling plans – OC curves – Producer's risk and consumer's risk. AQL, LTPD, AOQL, Concepts – standard sampling plans for AQL and LTPD – use of standard sampling plans.

Unit III	EXPERIMENTAL DESIGN AND TAGUCHI METHOD	9

Fundamentals – factorial experiments – random design, Latin square design – Taguchi method – Loss function – experiments – S/N ratio and performance measure – Orthogonal array.

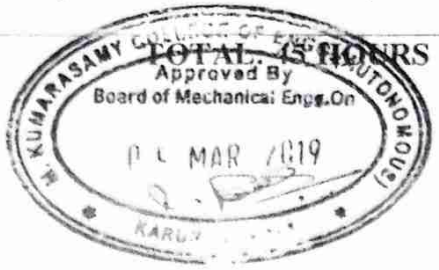
Unit IV	CONCEPT OF RELIABILITY	9

Definition – reliability vs quality, reliability function – MTBF, MTTR, availability, bathtub curve – time dependent failure models – distributions – normal, weibull, lognormal – Reliability of system and models – serial, parallel and combined configuration – Markove analysis, load sharing systems, standby systems, covarient models, static models, dynamic models.

Unit V	DESIGN FOR RELIABILITY AND MAINTAINABILITY	9

Reliability design process, system effectiveness, economic analysis and life cycle cost, reliability allocation, design methods, parts and material selection, derating, stress-strength and analysis, failure analysis, identification determination of causes, assessments of effects, computation of criticality index, corrective action, system safety – analysis of down-time – the repair time distribution, stochastic point processes system repair time, reliability under preventive maintenance state dependent system with repair. MTTR – mean system down time, repair vs replacement, replacement models, proactive, preventive, predictive maintenance maintainability and availability, optimization techniques for system reliability with redundancy heuristic methods applied to optimal system reliability.

TOTAL: 45 HOURS



REFERENCES:	
1.	Dhillon, Engineering Maintainability – How to design for reliability and easy maintenance, PHI, 2008.
2.	Amata Mitra -Fundamentals of Quality Control and improvementl Pearson Education, 2002.
3.	Patrick D To' corner, Practical Reliability Engineering, John-Wiley and Sons Inc, 2002 David J Smith, Reliability, Maintainability and Risk: Practical Methods for Engineers, Butterworth 2002.
4.	Charles E Ebling, An Introduction to Reliability and Maintability Engineering, Tata-McGraw Hill, 2000.
5.	Bester field D.H., -Quality Controll Prentice Hall, 1993.

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Department	MECHANICAL ENGINEERING					Semester			II
Course Code	Course Name	Hours / Week			Total Hours	Credit	Maximum Marks		
		L	T	P		C	CA	ES	Total
19PMEE013T	MEMS AND NANOTECHNOLOGY	3	0	0	45	3	50	50	100

Course Objective (s):

- To expose the students to the evolution of micro electromechanical systems, to the various fabrication techniques and to make students to be aware of micro actuators. Also to impart knowledge to the students about nano materials and various nano measurements techniques.

Course Outcomes:

- To inspire the students to expect to the trends in manufacturing of micro components and measuring systems to nano scale.

Unit I	OVER VIEW OF MEMS AND	9

Definition – historical development – properties, design and fabrication micro-system, microelectronics, working principle ,applications and advantages of micro system. Substrates and wafers, silicon as substrate material, mechanical properties of Si, Silicon Compounds - silicon piezo resistors, Galium arsenide, quartz, polymers for MEMS, conductive polymers.

Unit II	FABRICATION PROCESSES AND MICRO SYSTEM PACKAGING	9

Photolithography, photo resist applications, light sources, ion implantation, diffusion–Oxidation - thermal oxidation, silicon dioxide, chemical vapour deposition, sputtering - deposition by epitaxy – etching – bulk and surface machining – LIGA process – LASER, Electron beam ,Ion beam processes – Mask less lithography. Micro system packaging –packaging design– levels of micro system packaging - die level, device level and system level – interfaces in packaging – packaging technologies- Assembly of Microsystems

Unit III	MICRO DEVICES	9

Sensors – classification – signal conversion ideal characterization of sensors micro actuators, mechanical sensors – measurands - displacement sensors, pressure sensor, flow sensors, Accelerometer , chemical and bio sensor - sensitivity, reliability and response of micro-sensor - micro actuators – applications

Unit IV	SCIENCE AND SYNTHESIS OF NANO MATERIALS	9

Classification of nano structures – Effects of nano scale dimensions on various properties – structural, thermal, chemical, magnetic, optical and electronic properties fluid dynamics –Effect of nano scale dimensions on mechanical properties - vibration, bending, fracture Nanoparticles, Sol-Gel Synthesis, Inert Gas Condensation, High energy Ball Milling, Plasma Synthesis, Electro deposition and other techniques. Synthesis of Carbon nanotubes – Solid carbon source based production techniques – Gaseous carbon source based production techniques – Diamond like carbon coating. Top down and bottom up processes.

Unit V	CHARACTERIZATION OF NANO MATERIALS	9

Nano-processing systems – Nano measuring systems – characterization – analytical imaging techniques – microscopy techniques, electron microscopy,scanning electron microscopy, confocal LASER scanning microscopy - transmission electron microscopy, transmission electron microscopy, scanning tunneling microscopy, atomic force microscopy, diffraction techniques spectroscopy techniques – Raman spectroscopy, 3D surface analysis – Mechanical, Magnetic and thermal properties – Nano positioning systems.

REFERENCES:	
1.	Sami Franssila, Introduction to Micro fabrication, John Wiley & sons Ltd, 2004. ISBN:470-85106-6
2.	Norio Taniguchi, Nano Technology, Oxford University Press, New York, 2003
3.	Charles P Poole, Frank J Owens, Introduction to Nano technology, John Wiley and Sons, 2003
4.	Tai – Ran Hsu, MEMS and Microsystems Design and Manufacture, Tata-McGraw Hill, New Delhi,
5.	Mark Madou , Fundamentals of Microfabrication, CRC Press, New York, 1997.

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Department	MECHANICAL ENGINEERING					Semester			II
Course Code	Course Name	Hours / Week			Total Hours	Credit	Maximum Marks		
		L	T	P		C	CA	ES	Total
19PMEE014T	SURFACE ENGINEERING	3	0	0	45	3	50	50	100

Course Objective (s):

Course Outcomes:

C01:Understand the surface engineering and surface modification methods that will come in handy to solve the industrial problems.

C02: Examining related to various materials failure due to friction, wear and corrosion.

C03: Predicting the surface problems and select a suitable surface treatment.

C04: ntegrating case studies in various applications related to surface engineering.

C05: learn various process and techniques developed for surface treatment.

Unit I	FRICTION	9

Topography of Surfaces – Surface features – Properties and measurement – Surface interaction – Adhesive Theory of Sliding Friction – Rolling Friction – Friction properties of metallic and non-metallic materials – Friction in extreme conditions – Thermal considerations in sliding contact

Unit II	WEAR	9

Introduction – Abrasive wear, Erosive, Cavitation, Adhesion, Fatigue wear and Fretting Wear- Laws of wear – Theoretical wear models – Wear of metals and non metals - International standards in friction and wear measurements

Unit III	CORROSION	9

Introduction – Principle of corrosion – Classification of corrosion – Types of corrosion – Factors influencing corrosion – Testing of corrosion – In-service monitoring, Simulated service, Laboratory testing – Evaluation of corrosion – Prevention of Corrosion – Material selection, Alteration of environment, Design, Cathodic and Anodic Protection, Corrosion inhibitors

Unit IV	SURFACE TREATMENTS	9

Introduction – Surface properties, Superficial layer – Changing surface metallurgy – Wear resistant coatings and Surface treatments – Techniques – PVD – CVD – Physical CVD – Ion implantation – Surface welding – Thermal spraying – Laser surface hardening and alloying, Applications of coatings and surface treatments in wear and friction control – Characteristics of Wear resistant coatings – New trends in coating technology – DLC – CNC – Thick coatings – Nano-engineered coatings – Other coatings, Corrosion resistant coatings

Unit V	CASE STUDIES ON TRIBOLOGY AND CORROSION	9

Bio-fouling, Tribology and corrosion applicable in biomedical implants, Nano Tribology electronic devices, hot corrosion in power plants – corrosion in nuclear industry –Machining through controlled Wear and corrosion

TOTAL : 45 HOURS

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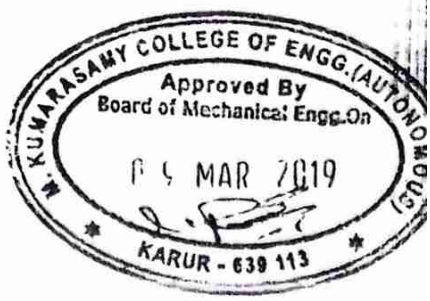
REFERENCES:

1.	Basu S K, Sengupta S N and Ahuja B.B, Fundamentals of Tribology, Prentice –Hall of India Pvt Ltd , New Delhi,1stEdition,2010.
2.	Halling J (Editor), "Principles of Tribology", Macmillian – 1991.
3.	Rabinowicz E, "Friction and Wear of materials", John Willey and Sons, UK, 2013.
4.	Stachowiak G W and Batchelor A W , "Engineering Tribology", Butterworth-Heinemann, UK, 4thedition 2014.
5.	Williams J.A, "Engineering Tribology", Oxford Univ. Press, 2005.



Department	MECHANICAL ENGINEERING					Semester			III
Course Code	Course Name	Hours / Week			Total Hours	Credit	Maximum Marks		
		L	T	P		C	CA	ES	Total
19PMEE015T	MICRO MANUFACTURING	3	0	0	45	3	50	50	100

Course Objective (s):

- The objective of the course is to acquaint the students with the principles, basic machine tools, and developments in the micro manufacturing process and research trends in the area of micro manufacturing process.

Course Outcomes:

- To impart the principles of various basic micro manufacturing process.

Unit I	MICRO MACHINING I	9

Mechanical Micro machining – Ultra Sonic Micro Machining – Abrasive Jet Micro Machining – Water Jet Micro Machining – Abrasive Water Jet Micro Machining – Micro turning – Chemical and Electro Chemical Micro Machining – Electric discharge micro machining.

Unit II	MICRO MACHINING II	9

Beam Energy based micro machining – Electron Beam Micro Machining – Laser Beam Micro Machining – Electric Discharge Micro Machining – Ion Beam Micro Machining –Plasma Beam Micro Machining – Hybrid Micro machining – Electro Discharge Grinding – Electro Chemical spark micro machining – Electrolytic in process Dressing.

Unit III	NANO POLISHING	9

Abrasive Flow finishing – Magnetic Abrasive Finishing – Magneto rheological finishing – Magneto Rheological abrasive flow finishing - Magnetic Float polishing – Elastic Emission Machining – chemo-mechanical Polishining.

Unit IV	MICRO FORMING AND WELDING	9

Micro extrusion – Micro and Nano structured surface development by Nano plastic forming and Roller Imprinting – Micro bending with LASER – LASER micro welding – Electron beam for micro welding.

Unit V	RECENT TRENDS AND APPLICATIONS	9

Metrology for micro machined components – Ductile regime machining– AE based tool wear compensation– Machining of Micro gear, micro nozzle, micro pins – Applications

TOTAL: 45 HOURS

REFERENCES:

1. Jain V. K., Micro Manufacturing Processes, CRC Press, Taylor & Francis Group, 2012
   Janocha H., Actuators – Basics and applications, Springer publishers – 2012
2. Jain V.K., Introduction to Micro machining' Narosa Publishing House, 2011
3. Bharat Bhushan, Handbook of nanotechnology, springer, Germany, 2010.
4. Bandyopadhyay. A.K., Nano Materials, New age international publishers, New Delhi, 2008, ISBN:8122422578.
5. Jain V.K., Advanced Machining Processes, Allied Publishers, Delhi, 2002
   Mcgeoug.J.A., Micromachining of Engineering Materials, CRC press 2001, ISBN: 0824706447.
   www.cmxr.com/industrial/ www.sciencemag.org.handbook

Department	MECHANICAL ENGINEERING					Semester			III
Course Code	Course Name	Hours / Week			Total Hours	Credit	Maximum Marks		
		L	T	P		C	CA	ES	Total
19PMEE016T	COMPUTER AIDED PRODUCT DESIGN	3	0	0	45	3	50	50	100

Course Objective (s):

- To model a product using CAD software.
- To apply the various design concepts and design tools and techniques while designing a product.

Course Outcomes:

- To introduce the computer aided modeling and various concepts of product design.

Unit I	INTRODUCTION	8

Introduction to Engineering Design – Various phases of systematic design – sequential engineering and concurrent engineering – Computer hardware & Peripherals – software packages for design and drafting.

Unit II	COMPUTER GRAPHICS FUNDAMENTALS AND GEOMETRIC MODEL	8

Computer graphics – applications – principals of interactive computer graphics – 2D 3D transformations – projections – curves - Geometric Modeling – types – Wire frame surface and solid modeling – Boundary Representation, constructive solid geometry – Graphics standards – assembly modeling – use of software packages

Unit III	PRODUCT DESIGN CONCEPTS AND PRODUCT DATA MANAGEMENT	10

Understanding customer needs – Product function modeling – Function trees and function structures – Product tear down methods – Bench marking – Product port folio – concept generation and selection – Product Data Management – concepts – Collaborative product design– manufacturing planning factor – Customization factor – Product life cycle management.

Unit IV	PRODUCT DESIGN TOOLS & TECHNIQUES	10

Hypothesis testing – Small samples – Tests concerning proportion, means, standard deviations – Tests based on chi square – and Redistribution - test One, two factor models-Design of experiments.

Unit V	PRODUCT DESIGN TECHNIQUES	5

FMEA – QFD – Poka Yoke - DOE – Taguchi method of DOE – Quality loss functions – Design for product life cycle.

TOTAL: 45 HOURS

REFERENCES:

1. Kevin Otto, Kristin Wood, —Product Design‖, Pearson Education, 2000
2. Biren Prasad, —Concurrent Engineering Fundamentals Vol.III, Prentice Hall, 1997.
3. James G.Bralla, —Handbook of Product Design for Manufacturing‖, McGraw Hill, 1994
4. Ibrahim Zeid, —CAD/CAM theory and Practice‖, Tata McGraw Hill, 1991.
5. David F.Rogers.J, Alan Adams, —Mathematical Elements for Computer Graphics‖, McGraw Hill, 1990

Department	MECHANICAL ENGINEERING					Semester			III
Course Code	Course Name	Hours / Week			Total Hours	Credit	Maximum Marks		
		L	T	P		C	CA	ES	Total
19PMEE017T	FINANCIAL MANAGEMENT	3	0	0	45	3	50	50	100

Course Objective (s):

- To train students in various functions of finance such as working capital management, current assets management so that students will be able to make investment decisions when they take up senior managerial positions

Course Outcomes:

- To introduce the concepts of financial and various functions of financial management so that the students will be able to handle higher level financial decisions.

Unit I	**FINANCIAL ACCOUNTING**	**8**

Accounting principles - Basic records - Preparation and interpretation of profit and loss statement -balance sheet - Fixed assets - Current assets.

Unit II	**COST ACCOUNTING**	**12**

Elements of cost - cost classification - material cost - labour costs - overheads - cost of a product - costing systems - cost determination - process - costing - Allocation of overheads - Depreciation - methods.

Unit III	**MANAGEMENT OF WORKING CAPITAL**	**10**

Current assets - Estimation of working capital requirements - Management of accounts receivable - Inventory - Cash - Inventory valuation methods.

Unit IV	**CAPITAL BUDGETING**	**8**

Significance of capital budgeting - payback period - present value method - accounting rate of return method - Internal rate of return method.

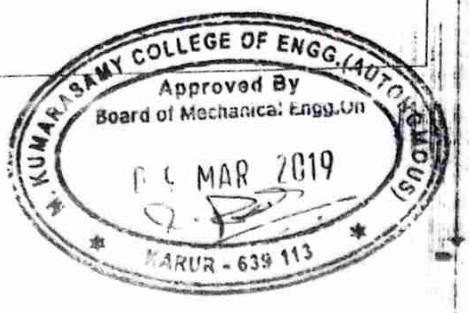
Unit V	**PROFIT PLANNING AND ANALYSIS**	**5**

Cost - Volume profit relationship Relevant costs in decision making profit management analysis - Break even analysis.

TOTAL: 45 HOURS

REFERENCES:

1. Presanna Chandra, Financial Management, Tata McGraw Hill, 2011.
2. C.James, Vanhorn, Fundamentals of Financial Management PHI 2008
3. G.B.S. Narang, Production and Costing, Khanna Publishers, 1993
4. R Kesavan, C.Elanchezian, Vijayaramnath, Process Planning and cost estimation, New Age International Publishers, New Delhi 2006



M.KUMARASAMY COLLEGE OF ENGINEERING (Autonomous) – KARUR 639113

Department	MECHANICAL ENGINEERING					Semester			III
Course Code	Course Name	Hours / Week			Total Hours	Credit	Maximum Marks		
		L	T	P		C	CA	ES	Total
19PMEE018T	MANUFACTURING MANAGEMENT	3	0	0	45	3	50	50	100

Course Objective (s):

- To train the students on various functions of manufacturing management so that the students will be able to take up these functions as they get in to senior managerial positions.

Course Outcomes:

- To introduce the concepts of manufacturing management and various manufacturing management functions to the students.

Unit I	PLANT ENGINEERING	7

Plant location – Factors affecting plant location – Techniques – Plant layout - principles - Types – Comparison of layouts – Materials handling – Principles – Factors affecting selection of Materials handling system – Types of materials handling systems – Techniques.

Unit II	WORK STUDY	8

Method study – Principles of motion economy – steps in method study – Tool and Techniques – Work measurement – Purpose – stop watch time study – Production studies – work sampling – Ergonomics – Value analysis.

Unit III	PROCESS PLANNING AND FORECASTING	9

Process planning – Aims of process planning – steps to prepare the detailed work sheets for manufacturing a given component – Break even analysis – Forecasting – Purpose of forecasting – Methods of forecasting – Time series – Regression and Correlation – Exponential smoothing.

Unit IV	SCHEDULING AND PROJECT MANAGEMENT	12

Scheduling – Priority rules for scheduling – sequencing – Johnson's algorithm for job sequencing – n job M machine problems – Project Network analysis – PERT/CPM – Critical path –Floats – Resource leveling – Queuing analysis.

Unit V	PERSONNEL AND MARKETING MANAGEMENT	9

Principles of Management – Functions of personnel management – Recruitment – Traiing – Motivation – Communication – conflicts – Industrial relations – Trade Union – Functions of marketing – Sales promotion methods – Advertising – Product packaging – Distribution channels – Market research and techniques.

TOTAL: 45 HOURS

REFERENCES:

1. Dr. R. Kesavan, G.Elanchezian and B.Vijayaramnath, Production Planning and Control, Anuratha Publications, Chennai – 2008
2. Martand T. Telsang, Production Management, S.Chand & Co., 2007
3. Dr. R. Kesavan,C. Elanchezian and T.Sundar Selwyn, Engineering Management – Eswar Press, Chennai – 2005

Department	MECHANICAL ENGINEERING					Semester		III
Course Code	Course Name	Hours / Week			Total Hours	Credit	Maximum Marks	
		L	T	P		C	CA	ES	Total
19PMEE019T	CONCEPTS OF GREEN MANUFACTURING	3	0	0	45	3	50	50	100

Course Objective (s):

- To impart knowledge about air pollution and its effects on the environment.
- To enlighten the students with knowledge about noise and its effects on the environment.
- To enlighten the students with knowledge about water pollution and its effects on the environment.
- To impart the knowledge of fire safety and its production.
- To impart the knowledge about the need, procedure and benefits of Green-Co rating.

Course Outcomes:

CO1 : Understand manufacturing processes towards minimization or prevention of air pollution.
CO2 : Understand manufacturing processes towards minimization or prevention of noise pollution.
CO3 : Understand manufacturing processes towards minimization or prevention of water pollution.
CO4 : Presenting the knowledge of fire safety and its production.
CO5 : Predicting green co-rating and its benefits.

Unit I | **AIR POLLUTION SAMPLING AND MEASUREMENT** | **9**

Primary and Secondary Pollutants, Automobile Pollutants, Industrial Pollution, Ambient air quality Standards, Metrological aspects of air Pollution, Temperature lapse Rates and Stability-wind velocity and turbulence-Pump behaviour dispersion of air Pollutants-solution to the atmosphere dispersion equation-the Gaussian Plume Model, Air pollution sampling-collection of gaseous air pollutants collection of particulate pollutants-stock sampling, analysis of air pollutants-sulphur dioxide-nitrogen dioxide, carbon monoxide, oxidants and ozone

Unit II | **NOISE POLLUTION AND CONTROL** | **9**

Frequency and Sound Levels, Units of Noise based power radio, contours of Loudness. Effect of human, Environment and properties, Natural and Anthrogenic Noise Sources, Measuring Instruments for frequency and Noise levels, Masking of sound, Types, Kinetics, Selection of different reactors used for waste treatment, Treatment of noise at source, Path and Reception, Sources of noise, Effects of noise-Occupational Health hazards, thermal Comforts, Heat Island Effects, Radiation Effects.

Unit III | **WATER DEMAND AND WATER QUALITY** | **9**

Factors affecting consumption, Variation, Contaminants in water, Nitrates, Fluorides, Detergents, taste and odour, Radio activity in water, Criteria, for different impurities in water for portable and non portable use, Point and non-point Source of pollution, Major pollutants of Water, Water Quality Requirement for different uses, Global water crisis issues.

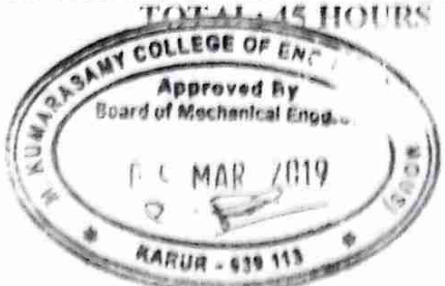
Unit IV | **FIRE SAFETY** | **9**

Basic Elements, Causes, Industrial Fires, Explosions, Effects on Environmental, Property and Human Loss, Prevention technique, Building Design, Fire Protection System, contingency plan, Emergency preparedness, Evacuation.

Unit V | **GREEN CO-RATING** | **9**

Ecological footprint, Need for Green Co-rating systems, Intent, System approach, Weightage, Assessment Process, types of ratings, Green Co-Benefits, Case studies of Green Co-Rating.

TOTAL : 45 HOURS



REFERENCES:	
1.	Dornfield David, Green Manufacturing, Springer, 2013
2.	Davim J Paulo, Green Manufacturing Processes and Systems, Springer, 2013
3	Cairncrss and Francis – Costing the earth – Harvard Business School Press – 2009
4	World Commission on Environment and Development (WCED), Our Common Future, Oxford University Press 2005.
5	Green Co Case Study Booklet, CII – Sohrabji Godrej Green Business Centre, 2015.
6	Dornfield David, Green Manufacturing, Springer, 2013

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09 MAR 2019
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Department	MECHANICAL ENGINEERING					Semester			III
Course Code	Course Name	Hours / Week			Total Hours	Credit	Maximum Marks		
		L	T	P		C	CA	ES	Total
19PMEE020T	NANOTECHNOLOGY	3	0	0	45	3	50	50	100

Course Objective (s):

- To expose the students to the evolution of Nano systems, to the various fabrication techniques.Also to impart knowledge to the students about nano materials and various nano measurements techniques.

Course Outcomes:

- To inspire the students to expect to the trends in development and synthesizing of nano systems and measuring systems to nano scale.

Unit I	OVER VIEW OF NANOTECHNOLOGY	6

Definition – historical development – properties, design and fabrication Nanosystems, , working principle ,applications and advantages of nano system. Nanomaterials – ordered oxides – Nano arrays – potential health effects

Unit II	NANODEFECTS, NANO PARTILES AND NANOLAYERS	8

Nanodefects in crystals – applications – Nuclear Track nano defects. Fabrication of nano particles – LASER ablation – sol gels – precipitation of quantum dots.Nano layers – PVD,CVD ,Epitaxy and ion implantation – formation of Silicon oxide- chemical composition – doping properties – optical properties

Unit III	NANOSTRUCTURING	8

Nanophotolithography – introduction – techniques – optical – electron beam – ion beam – X-ray and Synchrotron – nanolithography for microelectronic industry – nanopolishign of Diamond – Etching of Nano structures – Nano imprinting technology – Focused ion beams - LASER interference Lithography nanoarrays –Near-Field Optics - case studies and Trends

Unit IV	SCIENCE AND SYNTHESIS OF NANO MATERIALS	12

Classification of nano structures – Effects of nano scale dimensions on various properties – structural, thermal, chemical, magnetic, optical and electronic properties fluid dynamics –Effect of nano scale dimensions on mechanical properties - vibration, bending, fracture

Nanoparticles, Sol-Gel Synthesis, Inert Gas Condensation, High energy Ball Milling, Plasma Synthesis, Electro deposition and other techniques. Synthesis of Carbon nanotubes – Solid carbon source based production techniques – Gaseous carbon source based production techniques – Diamond like carbon coating. Top down and bottom up processes.

Unit V	CHARACTERIZATION OF NANO MATERIALS	11

Nano-processing systems – Nano measuring systems – characterization – analytical imaging techniques – microscopy techniques, electron microscopy scanning electron microscopy, confocal LASER scanning microscopy - transmission electron microscopy, transmission electron microscopy, scanning tunneling microscopy, atomic force microscopy, diffraction techniques – spectroscopy techniques – Raman spectroscopy, 3D surface analysis – Mechanical, Magnetic and thermal properties – Nano positioning systems.

TOTAL: 45 HOURS

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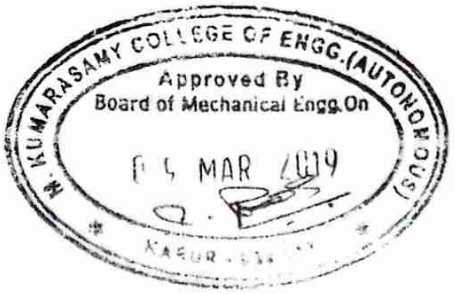
REFERENCES:	
1.	Tai – Ran Hsu, MEMS and Microsystems Design and Manufacture, Tata-McGraw Hill, New Delhi, 2002.
2.	Fahrner W.R.,Nanotechnology and Nanoelectronics, Springer (India) Private Ltd., 2011.
3	Mark Madou , Fundamentals of Microfabrication, CRC Press, New York, 1997.
4	Norio Taniguchi, Nano Technology, Oxford University Press, New York, 2003
5	Mohamed Gad-el-Hak, MEMS Handbook, CRC press, 2006, ISBN : 8493-9138-5
6	Waqar Ahmed and Mark J. Jackson, Emerging Nanotechnologies for Manufacturing, Elsevier



Department	MECHANICAL ENGINEERING					Semester			III
Course Code	Course Name	Hours / Week			Total Hours	Credit	Maximum Marks		
		L	T	P		C	CA	ES	Total
19PMEE021T	MECHATRONICS	3	0	0	43	3	50	50	100

Course Objective (s):

- This syllabus is formed to create knowledge in Mechatronics systems and impart the source of concepts and techniques, which have recently been applied in practical situation. It gives the frame work of knowledge that allows engineers and technicians to develop an interdisciplinary understanding and integrated approach to engineering.

Course Outcomes:

Unit I	**INTRODUCTION**	5

Introduction to Mechatronics-systems – Mechatronics approach to modern engineering and design – Need of Mechatronics – Emerging areas of Mechatronics – Classification of Mechatronics – Mechatronics elements.

Unit II	**SENSORS AND TRANSDUCERS**	12

Introduction – Performance Terminology – Potentiometers – Strain gauges – I VDT – Eddy current sensor – Hall effect sensor – Capacitance sensors – Digital transducers – Temperature sensors – Optical sensors – Piezo electric sensor-ultrosonic sensors – Proximity sensors – Signal processing techniques.

Unit III	**MICROPROCESSORS AND MICROCONTROLLERS**	12

Introduction – Architectures of 8 – bitmicrocontrollers (8051) series, PIC Microcontrollers (16f xxx) series – Assembly language programming instruction format, addressing modes, instruction sets, Basic program examples interface of keypads, leds, leds, A/D and D/A Converters, RS 232 serial communication interface, classification of memories.

Unit IV	**ACTUATORS**	8

Switching Devices, Classification of actuators – Electrical actuators – Solid state relays, solenoids, D.C. motors, Servo motors, Stepper motors – Interfacing with microcontroller through H-bridge Circuits – Piezoelectric actuators.

Unit V	**MECHATRONIC SYSTEMS**	9

Design process-stages of design process – Traditional and Mechatronics design concepts – Case studies – Engine management system, Automatic camera, Automatic wishing machine, Pick and place robots.

TOTAL: 45 HOURS

REFERENCES:

1.	R.K.Rajput.A Text Book of Mechatronics, Chand &Co, 2007
2.	W.Bolton, —Mechatronicsl Pearson Education Limited, 2004
3	M.A. Mazidi & J.G. Mazidi, 8051 Micrcontroller and embedded systems
4	Devadas shetty, Richard A. Kolk, —Mechatronics System Designl, PWS Publishing Company

Department	MECHANICAL ENGINEERING					Semester			III
Course Code	Course Name	Hours / Week			Total Hours	Credit	Maximum Marks		
		L	T	P		C	CA	ES	Total
19PMEE022T	MANUFACTURING TECHNIQUES	3	0	0	43	3	50	50	100

Course Objective (s):

- To familiarize the students about the concepts of inventory management.
- To introduce the students about production management techniques such as work study, plant location, layout, materials handling.
- To illustrate the students about the importance of financial management.
- To introduce profit planning and management as a concept to plan for profit.
- To familiarize the students, HR and marketing concepts and techniques.

Course Outcomes:

CO1 : design a suitable inventory system for a given situation.
CO2 : understand work study, develop plant layout and materials handling system.
CO3 : prepare financial statement such as balance sheet, income statement.
CO4 : apply concepts of break even analysis for profit planning.
C05: develop marketing and HR skills.

Unit I	FINANCIAL MANAGEMENT	9

Financial accounting – Income statement – Balance Sheet – Assets – Types – Liabilities – equity – Sources of finance- Capital budgeting – working capital management – inventory pricing.

Unit II	INVENTORY MANAGEMENT	9

Inventory – Purpose – Economic order quantity – Quantity discount model – Material Requirement Planning – Aggregate planning – ABC analysis.

Unit III	PRODUCTION MANAGEMENT9	9

Work study – Method study – steps in method study – Motion economy principles – work Measurement – stop watch time study – work sampling – plant location decision making – Plant layout – principles types – selection – plant layout, location techniques.

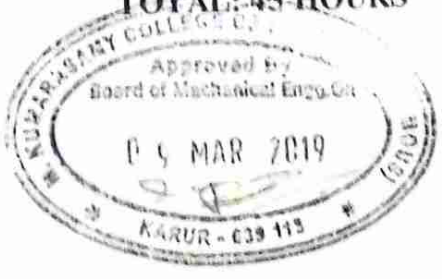
Unit IV	PROFIT MANAGEMENT	8

Breakeven analysis – profit planning – Angle of incidence – Margin of safety – Multi product break even analysis – Effect of variation in selling price, fixed cost and variable cost on break even quantity, angle of incidence and margin of safety

Unit V	HUMAN RESOURCE AND MARKETING MANAGEMENT9	9

Human resource management – Organization – Recruitment – Selection – Training and Development – Communication – Motivation – Trade Union – Industrial relations marketing – organization – difference between marketing and selling – sales promotion – distribution channels – Advertisement – publicity, packaging – market research.

TOTAL: 45 HOURS



REFERENCES:	
1.	Kesavan R, Elanchezhiyan.C, and Sundar Selwyn T, Engineering Economics and Financial Accounting – Laxmi Publications, 2005.
2.	Pannerselvam R, Production and Operations Management, PHI-2012.
3	Aswathappa – Human Resources Management – McGraw Hill (India) – 2018.
4	Chary S.N, Production and Operation Management, Tata McGraw Hill – 2012.
5	Philips Kotler, Marketing Management – Pearson Education – 2015.
6	Prasanna Chandra, Financial Management – McGraw Hill (India) – 2018.

Department	MECHANICAL ENGINEERING					Semester			III
Course Code	Course Name	Hours / Week			Total Hours	Credit	Maximum Marks		
		L	T	P		C	CA	ES	Total
19PMEE023T	PRODUCTION AND OPERATION MANAGEMENT	3	0	0	45	3	50	50	100

Course Objective (s):

- To familiarize with various forecasting models.
- To impress upon the importance of sequencing problem in industries.
- To design and develop inventory control models for a given industry.
- To familiarize with project management techniques such as CPM and PERT.
- To train on plant engineering techniques such as plant location, plant layout, materials handling and work study.

Course Outcomes:

CO1 : select an appropriate forecasting method for a given industry.
CO2 : obtain optimal solutions for sequencing problem in industry.
CO3 : design a suitable inventory system for any particular industry.
CO4 : use the project management techniques to minimize the project time.
CO5 : design plant layout and materials handling systems and can make use of the concepts of work study for work design.

Unit I	FORECASTING	9

Forecasts-Types-Purpose- opinion and judgmental method-Time series methods – moving average - weighted moving average – method of least squares – Exponential smoothing method- Regression and correlation methods – simple and multiple regression – Linear and Nonlinear regression.

Unit II	SCHEDULING AND SEQUENCING	9

Scheduling – Single Criterion rules –Sequencing –n job 2 machine problem – Johnson's algorithm – 3 machine problem – M machine problem – Graphical method for 2 jobs M machine problems –Heuristic methods.

Unit III	INVENTORY	9

Inventory – purpose of inventory – Basic EOQ Model –Quantity discount model – Reorder level – Fixed order quantity inventory system – Periodic review system – ABC analysis – Materials requirement planning – EOQ models under constraints – Purchasing management – Stores management – Just In Time inventory system – Vendor evaluation - Inventory pricing –Supply chain Management – Aggregate planning.

Unit IV	PROJECT MANAGEMENT	9

Project network analysis – Activities – Events- critical path method – Method based on time estimates – Programme Evaluation Review Technique –Optimistic, pessimistic time, most likely time - Probability of completion of projects – Time crashing of Projects –Optimum duration and cost.

Unit V	PLANT ENGINEERING AND WORK STUDY	9

Plant location – Factors affecting plant location – Break even analysis- Factors weighted rating method – Plant layout- Types- Selection – Plant layout Techniques – Travel chart method – Line balancing method– Work study – method study – Principles of Motion economy – steps in methods study - Charts – Micromotion study-memo motion study – multiple activity charts- therbligs – work measurement – stop watch time study – Production studies – PMTS – Work sampling – Materials handling – Principles – Selection.

TOTAL : 45 HOURS

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REFERENCES:	
1.	Chary S.N Production and Operations Management, Tata McGraw Hill, 3rd Edition 2012.
2.	Kanishka Bedi, Production and Operations Management, Oxford University Press,3rdEdition 2016.
3	Norma Gaither and Gregory Frazier, Operations Management, Cengage Learning, 9thEdition,2016.
4	Pannerselvam R, Production and Operations Management, Prentice Hall of India, 2ndEdition, 2008.
5	Richard B. Chase, Ravi Shankar, F. Robert Jacobs, Nicholas J. Aquilano, Operations and Supply Management, McGraw Hill,14th edition, 2017.
6	William J Stevenson, Operations Management, McGraw Hill, 11th edition, 2012.