PRIST Deemed to be University

VALLAM, THANJAVUR.

DEPARTMENT OF MECHANICAL ENGINEERING

PROGRAMME HANDBOOK

M.Tech. – Manufacturing Technology

FULL TIME PROGRAMME

Regulation 2017

(For candidates admitted to M.Tech Manufacturing Technology programme from June 2013 onwards)

COURSE STRUCTURE

Semester 1

Course Code	Title of Paper	Hours / Per Week			
		L	T	P	C
17248S11E	Advanced Engineering Mathematics	3	1	-	4
17254H12	Theory of Metal Cutting	3	1	-	4
17254H13	Advanced Manufacturing Processes	4	-	-	4
17254H14	Mechanical Metallurgy	4	-	-	4
17254H15	Automated Computer Integrated Manufacturing Systems	4	-	-	4
17254E16 (A To C)	Elective - I	4	-	-	4
17254HRS	Research Led Seminar	4	-	-	1
17254L17	CIM Lab	-	-	3	3
TOTAL NO. OF CREDITS					**28**

Semester 2

Course Code	Title of Paper	Hours / Per Week			
		L	T	P	C
17254H21	Production Management	3	1	-	4
17254H22	MEMS and Nano Technology	4	-	-	4
17254H23	Manufacturing Metrology and Quality Control	3	1	-	4
17254E24 (A to C)	Elective - II	4	-	-	4
17254E25 (A to C)	Elective - III	4	-	-	4
17254HRM	Research Methodology	4	-	-	3
17254HBR	Participation in Bounded Research	1	-	-	2
17254L26	Automation Lab	-	-	3	3
172TECWR	Technical Writing/Seminar	-	-	3	3
TOTAL NO. OF CREDITS					**31**

Semester 3

Course Code	Title of Paper	Hours / Per Week			
		L	T	P	C
17254H31	Metal Forming Process	4	-	-	4

17254E32 (A to C)	Elective - IV	4	-	-	4
17254E33 (A to B)	Elective - V	4	-	-	4
17254E34 (A to B)	Elective - VI	4	-	-	4
17254HSR	Design Project /SOCIO Technical Project (scaffolded Research)	4	-	-	4
17254P35	Project Work Phase I	-	-	6	6
TOTAL NO. OF CREDITS					**26**

Semester 4

Course Code	Title of Paper	Hours / Per Week			
		L	**T**	**P**	**C**
17254P41	Project Work Phase II	-	-	12	12
TOTAL NO. OF CREDITS					**12**

ELECTIVE -I

Course Code	Title of Paper	Hours / Per Week			
		L	**T**	**P**	**C**
17254E16A	Materials Management and Logistics	4	-	-	4
17254E16B	Tolerance Technology	4	-	-	4
17254E16C	Terotechnology	4	-	-	4

ELECTIVE -II

Course Code	Title of Paper	Hours / Per Week			
		L	**T**	**P**	**C**
17254E24A	Manufacturing of Products from Non-metallic Materials	3	1	-	4
17254E24B	Lean Manufacturing	4	-	-	4
17254E24C	Project Management	3	1	-	4

ELECTIVE -III

Course Code	Title of Paper	L	T	P	C
17254E25A	Fracture Mechanics and Mechanisms	4	-	-	4
17254E25B	Maintenance Management	4	-	-	4
17254E25C	Theory of Plasticity	3	1	-	4

ELECTIVE -IV

17254E32A	Tool Engineering and Design	4	-	-	4
17254E32B	Instrumentation and Control Engineering	4	-	-	4
17254E32C	Polymers and Composite Materials	3	1	-	4
17254E32D	Quantitative decision Making	4	-	-	4

ELECTIVE -V

Course Code	Title of Paper	Hours / Per Week			
		L	T	P	C
17254E33A	Data Analytics	4	-	-	4
17254E33B	Fluid Power Automation	4	-	-	4
17254E33C	Advanced Heat Treatment Of Metals	4	-	-	4

ELECTIVE -VI

17254E34A	Advanced Material Technology	4	-	-	4
17254E34B	Entrepreneurship Development	4	-	-	4
17254E34C	Modelling and Simulation	4	-	-	4

Total No of Credits - 97

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DEPARTMENT OF MECHANICAL ENGINEERING

M.TECH., MANUFACTURING TECHNOLOGY – FULL TIME PROGRAMME SYLLABI-REGULATIONS- 2017

I - SEMESTER

17248S11E - ADVANCED ENGINEERING MATHEMATICS 3 1 0 4

LAPLACE TRANSFORM:

Laplace transform methods for one-dimensional wave equation – Displacement in a long string – longitudinal vibration of an elastic bar – Laplace equation – properties of harmonic functions.

FOURIER TRANSFORM

Fourier transforms methods for one – dimensional heat conduction problems in infinite and semi infinite rod – Fourier transform methods for Laplace equation.

PROBABILITY OF DISTRIBUTION

Probability – definition and introduction – random variable – probability density functions – study of standard distributions: Binomial, poisson, normal exponential and weibull distributions – Applications – Baye's theorem.

TESTING OF HYPOTHESIS

Testing of Hypothesis – Parametric test – Small samples – Test related proportion, Means, Standard deviation – Test based on chi-square, Goodness of fit and test of independence.

THEORY OF ESTIMATION

Principles of least squares – Multiple and partial correlation and regression – Estimation of parameters – Method of moments.

BOOKS FOR REFERENCES:

1. Sankar Rao.K., Introduction to partial differential equations, Pnentile Hall of India, New Delhi – 1995.
2. Sneddon.I.N., Elements of partial differential equations, MC Graw Hill, 1996
3. Engineering Statistics, Bowher and LIberman
4. Gupta.S.C. & Kappor, V.K. Fundamentals of Mathematical Statistics, Sultan Chand & Sons, Reprint 1999.

17254H12 - THEORY OF METAL CUTTING 3 1 0 4

OBJECTIVE:

To know about the mechanics of chip formation, to analyse the tool failure, and thermodynamics involved in metal cutting and evaluation of tool materials.

UNIT- I: Orthogonal Cutting:

Orthogonal Cutting – Theories of merchant – Lee and Shaffer – Merchant's circle diagram – shear angle relationship – chip velocity – force – velocity relationships

UNIT-II: Chip Formation:

Mechanism of chip formation – Types of Chips – discontinuous,continuous continuous with BUE – Chip Formation in drilling and Milling – effect of cutting variables of chip reduction coefficient.

UNIT-III : Tool Life and Machinability:

Tool Failure:Mode of Plastic failure – Measurement of tool wear – tool life tests – tool life equation for variable theories – variables affecting tool life – machinability – machinability index – problems.

UNIT-IV: Thermal Analysis in Metal Cutting:

Thermodynamics of orthogonal cutting – analysis of temperature at shear plane and tool face – experimental methods for temperature measurement.

UNIT-V: Chatter:

Chatter - Importance of Chatter in machining – types of chatter – avoidance of chatter.Tools materials – requirements – alloy tools - HSS – carbides –PCD and CBN- properties and application.

BOOKS FOR REFERENCES:

1. Juneja .B.L, "Fundamentals of Metal cutting and Machine tools", New Age International, 1995.

2. Bhattacharya.A, "Metal Cutting Theory and Practice", Central book publications.

3. Kuppusamy .G, "Principle of Metal Cutting", University Press,1996.
4. Shaw .M.C, "Metal Cutting Principles",I BH Publications,1992.
5. Armarego E.J.A and Brown R.H, "The Machining of Metals", Prentice Hall,1969

17254H13

ADVANCED MANUFACTURING PROCESSES 4
0 0 4

AIM:

To expose the students in the art of manufacturing new products due to the development of new materials and processes. The students will totally get a feel of the relevant suitable process while evaluating and deciding.

OBJECTIVE:

- To inform the students about the various alternative manufacturing processes available.
- To develop an altitude to look for the unconventional manufacturing process to machine
- To make them to understand and appreciate the latest manufacturing process for micro fabrication and devices.

UNIT I NEWER MACHINING PROCESSES - I 9

(Non thermal energy) – Abrasive machining – water jet machining - ultrasonic machining – chemical machining – electro chemical machining – construction working principle – steps - types – process parameters – derivations – problems, merits, demerits and applications .

UNIT II NEWER MACHINING PROCESS – II 9

Wire cut EDM - Electro chemical machining – ECG - Electric discharge machining – construction – principle – types – control - circuits – tool design – merits, demerits & applications.

UNIT III NEWER MACHINING PROCESS – III 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 – films and film depurification – Oxidation - diffusion – ion implantation – etching – metallization – bonding – surface and bulk machining – LIGA Process – Solid free form fabrication.

UNIT V MICROFABRICATION TECHNOLOGY 9

Wafer preparation – monolithic processing – moulding – PCB board hybrid & mcm technology – programmable devices & ASIC – electronic material and processing.–
steriolithography SAW devices, Surface Mount Technology,

TOTAL: 45 PERIODS

BOOKS FOR REFERENCES:

1. Serope kelpekijian & stevan r. schmid- manufacturing process engg material – 2003
2. Micro senors Mems & smart devices- Julian W.Hardner – 2002
3. Brahem T. Smith, Advanced machining I.F.S. UK 1989.
4. Jaeger R.C., Introduction to microelectronic fabrication Addison Wesley, 1988.
5. Nario Taniguchi – Nano technology – Oxford University Press 1996.
6. Pandey P.C. & Shan HS Modern Machining Processes, Standard Publishing Co.,

17254H14 MECHANICAL METALLURGY 4 0 0 4

OBJECTIVE:

To study about the behaviour of Metals during the loading conditions related to distribution of Stress and Strain. To know about the fracture of metals and various test procedures.

UNIT-I: Tensile Study:

Study of Engineering stress-strain curve: Derivation of tensile strength , yield strength ductility, Young's modulus, resilience and toughness from stress strain curves, study of stress-strain curves for different materials-true stress-strain curve: true stress at ultimate load, true fracture strain, true uniform strain, true necking strain-necking factor-effect of strain rate, temperature- test of flow properties-Notch tensile test-tensile properties of steel-strengthening theory- strain hardening-strain aging-Yield point phenomena-Solid solution strengthening-Martensite strengthening-Grain refinement,

UNIT-II: Hardness and Toughness:

Hardness and Toughness: Hardness introduction, Hardness measurement methods-Brinell hardness, Meyer hardness, Vickers hardness, Rockwell hardness and Micro hardness- Relationship between hardness and the flow curve-Hardness at higher temperatures-Toughness –introduction, Toughness measurements: Charpy, Izod and instrumented Charpy-TTT curves: Significance, metallurgical factors affecting the curves, Drop weight test, explosion crack starter test.

UNIT-III: Fatigue:

Fatigue study: Introduction: Different stress cycles, S-N curves, Goodman diagram, Soderberg diagram, Gerbar diagram-Cyclic stress curve-Low cycle fatigue- Strain life equation-Fatique mechanism-High cycle fatigue-Effect of folloeing parameters on fatigue: Mean stress , stress concentration, specimen size, surface roughness, residual stress, micro structure and temperature. Fatique crack propagation.

UNIT-IV: Fracture Behaviour:

Fracture – Introduction –Types – Ductile and Brittle Cohesive Strength of Metals- Griffith Theory-Metallographic Examination of Fracture – Fractography – Notch Effect – Concept of Fracture curve – Fracture under combined stresses- Environment sensitive fracture: Hydrogen Embrittlement and Corrosion Cracking

UNIT-V: Creep:

Creep: Creep Curve – Stress rupture test- Structural changes during creep- Creep deformation- Deformation Mechanisms Maps – Activation Energy for Steady state creep – Fracture at higher temperatures

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BOOKS FOR REFERENCES:

1. George E. Dieter, "Mechanical Metallurgy", Mc Graw Hill, NewYork, 1988.
2. M.A. Meyers and K.Chawla, "Mechanical Metallurgy", PHI.
3. Metals Hand Book, "Mechanical Testing", Vol. 8, 9th Ed., ASM.
4. Thomas Countney.H., "Mechanical Behaviour of Materials",McGraw Hill, 2nd Ed., 2000.
5. Hertzberg R.W., "Deformation and Fracture Mechanics of Engineering Materials", 2ne Ed., John Wiley & Sons. 1983.

17254H15 AUTOMATED COMPUTER INTEGRATED MANUFACTURING SYSTEMS 4 0 0 4

AIM:

To stress the role of computers in production.

OBJECTIVE:

To teach the role of computers in processing the information knowing across the various Stages and various departments in a manufacturing concern.

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, Information's 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 feedback 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. Overviews of Automatic identification methods – Bar code technology – Other Automatic data capture technologies.

TOTAL: 45 PERIODS

BOOKS FOR REFERENCES:

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

17254L17

CIM LAB 0 0 3 3

AIM:

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

OBJECTIVES:

To teach the students about the drafting of 3D components and analyzing the same using various CAD/CAM software's.

CAM LABORATORY

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.

4. Mini project on any one of the CIM elements is to be done. This can be either a software or hardware simulating a CIM element. At the end of the semester, the students has to submit a mini report and present his work before a Committee.

CAD LABORATORY

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.

TOTAL: 30 PERIODS.

SEMESTER II

17254H21 PRODUCTION MANAGEMENT 3 1 0 4

OBJECTIVE:

To gain knowledge in operation management principles and the related quantitative approaches.

UNIT-I : Manufacturing System: 8

The concept of system - types of manufacturing system- the concept of a model - model classification - model building - decision making approaches. Forecasting: qualitative and quantitative methods - moving averages- single and multiple regression models.

UNIT-II : Aggregate Planning : 7

Methods of aggregate planning- graphical and charting methods, trial and error, transportation method- concepts of linear decision rule.

UNIT-III: Inventory Management Systems and Models 10

EOQ, model (without and with shortages)- inventory models allowing price breaks, EPQ model - single period inventory model - inventory control systems - P,Q and S-s system - selective inventory control techniques.

UNIT-IV: MRP & JIT: 10

Materials requirement planning (MRP) - master production schedule, bill of materials, MRP concepts, lot sizing - lot-for-lot technique, EOQ approach, silver-meal approach, period order quantity approach, least unit cost approach, least total cost approach. Principles of JIT production pull and push system, kanban, JIT purchasing, supply chain management.

UNIT-V: Scheduling: 10

Scheduling and assignment problems - notation and definitions - criteria, objective functions for scheduling - job shop scheduling: sequencing of n job s thorough 1 machine - priority rules, n jobs through 3, m machines - Johnsons rule, CDS algorithm, 2 jobs on m machine - graphical method- multi product assignment problem - index method, Hungarian method.

TEXT BOOKS:

1. Production Operation Management:Theory And Problems, Chary:S.N, TMH, New delhi,1990.
2. Production Operation Management, Pannerselvam.R, PHI, 1999.

REFERENCE BOOKS:

1. Operation Management Theory And Problems, Monks.J,G., McGraw HILL,1987.

2. Production operation management, chase.R.B,. Aquiliano.N.J and Jacobs.R.R.,8th Edition, TMH, 1988.

3. Production Planning And Inventory Control, Narashimhan. S.L., Mcleavy.D.W.,and Billington.P.J., 2nd Edition., PHI,1997

17254H22 **MEMS AND NANO TECHNOLOGY 4 0 0 4**

AIM:

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

OBJECTIVES:

• To expose the students to the evolution of micro electromechanical systems, to the various fabrication techniques and to make students to be award of micro actuators.

• Also to impart knowledge to the students about nano materials and various nano measurements techniques.

UNIT I OVER VIEW OF MEMS AND MICROSYSTEMS 6

Definition – historical development – fundamentals – properties, micro fluidics, design and fabrication micro-system, microelectronics, working principle and applications of micro system.

UNIT II MATERIALS, FABRICATION PROCESSES AND MICRO SYSTEM PACKAGING 10

Substrates and wafers, silicon as substrate material, mechanical properties of Si, Silicon Compounds silicon piezo resistors, Galium arsenide, quartz, polymers for MEMS, conductive polymers. Photolithography, photo resist applications, light sources, in implantation, diffusion process exudation – thermal oxidation, silicon diode, chemical vapour deposition, sputtering - deposition by epitoxy – etching – bulk and surface machining – LIGA process Micro system packaging – considerations packaging – levels of micro system packaging die level, device level and system level.

UNIT III MICRO DEVICES AND MATERIALS 8

Sensors – classification – signal conversion ideal characterization of sensors micro actuators, mechanical sensors – measurands displacement sensors, pressure and flow sensors, micro actuators – smart materials – applications.

UNIT IV SCIENCE OF NANO MATERIALS 10

Classification of nano structures – effect of the nanometer length scale effects of nano scale dimensions on various properties – structural, thermal, chemical, mechanical, magnetic, optical and electronic properties – effect of nanoscale dimensions on biological systems. Fabrication methods – Top down processes – bottom up process.

UNIT V CHARACTERIZATION OF NANO MATERIALS 11

Nano-processing systems – Nano measuring systems – characterization – analytical imaging techniques – microscopy techniques, electron microscopy scanning electron 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 PERIODS

BOOKS FOR REFERENCES:

1. Tai – Ran Hsu, MEMS and Microsystems Design and Manufacture, Tata-McGraw Hill, New Delhi, 2002.
2. Mark Madou Fundamentals of Microfabrication, CRC Press, New York, 1997.
3. Norio Taniguchi, Nano Technology, Oxford University Press, New York, 2003
4. The MEMS Hand book, Mohamed Gad-el-Hak, CRC Press, New York, London.
5. Charles P Poole, Frank J Owens, Introduction to Nano technology, John Wiley and Sons, 2003
6. Julian W. Hardner Micro Sensors, Principles and Applications, CRC Press 1993.

17254H23 MANUFACTURING METROLOGY AND QUALITY CONTROL 3 1 0 4

AIM:

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

OBJECTIVES:

To impart through knowledge in various latest measurement systems such as laser metrology, coordinate measuring machines and electro-optical devices. Also to make the students to understand quality

UNIT – I LASER METROLOGY 8

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 – calibration systems for industrial robots laser Doppler technique – laser Doppler anemometry.

UNIT – II PRECISION INSTRUMENTS BASED ON LASER 9

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 – laser gauging – bar coding – laser dimensional measurement system.

UNIT – III CO-ORDINATE MEASURING MACHINE 10

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.

UNIT – IV 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 – V QUALITY IN MANUFACTURING ENGINEERING 9

Importance of manufacturing planning for quality – concepts of controllability – need for quality management system and models – quality engineering tools and techniques – statistical process control – six sigma concepts – Poka Yoke – Computer controlled systems used in inspection.

TOTAL: 45 PERIODS

REFERENCES:

1. John A. Bosch, Giddings and Lewis Dayton, Co-ordinate Measuring Machines and Systems, Marcel Dekker, Inc, 1999.
2. Juran J.M. and Gyna F.M., Quality Planning and Analysis, Tata-McGraw Hill, New Delhi
3. Zuech, Nello Understanding and Applying Machine Vision, Marcel Dekker, Inc, 2000
4. Elanchezhian.C, Vijaya Ramnath.B and Sunder Selwyn, T., Engineering Metrology, Eswar Press, Chennai, 2004.

17254L26

AUTOMATION LAB **0 0 3 3**

AIM:

To impart knowledge in the area of hydraulic and pneumatic components and its functions.

OBJECTIVE:

• To make the students to learn the basic concepts of hydraulics and pneumatics and its applications in the area of manufacturing process.
• To simulate the various hydraulics and pneumatics circuits.

EXPERIMENTS:

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. Exercises on linear and angular measurements
7. Exercises on speed measurements
8. Exercises on Vibration measurements
9. Exercises on Motion controller using servo motors, encoders, etc.
10. Exercises on fiber optics transducers.
11. Exercises on stepper motor.
12. Exercises on microprocessor based data acquisition system.
13. Software simulation of fluid power circuits using Automation studio.

TOTAL : 30 PERIODS

172TECWR Technical Writing/Seminar: 0 0 3 3

Seminar should be based on the literature survey on any topic relevant to CAD/CAM/CAE. It may be leading to selection of a suitable topic of dissertation. The report shall contain some contribution by the candidate in the form of experimental results, deductions, compilation and inferences etc.

• Each student has to prepare a write-up of about 25 pages. The report typed on A4 sized sheets and bound in the necessary format should be submitted after approved by the guide and endorsement of the Head of Department.

• The student has to deliver a seminar talk in front of the teachers of the department and his classmates. The Guide based on the quality of work and preparation and understanding of the candidate shall do an assessment of the seminar.

Research Methodology

AIM:

To give an exposure to development of research questions and the various statistical methods suitable to address them through available literature, with basic computational operators.

OBJECTIVES:

- To understand the approaches towards and constraints in good research.
- To identify various statistical tools used in research methodology
- To appreciate and compose the manuscript for publication
- To train in basic computational and excel- skills for research in engineering.

OUTCOME:

Ability to develop research questions and the various research strategies, and compile research results in terms of journal manuscripts.

PREREQUISITES:

Research Methodology course in UG level or equivalent knowledge.

UNIT I

Introduction to Research — Criteria of Good Research, Research Problem: Definition of research problem, selecting the problem - Necessity of defining the problem - Techniques involved in defining the problem-Basic principles of experimental designs-Descriptive and experimental design – different types of experimental design – Validity of findings – internal and external validity – Variables in Research – Measurement and Scaling – Different scales. Ethics & Misconduct in research, Plagiarism,

UNIT II

Formulation of Hypothesis – Sampling techniques –Sampling error and sample size-Methods of data collection – Primary and secondary data – observation – Collection of literature, manual collection from library, usage of library, collection of literature from Scopus, Science Direct etc., compiling literature, software utilization in literature collection- Processing and analysis of data – editing – coding – transcription – tabulation –outline of statistical analysis.

UNIT III

Data Analysis using Excel- Tabulation of Data in excel (Creating Master Table and Sub Table), Formulas and Functions, Filters and Sort and Validation Lists, Data from External Sources. Data Analysis Using Charts and Graphs(Pivot Table & Charts), Time Value of Money, Measure of central tendency: mean, median, mode, Measure of dispersion: variance, standard deviation, Coefficient of variation. Correlation,

regression lines. Z-test, t- test F-test, ANOVA one way classification, Chi square test, independence of attributes. Time series: forecasting Method of least squares, Moving average method, Introduction to presentation tool, features and functions, Creating Presentation, Customizing presentation.

UNIT IV

Various research methods-Design of Experiments, Response Surface Methodology, Taguchi Methods- Modeling & Simulation of Engineering Systems, Artificial Neural Networks, Fuzzy Logic, MATLAB - Graph Theory- Finite Element Methods, Computational Fluid Dynamics -R programming in Statistics- open source software

UNIT V

Review of literature, Report writing – target audience – types of reports – contents of reports – styles and Conventions in reporting – steps in drafting a report. Basic concept of research paper writing for Journals and formats of publications in Journals, Report Structure - writing research abstract - introduction, review of literature, result, conclusions, Concepts of Bibliography and references

References:

1. C. R. Kothari, Research Methodology, New Age International Publishers. New Delhi, 2004.

2. Rajammal.P. Devadas, 1976, A hand book of methodology of research, RMM Vidyalaya Press.

3. R.A Day and A.L. Underwood, Quantitative analysis, Prentice Hall, 1999.

4. R. Gopalan, Thesis writing, Vijay Nicole Imprints Private Ltd., 2005.

5. W.J. DeCoursey, Statistics and Probability for Engineering Applications With Microsoft® Excel, Newnes, 2003.

6. Archibald Fripp, Jon Fripp, Michael Fripp; Just-in-Time Math for Engineers, Elsevier Science & Technology Books, 2003.

SEMESTER III

17254H31

METAL FORMING PROCESS 4 0 0 4

OBJECTIVE:

To study about the response of materials under plastic deformation and the various techniques for finding the stress for various metal working processes, and the recent developments in high speed forming.

UNIT-I: Stress and Strain: 8

Stress-State of stress in two dimensions – three dimensions – stress tensor-Mohr's circles – 2D and 3D state of stress – Description of strain at a point – Mohr's circle of strain- Hydrostatic and stress deviator component of stress- Plasticity- flow curve- true and true strain yield criteria for ductile loads combined stress test-plastic stress and strain relations- Levy Mises equations-Prandyl_Resus equations.

UNIT-II: Analysis of Metal Forming: 10

Work Load analysis – work formula for homogeneous deformation- rolling, rod drawing and extrusion processes -Determination of load by stress evaluation method-Determination of drawing load – strip drawing with wedge shaped dies and cylindrical rod drawing with a conical die.

UNIT-III: Stress Evaluation: 9

Stress evaluation method-Determination of forging load-plane strain forging of a thin strip and a flat circular disc- Determination of extrusion load for round band flat strip- upper bound analysis – plane strain indentation with frictionless interface

UNIT-IV: High velocity Forming: 9

Study of effect of high speed on stress strain relationships- High velocity forming equipment-Description of high speed forming machine – hot forging, pneumatic-mechanical, high velocity forging – Fuel combustion process- Electro magnetic forming –Introduction- Procedure - process variables-Applications

UNIT-V: Advanced Forming process: 9

Explosive Forming – Explosives – characteristics- stand off and contact operations- stress waves and their effects- process variables – properties of formed components- applications- Electro hydraulic forming – principles, requirements and characteristics – process variables- water hammer forming-principles and parameters- governing the process.

BOOKS FOR REFERENCES:

1. George E.Dieter, "Mechanical Metallurgy", Mc Graw Hill International Edition, New York,1988
2. Rowe G.W,Edward , "An Introduction to the Principles of Metal Working", Edward Arnold publications.
3. Davies.R and Austin.E.R, "Developments in High Metal Forming", The Machinery Publishing Co.Ltd

List of Electives - Elective I

17254E16A MATERIALS MANAGEMENT AND LOGISTICS 4 0 0 4

AIM:

To introduce to the students the various functions of materials management and logistics

OBJECTIVE:

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.

UNIT I INTRODUCTION 6

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

UNIT II MANAGEMENT OF PURCHASE 7

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 12

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 10

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

UNIT V INVENTORY MANAGEMENT 10

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

TOTAL: 45

BOOKS FOR REFERENCES:

1. Lamer Lee and Donald W.Dobler, Purchasing and Material Management, Text and cases, Tata McGraw Hill, 1996.
2. Gopalakrishnan.P, Handbook of Materials Management, Prentice Hall of India, 1996.
3. Guptha P.K. and Manmohan, Problems in Operations Research, Suttan Chand & Sons, 2003.

4. Dr.R. Kesavan, C.Elanchezian and B.Vijaya Ramnath, Production Planning and Control, Anuratha Publications, Chennai, 2008.
5. G. Reghuram, N. Rangaraj, Logistics and supply chain management – cases and concepts, Macmillan India Ltd., 2006.

17254E16B TOLERANCE TECHNOLOGY

(Use of approved design data book is permitted in the examination)

UNIT I

Limits, fits and tolerance - hole basis and shaft basis system, quality engineering based product development process.

UNIT II

Interpretation, inspection and application of form tolerances - datum system and targets – tolerance of position.

UNIT III

Fundamentals of descriptive statistics and inferential statistics - use of distributions - Taguchi approach - tolerance analysis.

UNIT IV

Tolerance stack analysis and allocation - linear and non-linear stack analysis - worst case tolerance analysis - computer aided tolerance technique – cost based optimal tolerance analysis - tolerance allocation methods

UNIT V

Tolerance charting - blue print dimensions - machining allowances - datum features - functional and manufacturing datum - exercises.

REFERENCES

1. ASME "study manual on tolerance stacks", Vol I, Second edition 1994.

2. ASME self study workbook on GD & T second edition 1994.

3. Spotts,, "Dimensioning and tolerancing of mass production", Prentice Hall, 1983

17254E16C **TEROTECHNOLOGY**

UNIT I

Probability concepts – Probability distributions – density and distribution functions for uniform, exponential, razeligh, weibull, normal distribution

UNIT II

Non-maintained systems – Reliability definition and its important

UNIT III

Method of improving reliability redundancy techniques

UNIT IV

failure data analysis – Reliability models –

UNIT V

Maintenances systems and economics of reliability - Maintenance and spares management - preventive replacement - Condition monitoring & analysis.

REFERENCES

1. Srinath L S,, "Reliability Engineering", East West Press Pvt Ltd, 1991.

2. Collact, "Mechanical Fault Diagnosis and Condition Monitoring", 1997.

3. Balagurusamy, "Reliability Engineering", Tata Mc Graw Hill,1984.

List of Electives - Elective II

17254E24A MANUFACTURING OF PRODUCTS FROM NON METALIC MATERIALS

UNIT I

Polymers - molding of thermoplastics - plastic sheet forming process - machining of thermoplastics - Thermosetting plastics - properties, molding processes and machining - other processing methods for plastics - plastic component design.

UNIT II

Rubber: Manufacturing process - Manufacturing techniques, materials design, sizing, components, building, moulding and vulcanising of tyres - Belting – manufacture and types of hose.

UNIT III

Types, processing and manufacturing techniques of Glass vessels.

UNIT IV

Ceramic materials - Processing of ceramic products.

UNIT V

Composite matearials, Fiber, particulate, whisker reinforced ceramics, properties of reinforcements and matrix. Manufacturing Techniques and applications of different Composites namely PMC, MMC and CMC.

REFERENCES

1. Blow C M,, "Rubber Technology and Manufacturing", Newman Butterworths, 1977.
2. Hasle Hurst, "Manufacturing Technology", ELBS, 1973.
3. Vanviack L.H, "Physical Ceramics for Engineers", Addision Wesley Publicxation, 1964.

17254E24B LEAN MANUFACTURING 4 0 0 4

AIM:

To introduce the concepts of lean manufacturing system.

OBJECTIVES:

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

UNIT – I INTRODUCTION TO LEAN MANUFACTURING 7

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

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 SET UP TIME REDUCTION, TQM, 5S, VSM 10

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 SIX SIGMA 9

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

UNIT – V CASE STUDIES 10

Various case studies of implementation of lean manufacturing at industries.

TOTAL: 45 PERIODS

BOOKS FOR REFERENCES:

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

17254E24C PROJECT MANAGEMENT

UNIT-I

Introduction: Introduction to Project Management, History of Project Management, Project Life Cycle.
Project Analysis: Facets of Project Analysis, Strategy and Resource Allocation, Market and Demand Analysis, Technical Analysis, Economic and Ecological Analysis.

UNIT-II

Financial Analysis: Financial Estimates and Projections, Investment Criteria, Financing of Projects

UNIT-III

Network Methods in PM: Origin of Network Techniques, AON and AOA differentiation, CPM network, PERT network, other network models.

UNIT-IV

Optimization in PM: Time and Cost trade-off in CPM, Crashing procedure, Scheduling when resources are limited.

UNIT-V

Project Risk Management: Scope Management, Work Breakdown Structure, Earned Value Management, Project Risk Management.

Text Books:

1. Project: A Planning Analysis, Prasanna Chandra, Tata McGraw Hill Book Company, New Delhi, 4th Edition,2009.

2. Project Management, Cleland, Gray and Laudon, Tata McGraw Hill Book Company, New Delhi, 3rd Edition, 2007.

3. Larson Project Management , Clifford F. Gray, Gautam V. Desai, Erik W., Tata McGraw-Hill Education, 2010

List of Electives - Elective III

17254E25A FRACTURE MECHANICS AND MECHANISMS

UNIT-I

Introduction sources of micro and macro cracks fracture criterion based on stress concentration and theoretical strength Griffith's energy - various approach - Stress Analysis for Members with Cracks.

UNIT-II

Crack tip Plastic Zone: Plastic zone estimation - yielding fracture mechanics.

UNIT-III

Elastic–Plastic Fracture Mechanics - Path-independent integrals, J-integral , J-integral fracture criterion, crack opening displacement(COD), experimental determination of Jintegral and COD - Fatigue and Fatigue crack growth rate.

UNIT -IV

Linear static fracture Mechanics Design Concepts - Introduction, the stress criterion, strain energy density, 2-D linear elastic crack problems.

UNIT-V

Dynamic Fracture: Mohr's model, strain energy release rates, crack branching, practical applications of crack arresting techniques. Experimental determination of dynamic SIF. - NDT and Fracture Mechanics

REFERENCES

1. S.A. Maguid,, "Engineering Fracture Mechanics", Elsevier, 1996

2. David Broke., "Elementary Engineering Fracture Mechanics", Noordhoff, 1995.

*3. Karen Hellan, "Introduction to Fracture Mechanics", Mc Graw Hill, 1982.*6. MILAN SONKA, VACLAV HLAVAC and ROGER BOYLE, "Image Processing, Analysis, and Machine Vision", Cengage-Engineering; 3 edition (March 19, 2007).

17254E25B MAINTENANCE MANAGEMENT 4 0 0 4

OBJECTIVE:

To understand the concepts of maintenance management and to have knowledge in developing a suitable maintenance system for any type of an organization.

UNIT I: Introduction to Maintenance Management: 7

Maintenance: Its role and scope in total Organizational contexts - role of Maintenance. Centralized and decentralized maintenance organization structures. Maintenance Economics – reliability and Availability – MTBF, MTTR.

UNIT II: Maintenance Categories: 10

Maintenance system– Categories - Design and its selection – Breakdown Maintenance –Routine Maintenance- Predictive Maintenance –Preventive Maintenance- Corrective Maintenance-Total Productive Maintenance –Maintenance Schedule – Repair Cycle.

UNIT III: Spare Parts Management: 8

Pareto's principles for repetitive breakdown analysis, spares management, planning considerations for each type of activities.

UNIT – IV: Condition Monitoring: 10

Condition Monitoring (CM) – Introduction- Economics of CM – On-load and off-load testing – Methods and instruments for CM – Temperature sensitive tapes – Pistol thermometers – wear-debris analysis.

UNIT V: Maintenance Manpower Cost, Performance Management: 10

Maintenance man power planning - Selection training - Scheduling maintenance costs - Budget preparation and budgetary control of maintenance expenditures Maintenance effectiveness various performance indices - evaluation, uses and limitations - Monitoring of Maintenance performance.

TEXT BOOKS FOR REFERENCES:

1. Gopalakrishnan P. and Sundarajan 1996. Maintenance Management. New Delhi, Prentice-Hall of India.
2. Srivastava S.K., "Industrial Maintenance Management", - S. Chand & Co.,1981.
3. Higgirs L.T and Morrow L.C., 1997, ``Maintenance Engineering Handbook``, McGraw Hill.
Armstrong, "Condition Monitoring", BSIRSA, 1988.

17254E25C THEORY OF PLASTICITY

UNIT-I

Iinvariance in terms of the deviatoric stresses, representative stress - Engineering and natural strains, cubical dilation, finite strains co-efficients, Octahedral strain, strain rate and the strain rate tensor.

UNIT-II

Yield criteria for ductile metal - Yield criteria for an anisotropic material. Stress – Strain Relations – Plastic stress-strain relations, Prandtl Roeuss Saint Venant, Levy – Von Mises, Yield locus, symmetry convexity, normality rule.

UNIT-III

Application to problems, simple forms of indentation problems using upper bounds. Problems of metal forming.

UNIT-IV

Crystal Plasticity, the crystalline state, crystallographic indices, the preferential planes and directions, critical shear stress, theory of simultaneous slip, slip bands, the plastic bending in crystals, dislocations and crystal growth, polycrystals and grain boundaries,

UNIT-V

Plane plastic strain and the theory of the slip line filed, two dimensional problems of steady and non steady motion, plastic anisotropy.

REFERENCES

1. Narayanasamy R, "Theory of Engineering Plasticity", Ahuja Publications, 2000.
2. Johnson and Mellor, "Plasticity for Mechanical Engineers", Ban Nostrand, 1973.
3. R.Hill , "The Mathematic theory of Plasticity", Oxford Publication, 1982.

List of Electives - Elective IV

17254E32A TOOL ENGINEERING AND DESIGN

UNIT-I

Introduction to manufacturing processes – objectives, organization and role of tool engineering – role of materials in tooling.

UNIT-II

Tooling for material removal process like traditional machining processes, nontraditional machining processes automats and NC and CNC machines.

UNIT-III

Tooling for forming processes.

UNIT-IV

Tooling for casting and metal joining processes – molding and pattern design mechanization of foundries Design of welding fixtures – tooling for mechanical joining processes.

UNIT-V

Tooling for inspection and gauging – design and manufacturing of gauges – CMM – CAD in tool design.

REFERENCES

1. Hoffman E.G, "Fundamentals of tool design", SME, 1984.
2. Kalpakjian S., "Manufacturing Engineering and Technology", Addision Wesley, 1995.
3. HMT "Production Technology", Tata McGraw Hll, 1991.

17254E32B INSTRUMENTATION AND CONTROL ENGINEERING 4 0 0 4

UNIT–I: Introduction to Instrumentation: 8

Mechanical Instrumentation- General concepts, General measurement system. Classification of Instruments - indicators, recorders and integrators- working principles, Precision and Accuracy: Measurement Error and calibration.

UNIT–II: Measuring Devices 10

Measurement of speed, frequency, acceleration - Vibrometer, Accelerometer etc. Pressure measurement: Gravitational, Bourdon, elastic transducers, strain gauge, pressure cells, and measurement of high and low pressure. Temperature measurement: Bi-Metallic, Resistance Thermometer, Thermocouples, Pyrometer, thermostats, Magnetic flow meter , Ultrasonic flow meter.

UNIT – III: Transducers: 8

Transducers – Introduction – Types -Variable resistance Transducers-Variable reactive transducers- Piezo Electric transducers- Fibre optic transducers- Laser instrumentation-analogue and digital type -incremental and absolute measurement.

UNIT – IV: Machine Diagnostic and Condition Monitoring: 10

Machine Diagnostics – Basic Concepts - Analysis of failure in machines-Distribution of fault occurrences-Objectives of monitoring-Monitoring techniques applied to Machineries.

UNIT – V: Computer Control System: 9

Data acquisition system-Introduction-Direct Digital control-Programmable Logic Controls (PLC) -Ladder diagrams-Communication used in PLC.

BOOKS FOR REFERENCES:

1. Thomas Beckwith, Lewis Buck N.Ray, D. Maragoni, “Mechabical Measurements”, Narosia Publishing House, NewDelhi.
2. M.P.Groover - " Automation, Production Systems and computer Intergrated Manufacturing ", Prentice Hall.
3. A.K. Sawhney, “Elecrical and Electronics Measurements & Instrumentation”, Dhanpat Rai & Sons, 1993
4. C.S.Rangan,V.S.V.Mani and G.R.Sarma - " Instrumentation Devices and systems", Tata McGraw Hill,1983

17254E32C POLYMERS AND COMPOSITE MATERIALS 4004

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.

TOTAL HOURS: 45

OUTCOMES:

At the end of this course the students are expected

- 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.

REFERENCES:

1. ASM Handbook – Composites, Vol-21, 2001, ISBN: 978-0-87170-703-1.
2. Harold Belofsky, Plastics, Product Design and Process Engineering, Hanser Publishers, 2002.
3. Jamal Y. Sheikh-Ahmad, Machining of Polymer Composites, Springer, USA, 2009. ISBN: 978-0-387-35539-9.
4. Krishnan K Chawla, Composite Materials: Science and Engineering, International Edition, Springer, 2012, ISBN:978-0-387-74364-6.
5. Mallick P.K., Fiber Reinforced Composites: Materials, Manufacturing and Design, CRC press, New Delhi, 2010, ISBN:0849342058.
6. Mallick, P.K. and Newman.S., Composite Materials Technology, Hanser Publishers, 2003.

List of Electives - Elective V

17254E33A DATA ANALYTICS

UNIT I INTRODUCTION TO BIG DATA 8

Introduction to Big Data Platform – Challenges of conventional systems - Web data – Evolution of Analytic scalability, analytic processes and tools, Analysis vs reporting – Modern data analytic tools, Stastical concepts: Sampling distributions, resampling, statistical inference, prediction error.

UNIT II DATA ANALYSIS 12

Regression modeling, Multivariate analysis, Bayesian modeling, inference and Bayesian networks, Support vector and kernel methods, Analysis of time series: linear systems analysis, nonlinear dynamics – Rule induction – Neural networks: learning and generalization, competitive learning, principal component analysis and neural networks; Fuzzy logic: extracting fuzzy models from data, fuzzy decision trees, Stochastic search methods.

UNIT III MINING DATA STREAMS 8

Introduction to Streams Concepts – Stream data model and architecture – Stream Computing, Sampling data in a stream – Filtering streams – Counting distinct elements in a stream – Estimating moments – Counting oneness in a window – Decaying window – Realtime Analytics Platform(RTAP) applications - case studies – real time sentiment analysis, stock market predictions.

UNIT IV FREQUENT ITEMSETS AND CLUSTERING 9

Mining Frequent itemsets – Market based model – Apriori Algorithm – Handling large data sets in Main memory – Limited Pass algorithm – Counting frequent itemsets in a stream – Clustering Techniques – Hierarchical – K- Means – Clustering high dimensional data – CLIQUE and PROCLUS – Frequent pattern based clustering methods – Clustering in non-euclidean space – Clustering for streams and Parallelism.

UNIT V FRAMEWORKS AND VISUALIZATION 8

MapReduce – Hadoop, Hive, MapR – Sharding – NoSQL Databases – S3 – Hadoop Distributed file systems – Visualizations – Visual data analysis techniques, interaction techniques; Systems and applications:

TOTAL : 45 PERIODS

OUTCOMES:

At the end of this course the students are expected to

- Apply the statistical analysis methods.
- Compare and contrast various soft computing frameworks.
- Design distributed file systems.
- Apply Stream data model.
- Use Visualisation techniques

REFERENCES:

1. Anand Rajaraman and Jeffrey David Ullman, Mining of Massive Datasets, Cambridge
Big Data Glossary, O‟Reilly, 2011.

2. Bill Franks, Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with advanced analystics, John Wiley & sons, 2012.
3. Glenn J. Myatt, Making Sense of Data, John Wiley & Sons, 2007 Pete Warden,
4. Jiawei Han, Micheline Kamber "Data Mining Concepts and Techniques", Second Edition, Elsevier, Reprinted 2008.
5. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, 2007.
University Press, 2012.

17254E33B FLUID POWER AUTOMATION

AIM:

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

OBJECTIVE:

• 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 ladder diagram.

UNIT I INTRODUCTION 5

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

UNIT II FLUID POWER GENERATING/UTILIZING ELEMENTS 8

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 8

Direction flow and pressure control valves-Methods of actuation, types, sizing of ports pressure and temperature compensation, overlapped and under lapped 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 7

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 PERIODS

BOOKS FOR REFERENCES:

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

List of Electives - Elective VI

17254E34A ADVANCED MATERIAL TECHNOLOGY 4 0 0 4

AIM:

To impart knowledge on advance concepts of material technology

OBJECTIVE:

- To enlight the PG students on elastic, plastic and fractured behaviour of engineering Materials.
- To train the PG students in selection of metallic and non-metallic materials for the various engineering applications.

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, Al2O3, SiC, Si3N4 CBN and diamond – properties, processing and applications.

TOTAL: 45 PERIODS

BOOKS FOR REFERENCES:

1. George E.Dieter, Mechanical Metallurgy, McGraw Hill, 1988.
2. Thomas H. Courtney, Mechanical Behaviour of Materials, (2nd edition), McGraw Hill, 2000.
3. Flinn, R.A., and Trojan, P.K., Engineering Materials and their Applications, (4^{th} Edition) Jaico, 1999.

4. ASM Hand book, Vol.11, Failure Analysis and Prevention, (10th Edition), ASM, 2002.
5. Ashby M.F., Material Selection in Mechanical Design, 3rd Edition, Butter Worth 2005.

17254E34B ENTREPRENEURSHIP DEVELOPMENT

UNIT I ENTREPRENEURSHIP 9

Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur – Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurical Growth.

UNIT II MOTIVATION 9

Major Motives Influencing an Entrepreneur – Achievement Motivation Training, self Rating, Business Game, Thematic Apperception Test – Stress management, Entrepreneurship Development Programs – Need, Objectives.

UNIT III BUSINESS 9

Small Enterprises – Definition, Classification – Characteristics, Ownership Structures – Project Formulation – Steps involved in setting up a Business – identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project Appraisal – Sources of Information – Classification of Needs and Agencies.

UNIT IV FINANCING AND ACCOUNTING 9

Need – Sources of Finance, Term Loans, Capital Structure, Financial Institution, management of working Capital, Costing, Break Even Analysis, Network Analysis Techniques of PERT/CPM – Taxation – Income Tax, Excise Duty – Sales Tax.

UNIT V SUPPORT TO ENTREPRENEURS 9

Sickness in small Business – Concept, Magnitude, causes and consequences, Corrective Measures – Government Policy for Small Scale Enterprises – Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger and Sub Contracting.

TOTAL HOURS: 45

TEXT BOOKS:

1. S.S.Khanka "Entrepreneurial Development" S.Chand & Co. Ltd. Ram Nagar New Delhi, 1999.
2. Kuratko & Hodgetts, "Enterprenuership – Theory, process and practices", Thomson learning 6th edition.

REFERENCES:

1. Hisrich R D and Peters M P, "Entrepreneurship" 5th Edition Tata McGraw-Hill, 2002.
2. Mathew J Manimala," Enterprenuership theory at cross roads: paradigms and praxis" Dream tech 2nd edition 2006.
3. Rabindra N. Kanungo "Entrepreneurship and innovation", Sage Publications, New Delhi, 1998.
1. EDII " Faulty and External Experts – A Hand Book for New Entrepreneurs

Research Integrated Curriculum

The relationship between teacher and learner is completely different in higher education from what it is in school. At the higher level, the teacher is not there for the sake of the student, both have their justification in the service of scholarship. For the students who are the professionals of the future, developing the ability to investigate problems, make judgments on the basis of sound evidences, take decisions on a rational basis and understand what they are doing and why is vital. Research and inquiry is not just for those who choose to pursue an academic career. It is central to professional life in the twenty-first century.

It is observed that the modern world is characterized by heightened levels of complexity and uncertainty. Fluidity, fuzziness, instability, fragility, unpredictability, indeterminacy, turbulence, changeability, contestability: these are some of the terms that mark out the world of the twenty-first century. Teaching and research is correlated when they are co-related. Growing out of the research on teaching- research relations, the following framework has been developed and widely adopted to help individual staff, course teams and whole institutions analyse their curricula and consider ways of strengthening students understanding of and through research. Curricula can be:

Research – Led: Learning about current research in the discipline

Here the curriculum focus is to ensure that what students learn clearly reflects current and ongoing research in their discipline. This may include research done by staff teaching them.

Research – Oriented: Developing research skills and techniques

Here the focus is on developing student's knowledge of and ability to carry out the research methodologies and methods appropriate to their discipline(s)

Research – Based: Undertaking research and inquiry

Here the curriculum focus is on ensuring that as much as possible the student learns in research and or inquiry mode (i.e. the students become producers of knowledge not just consumers). The strongest curricula form of this is in those special undergraduate programmes for selected students, but such research and inquiry may also be mainstreamed for all or many students.

Research- Tutored: engaging in research discussions

Here the focus is on students and staff critically discussing ongoing research in the discipline.

All four ways of engaging students with research and inquiry are valid and valuable and curricula can and should contain elements of them.

Moreover, the student participation in research may be classified as,

Level 1: Prescribed Research
Level 2: Bounded Research
Level 3: Scaffolded Research
Level 4: Self actuated Research
Level 5: Open Research

Taking into consideration the above mentioned facts in respect of integrating research into the M.Tech - Manufacturing Technology curriculum, the following Research Skill Based Courses are introduced in the curriculum.

Semester	RSB Courses	Credits
I	Research Led Seminar	1
II	Research Methodology	3
II	Participation in Bounded Research	2
III	Design Project/ Socio Technical Project (Scaffolded Research)	4
IV	Project Work	12