NORTH MAHARASHTRA UNIVERSITY, JALGAON (M.S.)

FINAL YEAR ENGINEERING (B.E.)

(MECHANICAL ENGINEERING)

TERM-I & II

W.E.F.: 2008-09

NORTH MAHARASHTRA UNIVERSITY, JALGAON
STRUCTURE OF TEACHING AND EVALUATION
B.E. (MECHANICAL ENGINEERING)

FIRST TERM **W.E.F. 2008-09**

Sr. No.	Subject	Teaching Scheme Hours/week			Examination Scheme				
		Lectures	Tutorial	Practical	Paper Duration Hours	Paper	TW	PR	OR
1	Refrigeration And Air Conditioning	4	--	2	3	100	25	--	25
2	CAD/CAM	4	--	2	4	100	25	--	25
3	***Mechatronics Systems	4	--	2	3	100	25	--	25
4	Operational Research	4	--	--	3	100	--	--	--
5	Elective – I	4	--	--	3	100	25	--	--
6	***Seminar	--	--	2	--	--	25	--	--
7	***Project	--	--	2	--	--	25	--	25
	Total	**20**	**--**	**10**	**--**	**500**	**150**	**--**	**100**
	Grand Total	**30**			**750**				

*** Common with Production Engineering and Automobile Engineering

SECOND TERM

Sr. No.	Subject	Teaching Scheme Hours/week			Examination Scheme				
		Lectures	Tutorial	Practical	Paper Duration Hours	Paper	TW	PR	OR
1	Finite Element Analysis and Simulation	4	--	4	4	100	25	--	25
2	Mechanical Vibration	4	--	2	3	100	25	--	25
3	Tribology	4	--	2	3	100	25	--	25
4	Elective – II	4	--	--	3	100	25	--	--
5	***Project	--	--	4	--	--	100	--	50
6	***Industrial Visit / Case Study	--	--	--	--	--	25	--	--
	Total	**16**	**--**	**12**		**400**	**225**	**--**	**125**
	Grand Total	**28**			**750**				

*** Common with Production Engineering and Automobile Engineering

Elective-I
1. Energy Conservation and Management
2. Advanced Machine Design
3. Machine Tool Design
4. Product Development And Rapid Prototyping
5. Automobile Engineering
6. Fluid Machinery

Elective-II
1. Power Plant Engineering
2. Process Equipment Design
3. Introduction To Robotics
4. Advanced Welding Technology
5. Energy Engineering
6. Industrial Fluid Power

B.E. (MECHANICAL ENGINEERING): FIRST TERM
REFRIGERATION AND AIR CONDITIONING

Teaching Scheme
Lectures : 4 Hours/week
Practical : 2 Hours/week

Examination Scheme
Theory Paper : 100 Marks
Term Work : 25 Marks
Oral : 25 Marks
Paper Duration : 3 Hours

UNIT - I **10 Hours (20 Marks)**

Introduction, standard rating of refrigerating machine, coefficient of performance of refrigerator and heat pump.
Reversed Carnot cycle and its limitations, reversed Brayton cycle, application to air craft refrigeration, Bootstrap refrigeration cycle, reduced ambient air cooling system, regenerative air cycle system. (Numerical treatment)
Designation of refrigerant, selection of refrigerant, chemical, physical and thermodynamic requirements of refrigerants, lubricant in refrigerating system, secondary refrigerant, azeotropes and its uses.

UNIT - II **10 Hours (20 Marks)**

Vapour compression refrigeration system study of theoretical and actual vapour compression cycle, use of p-h & T-s charts, effect of evaporator and condenser pressure and temperature on the performance of the refrigeration cycle, effect of sub cooling and super heating. (Numerical treatment)
Compound vapour compression system with inter cooling, flash chamber, multi compressor and multi evaporators systems. (Numerical treatment)
Cascade refrigeration system, production of dry ice, Joule Thomson coefficient, and inverse curve, liquefaction of air and gases. (no numerical treatment)

UNIT - III **10 Hours (20 Marks)**

Vapour absorption refrigeration simple & modified vapour absorption refrigeration systems, Electrolux refrigerator.
Desirable properties of solvent, absorbent & refrigerant combinations, aqua ammonia & lithium bromide refrigeration system use of enthalpy concentration charts. (Numerical treatment)

UNIT - IV **10 Hours (20 Marks)**

Psychometric- properties of moist air, psychrometric chart and process, mixing of air stream, bypass factor, sensible heat factor, room sensible heat factor, Gross sensible heat factor, humidifying efficiency, air washer. Study of various types of psychrometers, sling, aspirating, and industrial type. (Numerical treatment)

UNIT - V **10 Hours (20 Marks)**

Introduction to industrial and comfort air conditioning, human requirements of comfort, effective temperature and comfort chart.Air conditioning load calculations, inside and outside design conditions, Building cooling & heating load calculation, Effective sensible heat factor advanced psychrometry. (Numerical treatment)
Window and central air conditioning systems year round air conditioning, Direct and chilled water air conditioning.

TERM WORK

LIST OF PRACTICAL**:** Any eight out of the following to be performed with minimum three trials.
1) Trial on vapour compression refrigeration system.
2) Trial on ice plant/domestic refrigeration system.
3) Study and trial on vapour absorption refrigeration system.
4) Study and trial on window/central air conditioner.
5) Study and trial on heat pump test rig.
6) Study of construction of hermetically sealed compressor and actual viewing of a cut model of the same (reciprocating, rotary and car A/C compressor).
7) Study of evacuation and charging of refrigeration system.
8) Study and trial on cooling towers.
9) Study of expansion devices, solenoid valve and safety devices used in vapor compression system.
10) Study of thermostat and humidistat, dryer, oil separator.
11) Study of measuring instruments and various tools used in refrigeration and air-conditioning systems.

12) Visit to cold storage/ice plant/ central air conditioning system.
13) Cooling load calculation of any laboratory / class room in the institute & suggest the requirement of Air conditioner unit in terms of capacity.

Note: Oral will be based on the prescribed term work presented in the form of certified journal.

REFERENCE BOOKS

1) Arora C. P.," Refrigeration and air conditioning", TMH, New Delhi.
2) Monohar Prasad," Refrigeration and air conditioning", New Age Publishers New Delhi.
3) Ananthnarayanan," Basics of Refrigeration", TMH, and New Delhi.
4) Stocker W. F. and Jones," Refrigeration and air conditioning", McGraw Hill.
5) Dossat," Principles of Refrigeration", John Wiley Inc.
6) Arora and Domkundawar," Refrigeration and air conditioning", Dhanpatrai and sons, New Delhi.
t) Faye C McQuistom,"Heating Ventilatging nad Air conditioning",Wiley India Pvt.Ltd. New Delhi

B.E. (MECHANICAL ENGINEERING): FIRST TERM
CAD/CAM

Teaching Scheme
Lectures : 4 Hours/week
Practical : 2 Hours/week

Examination Scheme
Theory Paper : 100 Marks
Term Work : 25 Marks
Oral : 25 Marks
Paper Duration : 4 Hours

UNIT – I **10 Hours (20 Marks)**

INTRODUCTION TO CAD/CAM AND NETWORKING
Define CAD/CAM, Product Life Cycle & CAD/CAM, Application of Computers for Design Process, Selection of a CAD system, Desirable relationship of CAD/CAM database, Benefits & Application of CAD
Hardware in CAD, Introduction, The Design Work Station, The graphics terminal, Operator input/output devices,
Computer communication,Principle of networking, Classification of network, Transmission media & interface, LAN system.

UNIT – II **10 Hours (20 Marks)**

COMPUTER GRAPHICS
Introduction, Graphic Primitives, Point plotting, Drawing of lines, Co ordinate system used in graphic element, Transformation in graphics, D transformation, Homogeneous transformation, Concatenate co ordinate transformation, Translation, Rotation, Scaling, Mirror, Reflection, Inverse co ordinate transformation, clipping, 3D transformation, Projections, Scan conversion, Rendering, Shaving, View Port, Windowing, Standardization in graphics IGES files

UNIT – III **10 Hours (20 Marks)**

GEOMETRIC MODELING
Requirement of Geometric Modeling, Geometric Model, Geometric Model Construction Method,, Wire Frame Modeling, Surface Modeling, Solid Modeling, Representation of Curve & Surfaces, Design of curve shape, Cubic Spline, Bezier curve, B-spline curve, Nurbs B-spline, Representation of surfaces
AUTOMATION
Concept of Automation, Types of Automation, Advantages & limitations of Automation, Levels of Automation, Advanced Automation Function

UNIT – IV **10 Hours (20 Marks)**

INDUSTRIAL CONTROL SYSTEM
Continuous control system, Discrete control system, Computer process control, Forms of CPC, Computer process Monitoring, Direct Digital Control, Numerical Control & Robotics, Programmable logic controller, Supervisory control, Distributed Control & Personnel Computers
CNC PROGRAMMING
Axis of CNC Machines, Manual Part Programming using G codes, Use of Sub routines, Computer Aided Part Programming using APT or any other language/G- coding /M- coding.

UNIT – V **10 Hours (20 Marks)**

FMS, GT AND ROBOTICS
FMS – Introduction, Components of FMS, Types of FMS, Application & Benefits, Planning & implementation issue, Typical FMS layout.
GT – Part families, Part classification & coding, optic coding system, Multiclass coding system, Application of GT.
Robotics – Robot Anatomy, Robot Control System, End effectors, Sensors, Industrial Robot, Application and its selection.

TERM WORK

List of Practical-
1. Modeling of any three Machine Component *
2. Any Two Assembly of Mechanical Components*
3. Three assignments based on above syllabus

* Modeling & Assembly can be done by using any modeling software

Note: Oral will be based on the prescribed term-work presented in the form of certified journal.

REFERENCES

1) P. Radhkrishnan, S. Subramanyam, V. Raju ,"CAD/CAM/CIM" , New Age Publication
2) Grover, Automation, "Production System and Computer Integrated Manufacturing", Pearson Education.
3) Mikell P. Grover, Emory W. Zimmers ,"Computer Aided Design and Manufacturing", P.H.I
4) Rao, Tiwari, Kundra ,"Computer Aided Manufacturing" ,T.M.H
5) Zeid ,"CAD/CAM" ,T.M.H
6) James G. Keramas ,"Robot Technology Fundamentala", Vikas Publication House
7) B.S.Pabla, M.Adithan ,"CNC Machine ", New Age International(P) Ltd.
8) Rudra Pratap, "Getting Started with Matlab 7", OUP, New Delhi.

B.E. (MECHANICAL ENGINEERING): FIRST TERM
MECHATRONICS SYSTEMS
(Common with Production Engineering and Automobile Engineering)

Teaching Scheme
Lectures : 4 Hours/week
Practical : 2 Hours/week

Examination Scheme
Theory Paper : 100 Marks
Term Work : 25 Marks
Oral : 25 Marks
Paper Duration : 3 Hours

UNIT – I **10 Hours (20 Marks)**

INTRODUCTION TO MECHATRONICS
Scope and importance of mechatronics, Key issue, Systems, Measurement systems.
TRANSDUCERS AND SENSORS
Introduction, Difference between transducer and sensor, Transducer types, Transduction principle, Photoelectric transducers – photoemissive transducers, photoconductive transducers, photovoltaic transducers, Thermistors, Thermodevices, Thermocouple, Inductive transducers, Capacitive transducers, Pyroelectric transducers, Piezoelectric transducer, Half-effect transducer, Ionization transducers, Light Emitting diode, Optical encoder – incremental encoder, absolute optical encoder, Bimetallic strip, Bourdon tube, Strain gauge, Load cell, Diaphragms, Mechanical switches, Flow transducers, Fibre optic transducers.

UNIT – II **10 Hours (20 Marks)**

SIGNAL CONDITIONING
Introduction, Voltage divider, Rectification, Diode voltage stabilizer, Clipping and Clamping circuit, Amplifier – OPANP circuits, more about filter circuits, Isolator, Instrumentation amplifier, Bridge circuit, Comparator, Oscillator, 555 Timer, Sample and Hold, Clock, Analog to Digital conversion – digital to analog converter, counter based analog to digital converter, successive approximation, Galvanometer, Ammeter and Voltmeter, Cathode ray oscilloscope.
DATA PRESENTATION AND DATA LOGGING SYSTEMS
Introduction, Recorders – Graphic recorders, Strip chart recorders, X-Y recorders, Magnetic tape recorder.
Data loggers – block diagram description , Data acquisition system – generalized data acquisition system, computer based data acquisition system.

UNIT – III **10 Hours (20 Marks)**

ACTUATORS AND MECHANISMS
Introduction, Actuator types and application areas, Electromechanical actuators, DC Motors – brushed DC motor, brushless, coreless, AC Motors – induction motors, synchronous motors, stepper motor, Fluid power actuators – pneumatic actuators, valves actuators, hydraulic actuators, comparison, Piezoelectric actuators – an illustration, piezoelectric motor, Magnetostrictive actuators, Memory metal actuators, Ion-exchange polymer metal composites, Chemical actuator.
Mechanisms, Bearings – slide bearing, journal bearing, rolling element bearing, magnetic bearing, molecular bearing, Belt, Chain, Pulleys, Gears – gear ratio, Rack and pinion, Ratchet, Pawl and Crank, Slider and crank, Cam and Follower – shape of the cam, shape of the follower, Chain and Sprocket, Geneva wheel, Four bar linkages.

UNIT – IV **10 Hours (20 Marks)**

INTRODUCTION TO MICROPROCESSORS AND MICROCONTROLLERS
Microprocessor – Introduction, Basic element of control systems
Microcontrollers – Introduction, Difference between Microprocessors and Microcontrollers
Programmable logic controllers – Introduction.
CONTROL SYSTEMS AND CONTROLLERS
Introduction, Control system, Open-loop control systems, Closed-loop control systems – notations, reachability, transfer function.
The Controllers – on-off controller, proportional controller, integral controller, derivative controller, proportional plus integral controller, proportional plus derivative controller, proportional plus integral plus derivative controller, comparison, More about automatic control, Difing automatic control methods.

UNIT – V **10 Hours (20 Marks)**

INTEGRATION

Introduction, Background, Advanced actuators – advanced motorized actuators, pneumatic actuators, servo actuator systems, Consumer mechatronic products, Hydraulic fingers, Surgical equipment, Industrial robot – different parts of a robot, controller, drive, arm, end effector, sensor, functional requirements, robot based automation, Autonomous guided vehicle – AGV architecture, components based DCS view, man machine interface, design with fieldbus technology, Drilling machine, Conveyor based material handling systems – validation, design.

INDUSTRIAL DESIGN, AESTHETICS AND ERGONOMICS

Introduction, Element of product design – product physiogonomy aesthetics, product physiogonomy ergonomics, ergonomics in machine tool design, ergonomics in machine tool safety, product safety audit, Ergonomic factors for advanced manufacturing systems – machine oriented industrial design, factory without people, ergonomic problems in new technology.

TERM WORK

Term work shall consist of any five experiments and three assignments.

1) Study of Basic block diagram of mechatronics system components.
2) Study and demonstration of motion / force transducers.
3) Study and demonstration of temperature / pressure transducers.
4) Study and demonstration of AD / DA converter
5) Study and demonstration of hydraulic actuator / pneumatic actuator.
6) Study and demonstration of graphic / magnetic tape recorders.
7) Study of Microprocessors and Microcontrollers
8) Study of Robot / Autonomous guided vehicle

Note: Oral will be based on the prescribed term-work presented in the form of certified journal.

REFERENCE BOOKS

1)D.R. Appukuttan,"Introduction to Mechatronics", Oxford University Press, New Delhi
2)N.P.Mahalik,"Mehatronics", Tata McGraw-Hill Publishing Company Limited, New Delhi
3) W. Bolton," Mechatronics", Pearson Education, New Delhi
4) Dan Necsulescu , "Mehatronics", Pearson Education, New Delhi
5) R.P. Borole," Mehatronics", Nirali Prakashan, Jalgaon.
6) D. V. Alciatore, "Introduction to Mechatronic and Measurement Systems", Tata McGraw- Hill Publishing Company Limited, New Delhi
7) HMT Limited, "Mechatronics", Tata McGraw-Hill Publishing Company Limited, New Delhi
8) J.G. Joshi, "Mechatronics", Prentice Hall of India, New Delhi
9) A.Smaili, "Applied Mechatronics", Oxford University Press, New Delhi.

B.E. (MECHANICAL ENGINEERING): FIRST TERM
OPERATIONAL RESEARCH

Teaching Scheme
Lectures : 4 Hours/week

Examination Scheme
Theory Paper : 100 Marks
Paper Duration : 3 Hours

UNIT – I **10 Hours (20 Marks)**

Introduction to O.R., Models in O.R., Scope, Phases, O.R. in Decision Making, Linear Programming,-model formulation, Graphical Method, Simplex Method(ONLY THEORY) , Concept of Quality and its application, Sensitive Analysis.

UNIT – II **10 Hours (20 Marks)**

Linear Programming – Simplex Method, Standard Form of an L.P. Problem , Simplex algorithm (Maximization Case), Simplex Algorithm(Minimization Case) Two Phase Method, The Big- M Method.

UNIT – III **10 Hours (20 Marks)**

Dynamic Programming- Introduction, Basic Concepts and Application, Characteristic of D.P., Dynamic Programming Approach.
Special Techniques of L.P. such as Transportation Model, Assignments Model, Traveling Salesman, Transshipments Problem.

UNIT – IV **10 Hours (20 Marks)**

Decision Theory- Decision Trees, Classes of Decision Model, Utility, Decision under Certainty, Uncertainty and Risk.
Games Theory – Theory Concept, Characteristics, Maximum And Minimum Principles, Saddle Point, Dominance Basic Concept and Terminology of Two Person Zero Sum Games, MXZ and ZXN Games, Sub Games Method, Graphical Method.

UNIT – V **10 Hours (20 Marks)**

Job Sequencing – Introduction, Sequencing Algorithm, Processing N Jobs Through Two Machines, Three Machines and M – Machines, two Jobs and M-Machine Graphical Method.
Replacement Models – Introduction, Types of Failure, Replacement of Items whose efficiency deteriorates with time(Model I & II), Replacement of Item that fail suddenly.

RECOMMENDED BOOKS

1) L.C. Jhamb ,"Quantities Techniques" Vol I and II, Everest Publication
2) Hira , Gupta ,"Operation Research "
3) Taha ,"Operation Research"
4) S.D. Sharma, "Operation Research", Khanna Publication
5) Manohar Mahajan, "Operation Research"
6) J.K.Sharma ,"Operation Research, Problem and Solution" , Macmillan
7) N.D.Vohra ,"Quantitative Techniques in Management" ,TATA Mc Graw Hill
8) Ravindran," Operation Research Principles and Practice ",Wiley India Pvt.Ltd. New Delhi

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B.E. (MECHANICAL ENGINEERING): FIRST TERM
ENERGY CONVERSION AND MANAGEMENT
ELECTIVE - I

Teaching Scheme
Lectures : 4 Hours/week

Examination Scheme
Theory Paper : 100 Marks
Term Work : 25 Marks
Paper Duration : 3 Hours

UNIT - I **10 Hours (20 Marks)**

Global and linear market - Energy scenario in various sector and Indian economy. Need and importance of energy conservation and management pay back period. Return on investment (R.O.I.), life cycle cost, sanyes diagrams, specific energy consumption. Load management.

UNIT - II **10 Hours (20 Marks)**

Energy auditing - Methodology, analysis and reporting, portable and on-line instruments. Costing of utilities like steam, compressed air, electricity and water. Energy system modeling analysis general concepts, classification of models and use of digital computers in modeling and analysis.

UNIT - III **10 Hours (20 Marks)**

Steam and condensate systems boilers (including package boilers), efficiency testing, Demand control, power factor improvement its benefit and ways of improvement, load scheduling.
Electric motors, lowers, efficiency, energy efficient types of electrical motors for energy conservation, motor speed control variable speed drive.
Lighting: Illumination level, fixtures, timers, energy efficient illumination.

UNIT - IV **10 Hours (20 Marks)**

Energy conservation compressed air systems, refrigeration and air conditioning systems, and water systems. Elementary converge of energy conversation in pumps and fans co-generation concepts, options (steam/gas turbine/D C T based) selection criterion.

UNIT - V **10 Hours (20 Marks)**

Energy action planning : Key elements, force field analysis, energy policy purpose, perspective contents, formulation, ratification, organizing, location of energy management, top management support, managerial function, roles and responsibilities of energy manager, accountability, motivating – motivation of employees, information system designing barriers, strategies, marketing and communicating, training & planning.

TERM WORK

Term work shall consist minimum eight assignments based on above syllabus.

RECOMEMNDED BOOKS:

1) Prof. Henderson," India the energy sector", oxford university press.
2) L.J. Nagrath ," System modeling and analysis", Tata McGraw Hill Press.
3) D.A.Ray," Industial energy conservation pergamon press".
4) IGC Drydin editor," The efficient use of energy" (butter worths)
5) W.C.Turner editor,"Energy management handbook (Wiley)
6) Patrick Steven R, Patric Dake R, Fordo Stephen,"Energy conservation guidebook". Fairmont press Inc.
7) F. William Payne & Richard E. Thompsion ," Efficient Boiler" Operation Source Book.
8) W.C.Turner editor: energy management handbook (Wiley)

B.E. (MECHANICAL ENGINEERING): FIRST TERM
ADVANCED MACHINE DESIGN
ELECTIVE- I

Teaching Scheme
Lectures : 4 Hours/week

Examination Scheme
Theory Paper : 100 Marks
Term Work : 25 Marks
Paper Duration : 3 Hours

UNIT - I **10 Hours (20 Marks)**

OPTIMUM DESIGN
Introduction to optimum design, Adequate design, Johnson's method of optimum design, Case of normal specifications, Case of redundant specifications, Case of incompatible specifications.

UNIT - II **10 Hours (20 Marks)**

SYSTEM APPROACH
Introduction, System approach to design mathematical model, Dynamic response to a distributed system, Dynamic response to a lumped system, Modelling the elasticities, Modelling the masses, Modelling the inertia, Modelling friction and damping, Mathematical model for shock analysis, Cam system, Value engineering approach to design problem.

UNIT - III **10 Hours (20 Marks)**

CAM:
Introduction, Advance cam curves, Polynomical cam, 3-4-5 polynomoal cam, 4-5-6-7 polynomial cam, Jerk cycloidal cam, Sine acceleration cam, Forces on cam, Mathematical model with elasticity, Jump phenomenon, Ramp of the cam – Precam, Polydyne cam.

UNIT - IV **10 Hours (20 Marks)**

DESIGN OF I.C. ENGINE COMPONENTS
Introduction, Principal part of IC engine, Design of piston, piston rings and piston pin, Design of cylinder and cylinder head, Design of connecting rod, Design of crank shaft, Design of valve gear mechanism.

UNIT - V **10 Hours (20 Marks)**

DESIGN OF HOISTING MECHANISMS
Introduction, Design of hoisting chains and drums, Design of ropes, Design of wire ropes, Stress in curved beams, Design of crank hook.

TERM WORK

Term work shall consist minimum eight assignments based on above syllabus.

REFERENCE BOOKS

1) Dr. Rajendra Karwa ," A text book of Machine Design", Laxmi Publications (P) Ltd, New Delhi
2) J. Uicker,"Theory of Machines and Mechanism", 3ed., Oxford University Press, New Delhi.
3) Farazdak Haideri ," Machine Design", Nirali Prakashan, Jalgaon
4) M.F. Spotts," Design of Machine Elements", Pearson Education
5) N.C.Pandya ," Element of Machine Design", Charotar book stall, Anand
6) Norton ," Dynamics of Machinery", Tata Mc-Graw Hill, New Delhi
7) P.C.Sharma ,"Machine Design", S K Katuria & Sons
8) R. S. Khurmi ," A text book of Machine Design", Eurasis Publishing House Pvt. Ltd, Delhi
9) R.B.Patil ,"Design of Machine Elements", Tech- Max Publications, Pune

B.E. (MECHANICAL ENGINEERING): FIRST TERM
MACHINE TOOL DESIGN
ELECTIVE- I

Teaching Scheme
Lectures : 4 Hours/week

Examination Scheme
Theory Paper : 100 Marks
Term Work : 25 Marks
Paper Duration : 3 Hours

UNIT - I **10 Hours (20 Marks)**

DESIGN OF SPEED AND FEED RATES
Aim of speed and feed rate regulation, Stepped regulation of speed : Design of speed box, Design of feed box, Machine tool drives using multiple speed motors, Special cases of gear box design, General recommendations for developing the gearing diagram, Determining the number of teeth of gears, Classification of speed and feed boxes, Stepless regulation of speed and feed rates.

UNIT- II **10 Hours (20 Marks)**

DESIGN OF MACHINE TOOL STRUCTURES
Functions of Machine tool structures and their requirements, Design criteria for tool structures, Static and dynamic stiffness, Profiles of machine tool structures, Basic design procedure of machine tool structures, Design of beds, Design of columns, Design of housings, Design of bases and tables, Design of cross rails, arms, saddles and carriages, Design of rams.

UNIT - III **10 Hours (20 Marks)**

DESIGN OF GUIDEWAYS AND POWER SCREWS
Functions and types of guideways, Design of slideways, Design criteria and calculations for slideways, Guideways operating under liquid friction conditions, Design of aerostatic slideways, Design of anti-friction guideways, Combination guideways, Protecting devices for slideways, Design of Power screws.

UNIT - IV **10 Hours (20 Marks)**

DESIGN OF SPINDLES AND SPINDLE SUPPORTS
Functions of spindle unit and requirements, Material of spindles, Effect of machine tool compliance on machining accuracy, Design calculations of spindles, Antifriction bearings, Sliding bearings.
DYNAMICS OF MACHINE TOOLS : Machine tool elastic system cutting process closed loop system, General procedure for assessing dynamic stability of EES cutting process closed loop system, Dynamic characteristics of elements and systems, Dynamic characteristic of the equivalent elastic system, Dynamic characteristic of the cutting process, Stability analysis, Forced vibrations of machine tools.

UNIT - V **10 Hours (20 Marks)**

CONTROL SYSTEMS IN MACHINE TOOLS
Functions, Requirements and classification, Control systems for changing speeds and feeds, Control systems for executing forming and auxiliary motions, Manual control systems, Automatic control systems Adaptive control systems.
NUMERICAL CONTROL OF MACHINE TOOLS : Fundamental Concepts, Classification and structure of numerical control systems, Manual part programming, Computer aided part programming

TERM WORK

Term work shall consist minimum eight assignments based on above syllabus.

REFERENCE BOOKS

1) S.K. Basu," Design of Machine Tools"
2) Koenigs, "Berger Principles of Machine Tools "
3) Sen and Bhattacharya," Principles of Machine Tool"
4) N Acherkan, "Machine Tool Design", MIR Publication, Moscow 1973
5) Mehta Machine Tool Design

B.E. (MECHANICAL ENGINEERING): FIRST TERM
PRODUCT DEVELOPMENT AND RAPID PROTOTYPING
ELECTIVE- I

Teaching Scheme
Lectures : 4 Hours/week

Examination Scheme
heory Paper : 100 Marks
Term Work : 25 Marks
Paper Duration : 3 Hours

UNIT – I **10 Hours (20 Marks)**

Product Development history and product development process tool, product development verses design, modern product development theories and methodologist in design. Product development teams, product development planning, technical and business concerns. Understanding customer needs, Establishing product functions. Functionality, augmentation. Aggregation, common basis, functional functional modeling methods.

UNIT – II **10 Hours (20 Marks)**

Product tear down and experimentation, benchmarkting and establishing engineering specification. Product portfolios and portfolio architecture. Tear down process, tear down methods, post teardown reporting, benchmarking approach, support tools, setting specifications, portfolio architecture, types, platform, functional architecting, optimization selection, Product modularity, modular design.

UNIT – III **10 Hours (20 Marks)**

Concepts and Modeling - Generation of concepts, information gathering and brain storming, directed search, morphological analysis, combining solutions. Decision making, estimation of technical feasibility, concept selection process, selection charts, measurement theory, numerical concept scoring, design evaluation scheme, concept embodiment, geometry and layout, system modeling, modeling of product metrics, selection of model by performance specifications, physical prototyping, informal and formal models.

UNIT – IV **10 Hours (20 Marks)**

Rapid Product Development - Product Development: Classical steps of product development, Requirement of New Product development strategies, Critical factors affecting success, The Principle of simultaneous Engineering.
Model: Model classes, Influence of models to speed up product development.
Model making by Rapid prototyping: Definitions of rapid prototyping (RP), Rapid Tooling (RT), Rapid Manufacturing (RM). Relating Rapid prototyping models to product development phases.

UNIT – V **10 Hours (20 Marks)**

Generation of Layer information – description of the geometry by a 3D data record, Data flow, CAD model types.
Rapid prototyping Technologies –
Photo polymerization Stereo lithography (SL), Laser Sintering, Layer Laminate Manufacturing (LLM), Extrusion Processes.
Rapid Prototyping Materials-Photopolymers, SL Resins, Sintering Materials, FDM Materials, LOM Materials.
Rapid Prototyping Industrial Applications.

TERM WORK

Term work shall consist minimum eight assignments based on above syllabus.

REFERENCE

1) Roozenburg, J. Eekels, “Product Design : Fundamentals and Methods NFM”, John Wiley and Sons Ltd.,
2) D.Whitney, “Mechanical Assemblies”, Oxford University Press, New Delhi.
3)Geoftry Boothroyd, “Peter dew Product Design for manufacturing and Assembly”
4) Mike Baxter, “Product Design: A Practical guide to systematic methods of new product development”, Champman and Hall.
5) A. K. Chitale, R. C. Gupta,” Product Design and Manufacturing”, Prentice Hall India
6) John R. Lindbeck,”Product Design and Manufacturing”, Prentice Hall International Editime

7) Kevin Otto, Kristin wood, “Product Design : Techniques in Revenue Engineering and New Product Development”, Pearson Education Inc.
8) Andreas Gebharat, Hanser,” Rapid Prototyping” ,Gardner Publication Inc. Cincinnati.
9) Naber H., Macht M., “Fast Prototype Tools in : Rapid Protyping & Manufacturing”
10) Geuer A. Society of Manufacturing Engineers, Dearborn
11) D. Kochan, “Solid Free from Manufacturing ? Advanced Rapid Prototyipng “, Elsevier Science Publisher, B.V. New York.
12) Roozenburg, J. Eekels, Product Design : Fundamentals and Methods NFM, John Wiley and Sons Ltd.,

B.E. (MECHANICAL ENGINEERING): FIRST TERM
AUTOMOBILE ENGINEERING
ELECTIVE – I

Teaching Scheme
Lectures : 4 Hours/week

Examination Scheme
Theory Paper : 100 Marks
Term Work : 25 Marks
Paper Duration : 3 Hours

UNIT - I **10 Hours (20 Marks)**

Chassis & Breaking System
Classification of Automobile, Layout of Automobile Vehicle , Chassis and Frame , Sub- frame, Articulated Vehicle and Trailers, Breaking Systems- Necessity, requirement of good breaking system, classification, types of breaks- mechanical, hydraulic, pneumatic power break. Brake shoe & lining, brake testers. Brake effectiveness, factors controlling stop of an automobile

UNIT - II **10 Hours (20 Marks)**

Transmission Devices
Clutches:- Requirement of Clutches , Single Plate Clutch, Multiplate, Cone, Centrifugal ,Semi centrifugal ,and Fluid Coupling ,Troubleshooting of Clutches,Gear Box:- Sliding Mesh , Constant Mesh, Synchromesh, Epicyclic Gear Train, Torque Converter , Troubleshooting of Gear Box, Propeller Shaft , Differential Axle.

UNIT - III **10 Hours (20 Marks)**

Suspension and Steering System
Suspension System :- Spring, Types of Spring , Coil and helper spring ,Leaf, Transverse Leaf Spring , Independent suspension, Rubber suspension, Self Leveling suspension ,Pneumatic suspension, Troubleshooting of suspension System.
Steering System :- Function and Geometry, Types of Steering System ,Caster and Camber, Toe-in and Toe-out, Steering Linkage and Gear , Reversible Steering and Power Steering .

UNIT - IV **10 Hours (20 Marks)**

Wheel , Tyres and Tubes
Construction and Types of Wheel , Wheel Dimensions , Types of Tyres , Tyre Properties , Tyre Material , Specification of Tyre Size , Ply Rating , Class Ply, Radial Ply, Consideration in Tread Design , Wheel and Tyre Troubleshooting ,Retreading of Tyre Process, Precautions , Controls, Conventional and Procured retreading processes,Tubes ,Natural Rubber and Butyl Flops, Rims , types and Maintenance.

UNIT - V **10 Hours (20 Marks)**

Automobile Electrical System
Starting system - Introduction, battery, starting motors(self starters)
Charging system - Introduction, generator(dynamo),alternator-(A.C. generator)
Ignition system -Introduction, purpose, requirement, basic, ignition system-battery, magneto, and electronics ignition system, firing order, ignition timing, vacuum controlled distributor, spark plug

TERM WORK

Term work shall consist minimum eight assignments based on above syllabus.

RECOMMENDED BOOKS

1) W.L.Crouse, “Automotive Mechanics”, MaGraw Hill International.
2) G.B.S.Narang ,”Automotive Engineering” , Khanna Publishers.
3) Kripal Singh ,”Automobile Engineering” I & II , Standard Publisher distributors.
4) Heitner ,”Automotive Mechanics” , CBS Publisher distributors.
5) Dr. K.M.Gupta,”Automobile Engineering”, Umesh Publication.
6) R.K.Rajput,” Automobile Engineering”, Laxmi Publication, New Delhi

B.E. (MECHANICAL ENGINEERING): FIRST TERM
FLUID MACHINERY
ELECTIVE- I

Teaching Scheme
Lectures : 4 Hours/week

Examination Scheme
Theory Paper : 100 Marks
Term Work : 25 Marks
Paper Duration : 3 Hours

UNIT - I **10 Hours (20 Marks)**

MOMENTUM EQUATION AND ITS APPLICATION
Impulse momentum principle, fixed and moving flat plates and curved vanes ,series of plates and vanes, Velocity triangles and their analysis, work done, efficiency etc.
HYDRODYNAMIC MACHINES
Classification, General theory, Centrifugal head and fundamental equations, (Eulerean, Degree of reaction etc.) head on machines, various efficiencies, condition for max hyd. Efficiency.

UNIT - II **10 Hours (20 Marks)**

IMPULSE TURBINES
Main components and constructional features of a pelton wheel, velocity diagrams and analysis, Number of buckets, jets, non-dimensional parameters (speed ratio, jet ratio)
REACTION TURBINE
Main components and constructional features draft tube –types, efficiency, limitation to the use of draft tube, cavitations, types of reaction turbines (Francis, Kaplan,Deriaz, reversible.)
Governing mechanisms for Francis, Kaplan turbines, pelton wheels, safety devices of turbines (pressure regulator surge tanks, farebay.)
Types of characteristics curves and related terms (unit quantities.) specific speed and shape of runner. Selection of turbine considering various factors.

UNIT - III **10 Hours (20 Marks)**

HYDRODYNAMIC PUMPS
Components of centrifugal pumps. Its installations. Classifications, various terms associated with centrifugal pump (various head, velocity triangles and there analysis, effect of outlet blade angle.) cavitation, NPSH (Thomas cavitation factor), priming of pumps, installation, and specific speed and pump classification. Performance and characteristic of centrifugal pump. Axial thrust case and maintenance, troubles and remedies.

UNIT - IV **10 Hours (20 Marks)**

APPLICATION OF SIMILARITY AS APPLIED TO TURBINES AND PUMPS
Principals, scale effects.
SPECIAL PUMPS
Jet pump, lift pump, hyram pump, deep well pump, regenerative pump, accumulator, intensifier, screw pump.
FLUID COUPLING AND TORQUE CONVERTERS
Construction, working characteristic curves, applications.

UNIT - V **10 Hours (20 Marks)**

HYDRAULIC SYSTEMS
Study of elements such as pump valves packing, motors, Introduction to elements, hydraulic circuits, pertaining of machine tools, selection of fluids.
PNEUMATIC POWER
Basic principles study of elements used in circuits and control of pneumatic power. Applications in mechanical engineering practice. Comparison of pneumatic and hydraulic systems.

TERM WORK

Term work shall consist minimum eight assignments based on above syllabus.

REFERENCE BOOKS

1) S.Ananthswamy, “Fundamentals on hydraulic machinery” ,United book corporation , Pune.
2) V.P. Vasandani, “Theory of hydraulic machinery”Khanna publishers, Delhi.
3) Dr. J. Lal,” Hydraulic machines “ , Metropolitan Books co. pvt. Ltd. Delhi.
4) S.R.Majumda,r “Oil Hydraulic System”, Tata McGraw Hill.
5) S.R.Majumdar, “Pneumatic System”, Tata McGraw Hill.
6) Agrawal,” Fluid Mechanics and Machinery” , Tata McGraw Hill
7) Hicks,” Pump Operation and maintenance”, Tata McGraw Hill
8) E.D. Shaughnessy, “Introduction to Fluid Mechanics”, Oxford University Press, New Delhi.

B.E. (MECHANICAL ENGINEERING): FIRST TERM
PROJECT I
(Common with Production Engineering and Automobile Engineering)

Teaching scheme
Practical: 2 hrs / week

Examination scheme
Oral: 25 Marks
Term Work: 25 Marks

1. Every student individually or in a group (group size is of 4 students. However, if project complexity demands a maximum group size of 5 students, the committee should be convinced about such complexity and scope of the work.) Shall take a project in the beginning of the (B.E. first Term) seventh term in consultation with the guide and the project must be completed in the (B.E. Second Term) eighth term.

2. The project proposal must be submitted in the institute in the beginning of the (B.E. first Term) seventh term. While submitting project proposal care is to be taken that project will be completed within the available time of two term i.e. 2 Hrs per week for (B.E. first Term) seventh term and 4 Hrs per week for (B.E. Second Term) eighth semester (total time become 12*2 + 12*4 = 72 Hrs per project partner). The final title of the project work should be submitted at the beginning of the (B.E. Second Term) eighth semester.

3. Project title should be precise and clear. Selection and approval of topic:

Topic should be related to real life application in the field of MECHANICAL, AUTOMOBILE AND PRODUCTION ENGINEERING

OR

Investigation of the latest development in a specific field of MECHANICAL, AUTOMOBILE AND PRODUCTION ENGINEERING

OR

The investigation of practical problem in manufacture and / or testing of MECHANICAL, AUTOMOBILE AND PRODUCTION ENGINEERING equipments

OR

The MECHANICAL, AUTOMOBILE AND PRODUCTION ENGINEERING based applications project is preferable.

OR

Software development project related to MECHANICAL, AUTOMOBILE AND PRODUCTION ENGINEERING and Agriculture Engineering with the justification for techniques used / implemented is accepted.

OR

Interdisciplinary projects should be encouraged. The examination will be conducted independently in respective departments.

4. The group should maintain a logbook of activities. It should have entries related to the work done, problems faced, solution evolved etc., duly signed by guide.

5. The group is expected to complete details system design, layout etc. in (B.E. first Term) seventh term, as a part of term work in the form of a joint report. Project report must be submitted in the prescribed format only. No variation in the format will be accepted.

6. One guide will be assigned at the most three project groups.

7. The guides should regularly monitor the progress of the project work.

8. Assessment of the project for award of TW marks shall be done by the guide and a departmental committee (consisting of minimum two teachers with experience more than three years) as per the guidelines given in the following table.

A) ASSESSMENT OF PROJECT I TERMWORK B.E. FIRST TERM

NAME OF THE PROJECT _____

NAME OF THE GUIDE: _____

Sr No	Exam Seat No	Name Of Student Marks	Assessment by guide (70%)					Assessment by Departmental committee (30%)			Grand Total	Out of 25 Marks
			Literature survey	Topic Selection	Documentation	Attendance	Total	Evaluation (10%)	Presntaion (20%)	Total		
			10	05	15	05	35	05	10	15	50	25

Sign of Guide Sign. of Committee Members Sign. Of H. O. D.

9. The guide should be internal examiner for oral examination (If experience is greater than three years).

10. The external examiner should be from the related area of the concerned project. He should have minimum of five Years of experience at degree level / industry.

11 .The evaluations at final oral examination should be done jointly by the internal and external examiners.

B.E. (MECHANICAL ENGINEERING): FIRST TERM
SEMINAR
(Common with Production Engineering and Automobile Engineering)

Teaching scheme:
Practical: 2 hrs / week

Examination scheme:
Term Work : 25 Marks

1. **For seminar every student will individually study a topic assigned to him / her and submit a report and shall deliver a short lecture / Seminar on the topic at the end of term.**
2. **Selection of topic should be done by students in consultation with concerned guide**
    a. Topic should be related to branch but it should be extended part of the branch (latest and advance topic).
    b. The topic should be such that the student can gain latest knowledge. Student should preferably refer at least one research paper

3. **Seminar topic should not be repeated in the department and registration of the same should be done on first come first served basis**
4. **Seminar report should be submitted in paper bound copy prepared with computer typing**
    a. Size of report depends on advancement of topic.
    b. Student should preferably refer minimum 5 reference books / magazines.
    c. Format of content
        i. Introduction.
        ii. Literature survey.
        iii. Theory 1) Implementation 2) Methodology
        3) Application 4) Advantages, Disadvantages.
        iv. Future scope.
        v. Conclusion.

5 ASSESSMENT OF SEMINAR for TERM WORK
Title of seminar: _____
Name of guide: _____

Sr. No.	Exam Seat No.	Name of Student	Assessment by examiners					Grand Total
			Topic Selection	Literature Survey	Report Writing	Depth of understanding	Presentation	25
			5	5	5	5	5	

6. Assessment of Literature survey will be based on
    a. Collection of material regarding history of the topic.
    b. Implementation.
    c. Recent applications.

7. Assessment of Depth of understanding will be based on
    a. Questioning by examiners.
    b. Questioning by students.
    c. What the student understands i.e. conclusion regarding seminar.

8. Assessment of presentation will be based on;
    a. Presentation time (10 minutes)
    b. Presentation covered (full or partial)
    c. Way of presentation
    d. Questioning and answering (5 minutes)

9. Examiners should be a panel of two one of them must be guide. Examiner must have experience at least 3 years. Examiners will be appointed by HOD in consultation with Principal.

B.E. (MECHANICAL ENGINEERING): SECOND TERM
FINITE ELEMENT ANALYSIS AND SIMULATION

Teaching Scheme
Lectures : 4 Hours/week
Practical : 4 Hours/week

Examination Scheme
Theory Paper : 100 Marks
Term Work : 25 Marks
Oral : 25 Marks
Paper Duration : 4 Hours

UNIT - I **10 Hours (20 Marks)**

CONVENTIONAL NUMERICAL METHODS
Finite difference method ,method of least square, ritz method, boundary value problems, displacement methods, equilibrium method, mix method of solid mechanics, fe formulation, variational element,Introduction to FEM ,Discritization going from part to whole approach, Physical problem, mathematical models and finite element solution, FEA as a integral part of CAD.
FINITE ELEMENTS TYPES:One dimensional element such as two nodded & three nodded Spar or truss element. Two and three dimensional elements, triangular, rectangular quadrilateral, sector curved, iso parametric, sub parametric elements, etc.

UNIT - II **10 Hours (20 Marks)**

GENERAL PROCEDURE OF FEM
Discritation, element shape, interpolation function, shape function, element stiffness matrix, global stiffness matrix, application of boundary,FEM Softwares - Preprocessing, processing and post processing
Finite element analysis of 1D problem, bending of beams.Introduction, FEM direct approach elements stiffness, potential energy approach, treatment of boundary conditions, temperature effects.
Torsion of circular shaft, thin valve tubes steady state heat conduction, laminar pipe flow.
TRUSSES:Introduction plane trusses, space trusses.

UNIT - III **10 Hours (20 Marks)**

Finite element analysis for two dimensional problem, single variable problems, mesh generation and imposition, egine value and time dependent problems.
Application of heat transfer, fluid mechanics, solid mechanics, plane elasticity and analysis of structural vibration.
Finite element formation of beams.

UNIT - IV **10 Hours (20 Marks)**

Application of FEA to free vibration of thin plate cylindrical shell, transient heat conduction, shaft , motion of fluid in flexible container, flow of idle fluids, viscous fluids, shape structure.

UNIT - V **10 Hours (20 Marks)**

SIMULATION THEORY AND APPLICATION
System models and studies:- concepts of a system, system environment, stochastic activities, continuous and discrete systems, system modeling, types of models, principles used in modeling, types of system studies.
System simulation:-The techniques of simulation, Monte Carlo method, comparison of simulation and analytical methods, analog computers and methods, hybrid computer, simulators, continuous system simulation languages, system dynamics, growth models, logistic curves, multi segments models, probability concepts in simulation, system simulation, events, representation of time, arrival pattern.

TERM WORK

Any Five practical and three assignments based on above syllabus using analysis software.

Note: Oral will be based on the prescribed term-work presented in the form of certified journal.

RECOMMENDED BOOKS

1) J.N. Reddy, An Introduction to Nonlinear Finite Element Analysis, OUP.
2)C.S.Krishnamoorthy.,Finite element analysis TMH
3) J.N.Reddy, Finite element methods,Mc graw hill publition ltd.
4) Robert Cook ,Concept an application of Finite element analysis
5) Klaus-Jurgen Bhate, finite element analysis , PHI
6) C.S. Desai and J.F.Abel.,Introduction to finite element methods ,CBS
7) Tirapati R. Chandrupatla ,Finite element analysis by, PHI.
8) Geoffery Gordon ,System simulation
9) Narsingh Deo ,System simulation with digital computers
10) Kenneth Lt. Huebner, " The FEM for Engineers ",Wiley India Pvt.Ltd. New Delhi

B.E. (MECHANICAL ENGINEERING): SECOND TERM
MECHANICAL VIBRATION

Teaching Scheme
Lectures : 4 Hours/week
Practical : 2 Hours/week

Examination Scheme
Theory Paper : 100 Marks
Term Work : 25 Marks
Oral : 25 Marks
Paper Duration : 3 Hours

UNIT - I **10 Hours (20 Marks)**

FUNDAMENTAL OF VIBRATIONS
Introduction, Definitions, Vector method of representing harmonic motions, Addition of two simple harmonic motions of the same frequency, Beat phenomenon, Complex method of representing harmonic vibrations, Work done by a harmonic force on a harmonic motion, Fourier series and harmonic analysis.
UNDAMPED FREE VIBRATIONS OF SINGLE DEGREE OF FREEDOM SYSTEMS
Introduction, Derivation of differential equation, Solution of differential equation, Torsional vibrations, Equivalent stiffness of spring combinations, Energy method.

UNIT – II **10 Hours (20 Marks)**

DAMPED FREE VIBRATIONS OF SINGLE DEGREE OF FREEDOM SYSTEMS
Introduction, Different types of dampings, Free vibrations with viscous damping, Logarithmic decrement, Viscous dampers, Dry friction or coulomb damping, Solid or structural damping, Slip or interfacial damping.
FORCED VIBRATIONS OF SINGLE DEGREE OF FREEDOM SYSTEMS
Introduction, Forced vibrations with constant harmonic excitation, Forced vibrations with rotating and reciprocating unbalance, Forced vibrations due to excitation of support, Energy dissipated by damping, Forced vibrations with coulomb damping, Forced vibrations with structural damping, Determination of equivalent viscous damping from frequency response curve, Forced vibrations of a system having non-harmonic excitation, Vibration isolation and transmissibility, Vibration measuring instruments.

UNIT - III **10 Hours (20 Marks)**

TWO DEGREE OF FREEDOM SYSTEMS
Introduction, Principal modes of vibration, Other cases of simple two degree of freedom systems, Combined rectilinear and angular modes, System with damping, Undamped forced vibrations with harmonic excitation, Vibration absorbers.
CRITICAL SPEED OF SHAFT:
Introduction, Critical speed of a light shaft having a single disc without damping, Critical speed of a light shaft having a single disc with damping, Critical speed of a shaft having multiple discs, Secondary critical speed, Critical speed of a light cantilever shaft with a large heavy disc at its end.

UNIT - IV **10 Hours (20 Marks)**

MULTI DEGREE OF FREEDOM SYSTEMS EXACT ANALYSIS
Introduction, Free vibrations equations of motion, Influence coefficients, Generalized coordinates and coordinate coupling, Natural frequencies and mode shapes, Orthogonal properties of normal modes, Model analysis, Forced vibrations by matrix inversion, Torsion vibrations of multi-rotor systems.
MULTI DEGREE OF FREEDOM SYSTEMS NUMERICAL METHODS
Introduction, Rayleigh's method, Dunkerley's method, Stodola's method, Rayleigh-Ritz method, Method of matrix itrrations, Holzer's method.

UNIT - V **10 Hours (20 Marks)**

CONTINUOUS SYSTEMS
Vibrations of strings, Longitudinal vibrations of bars, Torsional vibrations of circular shafts, Lateral vibrations of beams.
TRANSIENT VIBRATIONS
Introduction, Laplace transformation, Response to an impulsive input, Response to a step input, Response to a pulse input, phase plane method, shock spectrum.
NON-LINEAR VIBRATIONS: Introduction, Examples of non-linear systems, Phase plane, Undamped free vibration with non-linear spring forces, Pertubation method, Forced vibration with non-linear spring forces, Self excited vibrations.

TERM WORK

Term work shall consist of any five experiments out of the following and three assignments based above syllabus.

1) To study the torsional vibrations of single rotor system.
2) To study the torsional vibrations of two rotor system.
3) To study damped torsional vibrations of single rotor system.
4) To study undamped free vibrations of a spring.
5) To study the natural vibrations of a spring mass system.
6) To study forced damped vibrations of a spring mass system.
7) To study the forced damped vibrations of simply supported beam.
8) To determine critical speed of a single rotor system.

Note: Oral will be based on the prescribed term-work presented in the form of certified journal.

REFERENCE BOOKS

1) Dilip Kumar Adhwarjee "Theory and Applications of Mechanical Vibrations"Laxmi Puyblications (p) Ltd., New Delhi
2) G.K.Grover "Mechanical Vibrations"New Chand & Bros Roorkee (U.P.)
3) Leonard Meirovitch " Element of Vibration Analysis" Tata McGraw-Hill Publishing Company Limited, New Delhi
4) Singiresu S. Rao " Mechanical Vibrations " Pearson Education Ptd. Ltd., Delhi
5) S. Graham Kelly " Schaum's Out lines Mechanical Vibrations " Tata McGraw-Hill Publishing Company Limited, New Delhi
6) Thompson," Theory of Vibration with Application", Pearson Education
7) V.P.Singh " Mechanical Vibrations " Dhanpat Rai & Co. (P) Ltd., Delhi
8)B.H.Tongue," Principles of Vibration", 2/ed. Oxford University Press, New Delhi.

B.E. (MECHANICAL ENGINEERING): SECOND TERM
TRIBOLOGY

Teaching Scheme
Lectures : 4 Hours/week
Practical : 2 Hours/week

Examination Scheme
Theory Paper : 100 Marks
Term Work : 25 Marks
Oral : 25 Marks
Paper Duration : 3 Hours

UNIT - I **10 Hours (20 Marks)**

Tribology: Introduction, Tribology in design, Tribology in Industry, Economic considerations.
Friction: Introduction, Laws of friction, Kinds of friction, Causes of friction, Friction measurement, stick slip oscillations & its elimination,Wear: Theory of wear, Types of wear, Various factors affecting wear, measurement of wear, wear between solids and flowing liquids, theory of wear.

UNIT - II **10 Hours (20 Marks)**

Lubricants and Lubrication: Lubricant properties – physical and chemical. Lubrication – introduction, basic modes of lubrication. Flow of viscous fluid through rectangular slot.
Hydrostatic bearings: Basic concept, operations, advantages and limitations. Hydrostatic conical and spherical bearings, load carrying capacity and flow of lubricants. Bearing power and film thickness, bearing temperature and power. Compensators and their action. Optimum design step bearing.

UNIT - III **10 Hours (20 Marks)**

Hydrodynamic bearing: Theory of hydrodynamic lubrication, Mechanism of pressure development in oil film. Two Dimensional Reynolds equation, Infinite tapered shoe slider bearings and infinite long journal bearing. Short bearing theory applied to journal bearing.

UNIT - IV **10 Hours (20 Marks)**

Hydrodynamic thrust bearing: Introduction, flat plate thrust bearing, step thrust bearing, tapered land thrust bearing, tilting pad thrust bearing, spring mounted thrust bearing, hydrodynamic pocket thrust bearing.
Friction and power losses in journal bearings: Evaluation of friction loss in concentric & eccentric journal bearing & quantity of oil flow with circumferential groove and hole.

UNIT - V **10 Hours (20 Marks)**

Hydrostatic squeeze film, circular & rectangular plates, impact conditions between lubricated solids, applications to journal bearing,Air lubricated bearings: Tilting pad bearings, magnetic recording disk with flying heads, hydrostatic & hydrodynamic thrust bearing with air lubrications. Lubrication practice, quality control & management – characteristics of lubricating methods, lubricating devices & systems, organizing application charts.

TERMWORK

Assignments Problems on -
Problem in hydrostatic bearing
Problem in hydrodynamic bearing
Reynolds equation
Derivation of squeeze film lubrication on rectangular plate and
Practical On (Any FOUR)
Journal Bearing apparatus.
Tilting pad thrust bearing apparatus
Friction in journal bearing
Break line friction test rig.
Coefficient of friction using pin on disc test rig.

Note: Oral will be based on the prescribed term-work presented in the form of certified journal.

REFERENCE BOOKS

1) B. C. Majumdar “Introduction Tribology and Bearings”, H. Wheeler and Company Pvt. Ltd.
2) Cameron A. “Basic Lubrication Theory , Wiley Eastern Ltd.
3) Fuller D. D., “Theory and Practice of Lubrication for Engineers”. John Wiley and Sons.
4) Halling J. “Principles of Tribology”, McMillan Press Ltd.
5) Hrassan & Powel , “Gas Bearing”.
6) Neale M. J. “Tribology Hand Book”, Butterworths.

B.E. (MECHANICAL ENGINEERING): SECOND TERM
POWER PLANT ENGINEERING
ELECTIVE - II

Teaching Scheme
Lectures : 4 Hours/week

Examination Scheme
Theory Paper : 100 Marks
Term Work : 25 Marks
Paper Duration : 3 Hours

UNIT - I **10 Hours (20 Marks)**

THERMAL POWER PLANT
Introduction, general layout of modern thermal power plant, working of thermal power plant, coal classification, coal handling, coal blending, coal desulphanization, Indian coals, selection of coal for TPP., coal handling, storage, preparation and feeding, ash handling and dust collection, fluidized bed combustion systems, steam turbines, condensers, cooling pond and cooling tower, necessity of feed water treatment, high pressure boilers and importance of water purity, thermodynamic cycles.

UNIT - II **10 Hours (20 Marks)**

HYDROELECTRIC POWER PLANT
Hydrograph, flow duration curve, site selection, classification of HPP, and their field of use, capacity calculation for hydro power, dam, head water control, penstock, water turbines, specific speeds, governors, hydro electric plant auxiliaries, plant layout, automatic and pumped storage , project coasty of hydroelectric plant. advantages of HPP

UNIT - III **10 Hours (20 Marks)**

NUCLEAR AND DIESEL POWER PLANT
Elements of nuclear power plant, nuclear reactor and its types, fuels moderators , coolants, control rod, classification of nuclear power plants, waste disposal, diesel power plant diesel engine performance and operation , plant layout, log sheet, application, selection of engine size

UNIT - IV **10 Hours (20 Marks)**

GAS TURBINE PLANT
Plant layout, method of improving output and performance, fuel and fuel systems, method of testing open and closed cycle plants, operating characteristics, applications, free piston engine plant, limitation and application , combined cycle plants, advantages , need of generation power plant in power systems based load station and peak load station.

UNIT - V **10 Hours (20 Marks)**

MAJOR ELECTRICAL EQUIPMENT IN POWER STATION
Generator and exciters, earthling of power system, power and unit transformer, circuit breakers, protective equipments, control board equipment, elements of instrumentation, plant layout, switch gear for power station auxiliaries, recent developments in methods of power generation, introduction to magneto hydrodynamic, fuel cells , geothermal, solar power, tidal power.

TERM WORK

Term work shall consist minimum eight assignments based on above syllabus.

REFERENCE BOOKS

1) Domkundwar and Arora " Power Plant Engineering", Dhanpat Rai & Sons, New Delhi
2) E.I. Wakil, "Power Plant Engineering", Publications, New Delhi
3) P.K.Nag,"Power Plant Engineering", Tata McGraw Hill, New Delhi
4) R.K.Rajput," Power Plant Engineering", Laxmi Publications, New Delhi

B.E. (MECHANICAL ENGINEERING): SECOND TERM
PROCESS EQUIPMENT DESIGN
ELECTIVE - II

Teaching Scheme
Lectures : 4 Hours/week

Examination Scheme
Theory Paper : 100 Marks
Term Work : 25 Marks
Paper Duration : 3 Hours

UNIT - I **10 Hours (20 Marks)**

PRESSURE VESSELS : Introduction, Operating conditions, Pressure vessel code, Selection of material, Vessel opening at low temperatures, Vessel opening at elevated temperatures, Design conditions and stresses, Design of shell and its components, Supports for vessels, Bracket supports, Leg supports, Skirt supports, Saddle supports, Stress from local loads and thermal gradient, Thermal stresses in cylindrical shell, Fabrication, Inspection and tests.

UNIT - II **10 Hours (20 Marks)**

HIGH PRESSURE VESSELS : Introduction, Constructional features, Material for high pressure vessels, Solid walled vessel, Multi-shell construction, vessel closures, jacket for vessels, STORAGE VESSELS: Introduction, Storage of Fluids, Storage of non-volatile liquids, Storage of volatile liquids, Storage of gases, Design of rectangular tanks, Design of tanks, Nozzles and mountings, Large capacity storage tanks.

UNIT - III **10 Hours (20 Marks)**

REACTION VESSELS : Introduction, Material of construction, Agitators, Types of agitators, Baffling, Power requirements for agitation, Design of agitators system components, Drive for agitators, Classification of reaction vessels, Heating systems, Design considerations,Heat Exchangers: Introduction, Types of heat exchangers, Design of shell and tube heat exchangers.

UNIT - IV **10 Hours (20 Marks)**

EVAPORATORS AND CRYSTALLISERS : Evaporators, Types of evaporators, Entrainment separators, Material of construction, Design considerations, Crystallisers,Distillation And Absorption Towers / Columns:Introduction, Basic features of Towers / Columns, Process engineering data, Towers / columns internals, stresses in columns shell, Determination of shell thickness, Elastic stability under compressive stresses, Allowable deflection, Design and construction features of column internals, Supports for column.

UNIT - V **10 Hours (20 Marks)**

AUXILIARY PROCESS VESSELS
Introduction, Reflux drum, Compressors knock-out drum, Liquid-liquid separators, Vapour/gas liquid separators, Wire mesh mist eliminators, Process Hazard And Safety Measures in Equipment Design:Introduction, Hazards in process industries, Analysis of hazards, Safety measures, Safety measures in equipment design, Pressure relief devices.

TERM WORK

Term work shall consist minimum eight assignments based on above syllabus.

REFERENCE BOOKS

1) B.C. Bhattacharyya ," Chemical Equipment Design", CBS Publishers and Distributors, Delhi
2) E.E. Ludwig"Applied Process Design for Chemical and petrochemical Plants", Gulf Publishing Co.
3) E.E. Ludwig "Applied Process Design for Chemical Plants", Gulf Publishing Co.
4) J.H. Perry ,"Chemical Engineering Handbook"
5) L.E. Brownell ," Process Equipment Design", John Wiley and Sons
6) M.V. Joshi ," Process Equipment Design", Macmillan India Ltd, New Delhi
7) S. D. Dawande ,"Process Equipment Design", Central Techno Publication
8) Babu," Process Plant Simulation", Oxford University Press, New Delhi.

B.E. (MECHANICAL ENGINEERING): SECOND TERM
INTRODUCTION TO ROBOTICS
ELECTIVE - II

Teaching Scheme
Lectures : 4 Hours/week

Examination Scheme
Theory Paper : 100 Marks
Term Work : 25 Marks
Paper Duration : 3 Hours

UNIT - I **10 Hours (20 Marks)**

PLANNER MECHANICS: Advanced synthesis of planner mechanics for ISP and FSP burmester theories and analytical techniques, applications.
MECHANICS DYNAMICS: Newtonian lagrangian techniques, energy methods, spatial mechanisms, axodes, and kinematics of open and closed loop mechanism.

UNIT - II **10 Hours (20 Marks)**

BASIC CONCEPT IN ROBOTICS: automation and robotics, robot anatomy, basic structure of robotics, resolution, accuracy and repeatability, classification and structure of robotics system, point to point and continuous past system, control loop of robotics system.

UNIT - III **10 Hours (20 Marks)**

DRIVES AND CONTROL SYSTEM: Hydraulic, DC servomotors, basic control system, concept and models, control system analysis, robot activation and feedback component, positional and velocity sensors, actuators, power transmission system, robot joint control design. Application of robot in manufacturing.

UNIT - IV **10 Hours (20 Marks)**

END EFFECTORS, SENSORS AND VISION SYSTEMS:
End Effectors Types of end effectors, mechanical grippers, vacuum / magnetic / adhesive grippers, tools as end effectors, Gripper selection and design.
Introduction to Sensors: Need of sensors in a robotic system, selection of sensors, photo sensors, limit switches. Range sensors, proximity sensors, touch / sensors.
VISION SYSTEMS: concept of low level and high-level vision in a robotic system.

UNIT - V **10 Hours (20 Marks)**

ROBOT PROGRAMMING: Methods of robot programming, lead through programming methods, a robot program as a path in space, motion interpolation WAIT, SIGNAL, AND DELAY commands.
ROBOT LANGUAGES: The textural robot languages, generation of robot programming languages, robot language structure, constant, variables and other data objects, motion commands, end effector and sensor commands.

TERM WORK

Term work shall consist minimum eight assignments based on above syllabus.

RECOMMENDED BOOKS

1) Groover," Industrial Robotics", McGraw Hill Publication Co.Ltd..
2) John J. Craig, "Introduction to Robotics Mechanics and Control", Pearson Education Inc.,
3) M.P.Groover,"Industrial Robotics - Technology, Programming and Applications"
4) Niku,"Introduction to Robotics : Analysis System and Application", Pearson Education
5) POVOV , Robotics", Mir Publication Co.Ltd.
6) Robot J.Schilling, " Fundamental of Robotics", Pearson Education
7)Mark W Sping," Robot Modelling And Control ",Wiley India Pvt.Ltd. New Delhi

B.E. (MECHANICAL ENGINEERING): SECOND TERM
ADVANCED WELDING TECHNOLOGY
ELECTIVE-II

Teaching Scheme
Lectures : 4 Hours/week

Examination Scheme
Theory Paper : 100 Marks
Term Work : 25 Marks
Paper Duration : 3 Hours

UNIT - I **10 Hours (20 Marks)**

SOLDERING AND BRAZING
Welding characteristics capillary attraction bond formation, metallurgy of solders, foreign materials in the solders alloy. Designing solder joint. Soldering iron, special soldering technique, thermal free solder, low temperature soldering, high temperature soldering, expanding type solders.
Metallurgical aspects of brazing, Design of joint, brazing fluxes, Method of heating – touch brazing, furnace brazing, induction brazing, Resistance brazing, disphasing, Salt bath brazing, brazing solders, silver solders.

UNIT - II **10 Hours (20 Marks)**

SPECIAL WELDING PROCESSES:
Electron beam welding, plasma arc welding, laser welding, bronze welding, under water welding. Ultrasonic, Diffusion welding, Friction and inertia welding, Forge welding, Expolsive welding, Thermit welding, Atomic hydrogen welding

UNIT - III **10 Hours (20 Marks)**

WELDABILITY OF STEELS:
Plain carbon steels-mild steel, medium carbon steel, high carbon steel, tool steels, low alloy and high alloy steels, stainless steels, Austenitic manganese steels.
WELDABILITY OF ALUMINIUM AND ITS ALLOY:
metallurgical behavior during welding, choice of methods, welding rods, fixtures, methods of welding.
WELDABILITY OF CAST IRON AND CASTING:
Gray cast iron, malleable cast iron spheriodal graphite cast iron, selection of cast iron, electrodes and welding rods-methods of welding.
WELDABILITY OF COPPER AND COPPER ALLOY:
Copper brasses, bronzes, Phospher bronze, aluminium bronze, welding of dissimilar metal joints on copper and copper alloys, methods of welding.

UNIT - IV **10 Hours (20 Marks)**

METULLURGICAL CONCEPT OF WELDABILITY:
Temperature changes in welding concepts of weldability carbon equivalent, cracking of welds, weldability testing, welding metallurgical of dissimilar metals, heat treatments of welds.
HARD FACING:
Types of wear, hard facing metallurgy, preparing hard facing, basic hard facing procedure, spray hard facing, basic treatment weld.

UNIT - V **10 Hours (20 Marks)**

DESIGN AND FABRICATION:
Designing for welding types of joints welds and stress distribution, layer sequences, deposition rates, expansion, contraction and residual stresses in weld structure.
Indian standards for welding electrodes, fluxes and properties, electrode selection.

TERM WORK

Term work shall consist minimum eight assignments based on above syllabus.

REFERENCE BOOKS

1) M. Lal , “Fabrication Technology”
2) O. P. Khanna , “Welding Technology”, Dhanpat Rai Publications
3) P.C. Sharma ,” Production Engineering”
4) P. N. Rao , “Manufacturing Tech”. Vol I & II
5) R. K. Jain , “Production Technology”

B.E. (MECHANICAL ENGINEERING): SECOND TERM
ENERGY ENGINEERING
ELECTIVE- II

Teaching Scheme
Lectures : 4 Hours/week

Examination Scheme
Theory Paper : 100 Marks
Term Work : 25 Marks
Paper Duration : 3 Hours

UNIT – I **10 Hours (20 Marks)**

INTRODUCTION:Global primary energy reserves, energy needs of growing economy, Indian energy scenario, energy pricing in India, energy conservation and its importance, energy conservation act-2001 and its features, energy management strategy, energy audit: types and methodology, energy audit reporting format

UNIT - II **10 Hours (20 Marks)**

SOLAR ENERGYsolar radiation, measurement of solar radiation, energy potential of sun, simple flat plate collector, design of liquid flat plate collector, application of liquid flat plate collector, performance analysis, testing procedure of liquid, air, water, FPC.Concentrating Collectors: types, material of construction parameters characterizing, the concentrators, thermodynamic limits on concentration, tracking, performance analysis of cylindrical parabolic & dish collector. Comparison with FPC.

UNIT - III **10 Hours (20 Marks)**

APPLICATION OF SOLAR SYSTEMS AND ECONOMICS ANALYSIS:
Solar ponds, solar distillatory, solar satellite power system, solar cooker, solar air & water heaters, solar dryers, photovoltaic direct energy conversion, solar cells, solar thermal power system, Solar passive heating, solar air-conditioning, solar energy storage's. Economics analysis of solar systems, net present value concept, calculation of pay back periods for solar system.

UNIT - IV **10 Hours (20 Marks)**

WIND ENERGY:Nature of wind, wind machines, classification & description, wind data and its representation, energy in wind, wind mill site characteristic , performance calculations, recent development.
BIOMASS ENERGY:Various forms of biomass energy as a potential energy source, various species of plants suitable for India, bio-fuel production processes, bio-gas plants gasifiers principle, bio-gas & plants, types of gober gas plants.

UNIT - V **10 Hours (20 Marks)**

OCEAN ENERGY:Types of ocean energy sources, ocean temperature difference, OTEC cycle (open and closed) comparison with normal vapor cycle.Ocean Waves: Wave motion energy, power from wave, wave energy conversion devices.Geothermal Energy:History, Future origin, types of geothermal energy, dry rock & hot aquifer analysis, vapour dominated geothermal systems, operational & environmental problems.

TERM WORK
Term work shall consist minimum eight assignments based on above syllabus.

RECOMMENDED BOOKS

1) B.S.Magal, "Solar Power Engineering"
2) G.D. Rai.,Non Conventional Energy Sources
3) Garg H.P.,Treatise on solar Energy Vol. I, II, III
4) John W. Twidell and Anthony D. Weir ,Renewable Energy Resources, ELBS Publication
5) J.A. Duffy, W.A. Beckman- John Willy, Solar Energy of Thermal Processes-
6) Krieth, Krieder ,Principles of solar Engineering ,Mc Graw Hill Pub. Co.
7) S.Rao & B.B.Parulekar, Energy Technology, TMT, New Delhi
8) S.P. Sukhatme ,Solar Energy, Principles of collection and storages , Tata McHill Publication, New Delhi
9) W.C. Turner.,Energy Management Hand Book
10) S.N. Bhadra, Wind Electrical Systems, Oxford University Press, New Delhi.

B.E. (MECHANICAL ENGINEERING): SECOND TERM
INDUSTRIAL FLUID POWER
ELECTIVE- II

Teaching Scheme
Lectures : 4 Hours/week

Examination Scheme
Theory Paper : 100 Marks
Term Work : 25 Marks
Paper Duration : 3 Hours

UNIT - I **10 Hours (20 Marks)**

Fluid power system: Component advantages, application in the field of machine tool, material handling. Hydraulic pressing, mobile and stationary machine clamping, devices etc. Transmission of power at static and dynamic states.
Laws of fluid flow, type of flow,Types of hydraulic fluids, petroleum base, synthetic, and water based. Properties of fluid, selection of fluids, additives, effect of temperature and pressure on hydraulic fluid.

UNIT - II **10 Hours (20 Marks)**

Seals, seating material, compatibility of seal with fluid, Types of pipes, hoses, material, quick acting couplings, presser drop in hosses/pipes, Fluid conditioning through filters, strainers, source of contamination, and contamination control, heat exchangers,Pumps - Types, classification, principal of working, power calculations, efficiency calculation, characteristic curves, selection of pump for hydraulic power transmission form vane pump, gear pump, redial and axial plunger pumps, screw pumps.

UNIT - III **10 Hours (20 Marks)**

Manually operated, solenoid operated, pilot operated. Directional control valve , check valve, Modular construction of valve.
Control of fluid power,Necessity of fluid control through pressure control, direction, control, flow control valves,Principle of pressure control valves, direct operated, pitol operated, relief valves, pressure reducing valve, sequence valve, quick exhaust valve,Principle of flow control valve- Pressure compensated, temperature compensated flow control valve, meter in circuit, meter out circuit, flow through restrictor, Types of direction control valves: Two way two position, four way three position, four way two piston valves, Open center, close center, Tandem center, position of valve

UNIT - IV **10 Hours (20 Marks)**

Actuators - linear and rotary, Symbols of hydraulic circuits, Hydraulic motors gear type vane type piston type radial piston type methods of control of acceleration and deceleration, Types of cylinder mountings, Calculation of piston velocity and thrust under static and dynamic application considering friction inertia loads, Design consideration for cylinders, Selection of components and design of hydraulic circuits for linear circuits regeneration circuits sequencing circuits with the use of electrical control, Laden diagram, Maintenance trouble shooting safety precaution of hydraulic circuits

UNIT – V **10 Hours (20 Marks)**

JIC symbols/ISO pneumatic symbol, Principle of pneumatic, Laws of compression , types of compression, selection of compression, Comparison of pneumatic with hydraulic power transmission, Types of filters regulators , lubrication, mufflers, driers, Pressure regulating valve, Direction control valve two-way three way four way valve solenoid operated valve push button level control valve,Speed regulating methods in pneumatic, Pneumatic actuators, rotary and reciprocating,Air motors radial piston vane type axial piston type,Basic pneumatic circuits, Selection of components for linear circuits sequencing circuits

TERM WORK

Term work shall consist minimum eight assignments based on above syllabus.

RECOMMENDED BOOKS

1) A.Esposito"Fluid Power with Application" Prencice Hall.
2) B. Lall ,"Oil Hydraulics"International Literature Association
3) D.A. Pease ," Basic fluid power " Prentice Hall
4) Godwin ," Power Hydraulics " Cleaver Hume.

5) H.L. Stewart ," Hydraulics and Pneumatics" Industrial Press
6) J.J. Pippenger ,"Industrial Hydraulics "McGraw Hill Co.
7) Vickers' manual on Industrial Hydraulics.
8) Yeaple ,"Fluid Power Design Handbook."
9)E.J.Shaughnessy, "Introduction to Fluid Mechanics" (SI Adoption),OUP, New Delhi.

B.E. (MECHANICAL ENGINEERING): FIRST TERM
PROJECT II
(Common with Production Engineering and Automobile Engineering)

Teaching scheme:
Practical : 4 hrs / week

Examination scheme:
Oral : 50 Marks
Term Work : 100 Marks

1. The Project group in (B.E. first Term) seventh term will continue the project work in (B.E. Second Term) eighth term and complete project in all respect (assembly, testing, fabrication, tabulation, test result etc.)
2. The group should maintain a logbook of activities. It should have entries related to the work done, problems faced, solution evolved etc., duly signed by guide.
3. The guides should regularly monitor the progress of the project work.
4. The project work along with project report should be submitted as part of term work in (B.E. Second Term) eighth term on or before the last day of the (B.E. Second Term) eighth term
5. Project report must be submitted in the prescribed format only. No variation in the format will be accepted.
6. Assessment of the project for award of TW marks shall be done by the guide and a departmental committee (consisting of minimum two teachers with experience more than three years) as per the guidelines given in the following table.

B) ASSESSMENT OF PROJECT II TERMWORK (B.E. SECOND TERM)

NAME OF THE PROJECT: _____

NAME OF THE GUIDE: _____

Sr. No	Exam. Seat No	Name Of Students	Assessment by guide (70%)						Assessment by department (30%)			Grand Total
			Fabrication /software / actual work	Execution of project	Project report	Scope/ Cost / Utility	Attende-nece	Total	Evaluation (10%)	Prese-ntaion (20%)	Total	
		Marks	20	10	20	10	10	70	10	20	30	100

Sign of Guide Sign. of Committee Members Sign. of H. O. D.

7. The guide should be internal examiner for oral examination (If experience is greater than three years).
8. The external examiner should be from the related area of the concerned project. He should have minimum of five years of experience at degree level / industry.
9. The evaluation at final oral examination should be done jointly by the internal and external examiners.

NORTH MAHARASHTRA UNIVERSITY JALGAON

B.E. (Common Automobile Engineering and Production Engineering)

W.E.F : 2008- 09

TERM - II

INDUSTRIAL VISIT / CASE STUDY

Teaching scheme: **Examination scheme:**

NIL **Term Work : 25 Marks**

EDUCATION TOUR / TECHNICAL VISITS / CASE STUDY AND ITS EVALUATION

1. During (B.E. First Term / Second Term) seventh and / or eighth terms or during vacation between (B.E. First Term / Second Term) seventh and eighth terms, every student; shall visit minimum two industries, factories arranged by colleges and accompanied by teachers. There shall be at least one teacher for a group of 20 students and at least one non-teaching staff accompanied with the students.

2. The colleges should obtain appropriate certificates of visit from the concerned organizations just after the visits.

3. Students should submit written report about the visits individually at the end of (B.E. Second Term) eighth term.

4. The report should contain information about the following points:

   (a) The organization - activities of organization and administrative setup technical personnel and their main duties.
   (b) The project / industry brief description with sketches and salient technical information.
   (c) The work / processes observed with specification of materials, products, equipments etc. and role of engineers in that organization.
   (d) Suggestions (if any) for improvement in the working of those organizations.

5. The evaluation of the report of technical visits will be made by panel of two teachers appointed by principal based on following points:

   (a) Coverage aspect: All above points should be covered.
   (b) Detailed observations: System / Process / Product explained with data, diagram specifications.
   (c) Quality of presentation: Report should be very objective and should consist of clear and systematic organization of topics and information.
   (d) Viva - voce: A viva -voce shall be conducted on the technical visit report by the teachers to assess the specific knowledge gained by the students for technical applications.

6. The case study should include the study problem in Mechanical Engineering, Automobile Engineering and Production branch.

NORTH MAHARASHTRA UNIVERSITY, JALGAON
ENGINEERING AND TECHNOLOGY FACULTY
Equivalent Subjects of B.E. Mechanical Engineering

FIRST TERM

S.N.	Old Subjects	S.N.	Equivalent Subjects	Year
1	Machine Design –III	1	--	--
2	Refrigeration And Air Conditioning	2	Refrigeration And Air Conditioning	B.E.Mech (New)
3	Project and Financial Management	3	--	--
4	Elective – I	4	Elective – I	
	1. Non-conventional Energy Sources		1. --	--
	2. Machine Tool Design		2. Machine Tool Design	B.E.Mech – Elective-I (New)
	3. Operation Research		3. --	--
	4. Robotics		4. --	--
	5. Automobile Engineering-I		5. --	--
	6. Mechanical Estimation and Costing		6. --	--
	7. Reliability Engineering		7. --	--

SECOND TERM

S.N.	Old Subjects	S.N.	Equivalent Subjects	Year
1	CAD/CAM	1	--	--
2	Tribology	2	Tribology	B.E.Mech (New)
3	Mechanical Vibration	3	Mechanical Vibration	B.E.Mech (New)
4	Elective - II	4	Elective - II	
	1. Power Plant Engineering		1. Power Plant Engineering	B.E.Mech – Elective-II (New)
	2. Management Information system		2. --	--
	3. Materials Management		3. --	--
	4. Energy Conservation and Management		4. --	--
	5. Automobile Engineering-II		5. --	--
	6. Production Planning and Control		6. --	--
	7. Analysis and Synthesis of Mechanism		7. --	--