KANNUR UNIVERSITY

Faculty of Engineering

Curriculum, Scheme of Examinations and Syllabi for M.Tech Degree Programme with effect from Academic Year 2011-2012

MECHANICAL ENGINEERING

M Tech in

ADVANCED MANUFACTURING AND MECHANICAL SYSTEMS DESIGN

FIRST SEMESTER

Code	Subject	Hours/Week			Sessional Marks	University Examination		Credi
		L	T	P		Hrs	Marks	
AMD101	Computational Techniques	3	-	-	50	3	100	3
AMD102	Mechanics of Machining	3	-	-	50	3	100	3
AMD103	Production Automation & CNC Technology	3	-	-	50	3	100	3
AMD104	Discrete Event System Simulation	3	-	-	50	3	100	3
AMD105	Elective I	3	-	-	50	3	100	3
AMD106	Elective II	3	-	-	50	3	100	3
AMD107(P)	Engineering Software Lab	-	-	2	50	3	100	2
AMD108(P)	Seminar	-	-	2	50	-	-	2
TOTAL		**18**		**4**	**400**		**700**	**22**

ELECTIVE I

AMD 105 (A) Vibration Analysis and Control
AMD 105 (B) Robotics and Control
AMD 105 (C) Mechanics of Composites
AMD 105 (D) Rapid Prototyping
AMD 105 (E) Advanced Mechanics of Solids

ELECTIVE II

AMD 106 (A) Experimental Stress Analysis
AMD 106 (B) Project Engineering & Management
AMD 106 (C) Material Selection in Mechanical Design
AMD 106 (D) Flexible Manufacturing Systems
AMD 106 (E) Management Information Systems

Sessional marks for all the Theory based Subjects

The marks allotted for internal continuous assessment and end-semester university examinations shall be 50 marks and 100 marks respectively with a maximum of 150 marks for each theory subject.

The weightage to award internal assessment marks should be as follows:

Test papers (two tests) : 25 marks

Assignments and/or class performance : 25 marks

SECOND SEMESTER

Code	Subject	Hours/Week			Sessional Marks	University Examination		Credit
		L	T	P		Hrs	Marks	
AMD201	Micro Machining and Nano Machining	3	-	-	50	3	100	3
AMD202	Intelligent Manufacturing	3	-	-	50	3	100	3
AMD203	Design and Analysis of Mechanical systems	3	-	-	50	3	100	3
AMD204	Elective III	3	-	-	50	3	100	3
AMD205	Elective IV	3	-	-	50	3	100	3
AMD206	Elective V	3	-	-	50	3	100	3
AMD207(P)	Advanced Manufacturing Lab	-	-	2	50	3	100	2
AMD208(P)	Term Paper	-	-	2	50	3	100	2
TOTAL		**18**		**4**	**400**		**800**	**22**

ELECTIVE III
AMD 204 (A) Design of Experiments
AMD 204 (B) Quality and Reliability Engineering
AMD 204 (C) Fracture Mechanics and Fatigue
AMD 204 (D) Industrial Tribology
AMD 204 (E) Theory of Plasticity

ELECTIVE IV
AMD 205 (A) Concurrent Engineering and Product Life cycle Management
AMD 205 (B) Finite Element Methods
AMD 205 (C) Terotechnology
AMD 205 (D) Energy Conservation
AMD 205 (E) Manufacturing System Analysis

ELECTIVE V
AMD 206 (A) Artificial Neural Networks and Fuzzy Systems
AMD 206 (B) Metrology and Computer Aided Inspection
AMD 206 (C) Energy Management
AMD 206 (D) Mechatronics
AMD 206 (E) Machine Tool Design

THIRD SEMESTER

Code	Subject	Hrs / Week			Marks					Credits
		L	T	P	Internal		University		Total	
					Guide	Evaluation Committee	Thesis	Viva		
AMD 301(P)	Thesis Preliminary			22	200	200	--	--	400	8
	Total			**22**	**200**	**200**			**400**	**8**

THESIS PRELIMINARY

This shall comprise of two seminars and submission of an interim thesis report. This report shall be evaluated by the evaluation committee. The fourth semester Thesis- Final shall be an extension of this work in the same area. The first seminar would highlight the topic, objectives, methodology and expected results. The first seminar shall be conducted in the first half of this semester. The second seminar is presentation of the interim thesis report of the work completed and scope of the work which is to be accomplished in the fourth semester.

FOURTH SEMESTER

Code	Subject	Hrs / Week			Marks					Credits
		L	T	P	Internal		University		Total	
					Guide	Evaluation Committee	Thesis	Viva		
AMD 401 (P)	Thesis			22	200	200	100	100	600	12
	Total			**22**	**200**	**200**	**100**	**100**	**600**	**12**

Towards the middle of the semester there shall be a pre submission seminar to assess the quality and quantum of the work by the evaluation committee. This shall consist of a brief presentation of Third semester interim thesis report and the work done during the fourth semester. The comments of the examiners should be incorporated in the work and at least one technical paper is to be prepared for possible publication in journals / conferences. The final evaluation of the thesis shall be an external evaluation.

AMD 101 – COMPUTATIONAL TECHNIQUES

3 hours lecture per week

Concepts of optimization: Engineering applications-Statement of optimization problem-Classification - type and size of the problem. Linear programming: Standard form-Geometry of LP problems-Theorem of LP-Relation to convexity - formulation of LP problems - simplex method and algorithm -Matrix form- two phase method. Duality- dual simplex method- LU Decomposition. Sensitivity analysis .Artificial variables and complementary solutions-QP.

Nonlinear programming: Non linearity concepts-convex and concave functions- non-linear programming - gradient and Hessian. Unconstrained optimization: First & Second order necessary conditions-Minimisation & Maximisation Local & Global convergence-Speed of convergence. Basic decent methods: Fibonacci & Golden section search - Gradient methods - Newton Method-Lagrange multiplier method - Kuhn-tucker conditions . Quasi-Newton method- separable convex programming - Frank and Wolfe method.

Dynamic programming: Multistage decision process- Concept of sub optimization and principle of optimality- Computational procedure- Engineering applications.

Genetic algorithms- Simulated Annealing Methods-Optimization programming, tools and Software packages.

References

1. David G Luenberger, .Linear and Non Linear Programming., 2nd Ed, Addison-Wesley Pub.Co.,Massachusetts, 2003
2. W.L.Winston, .Operation Research-Applications & Algorithms.,2nd Ed., PWS-KENT Pub.Co.,Boston, 2007
3. S.S.Rao, .Engineering Optimization., 3rd Ed.,New Age International (P) Ltd,New Delhi, 2007
4. W.F.Stocker, .Design of Thermal Systems., 3rd Ed., McGraw Hill, New York. 1990
5. G.B.Dantzig, .Linear Programming and Extensions. Princeton University Press, N.J., 1963.
6. L.C.W.Dixton,. Non Linear Optimisation: theory and algorithms. Birkhauser, Boston, 1980
7. Bazarra M.S., Sherali H.D. & Shetty C.M., .Nonlinear Programming Theory and Algorithms., John Wiley,New York,1979.
8 A. Ravindran, K. M. Ragsdell, G. V. Reklaitis, Engineering Optimization: Methods And Applications, Wiley, 2008 9 Godfrey C. Onwubolu, B. V. Babu, New optimization techniques in engineering, Springer, 2004
9. Kalyanmoy Deb,.Optimisation for Engineering Design-Algorithms and Examples., Prentice Hall India- 1998

Question Pattern:

There would be 7 questions out of which 5 should be answered. Each question would carry 20 marks each. Each question shall carry a maximum of four sub sections which can have uneven distribution of marks. The questions would touch upon all the sections of the syllabus as far as possible and would preferably be analytic in nature.

AMD 102 - MECHANICS OF MACHINING

3 hours lecture per week

Machining, definition and objectives. Geometry of cutting tools; turning, milling and drilling - indifferent reference systems like machine reference system, tool reference system and work reference system. Sharpening and resharpening of cutting tools.

Mechanism of chip formation by single point tools, drills and milling cutters. Types of chips and their characteristics. Effective rake. Mechanics of machining, theoretical estimation and experimental determination of cutting forces and power consumption.

Cutting tools; methods of failure, mechanics of tool wear, essential properties, assessment of tool life cutting tool materials and cutting fluids.

Economics of machining; principal objectives, main parameters and their role on cutting forces, cutting temperature, tool life and surface quality, selection of optimum combination of parameters.

Performance evaluation of manufacturing systems –Lean manufacturing assessment ,OEE ,and six sigma on advanced manufacturing systems

Virtual Organization –Basic concepts of CIM , Paperless factory ,introduction to virtual reality and its applications

References

1.HMT ,Production Technology , Tata Mc Graw Hill
2. Ghosh & Mallik ,Manufacturing Science , affiliated –West Press
3. Sharma P C , A Text book of Production Engineering
4. Askin R G and Gold berg J B “Design and Analysis of Production systems “ , John Wieley and sons Inc .. 2003
5. ASTME ,Fundamentals of Tool Design , Prentice Hall of India
6. Bhattacharya A Metal cutting : Theory and Practice , Central Book Publishers

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AMD 103 – PRODUCTION AUTOMATION AND CNC TECHNOLOGY

3 hours lecture per week

Concept and scope of industrial automation – automation strategies - devices, drives and control circuits in automation - Semi-automats, automats and transfer lines. Concepts, features, fundamentals, advantages and classification of NC systems - input media - Design consideration of NC machine tools - machining centre - MCU functions.

Controls and System devices - Control loops of NC system - CNC concepts, reference pulse and sampled data techniques - microprocessor and CNC adaptive control – ACO and ACC systems.

Graphical Numerical Control - part programming - design of post processor..

Manual part programming. Computer aided part programming - post processor – APT

programming – programming for CNC turning center, Machining center and CNC EDM.

REFERENCES:

1. Scrope Kalpakjian,, “Manufacturing processes for Engineering Materials”, Addision Wesley.
2. Radhakrishnan, P., “Computer Numerical Control Machines”, New Central Book Agencies

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AMD 104 – DISCRETE EVENT SYSTEM SIMULATION

3 hours lecture per week

Systems, models and simulation - Discrete and continuous systems – Advantages and limitations of simulation- Areas of application – Monte Carlo Simulation.

Steps in a simulation study-Time advance mechanisms- Components and organization of a discrete event simulation model.-Simulation of a single server queuing system-Simulation of an inventory system

Simulation software-selection- Random number generation and their techniques - tests for random numbers- Random variate generation.

Analysis of simulation data. - Input modeling – Selecting input probability distributions-goodness of fit tests-Output data analysis for a single system-analysis for steady state parameters-run length and replications

Verification and validation of simulation models

Simulation of manufacturing and material handling systems-Objectives, performance measures and issues- Simulation of a job shop production system.

REFERENCES:

1. Banks, J., Carson, J.S., Nelson, B.L., and Nicol, D.M., Discrete-Event System Simulation, Third edition, Pearson Education, Inc., 2001.
2. Law, A.W. and Kelton, W.D., Simulation Modelling and Analysis, Third Edition, McGraw Hill international, 2000.
3. Askin R.G. and Standridge, C.R., Modelling and Analysis of Manufacturing Systems, John Wiley & sons, 1993.
4. Gordon, G., System Simulation, Second Edition, Prentice Hall of India, 1995.

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AMD 105 (A) - VIBRATION ANALYSIS AND CONTROL

3 hours lecture per week

Introduction- Free and forced response of single and multi-degree-of freedom discrete linear systems, Energy and Newton's methods, Lagrange's equations, damped and undamped vibrations, normal modes and orthogonality relations, matrix formulation, eigen value problems and numerical solutions. Free and forced vibration of continuous systems (beams and bars).

Vibration control- passive and active vibration control, vibration isolation, dynamic vibration absorber, viscoelastic polymers as constrained and unconstrained configuration in passive vibration control. Applications of PZT, PVDF films, electrostrictive, magnetostrictive materials and shape memory alloys (SMA) in structural vibration control.

Books:

1. Elements of vibration analysis, Leonard Meirovitch, Tata McGraw-Hill Publishing Company Ltd., 2007
2. Theory of vibration with applications, William T Thomson, Marie Dillon Dahleh , Pearson Education, Inc., 1998.
3. Principles of vibration control, Mallik A.K., East-West Press Pvt. Ltd., New Delhi, 1990.
4. Srinivasan A.V. and Mc Farlad D.M. Smart Structures: Analysis and Design, Cambridge University Press, Cambridge,2001

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AMD 105 (B) – ROBOTICS AND CONTROL

3 hours lecture per week

Introduction: Definition, Classification of Robots, Geometric classification and control classification. Robot Elements: Drive systems, Control systems, sensors, End effectors, Gripper actuators and gripper design.

Robot Coordinate Systems and Manipulator Kinematics: Robot co-ordinate system representation, Transformation, Homogeneous transforms and its inverse, Relating the robot to its world. Manipulators Kinematics, Parameters of links and joints, Kinematic chains, Dynamics of kinematic chains, Trajectory planning and control, Advanced techniques of kinematics and dynamics of mechanical systems, Parallel actuated and closed loop manipulators.

Robot Control: Fundamental principles, Classification, Position, path and speed control systems, adaptive control.

Robot Programming: Level of robot programming, Language based programming, task level programming, Robot programming synthesis, robot programming for foundry, press work and heat treatment, welding, machine tools, material handling, warehousing assembly, etc., automatic storage and retrieval system, Robot economics and safety, Robot integration with CAD/CAM/CIM, Collision free motion planning.

REFERENCES:

1. Robotic Technology (Vol. I-V) Phillipe Collet Prentice Hall
2. An Introduction to Robot Technology Coiffet and Chirooza Kogan Page
3. Robotics for Engineers Y. Koren McGraw Hill
4. Robotics K.S. Fu, R.C. Gonzalez & CSG Lee McGraw Hill International
5. Robotics J.J. Craig Addison-Wesley
6. Industrial Robots Groover, Mitchell Weiss, Nagel Octrey McGraw Hill
7. Robots & Manufacturing Automation Asfahl Wiley Eastern

Question Pattern:

There would be 7 questions out of which 5 should be answered. Each question would carry 20 marks each. Each question shall carry a maximum of four sub sections which can have uneven distribution of marks. The questions would touch upon all the sections of the syllabus as far as possible and would preferably be analytic in nature.

AMD 105 (C) MECHANICS OF COMPOSITES

3 hours lecture per week

Definition of composites; Micromechanics of composites: effective properties of long and short fiber reinforced composites, effective strength of composites, effective properties of piezoelectric fiber reinforced composites; Ply mechanics; Macromechanics of laminated composite structures: description of laminates, laminate moduli, static and dynamic analysis of laminated composite structures (beams, plates and shells) using shear deformation theories, failure theories, analysis of impact on laminates; Analysis of smart composite structures.

Reference
Autar K. Kaw, Mechanics of composite materials, Taylor & Francis, 2006 **.**

Question Pattern:

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AMD 105 (D) – RAPID PROTOTYPING

3 hours lecture per week

Introduction: Historical developments, Fundamentals of RP Systems and its Classification, Rapid prototyping process chains, 3D modeling and mesh generation, Data conversion and transmission.

RP Systems: Liquid polymer based rapid prototyping systems, Teijin Seikis' solid form and other similar commercial RP systems, Solid input materials based rapid prototyping systems, laminated object manufacturing (LOM) and fused deposition modelling systems etc., Power based rapid prototyping systems, selective Laser sintering, Soligen Diren's shell production casting (DSPC), Fraunhofer's multiphase jet solidification (MJS) and MIT's 3D printing (3DP) etc.

RP Database: Rapid prototyping data formats, STL format, STL file problems, STL file repair, Network based operations, Digital inspection, Data warehousing and learning from process data.

RP Applications: Development of dies for moulding, RP applications in developing prototypes of products, application in medical fields, Development of bone replacements and tissues, etc., RP materials and their biological acceptability.

REFERENCES:

1. Rapid Prototyping Of Digital Systems: A Tutorial Approach Hamblen James O Kluwer Acad.
2. Rapid Prototyping: Principles And Applications Kai Chua Chee World Scie
3. Rapid System Prototyping With Fpgas: Accelerating The Design Process R C Cofer Newnes
4. Rapid Prototyping of Digital Systems James O Hamblen Springer

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AMD 105 (E) – ADVANCED MECHANICS OF SOLIDS

3 hours lecture per week

Theory of stresses and strains. Introduction of tensors. Constitutive modeling. Linear elasticity. Solutions of plane problems. Solutions using polynomials. Energy methods. Introduction to finite deformation, plasticity, stability, vibration, and wave propagation.

Application to thick cylinders, rotating discs, curved beams, beams on elastic foundations, torsion of non-circular cross-sections, stress concentration problems, Hertzian contact stresses.

Theories of failures. Static failure theories. Fatigue failure theories. Case studies, Design for fatigue

REFERENCES:

1. Durelli, Philips and Tsao, Introduction to the Theoretical and Experimental Analysis of Stress and Strain, McGraw Hill; New York.
2. Timoshenko S and Goodier J N, Theory of Elasticity, McGraw Hill.
3. Fung Y.C., Foundations of Solid Mechanics, Prentice Hall of India.
4. Boresi A.P. Schmidt R J and Sidebottom O M, Advanced Mechanics of Materials, John Wiley.
5. Fenner R T, Engineering Elasticity Application of Numerical and Analysis Techniques, Ellis Hordwood Ltd .

Question Pattern:

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AMD 106 (A) – EXPERIMENTAL STRESS ANALYSIS

3 hours lecture per week

Theory of stresses and strains review.

Basic concepts in measurement - Measurement of displacement, strain pressure, force, torque etc., - Type of strain gauges (Mechanical, Electrical Resistance, acoustical, etc.,). Electrica resistance strain gauges - Gauge sensitivity and gauge factor - Environmental effects. Strain gauge circuits - The potentiometer and the Wheatstone bridge - Effects of lead wires, switches, etc., - Use of electrical resistance strain gauges in transducer applications.

Indicating and recording devices - Static and dynamic data recording - Data (digital and analogue) acquisition and processing systems - Telemetry systems. Strain-analysis methods-Rosette analysis. Static & Dynamic testing techniques - Equipment for loading.

Nondestructive testing techniques. Photoelasticity - Optics of photoelasticity - Polariscope - Isoclinics and Isochromatics - Methods of stress separation - Frozen stress method. Introduction to holography and Moiré's techniques.

REFERENCES:

1. James. W. Dally & William E. Riley, *Experimental Stress Analysis*, McGraw-Hill
2. Budynas, *Advanced Strength and Applied Stress Analysis*, McGraw Hill.
3. L. Sreenath, M. R. Raghavan, K. Lingaiah, G. Garghesha, B. Pant, K. Ramachandra, *Experimental Stress Analysis*, Tata McGraw Hill
4. Timoshenko & Goodier, *Theory of elasticity*, McGraw Hill, New York.

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AMD 106 (B) – PROJECT ENGINEERING & MANAGEMENT

3 hours lecture per week

Introduction: Foundations of Project Management, Project Life Cycle, The Project Environment, Project Selection, Project Proposal, Project Scope, Work Breakdown Structure.

Network Scheduling, Critical Path Method, Program Evaluation & Review Technique, Planning and Scheduling of Activity Networks, Assumptions in PERT Modelling, Time-cost Trade-offs, Linear Programming and Network Flow Formulations.

Scheduling with limited resources, Resource Planning, Resource Allocation, Project Schedule Compression, Project Scheduling Software, Precedence Diagrams, Decision CPM, Generalized Activity Networks, GERT.

Estimation of Project Costs, Earned Value Analysis, Monitoring Project Progress, Project Appraisal and Selection, Recent Trends in Project Management

References:

1. Wiest & Levy, Management Guide To PERT/CPM, With GERT/PDM/DCPM And Other Networks, 2nd Ed. , PHI
2. David I. Cleland, Lewis R. Ireland, Project management: strategic design and implementation, McGraw-Hill.

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AMD 106 (C) – MATERIAL SELECTION IN MECHANICAL DESIGN

3 hours lecture per week

The evolution of engineering materials, Materials and the design process, Functional requirements of engineering materials, Material selection based on properties alone, Material selection based on properties and shape, Processing, materials and design, Materials property data, Latest developments in the use of materials, New materials, Case studies.

Books:

1. Charles, J. A., Crane, F. A. A., and Furness, J. A. G., Selection and Use of Engineering Materials, Butterworth-Heinemann, Oxford.
2. Ashby, M. F., Materials Selection in Mechanical Design,
3. Butterworth-Heinemann, Oxford.
4. Ashby, M. F., The Engineers Guide to Materials Selection - Modern
5. Methods and Best Practices, AEA Technology.
6. Watermann, N. A., and Ashby, M. F., (eds), Materials Selection, Chapmann and Hall, 1996.

Question Pattern:

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AMD 106 (D) – FLEXIBLE MANUFACTURING SYSTEMS

3 hours lecture per week

Introduction to FMS - concepts, advantages, components of FMS and their integration in the data processing systems - examples of FMS installations.

Distributed data processing in FMS –DBMS and their applications in CAD/CAM and FMS – distributed systems in FMS -Integration of CAD and CAM - Part programming in FMS, tool data base - Clamping devices and fixtures data base.

Material Handling systems: conveyors - AGVs – features of industrial robots - robot cell design and control- AS/RS.

Inspection: CMM – types – contact and non contact inspection principles - programming and operation- incycle gauging.

Interfacing of computers - machine tool controllers and handling systems: communications standards - programmable Logic Controllers (PLC's) – Interfacing -

Computer aided Project planning – dynamic part scheduling.

REFERENCES:

1. Paul Ranky., "The design and operation of FMS", IFS publication.
2. Mikell P Groover, "Automation Production systems, Computer Integrated Manufacturing", Prentice Hall.
3. David J.Parrish, "Flexible Manufacturing" Butterworth-Heinemann.

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AMD 106 (E) – MANAGEMENT INFORMATION SYSTEMS

3 hours lecture per week

Building blocks in information systems-input, output, model, technology, database, and control blocks, System view of business and information system design forces, Information systems development life cycle, Information systems for strategic planning.

System Investigation and requirements engineering, System requirements specification documents, Feasibility studies, System analysis and general system design, Charting tools in data base design, Data flow diagrams and E-R diagrams, Decision tools and models, Prototyping, Detailed system design, Form design, Code design, Database normalisation, Introduction to data structures and relational database.

Modern software design techniques, Verification and validation methods, Performance of software systems, Software metric and models, Software standards, Introduction to Capability Maturity Model(CMM) and Quality Management in software organizations.

Software testing, Review, walkthrough and inspection, Testing approaches, Software reliability, Errors, faults, repair and availability, Reliability and maintenance.

System implementation issues and solution procedures, training and post implementation audit, System fine-tuning, Monitoring and updating.

Multimedia technology, Distributed data management, Data mining and warehousing, Security features in global information systems.

References:

1. Burch and Gruditski, Information Systems-Theory and Practice, Fifth edition, John Wiley & Sons, New York, 1989.

2. Hawryszkiewycz, I.T., Introduction to Systems Analysis and Design, Prentice Hall of India, 1989.

3. Ian Sommerville, Software Engineering, 6th. Edition, Pearson Education Asia, 2001.

4. Lucas, Henry C., Analysis, Design, and Implementation of Information Systems, 4th Edition, McGraw Hill, New York, 1992.

5. O'Brien J.A., Management Information Systems, 4/e, Tata McGraw Hill, 1999

Question Pattern:

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AMD 107(P) ENGINEERING SOFTWARE LAB

2 hours lecture per week

This laboratory shall help the student to get acquainted with the latest software tools for simulation, design and analysis of systems in general. The list of experiments that shall be performed in this laboratory should supplement the topics of study in the first semester of course. As a general guideline, the experiments may be conducted in the areas given below.

1. Simulation of engineering and manufacturing systems using tools like ARENA, WITNESS etc
2. Modeling and optimization of linear and non-linear engineering problems using tools like LINGO,LINDO etc
3. Design and modeling of engineering components and systems using high end software like Pro/E, CATIA,UNIGRAPHICS, SolidWorks etc
4. Engineering analysis of components and systems using high end software like ANSYS, ABAQUS, Pro/E, CATIA,UNIGRAPHICS, SolidWorks etc
5. Using project management tools like Primavera, MSProject etc
6. Using software like MATLAB, LabVIEW etc for special problems in Mechanical Engineering

Sessional work assessment
Regularity – 5 marks
Class work, Lab Record, Mini project Report(if any), viva – 30 marks
Test – 15 marks
Total: Internal continuous assessment: 50 marks

University evaluation

Examination will be for 100 marks of which 70 marks are allotted for writing the procedure/formulae/sample calculation details, preparing the circuit diagram/algorithm/flow chart, conduct of experiment, tabulation, plotting of required graphs, results, inference etc., as per the requirement of the lab experiments, 20 marks for the viva-voce and 10 marks for the lab record.

Note: Duly certified lab record must be submitted at the time of examination

AMD 108 (P) – SEMINAR
(2 hours practical per week)

The student is expected to present a seminar in one of the current topics in the field of specialization and related areas. The student shall prepare a Paper and present a Seminar on any current topic related to the branch of specialization under the guidance of a staff member. The student will undertake a detailed study based on current published papers, journals, books on the chosen subject and submit seminar report at the end of the semester. The student shall submit typed copy of the paper to the Department. Grades will be awarded on the basis of contents of the paper and the presentation. A common format in (.pdf format) shall be given for reports of Seminar and Project. All reports of Seminar and Project submitted by students shall be in this given format.

Sessional work assessment
Presentation : 25
Report : 25
Total marks : 50

AMD 201 – MICRO MACHINING AND NANO MACHINING

3 hours lecture per week

Introduction: Definition of micro-machining and nano-machining, Nanotechnology.

Micro-machining processes: Mask-based methods: Wet etching, ion beam machining, LIGA, laser beam machining, plasma etching, electroforming.

Tool based micro-machining methods: cutting, grinding, milling, punching, pressing, EDM, ECM, laser beam machining, electron beam machining, ion beam machining.

Electrochemical, Nano-mechanical, Nano-physical and Nano-chemical processes, benefits.

Methods and mechanism of nano-mechanical processing of atomic clusters: size effect, specific energy, atomic bit processing, nano-indentation.

Nano-physical and chemical processing of atomic bits: electron and ion beam processing, plasma surface processing, principles of chemical and electro-chemical processing.

Nano processing systems: Diamond turning, Nano-grinding, Precision polishing.

References:

1) J.McGeough, Micromachining of engineering materials, Marcel Dekker, Inc. NY, 2002.
2) N.Taniguchi, Nanotechnology: Integrated processing systems for ultra-precision and ultra-fine products, Oxford University Press Inc., NY, 1996.

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AMD 202 – INTELLIGENT MANUFACTURING

3 hours lecture per week

Intelligent manufacturing-system components-system architecture and data flow, system operation.

Computer integrated manufacturing systems-structure and functional areas of CIM system-CAD, CAPP, CAM, CAQC, ASRS-Advantages of CIM.

Networking for manufacturing systems-Heirarchy of computers in manufacturing-types of networks, characteristics, methods of communication-LAN- network topologies-access methods –manufacturing communication systems-manufacturing automation protocol (MAP)-OSI model, data redundancy, Top-down and Bottom-up approach- Agile manufacturing.

Group technology (GT)-part classification and coding systems-opitz system, difference between opitz and MULTICODE systems.

Group technology-models and algorithms-visual method-coding method, cluster analysis method, similarity coefficient method, sorting-based algorithm, bond-energy algorithm, cost-based method, cluster identification method, extended CI method.

REFERENCES:

1. Andre Kusaic, " Intelligent Manufacturing Systems".
2. Mikell P Groover, "Automation Production systems, Computer Integrated Manufacturing", Prentice Hall.
3. Yagna Narayana., " Artificial Neural Networks ".
4. Andrew.S.Tanenbaum, " Computer Networks ", Prentice Hall

Question Pattern:

There would be 7 questions out of which 5 should be answered. Each question would carry 20 marks each. Each question shall carry a maximum of four sub sections which can have uneven distribution of marks. The questions would touch upon all the sections of the syllabus as far as possible and would preferably be analytic in nature.

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AMD 203 –DESIGN AND ANALYSIS OF MECHANICAL SYSTEMS

3 hours lecture per week

Engineering design fundamentals. Workable and optimum systems. Economic evaluation. Heat exchanger design and optimization. Pressure drop and pumping power. Pump characteristics. Pump system operation. Fans and nozzles. Modeling and simulation principles. Modeling of thermodynamic properties. Dynamic behavior of thermal systems. Introduction to knowledge based system design.

References

1. Y. Jaluria: Design and Optimization of Thermal Systems, Mc Graw Hill, 1998
2. A. Bejan: Thermal Design and Optimization, John Wiley, 1995
3. W.F. Stoeker: Design of Thermal Systems, 3e, Mc Graw Hill, 1989
4. B.K. Hodge: Analysis and Design of Energy Systems, Prentice Hall, 1990
5. R.F. Boehm: Design Analysis of Thermal systems, John Wiley, 1987
6. Jones J. B. and Dugan R. E.: Engineering Thermodynamics, Prentice Hall of India, 1998
7. Yunus A. Cengel: Thermodynamics: An Engineering approach, Mc Graw Hill, 1994
8. W.J. Gajda and W.E. Biles: Engineering Modeling and Computation, Houghton Mifflin, 1980

Question Pattern:

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AMD 204 (A) – DESIGN OF EXPERIMENTS

3 hours lecture per week

History of design of experiment; strategy, principle and application of DOE; basic statistical concepts, sampling techniques and distributions; inferences about means and standard deviations and considerations of different hypothesis; Experiments with single factorial design and application of ANOVA; randomized blocking and Latin squares.

Factorial design, 2k and 3k factorial design; blocking and confounding techniques in 2k factorial design; Concept of fractioning of factorial design; Response surface method; Introduction to robust design, robust parameter design for single response system; Experiments with non-normal data.

References:

1. Lawson, J. & Erjavec, J., "Modern Statistics for Engineering and Quality Improvement ", Thomson Duxbury, Indian EPZ edition $9.00.
2. Nibtginertm Diygkas C : **Design and Analysis of Experiments"**. Fifth ed, -John Wiley & Sons Inc.
3. Box, George E P, Hunter William G, Hunter Sturat J : **"Statistics for Experimenters"** John Wiley & Sons inc

Question Pattern:

There would be 7 questions out of which 5 should be answered. Each question would carry 20 marks each. Each question shall carry a maximum of four sub sections which can have uneven distribution of marks. The questions would touch upon all the sections of the syllabus as far as possible and would preferably be analytic in nature.

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AMD 204 (B) – QUALITY AND RELIABILITY ENGINEERING

3 hours lecture per week

Basic Concepts and Definition; Traditional Quality Control; Quality Policy and Objectives,

Quality planning, analysis and control. On-line and off-line quality control. Quality parameter design - Taguchi method - Orthogonal arrays. Robust design - noise factors, testing conditions, quality characteristics, DFMA, identification of control factors, System optimization. Quality audit, ISO 9000.

Fundamental aspects of reliability, Reliability testing and evaluation. Failure patterns and

mathematical models. Role of manufacturing processes in controlling reliability. Role of design in achieving reliability goals. Systems approach to reliability integration.

References:

1. Dale, Managing Quality, Blackwell
2. Caplen, Practical Approach to Quality Control, Random House
3. O'Connor, Practical Reliability Engineering, John Wiley
4. Ryan, Statistical Methods for Quality Improvement, John Wiley
5. Ross, Taguchi Techniques for Quality Engineering, McGraw Hill

Question Pattern:

There would be 7 questions out of which 5 should be answered. Each question would carry 20 marks each. Each question shall carry a maximum of four sub sections which can have uneven distribution of marks. The questions would touch upon all the sections of the syllabus as far as possible and would preferably be analytic in nature.

AMD 204 (C) – FRACTURE MECHANICS AND FATIGUE

3 hours lecture per week

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.

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

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

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

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.

Question Pattern:

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AMD 204 (D) – INDUSTRIAL TRIBOLOGY

3 hours lecture per week

Introduction: Definition and Scope of tribology, Contact of solids, Surface topology, Surface interaction.

Friction: Definitions, Types, Friction laws, Modern theory of dry solid friction, Temperature of sliding surface, Mechanism of rolling friction, Friction instability, Friction of elastomers.

Wear: Definition, Classification, Theories of adhesives, Abrasives, Surface fatigue and corrosive wear, Miscellaneous wear theory such as Erosive, cavitation and Fretting wear, Wear of miscellaneous machine components such as gears, Plane bearings and rolling elements.

Lubrication: Lubrication of bearing, Lubricant, Mineral Oil, Grease, Solid lubricant, Lubrication regime, Viscous flow, Reynolds equation and its limitations, Hydrodynamic lubrication, Hydrostatic lubrication, Elasto-hydrodynamic lubrication, Boundary lubrication, Squeeze films.

Applications: Application of tribology in manufacturing processes, Metal machining, Metal cutting, Tool wear, Action of lubricants, Friction welding, Extrusion process.

REFERENCES:

1. Engineering Tribology P Sahoo Prentice Hall of India
2. Principles and Applications of Tribology D.F. Moore Pergamon Press
3. Fundamentals of Tribology Basu, Sengupta

Question Pattern:

There would be 7 questions out of which 5 should be answered. Each question would carry 20 marks each. Each question shall carry a maximum of four sub sections which can have uneven distribution of marks. The questions would touch upon all the sections of the syllabus as far as possible and would preferably be analytic in nature.

AMD 204 (E) – THEORY OF PLASTICITY

3 hours lecture per week

Invariance 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.

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.

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

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, 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.

Question Pattern:

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AMD 205 (A) – CONCURRENT ENGINEERING AND PRODUCT LIFE CYCLE MANAGEMENT

3 hours lecture per week

Introduction: Extensive definition of Concurrent Engineering (CE), CE design

methodologies, Review of CE techniques like DFM (Design for manufacture), DFA (Design for assembly), QFD (Quality function deployment), RP (Rapid Prototyping), TD (Total design), for integrating these technologies, Organizing for CE, CE tool box, Collaborative product development.

Use of Information Technology: IT support, Solid modeling, Product data management, Collaborative product commerce, Artificial Intelligence, expert systems, Software hardware component design.

Design Stage: Lifecycle design of products, Opportunities for manufacturing enterprises, Modality of concurrent engineering design, Automated analysis Idealization control, CE in optimal structural design, Real time constraints.

Need for PLM: Importance of PLM, Implementing PLM, Responsibility for PLM, Benefits to different managers, Components of PLM, Emergence of PLM, Lifecycle problems to resolve, Opportunities to seize.

Components of PLM: Components of PLM, Product lifecycle activities, Product organizational structure, Human resources in product lifecycle, Methods, techniques, Practices, Methodologies, Processes, System components in lifecycle, slicing and dicing the systems, Interfaces, Information, Standards.

REFERENCES:

1. Integrated Product Development M.M. Anderson and L Hein , IFS Publications
2. Design for Concurrent Engineering J. Cleetus CE Research Centre, Morgantown
3. Concurrent Engineering Fundamentals: Integrated Product Development ,Prasad Prentice hall India
4. Concurrent Engineering in Product Design and Development I Moustapha New Age International
5. Product Lifecycle Management John Stark Springer-Verlag, UK
6. Product Lifecycle Management Michael Grieves McGraw Hill
7. Concurrent Engineering: Automation tools and Technology Andrew Kusiak Wiley Eastern

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AMD 205 (B) – FINITE ELEMENT METHODS

3 hours lecture per week

Basic concepts - Different methods in Finite Element Methods - Steps involved in

FEM.Interpolation Polynomials - Linear elements Shape function - Element and Global matrices Two dimensional elements, triangular and rectangular elements - Local and Global Coordinate systems.

Field problems, Steady state problems - Torsional problem - Fluid flow and Heat transfer

problems - Acoustic vibrations – Application in manufacturing problems – metal cutting and metal forming.

Finite element Solution of structural problems - Two dimensional elasticity problems –

Axisymmetric problem. Higher Order Elements and Numerical Methods - Evaluation of shape functions – Numerical Integration, Gauss Legendre quadrature - Solution of finite element equations – Cholesky decomposition, Skyline storage - Computer implementation- Use of FEM software.

REFERENCES:

1. Larry J Segerlind,, “Applied Finite Element Analysis”, John Wiley.
2. Bathe KJ, “Finite Element Procedures”, Prentice Hall.
3. J.N.Reddy, “An Introduction to the Finite Element Method”, Second Edition, McGraw Hill, New York.

Question Pattern:

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AMD 205 (C) – TEROTECHNOLOGY

3 hours lecture per week

Introduction, Probability concepts , Life cycle cost analysis of plants and concepts of terotechnology;

Various maintenance management strategies; Production maintenance interface and terotechnology based planning and control; Maintenance policy determination; Fixed time replacement prior to failure; Concept of health and usage monitoring of plants (HUM);

Condition based maintenance; Opportunity maintenance; Design out maintenance; Preventive maintenance; Reliability, maintainability and availability of plants and equipments; Replacement strategies, Computer application in terotechnology based critical analyses.

REFERENCES

1. Srinath L S,, “Reliability Engineering”, East West Press Pvt Ltd.
2. Terrotechnology Reliability Engineering & Maintenance Management by Prof. S.K. Basu & Prof. B. Bhadury
3. Balagurusamy, “Reliability Engineering”, Tata Mc Graw Hill

Question Pattern:

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AMD 205 (D) – ENERGY CONSERVATION

3 hours lecture per week

Potential for Industrial energy conservation-Economic analysis of investments- simple payback period- NPV-IRR.

Motors: Operational-retrofit-energy efficient motors-pf correction and variable speed drives

Lighting, Electric load management, power quality

Energy management information systems

Boilers, Compressors, Steam distribution, Refrigeration:

Pumps, Fans and blowers, Cooling tower, Industrial furnaces, Diesel generator

Water audit and conservation

Solar energy options for industries

Energy, climate change and clean development mechanism

Future cleaner energy options

Text Book:
Handbook on energy audit and environment management, Y P Abbi, Shashank jain, TERI press, New delhi-2006.
Further reading:

1. Energy management policy: guidelines for energy intensive industry, ministry of power, GOI, 2003.(available at www.bee-india.nic.in)
2. Compressed air systems, TERI, 1999.
3. Renewable energy resources, TERI, 2004
4. Power generation and diesel gen-sets, PCRA, New delhi
5. Energy conservation using electric drives, B K Bose

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AMD 205 (E) – MANUFACTURING SYSTEM ANALYSIS

3 hours lecture per week

Basic concept of manufacturing, manufacturing problems, Systems approach to manufacturing problems, Principle of modeling in mathematical and physical form, Types of model, Simulation in modeling, Sources of system error, Stability of linear and non-linear system, Adaptive control, System optimization techniques, Product design and part

configuration.

Project scheduling by PERT, GERT, flow graph, Productive maintenance.

Automation of production, Computer Aided Design, Computerised layout planning,

Automated process planning, Automatic operation planning, Automatic and Computer Integrated Manufacturing, Automated assembly and Testing information systems for manufacturing.

Fundamentals of information system, data bank, On-line production management systems, Parts oriented production information system, Production information and management systems.

REFERENCES:

1. Manufacturing Process & system Ostwald Willey India Pvt. Ltd
2. Materials & Process in Manufacturing E. Paul Degarmo, JT Black RA Kosher Prentice Hall of India
3. Manufacturing Systems Design and Analysis Wu B Kluwer Aca
4. Queuing Theory in Manufacturing Systems Analysis and Design Papadopoulos H T Chapman
5. Performance Analysis of Manufacturing Systems Altiok Tayfur Springer-V

Question Pattern:

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AMD 206 (A): ARTIFICIAL NEURAL NETWORKS AND FUZZY SYSTEMS

3 hours lecture per week

Biological foundations, ANN models, Types of activation function, Introduction to Network architectures : Multi Layer Feed Forward Network (MLFFN), Radial Basis Function Network (RBFN), Recurring Neural Network (RNN)

Learning process . Supervised and unsupervised learning . Error-correction learning, Hebbian learning,

Boltzmen learning, Single layer and multilayer percepturs, Least mean square algorithm, Back propagation algorithm, Applications in forecasting and pattern recognition and other engineering problems.

Fuzzy sets . Fuzzy set operations . Properties, Membership functions, Fuzzy to crisp conversion . fuzzification and defuzzification methods, applications in engineering problems.

Fuzzy control systems . Introduction, simple fuzzy logic controllers with examples, special forms of fuzzy logic models, classical fuzzy control problems . inverter pendulum, image processing . home heating system . Adaptive fuzzy systems, hybrid systems.

References

1. J.M. Zurada, .Introduction to artificial neural systems., Jaico Publishers, 1992.
2. Simon Haykins, .Neural Networks . A comprehensive foundation., Macmillan College, Proc, Con, Inc,
New York, 1994. 3. D. Driankov, H. Hellendorn, M. Reinfrank, .Fuzzy Control . An Introduction. , Narora Publishing
House, New Delhi, 1993.
4. H.J. Zimmermann, .Fuzzy set theory and its applications., III Edition, Kluwer Academic Publishers,
London. 2001
5. G.J. Klir, Boyuan, .Fuzzy sets and fuzzy logic., Prentice Hall of India (P) Ltd., 1997.
6. Stamatios V Kartalopoulos, .Understanding neural networks and fuzzy logic .basic concepts and
applications., Prentice Hall of India (P) Ltd., New Delhi, 2000.
7. Timothy J. Ross, .Fuzzy logic with engineering applications., McGraw Hill, New York.
8. Suran Goonatilake, Sukhdev Khebbal (Eds), .Intelligent hybrid systems., John Wiley & Sons, New York,
1995.

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AMD 206 (B): METROLOGY AND COMPUTER AIDED INSPECTION

3 hours lecture per week

Metrology and Techniques: Standards in metrology-definition, Traceability, Characteristics

Length & Angular measurements-Review of standard instruments, GD and tolerance procedure-Review of dimension & form tolerance and methods of measurement, Tolerance analysis, Surface metrology-Instruments, Methods and new approaches.

Laser Applications in Metrology: LASER light source, LASER interferometer, LASER alignment telescope, LASER micrometer, On-line and in-process measurements of diameter, Roundness and surface roughness using LASER, Micro holes and topography measurements, straightness and flatness measurement.

Special Measuring Instruments and Techniques: Optoelectronic devices, contact and noncontact types, Applications in on-line and in-process monitoring systems, Tool wear measurement, Surface measurement, Machine vision, shape identification, Edge detection techniques, Normalisation, gray scale correlation, Template Techniques, Surface roughness using vision system, Interfacing robot and image processing system.

Co-ordinate Measuring Machine: Types of CMM, Probes used, Applications, Non-contact CMM using electro optical sensors for dimensional metrology, Non-contact sensors for surface finish measurements, statistical evaluation of data using computer, Data integration of CMM and data logging in computers.

Sensors in Inspection: Manufacturing applications of photo detectors, deflection methods-beam detection, Reflex detection, & Proximity detection,

Applications of Inductive and Capacitive proximity sensors, Understanding microwave sensing applications laser sensors and limit switches. Advanced sensor technology-Bar code systems, Principles and applications of Colour sensors, electro-magnetic identifier, Tactile sensors, Ultrasonic sensors, Odour sensors.

REFERENCES:

1. Fundamentals of dimensional Metrology T. Busch and R. Harlow Delmar, 3e
2. Engineering Metrology G. Thomas and G. ButterWorth PUB
3. Sensors and Control systems in Manufacturing Sabne Soloman McGraw Hill Book
4. Measurement systems: Applications & Design Doebelin International Student Edition
5. Optoelectronics for Technology and Engineering Robert G. Seippel Prentice Hall India

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AMD 206 (C) – ENERGY MANAGEMENT

3 hours lecture per week

Importance of energy management. Energy auditing: methodology System approach and End use approach to efficient use of Electricity; Electricity tariff types; Types and objectives-audit instruments- ECO assessmet and Economic methods-specific energy analysis-Minimum energy paths-consumption models-Case study. Demand side management.

Electric motors-Energy efficient controls and starting -Motor Efficiency and Load Analysis-Energy efficient motors-Case study; Load Matching and selection of motors.

Variable speed drives; Pumps and Fans-Efficient Control strategies- Optimal selection and sizing -Case study Reactive Power management-Capacitor Sizing-Degree of Compensation-Capacitor losses-Location-Placement-Maintenance, case study. Peak Demand controls-Methodologies-Types of Industrial loads-Optimal Load scheduling-case study. Lighting-Energy efficient light sources-Energy conservation in Lighting Schemes- Electronic ballast-Power quality issues-Luminaries, case study.

Energy conservation in Pumps , Fans (flow control), Compressed Air Systems, Refrigeration & air conditioning systems. Boiler -efficiency testing, excess air control, Steam distribution & use- steam traps, condensate recovery, flash steam utilization

Cogeneration-Types and Schemes-Optimal operation of cogeneration plants-case study;lectric loads of Air conditioning & Refrigeration-Energy conservation measures- Cool storage. Types-Optimal operation-case study; Electric water heating-Gysers-Solar Water Heaters- Power Consumption in Compressors, Energy conservation measures;

References

1. Handbook on Energy Audit and Environment Management , Y P Abbi and Shashank Jain, TERI, 2006
2. Utilization, Generation & Conservation of Electrical Energy, Sunil S.Rao, Khanna publishers, 2007.
3. Anthony J. Pansini, Kenneth D. Smalling, .Guide to Electric Load Management., Pennwell Pub; (1998)
4. Partab H., 'Art and Science of Utilisation of Electrical Energy', Dhanpat Rai and Sons, New Delhi. 1975
5. Tripathy S.C.,'Electric Energy Utilization And Conservation', Tata McGraw Hill, 1991
6. L.C.Witte, P.S.Schmidt, D.R.Brown , Industrial Energy Management and Utilisation, Hemisphere Publ, Washington,1988.
7. Industrial Energy Conservation Manuals, MIT Press, Mass, 1982.
8. Guide Book for National Certification Examination for Energy Managers & Energy Auditors – Bureau of Energy Efficiency, Ministry of Power, Govt of India.

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AMD 206 (D) - MECHATRONICS

3 hours lecture per week

Introduction to mechatronics-sensors and transducers-signal conditioning-pneumatic and hydraulic systems-mechanical and electrical systems.

System modeling-mathematical models-mechanical, electrical, fluid and thermal system building blocks-system models- dynamic response of systems- first and second order systems-modeling dynamic systems-systems transfer functions-frequency response-stability.

Controllers Closed loop controllers-continuous and discrete processes-proportional, derivative and integral controls-PID controller-digital controllers-controller tuning-adaptive control.

Digital circuitsMicro controllers and micro processors-digital logic circuits-micro controller architecture and programming-programmable logic controllers

References

1. Dorf R.C. & Bishop R.H., *Modern Control Systems,* Addison Wesley
2. Krishna Kant, *Computer Based Industrial Control,* Prentice Hall of Indian Private Limited
3. HMT Limited, *Mechatronics,* Tata McGraw Hill Publishing Company Limited
4. Herbert Taub & Donald Schilling, *Digital Integrated Electronics,* McGraw Hill InternationalEditions

Text Book

1. Bolton W., *Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering,* Addison Wesley Longman Limited

Question Pattern:

There would be 7 questions out of which 5 should be answered. Each question would carry 20 marks each. Each question shall carry a maximum of four sub sections which can have uneven distribution of marks. The questions would touch upon all the sections of the syllabus as far as possible and would preferably be analytic in nature.

AMD 206 (E) - MACHINE TOOL DESIGN

3 hours lecture per week

Machine Tool Drive: working and auxiliary motion in machine, Machine tool drives, Hydraulic transmission, Mechanical transmission, General requirements of machine tool design, Layout of machine tools.

Regulation of Speed and Feed Rates: Aim of speed feed regulation, stepped regulation of speed, design of speed box, Design of feed box, Special cases of gear box design, Set stopped regulation of speed and feed rates.

Design of Machine Tool Structure: Fundamentals of machine tool structures and their requirements, Design criteria of machine tool structure, Static and dynamic stiffness, Design of beds and columns, Design of housing models, Techniques in design of machine tool structure.

Design of Guide-ways and power Screws: Function and type of guide-ways, design of slide-ways, Protecting devices for slide-ways, Design of power screws.

Design of Spindles and Spindle Supports: Materials for spindles, Design of spindles, Antifriction bearings, Sliding bearings.

Dynamics of Machines Tools: General procedure of assessing dynamic stability of EES, Cutting processing, Closed loop system, Dynamic characteristics of cutting process, Stability analysis.

REFERENCES:

1. Machine Tool Design N.K. Mehta Tata McGraw Hill
2. Machine Tool design Handbook - CMTI Banglore

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AMD 207(P) ADVANCED MANUFACTURING LAB

3 hours lecture per week

This laboratory shall primarily address the key issues of advanced manufacturing. The list of experiments should include the latest manufacturing design tools and on hand experience on CNC machines, robots and the like. As a general guideline, the experiments may be conducted in the areas given below.

1. CNC programming (Manual and computer aided)
2. Exercises on Manual CNC Part programming using G, M codes.
3. Machining of parts on CNC Machines including preparation of part program, after simulation of tool path using suitable CAM software package.
4. Robotics programming and assembly.
5. Experiments on micro-machining
6. Study and experimentation with CMM
7. Experimental investigation of machining parameters like cutting force, tool wear, life etc
8. Experiments on CAI and Quality control
9. Experiments with NDT techniques
10. Study and experimentation with intelligent control systems
11. Experiments with non conventional machining processes.

Sessional work assessment
Regularity – 5 marks
Class work, Lab Record, Mini project Report (if any), viva – 30 marks
Test – 15 marks
Total: Internal continuous assessment: 50 marks

University evaluation

Examination will be for 100 marks of which 70 marks are allotted for writing the procedure/formulae/sample calculation details, preparing the circuit diagram/algorithm/flow chart, conduct of experiment, tabulation, plotting of required graphs, results, inference etc., as per the requirement of the lab experiments, 20 marks for the viva-voce and 10 marks for the lab record.

Note: Duly certified lab record must be submitted at the time of examination

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AMD 208 (P) TERM PAPER

The student is expected to present a report on the literature survey conducted as a prior requirement for the project to be taken up in the third and fourth semesters. Head of department can combine TP hours of many weeks and allot a maximum of 4 weeks exclusively for it. Students should execute the project work using the facilities of the institute. However, external projects can be taken up, if that work solves a technical problem of the external firm. Prior sanction should be obtained from the head of department before taking up external project work. Project evaluation committee should study the feasibility of each project work before giving consent. An overview on the project work should be introduced before the closure of first semester. A paper should be prepared based on the project results and is to published in refereed Conferences/Journals.

Sessional work assessment
Presentation : 25
Report : 25
Total marks : 50

AMD 301 (P) THESIS – PRELIMINARY

This shall comprise of two seminars and submission of an interim thesis report. This report shall be evaluated by the evaluation committee. The fourth semester Thesis-Final shall be an extension of this work in the same area. The first seminar would highlight the topic, objectives, methodology and expected results. The first seminar shall be conducted in the first half of this semester. The second seminar is presentation of the interim thesis report of the work completed and scope of the work which is to be accomplished in the fourth semester.

Weightages for the 8 credits allotted for the Thesis-Preliminary

Evaluation of the Thesis-Preliminary work: by the guide - 50% (200 Marks)

Evaluation of the Thesis–Preliminary work: by the Evaluation Committee-50%(200 Marks)

AMD 401 (P) THESIS

Towards the end of the semester there shall be a pre submission seminar to assess the quality and quantum of the work by the evaluation committee. This shall consists of a brief presentation of Third semester interim thesis report and the work done during the fourth semester. At least one technical paper is to be prepared for possible publication in journals / conferences. The final evaluation of the thesis shall be an external evaluation. The 12 credits allotted for the Thesis-Final may be proportionally distributed between external and internal evaluation as follows.

Weightages for the 12 credits allotted for the Thesis

Internal Evaluation of the Thesis work: by the guide - (200 Marks)

Internal Evaluation of the Thesis work: by the Evaluation Committee - (200 Marks)

Final Evaluation of the Thesis work by the Internal and External Examiners:-
(Evaluation of Thesis + Viva Voce) - (100+100 Marks)