WITH EFFECT FROM THE ACADEMIC YEAR 2005-2006

SCHEME OF INSTRUCTION & EXAMINATION

B.E IV YEAR (REGULAR)

(MECHANICAL ENGINEERING)

SEMESTER - II

Sl. No.	Syllabus Ref.No	SUBJECT	Scheme of Instructions Periods per Week L/T	D/P	Scheme of Examination Dura-tion in Hrs	Maximum Marks Univ. Exam	Sessi-onals
		THEORY					
1.	ME 451	Management Information Systems	**4**	**-**	**3**	**75**	**25**
2.	CE 405	Environmental Studies*	**4**	**-**	**3**	**75**	**25**
3.		**Elective -II**	**4**	**-**	**3**	**75**	**25**
4.		**Elective - III**	**4**	**-**	**3**	**75**	**25**
		PRACTICALS					
1.	ME 481	Seminar	**-**	**3**	**3**	**-**	**25**
2.	ME 482	Project	**-**	**6**	**Viva Voce**	**Gr****	**50**
		TOTAL	**16**	**9**	**-**	**225**	**150**

* 40% for pass. Marks not to be considered for award of division
** Excellent/ Very Good/ Good/Satisfactory/Unsatisfactory

Elective –II
ME 452 Composite Materials.
ME 453 Artificial Intelligence & Expert Sys
ME 454 Machine Tool Design
ME 455 Manufacturing Sys & Simulation
ME 456 Mechatronics
LA454 Intellectual Property Rights

Elective-III
ME 457 Robotics
ME 458 Product Design & Process
ME 459 Modern Machining & Forming Methods
ME 460 Plastic Eng. & Tech
CS 452 Computer Graphics
CS 408 Internet Programming

Service Course: ME 472 (Industrial Admn & Financial Mgmt) – Service course to EE & IE

ME 451

MANAGEMENT INFORMATION SYSTEMS

Instruction:	4 Periods per Week
Duration of University Examination:	3 Hours
University Examination:	75 Marks
Sessionals	25 Marks

Unit – I

Inventory Control: Deterministic and stochastic inventory models; variable demand, lead time, specific service level, perishable products and service.

Inventory control in application; concepts for the practitioners; saving money in inventory systems; ABC classifications.

Inventory control procedures; Quantity – reorders versus periodic inventory systems; material requirement planning (MRP) MRP as scheduling and ordering system; MRP system components; MRP computational procedure; Detailed capacity planning; MRP – limitation and advantages; Manufacturing Resource Planning (MRP-II)

Unit – II

Forecasting: Demand over time; dependant versus independent demand Forecast error; Forecast models for operations; Qualitative models – Delphi, Nominal group technique, Time – series qualitative models; Single average; Single moving average; Weighted moving average; Exponential smoothing; smoothing coefficient selection; Adaptive exponential smoothing; Double exponential smoothing; Supply chain management.

Unit – III

Marketing Management:Marketing concept – 4P components of marketing mix management, product life cycle and its forecasting strategies. Marketing Research Techniques and different sales promotion methods.

Financial Management: Element of cost – establishing selling price of a product, overheads and its distribution. Nature of financial management. Time value of money, techniques of capital budgeting.

Unit - IV

Project Management:

Network Analysis: Network fundamentals; PERT / CPM; Scheduling the activities;

Fulkerson's rule; Earliest and latest times; Determination of ES and EF in the forward pass; LS and LF in backward pass; Determination of critical path; Beta distribution; Deterministic and probabilistic models; Time- Cost trade-offs; Network flow; Resource analysis and allocation.

Unit – V

Information Systems: Managerial functions and roles, comparison of the characteristic of the information systems used at operation, tactical and strategic planning levels, concepts of systems and organizations, Model of an information system, strategic uses of information technology. Categories of Computers, Input/output devices, primary and secondary storage, introduction to operating system.

Suggested Reading:

1. Everett E, Adam, Jr and Ronald J.Ebert, "Production and Operations Management-concepts, models and behavior" 5th edition1998(EEE) Prentice Hall of India(P)Ltd., New Delhi.
2. Robert Schulthesis, Mary Summer, "Management information Systems" Irvin Mc Graw Hill, 1998.
3. Laudon, K.C. & Laudon, J P "Management Information Syustems", Pearson Education(India),2002.
4. Khalid Sheik, "Manufacturing Resource Planning (MRP-II) with intrduction to ERP,SCM and CRM" Tata Mc Graw Hill Publishing Company ltd., New Delhi,2001

CE 405

ENVIRONMENTAL STUDIES

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks

Unit – I

Environmental Studies: Definition, scope and importance, need for public awareness. Natural resources: Water resources; use and over utilization of surfaced and ground water floods, drought, conflicts over water, dams-benefits and problems. Effects of modern agriculture, fertilizer pesticide problems, water logging salinity.

Energy resources; growing energy needs, renewable and non-renewable energy sources, Land Resources; land as a resource, land degradation, soil erosion and desertification.

Unit – II

Ecosystems: Concept of an ecosystem, structure and function of eco system, producers, consumers and decomposers, energy flow in ecosystem, food chains, ecological pyramids, aquatic ecosystem(ponds, streams, lakes rivers, oceans, estuaries).

Unit – III

Biodiversity: Genetic species and ecosystem diversity, bio-geographical classification of India. Value of biodiversity, threats to biodiversity, endangered and endemic species of India, conservation of biodiversity

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Unit – IV

Environmental Pollution: Causes, effects and control measures of air pollution, water pollution, soil pollution, noise pollution, thermal pollution and solid waste management. Environment protection act: Air, water, forest & wild life acts, issues involved in enforcement of environmental legislation.

Unit – V

Social Issues and the Environment: Water conservation, watershed management and environmental ethics. Climate change, global warming, acid, rain, ozone layer depletion. Environmental protection act, population explosion

Suggested Readings:

1. De. A. K. Environmental Chemistry, Wile Eastern Ltd.
2. Odum E.P Fundamentals of Ecology, W.B Sunders Co., USA
3. Rao. M.N and Datta A.K., Waste Water Treatment, Oxford and IBH Pub
4. Miller T.G. Jr., Environment Science, Wadsworth Publishing Co.,

ME 481

SEMINAR

Instruction	3 Periods per week
Sessional	25 Marks

Oral presentation is an important aspect of engineering education. The objective of the seminar is to prepare the student for a systematic and independent study of the state of the art topics in a broad area of his/her specialization.

Seminar topics may be chosen by the students with advice from the faculty members. Students are to be exposed to the following aspects of a seminar presentation.

- Literature Survey
- Organization of the material
- Presentation of OHP slides/PC presentation
- Technical writing

Each student is required to:

1. Submit a one page synopsis before the seminar talk for display on the notice board
2. Give a 20 minutes presentation through OHP, PC, Slide projector followed by a 10 minute discussion.
3. Submit a report on the seminar topic with a list of reference and slides used.

Seminars are to be scheduled from the 3rd week to the last week of semester and any change in schedule should be discouraged.

For award of Sessional marks students are to be judged by at least two faculty members on the basis of an oral and written presentation as well as their involvement in the discussions.

ME 482

PROJECT

Instruction	6 Periods per week
Duration of University Examination	Viva voce
University Examination	Grade*
Sessional	50Marks

Solving a real life problem should be the focus of U.G projects. Faculty members' should propose the projects brief (scope and references) well in advance which should be made available to the students through department library. The project could be classified as Hardware, Software, Modeling, Simulation etc., It should involve one or many elements of techniques such as Analysis, Design and Synthesis. The Department will appoint a Project coordinator who will coordinate the following

- Grouping of students (Max. 3 in group)
- Allotment of Projects and Project Guides
- Project monitoring at regular intervals

All Projects allotment will be completed by the 4th week of the 4the year I semester, so that students get sufficient time for completion of the project.

All Projects will be monitored Atleast twice in a semester through students presentation. Sessional marks should be based on the grading/marks awarded by monitoring committee of faculty members and marks given by the supervisers.

Effort should be made that some of the projects are carried out in industries with the help of industry co-coordinators. Problems can also be invited from the industries to be worked out through UG projects.

Common norms will be established for final documentation of the project report by the respective departments.

*Excellent/Good/Satisfactory/Unsatifactory

Note: 3 periods of contact load will be assigned to each project guide.

ME 452

COMPOSITE MATERIALS

Instruction	4 Periods per Week
Duration of University Examination:	3 Hours
University Examination:	75 Marks
Sessionals:	25 Marks

Unit –I

Introduction: Fibers, Matrix Materials, Interfaces, Polymer matrix Composites, Metal matrix Composites, Ceramic Matrix composites, Carbon fiber composites.

Unit - II

Micro Mechanics of Composites:

Mechanical Properties: Predication of Elastic Constants, Micro Mechanical Approach, Halpin-Tsai Equations, Transverse Stresses.

Thermal Properties: Hydro Thermal Stresses, Mechanics of Load Transfers from Matrix to Fiber.

Unit – III
Macro Mechanics of Composites:
Elastic Constants of Lamina, Relations between Engineering constants, and reduced stiffness and compliances, variation of lamina properties with orientation, analysis of laminated composites, stresses and strains with orientation.

Unit – IV
Inter – Laminar stresses and Edge Effects. Simplified Composite beam solutions Bending of laminated beams.

Tensile and Compressive strength of unidirectional fiber composite, fracture modes in composites: Single line Multiple Fracture, de-bonding, fiber pullout and de-lamination failure, fatigue of laminate composites. Effect of variability of fiber strength.

Unit – V
Strength of an Orthotropic Lamina: Maximum stress theory, Maximum strain Criteria, Maximum Work (Tsai – hill) Criterion, Quadratic Interaction Criteria. Designing with Composite Materials.
Measurement of Constituent Material Profits: Fiber Tests, Matrix Test.
Measurement of Basic Composite Properties: Tensile Test, Compressive Test,
In–plane shear test, Inter-laminar sheer test, flexure test.

Suggested Reading:

1. Jones, R.M., "Mechanics of Composite Materials" McGraw Hill.Co.1967
2. Ronald F.Gibbson, "Principles of Composite Material Mechanics", McGraw Hill inc. 1994.
3. Krishna, K. Chewla, "Composite Materials", Springer – Verlag, 1987.
4. Carl.T.Herakovich, "Mechanics of Fibrous Composites.", John Wiley Sons Inc.,1998

ME 453

ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS

Instruction	4 Periods per Week
Duration of University Examination:	3 Hours
University Examination:	75 Marks
Sessionals:	25 Marks

Unit – I
Introduction: Intelligence, definition, types, cognitive aspects approach measuring intelligence, early efforts. IQ and AI, aspects of intelligence, learning problem solving, creativity, behavior and biology.

Unit – II
Congnitiue Psychology: The mid, information and cybermatics, components for thought, modes of perception, visual, auditory and other systems, memory mechanism, problem solving –

planning search, the GPS systems, types of learning – route parameters methods and concept, game playing, reasoning.

Unit – III
Knowledge Engineering: Introduction, role of knowledge engineer, knowledge representation, psychology, production rules, logic and programming, common sense and fuzzy logic semantic networks, learning systems.

Unit – IV
Visual Perception: Introduction, biology of vision, computation aspects, towards artificial vision, picture processing – identifying real objects; vision programmed, factory vision systems. Robotics: AL impact, robot sensors, factory robots, personal robots, future robot.

Unit –V
Expert Systems: Introduction, knowledge acquisition for expert systems, features of expert systems, system structure, inference engines, uncertainties, memory mechanism, range of applications, actual expert systems – VP expert

Suggested Reading
1. E. Rich Kevin Knight, "Artificial Intelligence" 2nd Edition TMH
2. Charnaik E. and Mc Dermott D,, "Introduction to Artificial Intelligence", Addison Wesley, 1995.
3. "Artificial Intelligence in Business Science and Industry", Vol.2. Applications PH. 1985
4. PH Winston, "Artificial Intelligence", Addison Wesley.

ME454

MACHINE TOOL DESIGN

Instruction	4 Periods per Week
Duaration of University Examination:	3 Hours
University Examination:	75 Marks
Sessionals:	25 Marks

Unit – I
Basic Features: Classification of machine tools- Basic features of construction and fundamental kinematics mechanism of general purpose, special purpose machine tools, transfer machines, Automatic and N.C. machines. Mechanisms used for converting rotary to linear motion; Mechanism for intermittent motion.

Unit – II
Kinematics, Drives of Machine tools; selection of range of speeds and feeds, Layout in G.P., A.P., and Logarithmic progression, standardization of speeds and feeds. Productivity Loss. Selection of highest and lowest speeds, range ratio, Design of ray diagram and structural diagrams for machine tool gear boxes. Sliding, clustered and clutched drives, Ruppert drive.

Unit – III
Feed gear boxes: Norton and Meander drives pre-selection of speed, stepped and stepless regulation. Strength, rigidity and design analysis; Analysis of beds, frames, columns, Materials

for structures. Methods to improve the rigidity of structures. Guide ways overall compliance of machine tool. Thermal effects- functional accuracy of machine tool.

Unit _ IV

Spindle Units: Spindle units of lathe, drilling, milling and grinding machines. Materials for spindles. Spindle design. Effect of clearance on the rigidity of spindle. Hydrodynamic, hydrostatic, bearings. Selection of bearings.

Unit – V

Hydraulic controls: Various controls used in machine tools. Hydraulic and pneumatic systems used in machine tools-positive displacement pumps-properties of fluids- relief valves; check valves, flow control valves, multi-position valves, filters, accumulators. Power pack and speed regulation of surface grinding machine, hydro-copying systems.

Suggested Reading:

1. G.S. Sen & Bhattacharya," Principles of Machine Tools", New Central Book Agency, Calcutta, 1986.
2. N.Acherkan, "Machine Tool Design", vol-2 & 3, Mir Publishers Moscow, 1968.
3. S.K. Basu,"Design of Machine Tools", Allied Publishers.
4. Koeinsberger & Tlusty, "Design of Machine Tools", Pergaman press, 1970.
5. Russe W. Henke, "Introduction to Fluid Power Circuits and systems",Addison Wesley,1970

ME 455

MANUFCTURING SYSTEMS AND SIMULATION

Instruction	4 Periods per Week
Duration of University Examination:	3 Hours
University Examination:	75 Marks
Sessionals:	25 Marks

Unit I

Manufacturing Systems: Definition of systems; basic concepts and problems concerning systems; Systems design: Decision making procedures; Structural, Transformational and procedural aspects of manufacturing; Modes of production. Process systems for manufacturing; logistic systems; material flow and technological information flow. Management and information systems for manufacturing: Managerial information flow in manufacturing systems.

Unit II

Information Systems: Fundamentals of information technology, information systems, information networking, and parts oriented production information systems, and computerized production scheduling, online production control systems. Computer based production management systems. Automation systems for manufacturing: Industrial automation, kinds of automat*on,* principles of CIM, effectiveness of CIM, factory automation, automatic machine tools for mass production, NC machine tools, computer controlled manufacturing systems, FMS, automated assembly automatic material handling, automatic inspection and testing, computer integrated automation systems-unmanned factory

Unit III

System Models: Concepts, continuous and discrete systems, systems modeling, type of models, subsystems, corporate model, and system study. System simulation: Techniques, comparison of simulation and analytical methods, types of simulation, distributed log modes, cobweb models.

Unit IV

Continuous system Simulation: Numerical solution of differential equation analog computes, hybrid computers, continuous system simulation languages CSMP, system dynamic growth models logistic curves. Discrete systems simulation: Evens generation of arrival patterns, simulation-programming tasks, analysis of simulation output.
Queuing theory: Arrival pattern distribution, service timers, queuing disciplines and measure of queues.

Unit V

GPSS and SIMSCRIPT: General description of GPSS and SIMSCRIPT programming in GPSS simulation programming techniques: Data structures, implement of activities, event and queues, even scanning, simulation algorithms in GPSS and SIMSCRIPT.

Suggested Reading:

1. David Bedworth & James Bailey, "Integrated production control system management¸ analysis & design", 2nd ed;l John Wiley & Sons Ltd.
2. Ronald Zskin & Charles Standridge, "Modeling and analysis of manufacturing systems", John Wiley & Sons Ltd.
3. Geofery Gordan: Systems Simulation, Prentice Hall, 1980
4. Deo N: System Simulation with Digital Computers, Prentice Hall, 1980

ME 456

MECHATRONICS

Instruction	4 Periods per Week
Duration of University Examination:	3 Hours
University Examination:	75 Marks
Sessionals:	25 Marks

Unit I

Introduction: The concept of Mechatronics; Elements and techniques needed in the design and control of Electro-Mechanical systems. Application in industries and systems development. Drive mechanisms-Feeding and indexing, orientation, escapement and sorting devices, conveyor systems, etc.

Unit II

Electronic Systems: Conductors, Insulators and Semiconductors: Passive components used in Electronics: Transformers, Transistors, Silicon controlled Rectifiers(SCR); Integrated Circuits(IC); Digital Circuits. Mechatronics and measurement systems: Data acquisition, sensors and actuators. Digital to analog and/or analog to digital conversion. Signal processing using operational amplifier. Temperature measurement interface and LVDT interface, System Response.

Unit III

Design of Modern CNC machines and Mechatronics elements: Machine structure; Guide ways, Feed drives, Spindle/Spindle beatings: Thermal behaviour of Machine tools; Measuring systems, control, Gauging, Tools Monitoring System; Adaptive control for the cutting process; Wear sensors for adaptive control;
Controls used in CNC machines: FANUC, SINUMERIC etc., Structure and design of these control systems.

Unit IV

Applied industrial pneumatics and hydraulics. Merits of fluid power of pneumatic and hydraulic elements symbols. Study o hydraulic control values, accessories, pumps. Hydraulic circuits and mechanical servo control and Electro-hydraulic and Hydro-pneumatic circuits.

Unit V

Modern manufacturing and Mechatronics systems special purpose machines, automation, mechanization, elements of flexible manufacturing systems. Multipurpose control machines; PLC programming, Mechatronics systems, Design and control architecture.

Suggested Reading:

1. Auslander D.M & Kempf C.J., "Mechatronics-Mechanical System Interfacing", Prentice Hall, Inc. 1996.
2. HMT Limited "Mechatronics" 1998 edn. Tata McGraw Hill Publishing company Limited, New Delhi
3. Michael B. Histand & David G. Alciatore, "Introduction to Mechatronics and Measurement Systems", New McGraw Hill International edition
4. Bolton-Mechatronics

LA 454

INTELLECTUAL PROPERTY RIGHTS

Instruction	4 Periods per Week
Duration of University Examination	3 Hours
University Examination	80 Marks
Sessional	20 Marks

Unit –I

Meaning of Intellectual Property – Nature of I.P.- protection of I.P. Rights –Kinds of Intellectual Property Rights – International Conventions of intellectual Property Rights – patent Treaty 1970, GATT 1994, TRIPS & TRIMS – International Organization for Protection of IPR – WTO, WIPO, UNESCO.

Unit –II

Meaning of Patent – commercial Significance – Obtaining of patent – patentable subject matter – rights and obligations of patentee – Specification – Registration of patents – Compulsory licensing and licenses of rights – Revocation.

Unit – III: INDUSTRIAL DESIGNS

Definition of Designs – Registration of Designs – Rights and Duties of Proprietor of Design – Piracy of Registered designs.

Unit – IV TRADE MARKS
Meaning of trademark – purpose of protecting trademarks registered trade mark – procedure – passing off – Assignment and licensing of trade marks – Infringement of trademarks.

Unit – V: COPY RIGHT
Nature, scope of copyright – subject matter of copyright – rights conferred by copyright – Publication – Broad – Casting, telecasting – Computer programme – database right – Assignment – transmission of copyright – Infringement of copy right.

Recommended Readings:

1. Cornish W.R. : Intellectual Property Patents, Copyright, Trademarks and Allied Rights: Sweet & Maxwell 1993
2. P. Narayanan : Intellectual Property Law : Eastern Law House 2nd Edn. 1997.
3. Robin Jacob & Daniel Alexander : A Guide Book to Intellectual Property Patents, Trademarks Copyrights and Designs, Sweet and Maxwell 4th Edn. 1993

ME 457

ROBOTICS

Instruction:	4 Periods per Week
Duration of University Examination:	3 Hours
University Examination:	75 Marks
Sessionals	25 Marks

Unit-I
Robots: History and evolution of robots, Laws of robotics, Basic configuration, degree of freedom, work envelope, motion control methods. Application in industry - material handling, loading & unloading processing, welding & painting applications, assembly and inspection, Robot specification requirements.

Unit-II
Rotation matrix. Homogenous transformation matrix. Denavit - Hartenberg convention. Euler angles, RPY representation. Direct and inverse Kinematics for industrial robots fo*r* position and orientation Redundancy.

Unit-III
Manipulator Jacobian Joint - End effector velocity - direct and inverse velocity analysis, Trajectory planning, interpolation, cubic polynomial linear segments with parabolic blending, static force and moment transformation, Solvability, Stiffness, Singularities.

Unit-IV
Robot dynamics: Lagrangian formulation, link Inertia tensor and manipulator Inertia tensor, Newton -: Euler formulation for RR & RP Manipulators. Control: Individual joint, computed torque.

Unit-V

End effectors, Position and velocity measurement. Sensors: Proximity and range, tactile, force and torque. Drives for robots: Electrical, hydraulic and pneumatic. ,Robot vision: Introduction to techniques, image acquisition and processing. Introduction to robot programming languages like AL and AML.

Suggested Reading:

1. Spong and Vidyasagar, "Robot Dynamics and Control", John Wiley and Sons, 1990
2. R.K. Mittal, I.J. Nagrath, "Robotics and Control" Tata McGraw Hill, 2003.
3. Groover, "Industrial Robotics", McGraw-Hill.
4. Asadaand Siotine, "Robot Analysis and Intelligence". Wiley Interscience, 1986.
5. FU. K.S. Gon Zalez R.C., Lee C.S.G., "Robotics, Control Sensing Vision and Intelligence" McGraw Hill, int. Ed., 1987.

ME 458

PRODUCT DESIGN AND PR0CESS PLANNING

Instruction:	4 Periods per Week
Duration of University Examination:	3 Hours
University Examination:	75 Marks
Sessionals	25 Marks

Unit-I

Product Design and Process Design functions. Selection of right product. Systematic procedure of product innovation.: F51_tors contributing to successful technological innovation - need for creativity and innovation. Techniques of innovation like brain storming and Delphi techniques.

Unit-II

Project Selection and Evaluation:
Function of design - Design with Human Machine Interaction (HMI). Collection of ideas and purpose of project. Selection criteria - screening ideas for new products using evaluation techniques. Principles of ergonomics.

Unit-III

New Product Development:
Research and new product development. Patents, definitions, patent search, patent laws, international code for patents -Intellectual Property Rights (IPR).

Unit-IV

New - Product Planning:
Interaction between the functions of design, manufacture, quality, testing and marketing. Steps for introducing new products after evaluation.

Unit-V

-Process Planning:

Process planning, process sheets. Selection of manufacturing process, estimation of machining time in various cutting operations - estimation of costs for manufacture. Value engineering in product design, group technology, concepts of concurrent engineering.

Suggested Reading:

1. Niebel BW & DraperAB: "Production Design & Process Engg.", McGraw Hill, Kogakusha, 1974.
2. Harry Nystrom, "Creativity and Innovation", John Wiley & Sons, 1979.
3. Brain Twiss, "Managing Technological Innovation", Pittman Publ, 1992.
4. Harry, B. Waton, "New Product Planning", Prentice Hall Inc., 1992
5. Chitale, A. K & Gupta R.C., "Product Design & Manufacturing" -PHI, 1997

ME 459

MODERN MACHINING AND FORMING METHODS

Instruction:	4 Periods per Week
Duration of University Examination:	3 Hours
University Examination:	75 Marks
Sessionals	25 Marks

Unit-I

Ultrasonic Machining (USM): Introduction, process description, abrasive slurry, Abrasive materials and their characteristics. Functions of liquid medium in slurry, Types of Transducers, effect of process parameters, applications and limitations. Abrasive Jet Machining (AJM). Principle of operation, process details, process variables and their effect on MRR and accuracy. Equation for MRR. Advantages, disadvantages and applications. Water Jet Machining (WJM): Schematic diagram, equipment used, advantages and applications.

Unit-II

Electro Discharge Machining (EDM): Process description with schematic diagram, process parameters, functions and characteristics of dielectric medium. Dielectric fluids, over cut and side _taper Flushing, Mechanism of metal removal, crater volume, types of power supply circuits, mathematical analysis of metal removal rate (MRR), and characteristics of spark eroded surfaces, advantages, disadvantages and applications. Wire EDM: Process description and applications. Electro-Chemical Machining (ECM): Schematic of the process parameters, function and characteristics of electrolyte; chemistry of the process, Equation for specific MRR and electrode feed rate, advantages, limitations and applications. Rotary Machining: Hot machining, high speed machining, description of each process, process parameters, advantages and applications.

Unit-III

LASER Beam Machining (LBM): Principle of LASER Beam production, materials used, thermal analysis of the process, process parameters, equations for power density and machining rate, advantages, limitations and applications. Plasma Arc Machining (PAM): Introduction, equipment used, process description and parameters, types of plasma arc; Transferred arc and non-

transferred arc and process applications. Electron Beam Machining (EBM): Schematic of the process, process parameters, principle of production of Electron beam, equipment used, Advantages, disadvantages and applications. ION Etching: Process description and applications.

Unit-IV

Rubber Pad Forming: Principle of the process, process details and its types; Guerin, wheelon, Marforming and Hydro forming processes and applications. Electro-Hydraulic forming (EHF): Schematic of the process description and its applications. High Energy Rate Forming (HERF): HERF hammers, principle of explosive forming, Explosive materials, types of explosive forming, stand off operation and contact operation, the pressure pulse, Gas bubble and the process applications.

Unit-V

Stretch Forming: Introduction, types of stretch forming: stretch draw forming, rotary stretch forming or stretch wrapping, compression forming, radial draw forming. Stretch forming equipment and accessories, accuracy and surface finish, process variables and limitations. Tube spinning: Introduction, methods of tube spinning, backward spinning, Forward spinning, machines and tools used. Machine variables, speeds and feeds, effect of tube spinning on work metal properties and applications. Hydrostatic Forming: Process principle, description and applications. Water Hammer Forming (WHF): Schematic diagram of the process, principle of operation, process variables, work materials, process limitations and applications.

Suggested Reading:

1. P.C. Pandey and H.S. Shah, "Modern Machining Process", Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1980.
2. A. bhatacharya, "New Technology", The Instn of Engineers, India, 1984.
3. Davies and Austin, "Developments in High Speed Metal Forming", The Machinery Publishing Co. Ltd., 1985.
4. "Production Technology" - HMT.

ME 460

PLASTICS ENGINEERING AND TECHNOLOGY

Instruction:	4 Periods per Week
Duration of University Examination:	3 Hours
University Examination:	75 Marks
Sessionals	25 Marks

Unit-I

General properties of plastics:

Polymeric Materials, Plastics available to the designer, Engineering Plastics, Thermo sets, composites, structural foam, Polymer alloy, selection of plastics, Mechanical properties, Impact Enhancement, Degradation, wear resistance and frictional properties, special properties processing, costs -selection for strength at minimum cost.

Unit-II

Mechanical properties of plastics -Deformation, Viscoelastic behaviour of plastics, short term testing of plastics, long term testing of plastics, Design methods of plastic using deformation data, Mathematical models of viscoelastic behaviour, Intermittent loading, Deformation behaviour of reinforced plastics.

Unit-III

Mechanical properties of plastics -Fracture.

The concept of stress concentration, Energy approach to fracture, Stress Intensity. Factor approach to fracture, J. integral approach general fracture behaviour of plastics, creep failure of plastics. Fatigue of plastics, Impact behaviour of plastics. .

Unit-IV

Processing of plastics.
Extrusion -Mechanism of flow, analysis of flow in extruder, Extruder volumetric efficiency power requirements.
Injection Moulding: Moulds, CAD of moulds, structural foam Injection moulding, Reaction injection moulding, Injection blow moulding, injection moulding of thermo sets.
Thermoforming, calendering, Rotation moulding, compression moulding, transfer moulding, automatic processes, die design of plastics, Joining process -Hot air, ultrasonic, and solvent welding.

Unit-V

Analysis of polymer melt flow.
General behaviour of polymers melts, Isothermal flow of polymers Melts, Residence and Relaxation times, Experimental Methods used to obtain flow data..

Suggested Reading:

1. Plastics and Rubber -"Engineering Design and Application", R.J.Crawford.
2. "The selection and use of Engineering Materials" - N.A. Waterman.
3. "Welding Engineering",-Rossi -McGraw Hill.

CS 452

COMPUTER GRAPHICS

Instruction	4 Periods per Week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks

UNIT -I

Overview of Graphics Systems: Refresh CRT, Raster-Scan Displays, Random-Scan Systems, Color CRT, Flat Panel Displays, Three Dimensional Viewing Devices, Input Devices, Graphics Software.

Output Primitives: Line drawing Algorithms, Circle Generating Algorithms, Ellipse Generating Algorithm, Pixel Addressing, Fill Area Primitives, Character Generation.

UNIT – II

Getting Started Drawing Figures using OpenGL: Getting started making pictures, drawing basic Graphics Primitives, making line drawing, simple interaction with Mouse and Keyboard.

Two Dimensional Geometric Transformations: Basics Transformation, H- Coordinates, Composite transformations, Other Transformations, Transformation between Coordinates, Affine Transformations, Transformation functions, Raster methods of Transformations.

UNIT-III

Two Dimensional viewing: Viewing Pipeline, Viewing Transformations & Functions. Clipping operations, Point Clipping, Line Clipping, Polygon Clipping, Curve Clipping, Text Clipping, and Exterior Clipping.

Graphical User Interface & Interactive Input Methods: The user dialogue, logical classification of input devices, input functions & modes, interactive picture construction techniques.

UNIT-IV

Three Dimensional Concepts: Three Dimensional Display Methods.
Three Dimensional Object Representations: Polygon surfaces, curved line and surfaces, spline representations, Bezier Curves & Surfaces, B-SPline Curves and Surfaces, Constructive Solid-Geometry Methods, Octrees, BSP trees, Fractal geometry methods.

UNIT-V

Three Dimensional Geometric and, Modelling Transformations.

Three Dimensional viewing: Projections.
Visible Surface Detection Methods: back face detection method, 'depth buffer method Basic illumination methods: Phong & Gourand Shading, Texture Mapping.

Computer Animation: Design of Animation Sequences, General Computer Animation, Raster Animations, Computer -Animation Languages, Key-frame Systems, Motion Specifications.

Suggested Reading:

1. D. Hearn, P. Baker, "Computer *Graphics -C Version"*, 2nd Edition, Pearson Education, 2004.
2. F. S. Hill, *"Computer Graphics Using Open GL",* 2nd Edition, Peal Education, 2003.
3. S. ,Harrington: *"Computer Graphics* ", McGraw Hill.
4. James D. foley, Steven K. Feiner, ADam, f. Hughes John, " *Computer Graphics: Principles* & *Practice* "2nd Edition, Pearson Education

CS 408

INTERNET PROGRAMMING

Instruction	4 Periods per week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks

Unit-I

Introduction to Internet and Intranet HTTP protocol. TCP/IP -Concepts, addressing routing, web application building blocks, HTML, CGI, Integrating ODBC and CGI.

Unit-II

Java programming -Overview of Java, Data types, Variables, Arrays, Operators, Control structures, Classes, Inheritance, packages and interface.

Unit-III

Java programming -Exception handling, multithreaded programming, I/O, Applets Networking, AWT, AWT Controls.

Unit-IV

Internet Concepts -Cross -Platform client browser setup, corporate information models, structuring company information resources, document management, workflow software, groupware, case studies.

Unit- V

Information servers -DNS, Mail Servers, News Servers, Chat, FTP Servers, proxy servers, security and firewalls, search engines.

Suggested Reading:

1. John Desborough, "Intranet Web Development", New Riders Publ. 1996.
2. Partrik Naughton, Robert Schildt. "The complete reference Java", Tata McGraw Hill., 1997