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SHIVAJI UNIVERSITY, KOLHAPUR.

Revised Syllabus of

(B.E. Mechanical Engineering Sem –VII & VIII)

To be introduced from the academic year 2010-11
(i.e. from June 2010) Onwards

(Subject to the modifications will be made from time to time)

SHIVAJI UNUVERSITY, KOLHAPUR

Structure of B. E. (MECHANICAL ENGINEERING) Semesters VII & VII

Sr. No.	Subject	L	TUT	P	Dr	Total	PT	TW	OE	POE	Total
1	Refrigeration & Air Conditioning	3	-	2	-	5	100	25	---	25	150
2	Mechanical System Design	3	-	2	-	5	100	25	25	--	150
3	Finite Element Analysis	3	-	2	-	5	100	25	--	--	125
4	Elective - I	3	-	2	-	5	100	25	--	25	150
5	Elective - II	3	-	2	-	5	100	25	--		125
6	Seminar	-	-	2	-	2	-	50	--	-	50
7	Project	-	-	3	-	3	-	50	--	-	50
8	Industrial Training @	-	-	-	-	-	-	50		-	50
	Total	**15**	**-**	**15**	**-**	**30**	**500**	**275**	**25**	**50**	**850**

Sr. No.	Elective I	Elective - II
01	Experimental Mechanics	Total Quality Management
02	Noise & Vibration	Nano Technology
03	Automobile Engineering	Industrial Product Design
04	Jigs and Fixture Design $	Human Values And Professional Ethics

@ Industrial training of minimum two (2) weeks should be done after T.E. (II) in summer vacation and it's assessment will be done in B.E. (I) based on report submitted
Work load of the assessment can be assigned to the project seminar guide.
$ The Theory of paper examination duration 4 hours
Unless mentioned ,theory paper examination duration 3 hours

B.E. (MECHANICAL ENGINEERING)

Sr. No.	Subject	L	TUT	P	Dr	Total	PT	TW	OE	POE	Total
1	Mechatronics	3	-	2	-	5	100	25	25	--	150
2	Industrial Engineering	3	-	2	-	5	100	25	--	---	125
3	Power Engineering	3	-	2	-	5	100	25	25-	---	150
4	Elective III	3	-	2	-	5	100	25	--	---	125
5	Elective IV	3	-	2	-	5	100	25		---	125
6	Project	-	-	5	-	5	-	100		75	175
	Total	**15**	**-**	**15**	**-**	**30**	**500**	**225**	**50**	**75**	**850**

Sr. No.	Elective III	Elective IV
01	Production Management	Industrial Automation & Robotics
02	MEMS	Enterprise Resource Planning
03	Machine Tool Design	Cryogenics
04	**Computational Fluid Dynamics**	P.L.C. & SCADA Programing

[Note :- Examination scheme and term work marks strictly as per above structure]

COURSE CODENO. **SUBJECTCODE NO.**

B.E. (MECHANICAL) PART-I (W.E.F. 2010-11 From July 2010)

1. REFRIGERATION AND AIR CONDITIONING

Teaching Scheme
Lectures: 3 Hrs/ Week
Practicals: 2 Hrs/ Week

Examination Scheme
Theory :100 Marks
Term work: 25 Marks
Practical and Oral: 25 Marks

SECTION I

1 Review of Thermodynamics: **01**
Laws, General equations, Processes, Equations applied to processes.

2 Basic Refrigeration Cycles: **07**
Carnot cycle, Reversed Carnot cycle, Simple Vapour compression cycle, sub-cooling, superheating, Liquid to suction vapour heat exchanger, Calculations and performance of above cycles, Actual vapor compression cycle, Bell Coleman - Reversed Bryton cycle, Air cycles for air crafts (Descriptive Treatment).

3 Refrigerants: **05**
Classification, Desirable Properties like Thermodynamic, physical,& chemical. Comparison among commonly used refrigerants, Selection of Refrigerants, Effect on Ozone depletion and global warming, Alternative Refrigerants.

4 Multi pressure System: **03**
Removal of flash gas, Flash inter-cooling, Water-cooling, Multistage, Multi-evaporator & Cascade System, Introduction to cryogenic engg & application, Claude cycle, Linde Cycle.

5 Vapor Absorption System: **02**
Aqua Ammonia system, Lithium Bromide water vapour system, Crystallization, Coefficient of Performance, Comparison with Vapour Compression cycle. (Descriptive treatment only)

6 Refrigeration Equipments: **03**
Compressor, Condenser, Evaporator, Expansion devices, Types, selection, use of insulation, methods of charging and testing, Non conventional methods of refrigeration like vortex tube, Pulse Tube.

SECTION II

7 Psychrometry: **07**
Moist air as a working substance, Psychrometric properties of air, Use of Psychrometric tables and charts, Processes, Combinations and Calculations, ADP, Coil Condition lime, Sensible heat factor, Bypass factor, Air washer and it's applications.

8 Comfort: **02**
Thermal exchange between human body and environment, factors affecting comfort, effective temperature comfort chart, ventilation requirements.

9 Heating and Cooling Load Calculation: **07**
Representation of actual air conditioning process by layouts & on psychrometric charts, Load analysis RSHF, GSHF, ESHF, Enumeration & brief explanation of the factors forming the load on refrigeration and air conditioning systems, Energy requirements of different types of air conditioning systems, Energy conservation in air conditioning.

10 Air Distribution System: **04**

Re-circulated air, Ventilation air, Duct work, Use of friction loss & rectangular equivalent of round duct chart, duct system, principle of duct sizing, and air distribution it's norms, diffusers, dampers, layout, duct systems for theaters, auditorium, hospitals, assembly shop,etc

Reference Books:

1 Principles of Refrigeration - Roy J. Dossat
2 Refrigeration and Air Conditioning - Stoker
3 Refrigeration and Air Conditioning - C. P. Arora
4 Refrigeration and Air Conditioning - Arora Domkundwar
5 Refrigeration and Air Conditioning - V. K. Jain
6 Air Conditioning Principles and Systems - Pita
7 Air Conditioning Applications and Design - W. P. Jones
8 Air Conditioning Engineering - W. P. Jones
9 Thermal environmental engineering - Tnerellaild

Term Work

1 Study of various methods of refrigeration and its applications
2 Study and demonstration of refrigeration system.(water cooler refrigeration, chiller, ice plant and cold storage).
3 Study and demonstration on air conditioning systems. (Unitary and central air conditioning / system)
4 Study and demonstration of controls in refrigeration.
5 Visit to central air conditioning or cold storage or dairy plant ot ice plant related with refrigeration & air conditioning system.
6 Study or demonstration of dehydration, charging leak testing and testing of refrigeration system with trouble shooting.
7 Study or demonstration or trial on vapour absorption system.
8 Study / Trial on heat pump.
9 Market survey of various refrigerating & air conditioning systems which include the equipments with related specifications, manufacturer, cost. (minimum 3 to 4 equipments)
10 Study & trial on Cascade refrigeration system.
11 Trial on refrigeration system
12 Trial on air conditioning system.
13 Trial on ice plant.
14 Trial on Cascade system.

*** Minimum Three trials are to be conducted.**

COURSE CODENO. **SUBJECTCODE NO.**

B.E. (MECHANICAL) PART-I (W.E.F. 2010-11 From July 2010)

2. MECHANICAL SYSTEM DESIGN

Teaching Scheme:
Lectures:-3 Hrs/week
Practicals:-2 Hrs/week

Examination Scheme:
Theory: - 100 marks
Term work: - 25 marks
Oral exam. : - 25 marks

SECTION-I

1 Aesthetic and Ergonomic consideration in Design:- **05**

Basic types of product forms, Designing for appearance, shape, Design features, Materials, Finishes,proportions,Symmetry,Contrast etc.Morgon's colour code. Ergonomic considerations-Relation between man, machine and environmental factors. Design of displays and controls. Practical examples of products or equipments using ergonomics and aesthetic design principles.

2 System Approach to Design:- **04**

System Approach to Design; Mathematical model; Lumped system; Dynamic response of lumped & distributed system; Modeling of masses, Elasticity, Inertia, Damping and friction.

3 Pressure Vessel Design:- **06**

Thin and thick cylinders; failure criteria of vessels; Lame's equation; Clavarino's and Birnie's equation; Autofrettage and compound cylinders; Types of pressure vessels-Horizontal and vertical; Classification of pressure vessel as per IS2825, 1969.Introdduction to design of pressure vessels as per IS Codes. Shell and end closures. Effect of opening & nozzles in shell & covers. Types of pressure vessel support .

4 A) Brakes:- Design consideration in brakes, Band, Internal expanding shoe, External contracting shoe. Thermal consideration and rating of brakes. **05**

B) Clutches:- Design requirement of friction clutches, Selection criteria. Torque transmitting capacity of single plate, Multidisc clutch, Cone clutch and Centrifugal clutch.

SECTION-II

5 Stastical considerations in Design:- **04**

Frequency distribution- Histogram and frequency polygon- Normal distribution- Units of measurement of central tendency and dispersion- Standard variable- Population combination-Design and natural tolerances- Design for assembly- Statistical analysis of tolerances-Mechanical reliability and factor of safety.

6 Design of Gear boxes for machine tool applications:- **05**

Determination of variable speed range- Graphical representation of speeds- Structure diagram- Deviation diagram- Ray diagram- Selection of optimum ray diagram- Difference between number of teeth of successive gears in a change gear box- Analysis of twelve speed gear box- Compound ray diagram

7 Design of Material handling system:- **05**

Design of belt and chain conveyors – Power requirement, Selection of belt and chain, Design of tension take up unit, Idler pulley

8 Optimum Design:- **06**

Objectives of optimum design- Johnsons Method of Optimum Design (MOD),Adequate and optimum design. Primary, Subsidiary and Limit equations- Optimum design with normal specifications of simple machine elements like tension bar, transmission shaft, helical spring. Introduction to optimum design with Langrange Multiplier.

TERM WORK

1) **A detail design report and A2 size sheet containing working drawing of detail and assembly of the following**
    a) Design of Machine Tool Gear Box.
    b) Pressure vessel design, Brake design or Clutch design.
2) **Assignment based on**
    a)Aesthetic and Ergonomic design consideration –case study
    b) Problems on Optimum design.
    c) Problems on Material handling equipments.

Reference Books

1 1 Design of machine element by V.B.Bhandari, Tata Mc- Graw Hill Publication
2 Mechanical Engineering Design by Shigley and C.R.Miscke, Tata Mc- Graw Hill Publication
3 Mechanical design analysis by M.F.Spotts, Prentice Hall publication
4 Machine Design by Black P.H.and O.Eugene Adams, Tata Mc- Graw Hill Publication
5 Mechanical Design Synthesis with Optimisation Applications by Johnson R.C.,Von-Nostrand-Reynold Publicaion
6 Engineering Design by Dieter G.E. Tata Mc- Graw Hill Publication.
7 Design of Machine Tools by S.K.Basu and D.K.Pal, Oxford and IBH Publication
8 Machine Tool Design by N.K.Mehta, Tata Mc- Graw Hill Publication
9 Mechanical System Design by S.P.Patil, Jaico Publication House,New Delhi
10 Product design and process engineering –Benjamin W. Niebel , Alan B. Draper, Tata Mc- Graw Hill Publication
11 Design data PSG College of Technology Coimbatore
12 I.S.:2825 Code for unfired Pressure Vessels
13 Design of Pressure vessel by Harve, CBS publishers and distributors
14 Engineering Optimization Theories and Practice by S.S.Rao, New Age Publication
15 Principles of machine tool by Sen. Bhattacharya, New central book agency
16 Process Equipment Design by M.V.Joshi , Macmillal Publication
17 Machine Design by Robert L.Norton, Tata Mc- Graw Hill Publication
18 Material Handling Equipment by Rudenko, M.I.R.publishers, Moscow
19 Reliability in Engineering Design by Kapur Wiley India
20 Fundamentals of Machine Component Design by Junvinall Wiley India
21 Mechanical System Design by Anurag Dixit SCITECH publication
22 Design of Machine Element/Machine Design by Kannaiah SCITECH publication
23 Design of Machine Element by Spotts/Shoup/Hornberger/Jayram/Venketesh Pierson Education
24 Machine Design by T H Wentzell Cengage Learning

B.E. (MECHANICAL) PART-I (W.E.F. 2010-11 From July 2010)

3. FINITE ELEMENT ANALYSIS

Teaching Scheme:
Lecturers: 3 Hrs/ Week
Practicals: 2 Hrs/ Week

Examination Scheme:
Theory: 100 Marks
Term work: 25 Marks

SECTION – I

1 Introduction: 03
Brief history, Introduction to Matrix Notation, General steps of FEM using a simple 1-d element for stress analysis of a stepped bar, Thermal rod, Heat conduction through wall. Applications of FEM.

2 Introduction to Calculus of Variations: 03
Functional, Extremization of a functional, obtaining the variational form from a differential equation, Principle of virtual work, Principle of Minimum potential energy.

3 Approximation methods for solving differential equations: 03
Introduction, Rayleigh-Ritz method, Galerkin method, Least square method, Collocation method, Sub-domain method.

4 Discritization of the problem: 03
Introduction, Geometrical approximations, Simplification through symmetry, Basic element shapes and behaviour, Choice of element type, Size and number of elements, Element shape and distortion, Location of nodes, Node and element numbering

5 Interpolation Functions and Simplex Elements: 03
Introduction, simplex, complex and multiplex elements, Linear interpolation polynomials for simplex elements, Natural co-ordinates, vector quantities, an axi-symmetric element

6 Formulation of the Elements Characteristic Matrices and Vectors for Elasticity Problems: 04
Introduction, one dimensional elasticity, two dimensional elasticity, axi-symmetric elasticity

SECTION – II

7 Formulation of the Elements Characteristic Matrices and Vectors for Field Problems 04
Introduction, Thermal problems, One dimensional heat transfer, two dimensional heat transfer, axi-symmetric heat transfer. Torsional problems, Fluid flow problems

8 Assembly And Solution Of The Finite Element Equations: 04
Introduction, co- ordinate transformations, assembly of element equations, Incorporation of the boundary conditions, solution of the equations, elimination method, penalty method.

9 Higher Order Element Formulations: 08
Introduction, Natural co – ordinates systems and numerical integration, higher order one dimensional elements – quadratic and cubic elements, evaluation of the element equations, an alternative formulation. Higher order two and three dimensional elements – iso-parametric triangular elements, iso-parametric quadrilateral elements, isoparametric solid elements, stress and heat flow calculations. Structural beam, plate and shell elements, convergence requirements of interpolation functions.

10 Modeling Procedures And Results Processing: 03

Introduction, model validity and accuracy, mesh design and refinement, element distortions, result processing , model checking

11 Solving FEM Problems on a computer: 02

Introduction, Developing on FEM code, Finite element packages.

TERM WORK

1. One assignment on past, present and future of FEA.
2. One assignment on Meshing – types of elements, choice of element, type of meshing – automatic, mapped, meshing in critical areas.
3 Minimum two examples of one dimensional bar element without using computer
4 Development of Computer code to solve above mentioned problems.
5. Use of Standard software packages like ANSYS, NISA, NASTRAN, HYPERWORKS for solving following types of problems –

   a) Design of steel bracket.
   b) Beam analysis.
   c) Plate with a circular hole.
   d) Buckling.
   e) Analysis of Fin.

REFERENCE BOOKS:

1. "Introduction to Finite Elements in Engineering"; Chandrapatala, Belgundu, PHI.
2. "Finite Element Methods for Engineers"; U.S. Dixit, Cengage Learning.
3. "An Introduction to Finite Element Method"; J. N. Reddy; 2/e, McGraw Hill International Editions, ISBN 0-07-112799-2
4. "Finite Element Analysis – Theory and Practice"; M.J. Fagan, Longman Scientific & Technical.
5. "The Finite Element Method – Basic Concepts and Linear Applications"; O. C, Zienkiewicz; McGraw Hill International Editions; ISBN 0-07-084175-6
6. "Practical Finite Element Analysis", N.S. Gokhale, S.S. Deshpande, S.V. Bedekar, A.N. Thite, Finite to Infinite Publication.
7. The Finite Element Method For Engineers – Huebner Willy India
8. Concepts of Finite Element Methods by Manicka Selvam SCITECH publication

9 A First Course in the Finite Element Analysis By D.L.Logan CENGAGE Learning

10 Practical Finite Element Analysis By Gokhale, Deshpande, Bedekar, Thite Finite to Infinite Pune

B.E. (MECHANICAL) PART-I (W.E.F. 2010-11 From July 2010)

4. ELECTIVE-I

1. EXPERIMENTAL MECHANICS

Teaching Scheme:
Lectures :-3 Hrs/week
Practicals:-2 Hrs/week

Examination Scheme:
Theory: - 100 marks
Term work: - 25 marks
Practical and Oral Exam.: - 25 marks

1. **Elementary elasticity :** Stress, stress equations of equilibrium, principle stresses, stress strain relations, principal strains. **04**
2. **Brittle coating methods:** Coating stress, brittle coating crack patterns, crack detection, test procedures, calibration, and analysis. **04**
3. **Strain gauges :** Electrical resistance strain gauges, semi conductor strain gauges, strain gauge circuits, recording instruments, analysis of strain gauge data. **06**
4. **Moire methods :** Mechanism of formation of Moire fringe, geometrical approach to moire fringe analysis, displacement field approach to Moire fringe analysis, out of plane: measurements experimental procedure. **06**
5. **Photo elasticity methods :** Temporary double refraction, stress optic law, effects of stressed model in a plane polariscope, fringe multiplication. **05**
6. **Two dimensional photo elasticity :** Isochromatic fringe patterns, isoclinic fringe pattern, compensation techniques, calibration method separation method, scaling model to prototype stresses, materials. **05**
7. **Three dimensional photo elasticity :** Locking in model deformations, materials, shear difference method, scattered light method. **05**
8. **Birefringent coatings :** Coating stresses and strains, sensitivity, materials and applications, effects of thickness, stress separation. **05**

Term Work

Minimum Ten of the following Experiments to Be Performed

1 Bonding Of Strain Gauge And Checking Its Installation
2 Calculation Of Gauge Factor And Strain For Single And Two Arm Bridges.
3 Calculation Of Gauge Factor And Strain For Four Arms Lateral And Linear Sensitive Bridges.
4 Measurement By Using Commercial Strain Indicator And Transducers.
5 Sheet Casting And Preparation Of Photo Elastic Model
6 Calibration Of Photo Elastic Model Material.
7 Study Of Isoclinic, Iso-chromatics And Tardy Method.
8 Separation Of Stresses Using Oblique Incidence Method.
9 Separation Of Stresses Using Electrical Analogy Method, Use Of Analogue Field Plotter.
10 Study Of Moiré Fringe Technique.
10 Study Of Brittle Coating Method.
12 Study Of **Three dimensional photo elasticity**

References:

1 Experimental stress analysis – Dally and Riley.-McGraw Hill
2 Experimental stress analysis – Dr. Sadhu Singh., Khanna Publications.
3 Experimental stress analysis – L.S.Srinath., Tata McGraw Hill
4 Experimental stress analysis – Dove and Adams
5 The strain gauge primer – Perry Listner.
6 Moiré fringes – Theocoris. Pergamon press limited.

B.E. (MECHANICAL) PART-I (W.E.F. 2010-11 From July 2010)

4. ELECTIVE-I
2. NOISE & VIBRATIONS

Teaching Scheme:
Lectures :-3 Hrs/week
Practicals:-2 Hrs/week

Examination Scheme:
Theory: - 100 marks
Term work: - 25 marks
Practical and Oral Exam.: - 25 marks

SECTION-I

1 Introduction: **03**

Importance & scope, Concepts & terms used, SHM, Vector and Complex method of representing vibration, Fourier series & harmonic analysis.

2 Single DOF system: **09**

(a) Damped free vibrations, Types of damping, Logarithmic decrement, Coulomb damping, and damping materials.
(b) Forced Vibrations: Types of excitation, Forced excitation, Support excitation, Excitation due to unbalance in machines, Response due to above types of excitations, transmissibility, Force transmissibility & motion transmissibility, Vibration isolators, commercial isolation materials & shock mounts.
(c) Forced vibrations of un-damped systems due to non-harmonic excitations

3 Two DOF system: **08**

(a) Free un-damped vibrations – Principal modes and natural frequencies, Co-ordinate coupling and principal co-ordinates.
(b) Forced vibrations (Undamped) – Harmonic excitation, Vibration, Dampers & absorbers, Dynamic vibration absorber – Tuned & Untuned type

SECTION II

4 Introduction to Numerical Methods in Vibration **05**

Holzer method, Raleigh's method, Matrix iteration method

5 Vibration Measuring Instruments **05**

Instruments for measurement of displacement, velocity, acceleration & frequency of vibration, Sensors and Actuators, Introduction of X – Y plotter, Spectral analyzers, FFT analyzer.

6 Sound level & subjective response to sound

Frequency dependent human response to sound , Sound pressure dependent human response , Decibel scale, Relation among sound power, Sound intensity & sound pressure level, Octave band analysis. **05**

7 Noise- Effects, Rating &regulation

Non auditory effects of noise on people, Auditory effects of noise, Noise standards & limits, Ambient emission noise standards in INDIA, Hazardous noise explosion, Day night noise level, Noise sources &control. **05**

Term Work

Minimum Eight Experiments out of following list.

1 Experiment on equivalent spring mass system.
2 Experiment on study of forced vibration characteristics
3 Determination of logarithmic decrement for single DOF damped system
4 Experiment on torsional vibration of two rotor without damping
5 Experiment on free vibration of a coupled pendulum and double pendulum
6 Use of different types of exciters for vibration analysis
7 Measurement of vibration parameters using vibration instruments
8 Exercise on numerical calculation of natural frequencies by either Holzer, Raleigh's or matrix iteration method.
9 Measurement of Noise by using noise measuring instruments

Reference Books:

1 Mechanical Vibration by G. K. Grover, Published by Nemchand & Brothers, Roorkee
2 Mechanical Vibration – Austin Church, Wiely Eastern.
3 Schaumm's Outline series in Mechanical Vibration by S. Graham Kelly
4 Mechanical Vibration by Dr. V. P. Singh, Published by S. Chand & Sons New Delhi.
5 Noise and vibration control by Leo L. Bernack, Tata Mc- Graw Hill Publication
6 Machanical vibration & noise engineering by A.G.Ambekar prentice hall of INDIA
7 Kinematics,Dynamics and Design of Machinery by Waldron Willey India
8 fundamentals of Vibrations ByBalchandran Magrab CENGAGE LEARNING

COURSE CODENO. **SUBJECTCODE NO.**

B.E. (MECHANICAL) PART-I (W.E.F. 2010-11 From July 2010)

4. ELECTIVE-I
3. AUTOMOBILE ENGINEERING

Teaching Scheme
Lecturers: 3 Hrs/ Week
Practicals: 2 Hrs/ Week

Examination Scheme
Theory: 100 Marks
Term work: 25 Marks
Practical and Oral Exam.: - 25 marks

SECTION – I

1 Classification of Automobiles: 04

Broad classification of Automobiles. Major Components and their functions. Types of vehicle layouts, Front engine rear wheel drive, Front engine front wheel drive, All wheel drive, Types of bodies, Body construction and materials.

2 Automobile Power Plants: 03

Requirements of automotive power plants. Comparison and suitability considerations. Types and special features of automotive engines, Fuel cells, Electric vehicles, Hybrid Vehicles , advantages and limitations.

3 Performance of Automobiles: 04

Resistance to vehicle motion, Air, Rolling and Gradient resistance, Acceleration, Grade ability and draw bar pull, Traction and Tractive effort, Distribution of weight, Power required for vehicle propulsion, Selection of gear ratio, Rear axle ratio. (Numerical)

4 Transmission: 03

Automobile clutch requirements, Types & functions.

5 Gear box: 06

Requirements & Types & functions,Overdrive, Principle of operation of automatic transmission, Torque converter, Epicyclic gear trains, Propeller shaft, Universal and slip joint, Final drive and its types, Differential, Construction and types of rear axles.

SECTION II

6 Steering System: 05

Function of steering, Steering system layout, Automotive steering mechanism-Ackerman and Davis, Types of steering gear boxes, Condition for true rolling, Steering geometry-Camber, Caster, King pin inclination, Included angle, Toe-in and Toe-out, Wheel alignment, Slip angle, Under steer & over steer, Types and working of power steering,.

7 Braking System: 05

Function of automotive brake system, Types of braking mechanism internal expanding & Disc brake, Mechanical, Hydraulic& Air brake system, Servo and power brakes, Anti lock and antiskid braking, Calculation of braking force required, stopping distance and dynamic weight transfer.(Numerical)

8 Suspension Systems: 04

Suspension requirements, Sprung and Un sprung mass, Types of automotive suspension systems. Conventional and Independent, Shock absorber, Types of springs, Hotch- kiss and Torque tube drive, Reaction members-Radius rod, Stabilizer bar, Air suspension system.

9 Electrical System: 04

Automotive batteries, Automotive lighting system. Starting system, Charging system, Voltage and current regulator, Electric horn, Dash board gauges, Wiper & side indicator circuit, Engine electronic control modules, Safety devices.

10 Two Wheelers And Three Wheelers 02

Distinguishing features and general layout of two wheelers and three wheelers.

TERM WORK

Minimum eight experiments from Group A and all experiments from Group B are to be performed

Group A.

1. Study and demonstration of four wheeler chassis layout. Two-wheel & four-wheel drive layouts.
2. Study and Demonstration of working of single plate automobile clutch.
3. Study and demonstration of synchromesh gearbox.
4. Study and demonstration of final drive and differential.
5. Study and demonstration of working Hydraulic braking system.
6. Study and demonstration of front wheel steering geometry and steering mechanism.
7. Study and demonstration of suspension system of a four-wheeler.
8. Study and demonstration of battery, electrical charging system.
9. Study and demonstration of electrical starting system
10. Study and demonstration of a] D. C. Electric horn.
    (a) Electric Fuel Gauge
    (b) Electric fuel Gauge.
    (c) Flasher unit.
    (d) Wiper circuit

Group B.

1 Experiment on wheel balancing & front wheel alignment.
2 Visit to servicing station for study of vehicle maintenance, repairs and report.

REFERENCE BOOKS:

1 Automobile Engineering; G. B. S. Narang
2 Automobile Mechanics; N. K. Giri
3 Automobile Electrical Equipment; P. S. Kohali
4 Motor Vehicle; Newton & Steeds
5 Automobile Engineering; Course
6 Motor Vehicle; Ketts.
7 Automobile Engineering by Ramalingam SCITECH publication
8 Fundamentals of Automobile Engineering by Ramalingam SCITECH publication
9 Automotive Engines Theory & Servicing 5e by J D Harderman/C D Mitchell Pierson Education

COURSE CODENO. **SUBJECTCODE NO.**

B.E. (MECHANICAL) PART-I (W.E.F. 2010-11 From July 2010)

4. ELECTIVE-I
4. JIG & FIXTURE DESIGN

Teaching Scheme:
Lectures: 3 Hrs. / Week
Practical: 2 Hrs. / Week/ Batch

Examination Scheme:
Theory Paper (4 Hrs): 100 Marks
Term work: 25 Marks
Practical and Oral Exam.: - 25 marks

Course Objective
To introduce the students to the design practices of toolings (Jigs and Fixtures) and die design for presswork.

SECTION – I

1. Introduction to Jigs and Fixtures : Necessity, applications and types, basic concept of jigs and fixtures for different manufacturing processes, dependency of jig and fixture design on operation sequence. (3)

2. Location & clamping system: Principles, types, applications, locating pins, pads, diamond pins, adjustable supports, Vee & post locators, clamping system - principle, types, screw clamp, strap, lever, hinge type, cam operated, toggle clamps, centralizer & equalizer clamp, multiple clamping, quick acting clamps, pneumatically operated clamps. (5)

3. Design of Jigs: Principles of jig design, types of jigs- plate, template, box, channel, sandwich, latch, tumble, turn-over, tumble jig etc., types of bushes, selection of bushes and liners, construction of jig and fixture bodies, use of standard parts (5)

4. Design of fixtures: Principles of fixture design, types of fixtures- gang, straddle, vertical, slot, string milling fixture etc, selection of the suitable type, design of milling fixtures, use of setting block, tennons, T-bolts etc, design of turning fixture for lathe (5)

5. Indexing System: Necessity, different indexing systems for jigs and fixtures. **(**2)

SECTION – II

6. Introduction to press tools: Dies, punches, types of presses, types of dies, simple, compound, combination and progressive dies, press tools for operations like blanking, piercing, drawing, shaving, trimming, etc. (4)
7. Design of die set for cutting operations : Theory of metal cutting, cutting force and lank holding force estimation, punch and die clearance, scrap strip layout, design of punches, design of dies, pilots, strippers, stock stops, finger stops, auto stops, center of pressure, selection of die set. (6)
8. Design of drawing die: blank size determination, no. of draws, stage wise achievement of drawn component, stage wise component drawings, drawing radii and clearance, drawing forces, defects in drawing. (6)
9. Miscellaneous dies like- cut off dies, trimming, shaving, bulging, rubber, lancing, slitting, horn type, side cam dies, bending, forming, curling dies. (theoretical treatment only) (3)

TERM WORK:

Note: All standard components shall be selected using relevant IS codes in the following exercises.

1. At least one industrial visit to study industrial practices related to the subject and submission of the visit report.
2. Study of various elements of jigs and fixtures
3. Design and drawing of two drilling / reaming jigs. (Details of at least one sheet showing manufacturing drawing with tolerances, material specification and heat treatment.)
4. Design and drawing of two milling fixtures. (Details of at least one sheet showing manufacturing drawing with tolerances, material specification and heat treatment.)
5. Design and drawing of one progressive die.
6. Design and drawing of one drawing die.

REFERENCE BOOKS

1. Tool Design, Donaldson, (TMH)
2. Tool Design, Pollock, Reston Pub. Co. Inc.
3. An Introduction to Jig & Tool Design, M.H.A. Kempster, (ELBS)
4. Fundamentals of Tool Design, Ed. Frank Wilson, ASTME (TMH)
5. Jigs and Fixture Design Manual, Henirkson (Industrial Press, NY)
6. A Text Book of Prod. Engineering, P. C. Sharma, S. Chand
7. Handbook of Die Design- Suchy, (McGraw Hill)
8. Die Design Fundamentals, J. R. Paquin, R. E. Crowley, Industrial Press Inc.
9. Jigs and Fixture, P. H. Joshi, Tata Mc-Graw Hill Pub. Co
10. Techniques of Press Working of Metals by Eary and Reed
11. CMTI Machine Tool Design Handbook, (TMH)
12. Design Data Handbook –PSG College of Tech., Coimbtore
13 Jigs and Fixture Design 5e E.G. Hoffman CENGAGE Learning

B.E. (MECHANICAL) PART-I (W.E.F. 2010-11 From July 2010)

5. ELECTIVE-II
1. TOTAL QUALITY MANAGEMENT

Teaching Scheme:
Lectures: 3 Hrs. / Week
Practical: 2 Hrs. / Week/ Batch

Examination Scheme:
Theory Paper (4 Hrs): 100 Marks
Term work: 25 Marks

SECTION – I

1. Quality basic concepts – various definitions and their implications. ISO definition of quality. Quality cost estimation and reduction. (3)
2. Q.A. system: Concept of total quality, role and objectives of Q.A. Q.A. cycle, process approach to Q.A. (input-process-output), significance of feedback, internal customer approach. (3)
3. Planning for quality – specifications of quality, planning for specification of processes, planning through trial lots, information feedback, field complaints analysis, defect prevention programs, quality planning with vendors, vendor control procedures, vendor rating. (4)
4. Controlling techniques for quality – significance of N-D curve, SPC, problem solving QC tools, process capability analysis, six sigma- concept, need, implementation, DPMO, gradation. (5)
5. Product and system reliability : Basic concepts, prediction and evaluation of parallel, series and combined system reliability, reliability tests (life testing , burn-in test, accelerated life testing) (3)
6. Taguchi's quality engineering : Taguchi's quality philosophy, system design, parameter design, tolerance design, orthogonal arrays, S/N ration, loss functions. (2)

SECTION –II

7. Principles of TQM : Concept and definition of TQM, principles, Models, characteristics, and benefits of TQM. (3)
8. Approaches to TQM : Deming's approach, Juran's triology, Crosby and quality improvement, Ishikawa's CWQC, Feignbaum's theory of TQC. (3)
9. The essential's of TQM : Customer focus,- customer perception of quality, customer satisfaction, Kano's model of satisfaction, customer retention,.
   TQM leadership,- role and commitment and accountability of leadership, quality policy and objectives, Organizational structure for TQM, role of HR in TQM, training for TQM, developing quality culture. (3)
10. Tools and techniques for TQM: 5-S campaign, TEI, quality circles, QFD, FMEA; and FTA, poka-yoke, KAIZEN (5)
11. TQM in service sector : Definition and meaning and service, problems in defining service quality, attributes of service quality, SERVQUAL model, Implementing TQM in service industries, measurement system for service quality. (3)
12. ISO 9001:2008 series of standards : Structure of ISO 9001:2008 series standards, clauses, contents, interpretation and implementation, audit (3)

REFERENCE BOOKS

1. Grant E.L. Statistical Quality Control- McGraw Hill Book Company, New York.
2. Juran J.M & Gryna Quality Planning and analysis
3. Total Quality Control Feigenban - McGraw Hill Book Company, New York
4. ISO-9000- Preparing for registration Lamprecht
5. Implementing Total Quality-Joe Culle
6. ISO9000 Quality System – Dalela
7. SQC-R.C.Gupta.
8. Dale H. Besterfilee, "Total Quality Management", Pearson Education
9. Tapan Bagchi, " Taguchi Methods Explained".
10. Amitava Mitra, " Fundamentals of Quality Control and Improvement", Pearson Education
11. Introduction to Statistical Quality Control Montgomery Willey India
12. Quality Control by Kulkarni Bewoor Willey India
13. Total Quality Management by Senthil Arasu/Paul SCITECH publication

COURSE CODENO. **SUBJECTCODE NO.**

B.E. (MECHANICAL) PART-I (W.E.F. 2010-11 From July 2010)

5. ELECTIVE-II
2. NANO TECHNOLOGY

Teaching Scheme:
Lecturers: 3 Hrs/ Week
Practicals: 2 Hrs/ Week

Examination Scheme:
Theory: 100 Marks
Term work: 25 Marks

Course Objective:

To understand the concept and context of nanotechnology, the top-down and bottom-up approaches to nanotechnology, nano-manufacturing methods and design concepts of nanoscale products or processes.

1. **Introduction to Nanotechnology: W**hat is Nanotechnology, Nanoscale, consequences of the nanoscale for technology and society, Beyond Moore's Law (06)
2. **Technologies for the Nanoscale:** Top-down versus bottom –up assembly, Visualisation, manipulation and characterization at the nanoscale, proximal probe technologies, Self-assembly, Biomimetic systems. Assemblers. (08)
3. **Nanoscale Manufacturing :** Nanomanipulation, Nanolithography. (08)
4. **Nanoscale Material and Structures:** Nanocomposite, Safety issues with nanoscale powders, Quantum wells, wires dotes and nanoparticles. (08)
5. **Applications :** Applications in Energy, Tribology, Informatics, medicine, etc… (07)

Tutorial:

It shall consist of six exercises based on the syllabus.

Reference Books:

1. David ferry, transports in nanostructures, Cambridge University Press, 2000.
2. Engine of Creation, K E Drexler, Oxford Paperbackes, New York (1996).
3. Y.Imry, Introduction to Mesoscopic Systems, Cambridge University Press, 1997
4. S.Datta, Electron Transport in mesoscope Systems, Cambridge University Press, 1995
5. H.Grabert and M. Devoret, Single Charge Tunneling, Plenum Press, 1992.
6. Beenaker and Van Houten, Quantum Transportun Semiconductor Nanostructures, in solid state physics v. 44, eds. Ehernreich and Turnball, Academic Press, 1991.
7. P.Rai- Choudhury, Handbook of Microlithography, Micromachining & Microfabrication, SPIE,1997.
8. Nanosystems: Molecular Machinery, Manufacturing & Computation, K E Drexler, (Wiley),1992, ISBN 0471575186
9. Our Molecular Furure: How Nanotechnology, Robotics, Genetics and Artificial Intelligence will transform the World, Prometheus (2002) ISBN 1573929921
10. Web Resources: www.nanotechweb.org, www.nano.gov, www.nanotec.org.uk
11. Principles of Nano Technology by PhaniKumar SCITECH

B.E. (MECHANICAL) PART-I (W.E.F. 2010-11 From July 2010)

5. ELECTIVE-II
3. INDUSTRIAL PRODUCT DESIGN

Lecture : 3 Hrs/week
Practical: 2 Hrs/week

Theory : 100 Marks
Term Work : 25 Marks

SECTION - I

1. Introduction: Challenges of product development; Successful product, development Quality aspect of product design; Market Research; Survey. (2)
2. Identify customer needs and Product Planning Processes. Product specifications: Process of setting specifications. Concept generation–selection–testing. (4)
3. Product Architecture: Implication of architecture, establishing the architecture, related system level design issue. Industrial design : Overview (4)
4. Design for manufacturing and assembly - tolerancing, design of gauges; Design for environment; Robust design. Prototyping; Engineering Materials. Concurrent engg.. Product costing, value engineering, Aesthetic concepts; visual effects of form and colour. (6)
5. Product data management. (2)
6. Innovation and Creativity in Product Design. Case Studies. (2)

SECTION - II

7. Ergonomics and Industrial Safety (EIS) : Introduction - General approach to the man-machine relationship-workstation design-working position and posture. An approach to industrial design - elements of design structure for industrial design in engineering applications in manufacturing systems. (3)
8. Control and Displays: configurations and sizes of various controls and displays;- design of controls in automobiles, machine tools etc., - design of instruments and controls. (2)
9. Ergonomics and Manufacturing: Ergonomics and product design; ergonomics in automated Systems; Anthropomorphic data and its applications in ergonomic design; limitations of anthropomorphic data - use of computerized database. (4)
10. Safety & Occupational Health and Environment: Application of Ergonomics in industry for Safety, Health and Environment Control; (2)
11. Prevention and specific safety measures for manufacturing and processing industry – safety in the use of machines, precaution for certain chemical types of industry like foundry, process industry, chemical industry. (3)
12. Environmental Safety and ISO 14000 Systems. (3)
13. Occupational Health – Health and Safety consideration; Personal protective protective Equipment. (3)

TERM WORK:

Eight assignments with case studies on above topics using modeling softwares like CATIA V5, ProE, SolidWorks and UniGraphics.

REFERENCES:

1. Product Design and Development: Karl T. Ulrich, Steven G. Eppinger; Irwin McGraw Hill
2. Product design and Manufacture: A.C. Chitale and R.C. Gupta; PHI
3. New Product Development: Tim Jones, Butterworth, Heinemann, Oxford, 1997.
4. Product Design for Manufacture and Assembly: Geoffrey Boothroyd, Peter Dewhurst and Winston Knight.
5. Product Design : Otto and Wood; Pearson education.
6. Industrial Design for Engineers: Mayall W.H, London, Hiffee books Ltd, 1988
7. Applied Ergonomics, Hand Book: Brian Shekel (Edited) Butterworth Scientific, London 1988.
8. Introduction to ergonomics – R.C. Bridger, McGraw Hill Pub.
9. Human Factor Engineering – Sanders & McCormick, McGraw Hill Publications.
10. Product Design – Kevin Otto, Kristin Wood Pierson Education

B.E. (MECHANICAL) PART-I (W.E.F. 2010-11 From July 2010)

5. ELECTIVE-II
4. HUMAN VALUES AND PROFESSIONAL ETHICS

Teaching Scheme	**Examination Scheme**
Lecturers: 3 Hrs/ Week	Theory: 100 Marks
Practicals: 2 Hrs/ Week	Term work: 25 Marks

COURSE OBJECTIVES

The objective of the course is an exploration of human values which go into making a good human being, a good human society and a good life. The context is the work life and the personal life of modern Indian professionals. The movement to identify and promote the values shared by societies around the world is relatively new. It is only in recent years as globalization extended its reach to even remote corners of the earth that the need to refocus and build upon what we as a human society have in common, has become apparent. Increased contact between peoples and nations enhances awareness of our kinship and the shared code of ethics and conduct that underlies all civilization. It is the Human values that we must now promote to create a common vision and means for moving forward toward a more peaceful and sustainable world.

The course also aims to have students appreciate the vastness of the Universe and the wonder of its parts, and the philosophical significance of this for improving the quality of human life through value clarification.

Course Objectives and Student Learning Outcomes: Students will demonstrate in college level writing

- an understanding of the role of cognitive and moral values in world views, by discussing and writing about the ethical implications of modern scientific and technological results
- a recognition of the difference between matters of fact and matters of value, while understanding the important ways in which facts influence value assessments and how value judgments shape our vision of "the facts"
- an understanding of ethical methodologies and competency in ethical deliberation on rationally applying these methodologies to contemporary ethical questions related to scientific progress and technological power
- why ethics plays an important role in science and technology

1. HUMAN VALUES 10

The value-crisis in the contemporary Indian Society-The Indian system of values-Values in the Indian constitution -Aesthetic values: perception and enjoyment of beauty-Relative and absolute values-Morals- Values and Ethics – Integrity-Service – Work Ethic – Service Learning – Civic Virtue – Respect for Others –Respect for the Environment-Quest for Living Peacefully and happily–Attitude of Nonviolence-Innate dignity for human life – Bring out the best in oneself -caring – Sharing – Honesty – Courage – Valuing Time – Co-operation – Commitment – Empathy – Self-Confidence – Character – Spirituality

2. ENGINEERING ETHICS 8

Senses of 'Engineering Ethics' - variety of moral issued - types of inquiry - moral dilemmas - moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy – Models of Professional Roles - theories about right action - Self-interest - customs and religion - uses of ethical theories.

3. ENGINEERING AS SOCIAL EXPERIMENTATION 8

Engineering as experimentation - engineers as responsible experimenters - Research Ethics - codes of ethics - a balanced outlook on law - the challenger case study

4. SAFETY, RESPONSIBILITIES AND RIGHTS 8

Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - The Government Regulator's Approach to Risk- the three mile island, chernobyl and Bhopal case studies. Collegiality and loyalty - respect for authority - collective bargaining - confidentiality - conflicts of interest - occupational crime - professional rights - employee rights - Intellectual Property Rights (IPR) - discrimination.

5. GLOBAL ISSUES 8

Multinational corporations - Business Ethics -Environmental ethics –Role in Technological Development- computer ethics - weapons development - engineers as managers-consulting engineers-engineers as expert witnesses and advisors -Honesty-moral leadership-sample codes of Ethics like ASME, ASCE, IEEE, Institution of Engineers (India), Indian Institute of Materials Management, Institution of electronics and telecommunication engineers (IETE), India,etc.

Term Work

The term work should be carried out with the methodology of lectures, group discussions(based on case studies), movies, field visits, essays and student self investigation sessions.

1. 10 modules based on the topics mentioned above and Including –

- Group Discussions on Case Studies with report/Essays
- Undergoing the Art of Living Part I course on Awareness of Human Values conducted by Vyakti Vikas Kendra ,Bangalore in assistance with INTERNATIONAL ASSOCIATION OF HUMAN VALUES.
- Visits (with report writing) to Public Institutes like Municipal Corporation,ZP,Co op organizations, social clubs like charitable trusts, Waste Water/Air Pollution Control Plant, Slum Areas etc.
- Conduction of Health and Hygiene Awareness Camp for Society
- Study of economic status of the society –Survey data collection, analysis and any suggestions.
- Study of impacts of technology on society.

TEXT BOOKS

1. Professional Ethics and Human Values by M.P. Raghavan,Scitech Publications (India) Pvt Ltd
2. Human Values and Professional Ethics by Jayashri and Suresh B S ,S Chand Mike Martin and Roland Schinzinger,
3. "Ethics in Engineering", McGraw-Hill, New York 1996. Govindarajan M, Natarajan S, Senthil Kumar V. S,
4. "Engineering Ethics(Including Human Values)", Prentice Hall of India, New Delhi,
5. A Textbook on Professional Ethics and Human Values by Naagarazan, R.S. ,New Age Publishers
6. Professional Ethics and Human Values by A Alavudeen,R Kalil Rahman M Jayakumaran ,Laxmi Publisher
7. Understanding Human Values :Individual and Societal by Milton Rokeach ,Fres Press Publication

8. Human Values by A N Tripathy, New Age International
9. A Foundation Course in Value Education by R R Gaur, R Sangal,2009
10. Science and humanism by P L Dhar and R R Gaur, Commonwealth Publishers
11. "Wisdom for The New Millennium" by H.H .Sri Sri Ravishankarji, founder Art Of Living ,Vyakti Vikas Kendra Bangalore.
12. "The Monk Who Sold his Ferrari" by Robin Sharma, Jaico Publishing House
13. "Mega Living" by Robin Sharma, Jaico Publishing House
14. The Story of Phillosophy by W,Durant

REFERENCES

1. Charles D. Fleddermann, "Engineering Ethics", Pearson Education / Prentice Hall, New Jersey, 2004 (Indian Reprint now available).
2. Charles E Harris, Michael S. Protchard and Michael J Rabins, "Engineering Ethics – Concepts and Cases", Wadsworth Thompson Leatning, United States, 2000 (Indian Reprint now available)
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003.
4. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford,
5. Prof. (Col) P S Bajaj and Dr. Raj Agrawal, "Business Ethics – An Indian Perspective", Biztantra, New Delhi, (2004)
6. Science and the Human Prospect, by Ronald C. Pine
7. Brave New World, Aldous Huxley
8. Society ,Environment and Engineering by H R Mukhi , Birla Publications ,New Delhi
9. Society, Environment and Engineering by R Agor, Satya Prakashan,New Delhi

Relevant CDs ,Movies ,Documentaries and Websites

www.onlineethics.org, www.storystuff.com, www.iahv.org, www.5h.org, www.artofliving.org
Al Gore ,*An Inconvinient Truth*, Paramount classics USA
Charlie Chaplin, *Modern Times* ,United Artits ,USA
IIT Delhi, Modern *Technology*-The Untold Story

6 SEMINAR

Teaching Scheme		Examination Scheme	
Practical:	2 Hrs/ Week	Term work:	50 Marks

Topic
Any topic of mechanical engineering application may be a seminar topic. The seminar may be based on proposed project work also.

Seminar Load:-

Maximum 9-10 students in one batch, Maximum 9-10students shall work under one Faculty Member Group of one student is not allowed under any circumstances

Seminar Term :
Seminar report should be of 25 to 35 pages. For standardization of the seminar reports the following format should be strictly followed.

1	Page size	:	Trimmed A4
2.	Top Margin	:	1.00 Inches
3.	Bottom Margin	:	1.32 Inches
4.	Left Margin	:	1.5 Inches
5.	Right Margin	:	1.0 Inches
6.	Para Text	:	Font - Times New Roman; 12 point
7.	Line Spacing	:	1.5 Lines
8.	Page Numbers	:	Right aligned and in footer. Font Times New Roman; 12 point
9.	Headings	:	New Times Roman, 14 point, Boldface
10.	Certificate	:	All students should attach standard format of

The entire seminar should be documented as one chapter. References should have the following format

For Books:

1. "Title of Book"; Authors; Publisher; Edition;

For Papers:

1. "Title of Paper"; Authors; Conference Details; Year.

		Marks
1	Seminar Report:	25
2	Presentation:	25

All students have to present their seminars individually in front of the faculties

B.E. (MECHANICAL) PART-I (W.E.F. 2010-11 From July 2010)

7. PROJECT

Teaching Scheme: Practicals 3 Hrs/ Week

Examination Scheme: Term work: 50 Marks

1. To provide an opportunity to students do work independently on a topic/ problem/ experimentation selected by them and encourage them to think independently on their own to bring out the conclusion under the given circumstances of the curriculum period in the budget provided with the guidance of the teachers.
2. To encourage creative thinking process to help them to get confidence by planning and carrying out the work plan of the project and to successfully complete the same, through observations, discussions and decision making process.

Project Load:

Maximum 9-10 students in one batch, involving 03 groups Maximum 9-10 students shall work under one Faculty Member Group of one student is not allowed under any circumstances.

Project Definition:

Project work shall be based on any of the following:

1. Fabrication of product/ testing setup of an experimentation unit/ apparatus/ small equipment, in a group.
2. Experimental verification of principles used in Mechanical Engineering Applications.
3. Projects having valid database, data flow, algorithm, and output reports, preferably software based.

Project Term Work: 50 Marks

The term work under project submitted by students shall include and assessment of Term work should be as below

Marks :

1 Work Diary: 10 Marks for Semister VII

Work Diary maintained by group and countersigned by the guide weekly.

The contents of work diary shall reflect the efforts taken by project group for

1. Searching suitable project work
2. Brief report preferably on journals/ research or conference papers/ books or literature surveyed to select and bring out the project.
3. Brief report of feasibility studies carried to implement the conclusion.
4. Rough Sketches/ Design Calculations, etc.

2 Synopsis: 15Marks

The group should submit the synopsis in following form.

1. Title of Project
2. Names of Students
3. Name of Guide
4. Relevance
5. Present Theory and Practices
6. Proposed work
7. Expenditure
8. References

The synopsis shall be signed by the each student in the group, approved by the guide and endorsed by the Head of the Department

8 INDUSTRIAL TRAINING REPORT

Teaching Scheme		Examination Scheme	
Practical:	00 Hrs/ Week	Term work:	50 Marks

Training Report:

Maximum fifteen students in one batch, involving three groups of maximum five students, shall work under one teacher. The same group shall work for project under the same guide. However, each student should have different industrial training and its presentation.

The report should be of 20 to 30 pages. For standardization of the report the following format should be strictly followed.

1	Page size	:	Trimmed A4
2.	Top Margin	:	1.00 Inches
3.	Bottom Margin	:	1.32 Inches
4.	Left Margin	:	1.5 Inches
5.	Right Margin	:	1.0 Inches
6.	Para Text	:	Font - Times New Roman; 12 point
7.	Line Spacing	:	1.5 Lines
8.	Page Numbers	:	Right aligned and in footer. Font Times New Roman; 12 point
9.	Headings	:	New Times Roman, 14 point, Boldface
10.	Certificate	:	All students should attach standard format of

The entire report should be documented as one chapter. References should have the following format

1. "Name of Industry with address along with completed training certificate"
2. Area in which Industrial training is completed

	MARKS
Training Report:	10
Presentation:	15

All students have to present their reports individually before the faculties

COURSE CODENO. **SUBJECTCODE NO.**

B. E. (MECHANICAL) PART – II(W.E.F. 2010-11 FROM JULY 2010)
1 MECHATRONICS

Lectures: 3 hrs./week
Practical: 2 hrs./week

Theory paper: 100 marks
Term work : 25 marks
OralExam.: 25 marks

SCOPE OF THE SUBJECT
Mechatronics emphasizes the necessity of integration and interaction among different branches of engineering. Mechatronics philosophy challenges traditional engineering thinking and practices. Mechatronics implementation involves a team activity and crossing boundaries between conventional engineering disciplines.

PREREQUISITES
Knowledge of Mechanical, Electronic, Instrumentation and measurement systems.

COURSE OBJECTIVES
1. To produce competent Mechanical engineers with comprehensive knowledge of Mechatronics to enable them to apply the relevant knowledge and technologies for the design and realization of innovative systems and products.
2. To supply qualified personnel to meet the requirement of specialist in Mechatronics.
3. To prepare Mechanical Engineering students for advanced graduate studies in Mechatronics, Manufacturing engineering and related field.

LEARNING OBJECTIVES
1. Understand the importance of integration of Mechanical, Electronics and Control in the design of Mechatronics system.
2. Understand key elements of sensors and transducers and interfacing the same with problem under consideration through PLC.

SECTION – I
1. Introduction:
Introduction to Mechatronics: What is mechatronics, Mechatronic systems, Measurement systems, Control systems, micrpoprocessor based controllers, multi discipline scenario

2.Signal Conditioning:
Signal conditioning process, Operational amplifier (inverting amplifier, non-inverting amplifier, summing, integrating amplifier), protection, filtering, data acquisition, multiplexer, analog to digital converter (ADC), digital to analog converter (DAC).
Oscillators to generator sinusoidal, square, triangular and impulse waveforms, 555 timer, sample and hold, analog to digital and digital to analog converters, multiplexing. Interfacing input output ports, serial and parallel interfacing requirements, buffers, handshaking, polling and interrupts.

3. Transducers & Sensors:
Position Sensors: Limit switch, photoelectric switches, proximity sensors, pneumatic limit valves and backpressure sensors, pressure switches, resolvers, incremental & absolute encoders, decoders & relays.
Displacement: Potentiometer sensors, LVDT, capacitive displacement sensors. Velocity sensors: Tachogenerator, use of encoders

4. Digital circuits:
Digital logic, number systems, logic gates, Boolean algebra, application of logic gates, sequential logic, flip flop, D flip flop, JK flip flop, Master slave flip flop.

5. Microprocessor and Microcontroller:
Microcontroller: Comparison between microprocessor and micro controller, organization of a microcontroller system, architecture of MCS 51 controller, pin diagram of 8051, addressing modes, instruction types and set, Applications.

SECTION II

6. Programmable Logic Controllers(PLC):
Introduction, definition and history of PLC, PLC system and components of PLC input output module, PLC advantages and disadvantages.

7. Ladder diagram & PLC programming fundamentals:
Basic components and other symbols, fundamentals of ladder diagram, machine control terminology, update – sole ladder – update, physical components Vs. program components, light control example, internal relays, disagreement circuit, majority circuit, oscillator, holding (sealed or latches) contacts, always ON always OFF contacts, Nesting of ladders.

8. PLC programming:
PLC input instructions, outputs, coils, indicators, operational procedures, contact and coil input output, programming example, fail safe circuits, simple industrial applications.

9. PLC Functions:
PLC timer functions – Introduction, timer functions, industrial applications, industrial process timing applications
PLC control functions – PLC counters and its industrial applications

10. Mechatronics systems:
Traditional Vs Mechatronic Design, Case studies of Mechatronic systems designs, like piece counting system, pick and place manipulator, simple assembly task involving a few parts, part loading / unloading system, automatic tool and pallet changers etc.

Term Work

1. One assignment on "Introduction to PLC"
2. Three experiments on PLC programming examples for simple sequence control.
3. Two experiments based on Timers
4. Two experiments based on Copunters.
5. One assignment on Microprocessor.
6. One assignment on Microcontroller.
7. Industrial visit to study Mechatronic system application & submission of visit report.

Note: The Measurement and Control Laboratory is expected to have a simple 10 input 10 output PLC and a economic plug and play robot of ready to assembly in different configurations.

Reference Books

1. Mechatronics – W. Bolton, Pearson education
2. Mechatronics – Mahalik, TATA McGraw Hill
3. Microprocessor 8085 – Gaokar
4. Mechatronics – Appu Kuttam, Oxford publications
5. Automated Manufacturing systems, S. Brain Morris, McGRaw Hill
6. Introduction to PLC programming, NIIT, P
7. Programmable logical controller, Hackworth % Hackworth, Pearson Education
8. Programmable logical controller, Reis Webb, Prentice Hall
9 Mechatronics and Microproceesor by Ramchandran Willey India
10 Mechatronics : Integrated Mechanical Electronic System by Ramchandran Willey India
11. Programmable logical controller,3e Gary Dunning Cengage Learning
12.Mechatronics Source Book by N C Braga Cengage Learning

B.E. (MECHANICAL) PART-II (W.E.F. 2010-11 From July 2010)

2. INDUSTRIAL ENGINEERING

Teaching Scheme:
Lecturers: 3 Hrs/ Week
Practicals: 2 Hrs/ Week

Examination Scheme:
Theory: 100 Marks
Term work: 25 Marks

SECTION-I

1 Introduction to Industrial Engineering: **01**
Definition, Scope, Responsibilities, Important contributors to I.E., Tools and techniques of I.E.

2 Production Planning and Control: **08**
Sales Forecasting – Need, types and various techniques, Elements of PPC, PPC activity cycle.

Planning –
Pre-requisites of process planning, Steps in process planning, Factors affecting process planning, Process selection, Machine selection, Make or buy decision, Line Balancing, Plant capacity, Machine capacity and machine selection planning.

Loading & Scheduling –
Machine loading procedure, Concept of scheduling, Single machine scheduling, Job shop scheduling, n jobs one machine, n jobs two machines, two jobs – m machine cases.

Production Control –
Control function and its objectives, mechanism used in effecting production control

3 Inventory Control: **03**
Different Models And Inventory Systems, MRP, Make or Buy decision.

4 Network Techniques: **04**
CPM and PERT, Construction, Time cost trade off.

5 Facility Planning: **04**
Location model, Principles & objectives of plant layout. Tools & techniques of PL

Material Handling: **02**
Objectives and principles, Material Handling Equipments, Selection, types and application.

SECTION-II

6 Productivity: **02**
Concept, objectives, Factors affecting productivity, Tools and techniques to improve productivity, Productivity measurement. – Models.

7 Value Engineering: **03**
Concept, steps, Applications.

8 Work Study: **10**
Definition, objectives and steps Method Study: Recording techniques, principles of motion economy, Cases on methods improvement. Work Measurement: Steps, Performance rating, various techniques, Allowances and standard time estimation, Work Sampling, MOST Techniques.

9 Human Factors Engineering: **02**
Physiological work measurement Scope, application, Load analysis.

10	Job Evaluation and Merit Rating- Methods, Incentive schemes.	**03**

\Term Work

Part I - Case Study (Minimum Six)

1 Forecasting Methods (At least 2 problems each on Moving average, Exponential smoothing, Linear Regression)
2 Aggregate Planning- Problems on managing non-uniform demand. Linear Programme approach
3 ABC Analysis.
4 Inventory Model (At least 2 problems each on Basic, shortage, production and quantity discount)
5 Plant Layout problems. (At least 3 problems)
6 Problems on Productivity measurement.
7 Case study on Value analysis concept
8 Standard time estimation by different methods.
9 Case on Job Evaluation and merit rating.

Part II - Experiments (All Experiments)

1 Stop watch time study for an operation.
2 Application of work Sampling technique in work area.
3 Physiological work measurement using Bicycle Ergometer.
4 Work place layout using pin board assembly.

Reference Books:

1 Maynard. H.B – Industrial Engineering Hand Book, McGraw Hill Book Company, New York
2 J. Adam EE , RJ Ebert Production and operation management- Prentice Hall Englewood Cliff, N.
3 Riggs. J L - Production system, planning, analysis and control – John Weily and sons, New York
4 David Sumanth, Productivity Engineering and Management- Tata McGraw Hill, New Delhi.
5 Bernes, R.L Motion and Time Study, Design and measurement of Work, John Weily India
6 Introduction to Work Study- International Labour Office Geneva
7 L.C.Jhamb- Work study and Ergonomics.
8 Miles Lawrence- Techniques of value Analysis and engineering- McGraw Hill Book Company, New York.
9 Samuel Eilon – Production planning and control.
10 James Dilworth, Production and operation management- McGraw Hill Book Company, New York.
11 Martand Telsang Industrial Engineering and Production Management- S Chand & Co, New Deldi.
12 Srinath. L.S. – PERT and CPM.
13 Industrial Engineering and Management by Vishwanath SCITECH publication
14 Industrial Engineering and Management by Arun Vishwanath SCITECH publication

COURSE CODENO. **SUBJECTCODE NO.**

B.E. (MECHANICAL) PART-II (W.E.F. 2010-11 From July 2010)

3. POWER ENGINEERING

Teaching Scheme:
Lecturers: 3 Hrs/ Week
Practicals: 2 Hrs/ Week

Examination Scheme:
Theory: 100 Marks
Term work: 25 Marks
Oral exam. : - 25 marks

1. **Introduction**: Resources and development of power in India, NTPC, NHPC and their role in Power development in India, Power generation in Private sector, Power distribution, National Grid, Indian Electricity Grid Code, Structure of IEGC, Operating Policies and Procedures, Present Power position in India and Maharashtra.
2. **Power Plants**: Different types of power plants – Thermal, Hydro, IC Engine, Gas Turbine, Nuclear and their characteristics, Combined Cycle, Pumped storage, Compressed Air storage power plants and their characteristics. Comparison of Power plants with respect to various parameters. Issues in Power plants.
3. **Future trends in Power plants:** MHD - steam plant, Fuell Cells, Thermoelectric Steam Plant, Thermiionic Steam plant.
4. **Power Plant Analysis**: Load Curves, Load duration curves, Performance and operational characteristics of power plants, Peak load, Intermediate load and Base load plants and their characteristics, Input output characteristics of power plants, Economic division of between Bas load plant and peak load plants. Cost of energy generation, Tariff methods.
5. **Power Plant Instrumentation**: Steam pressure and steam temperature measurement, Flow measurement of feed water, fuel, air and steam with correction factor for temperature, Speed measurement, Level recorders, Radiation detector, smoke density measurement ,dust monitor.
   Flue gas oxygen analyser – analysis of impurities in feed water and steam – dissolved oxygen analyser – chromatography – PH meter-fuel analyser – pollution monitoring instruments.
6. **Energy Storage Technology Descriptions :** Pumped Hydroelectric Storage, Compressed Air Energy Storage, Battery Technologies - Traditional and Advanced, Flow Batteries, Flywheels, Superconducting Magnetic Energy Storage, Supercapacitors/Ultracapacitors, Energy Storage Technology Comparisons, Functional Comparison, Cost Comparison
7. **Environmental Aspects in Power generation**: Different pollutants due to power plants and their effects on ecology, control over different types of air and water pollution. Pollution control devices, National and International protocols on pollution control.
8. **Safety & Maintenance in Power Plants:** Operation and Maintenance procedures of Power plants, Operator training, Safety during selection of power plant equipment -safety in commissioning of thermal power plant equipments, hydrostatic and air leakage test, acid and alkali cleaning, safety in auxiliary plants. Cooling water system, Safety in maintenance of power plants.
9. **Energy Audit and Energy Marketing:** Selling and marketing in India, Creating supply chain in India, Successfully working with business and virtual teams in India, Navigating the financial, legal and accounting environment, Human Resources issues, India's business culture in transition.

TERM WORK:

1. Study of National & International Grid, Indian Electricity Grid Code
2. Study of combined cycle gas based and coal based Power plant. Analysis of various performance parameters of CC Power Plant.
3. Study of typical load curve of Hydro/ Thermal power plant and its performance analysis.
4.. Economic Analysis of power plants and selection of plant for power generation (Numerical Treatment).
5. Study of Power plant Instrumentation
6. Study of Heat Exchangers used in Power Plant
7. Visit to Power Plant
8. Study of pollution control devices.

BOOKS:

1. Modern Power Station Practice, Vol.6, Instrumentation, Controls and Testing, Pergamon Press, Oxford, 1971.
2. John V Grimaldi and Rollin H Simonds., Safety Management
3. Power Plant Technology – M.M.El Wakil Mc Graw Hill. Int edition.
4. Power Plant Engineering by Domkundwar and Arora, Dhanpatrai and Sons.
5. Grainger John J, and Stevenson Jr.. W.D. Power System Analysis, McGraw Hill 1994
6. L.K.Kirchmeyer, Economic operation of power systems, John Wiley and Sons, 1993.
7. C.A.Gross Power system analysis, John wiley and Sons, Inc.1986.
8. John Weisman & L.E. Eckart, Modern Power Engineering, Prentice hall, 1985
9. A course on Power Plant Engineering By Ramlingam SCITECH publication
10. Power Plant Engineering By Ramlingam SCITECH publication

COURSE CODENO. **SUBJECTCODE NO.**

B.E. (MECHANICAL) PART-II (W.E.F. 2010-11 From July 2010)

4. ELECTIVE-III
1. PRODUCTION MANAGEMENT

Teaching Scheme:
Lecturers: 3 Hrs/ Week
Practicals: 2 Hrs/ Week

Examination Scheme:
Theory: 100 Marks
Term work: 25 Marks

1. Production function (02)
Production types, objectives and scope of Production Management, Production Planning and Control (PPC)- Definition, elements, Activities of production planning and production control Interrelationship of Production with other functional areas

2. Production/ Operation strategy (02)
Relevance, strategy formulation process, order qualifiers and order winners, attributes, strategic options for Operations- Product portfolio, process technology, capacity, Supply chain issues, Measures to ensure Optional Excellence, WCM practices

3. Product Design and Development (04)
Role of Product Development in competitiveness, Product Life Cycle (PLC), Product Development Process. Tools for efficient product development- FMECA, concurrent engineering, Design for Manufacturing Mass Customization

4 Process Design (05)
Determinants of process characteristics- volume, variety, flow. Types of processes, choice of Process, equipment selection, use of BEP in selection process- product matrix. Estimation of Demand- Time series Analysis and causal forecasting techniques, Least square method, moving average and exponential smoothing forecasting method

5. Capacity and Aggregate Planning (05)
Capacity- Definition, Measure of Capacity, capacity strategies Estimation of number of machines, Overcapacity and under capacity factors, Aggregate Planning, Aggregate Planning Strategies, Pure and mixed strategies, Use of transportation model approach to aggregate planning

6. Scheduling of Operations (04)
Loading, scheduling and sequencing, Priority sequencing rules. Sequencing problems, n job 2 machines, n Job '3' machines. Forward and backward scheduling, critical ratio scheduling, Production Control Activities

7. Supply chain Management (04)
Concept of supply chain and supply chain management, Manufacturing supply chain, SCM activities Supply chain strategies, Managing supply chain, Measuring supply chain performance

8. Just in Time and Lean Manufacturing (03)
JIT Philosophy, origin and core logic of JIT, Elements of JIT, Kanban System- Design of Kanban containers, JIT. Implementation issues and performance, Lean Manufacturing- Pillars, features and process comparison with Traditional Manufacturing.

9. Total Productive Maintenance and Replacement (04)

Introduction, Definition, six big losses, stages of maintenance, pillars stages of TPM Development, Overall Equipment Effectiveness (OEE) computation Replacement - need, Replacement of items whose maintenance cost increases with time (with and without considering time value of money), Replacement of items that fail suddenly

10. Manufacturing Optimization (03)

Evaluation criteria for Production/ Manufacturing Optimization, Single stage Manufacturing Optimization. Basic Mathematical models, Single stage manufacturing model as a function of machine speed, Determining machine Speed, unconstrained optimization

11. Managerial / Engineering Economics (04)

Demand and supply, Demand curve and supply curve, equilibrium of supply and demand, elasticity of demand Production function, factors of production, Isoquants, Least cost Combination for a given output, Theory of firm Introduction, Review of Time value of money, cash flows, evaluation criteria for capital projects (investment)- Payback period, IRR and BCR.

TERM WORK

1. Case study on interdepartmental relationship in a business organization
2. Case study on Design for Manufacturing
3. Process selection, case study and choice of process and Equipments BEA technique
4. Problems on Demand Forecasting
5. Problems on Aggregate Planning strategies
6. Problems on Job sequencing- Single Machine Scheduling, Priority sequence and Johnson's Algorithm
7. Case study on implementation of JIT in a small/ medium company
8. Problems on Estimate OEE and Replacement Analysis
9. Exercises on Manufacturing Optimization
10. Exercises on Analysis tools in Project appraisal

REFERENCES:

1. Joseph. Operations Management 3e McGraw Hill International
2. Martand Telsang – Industrial Engineering & Production Management, S Chand & Company New Delhi (2009)
3. Buffa. Elwood modern Production and operations Management, 7e Willey Eastern
4. Krajewski & Ritzman, Malhotra– Operation Management,processand Value chain 8th Edition Pearson Education
5. Ashwathappa, Bhat Production and operations Management, Himalaya Publishing
6. Kitsundo .Hitomi manufacturing system Engineering Viva publishing
7. Miles Lawrence – Techniques of Value Analysis & Engineering
8. Mahadevan B Operation Management Theory and Practice Pearson Education (2007)
9. M.T. Telsang Production Management S.Chand and Company New Delhi
10. Design and Analysis of Lean Production System by ASKIN Willey India
11. Manufacturing Process Planning and System Planning by Bewoor Willey India
12. Project Management: Planning and Control Techniques By Burake Willey India
13. Production and Operation Management by Tripathi SCITECH Publications

COURSE CODENO. **SUBJECTCODE NO.**

B.E. (MECHANICAL) PART-II (W.E.F. 2010-11 From July 2010)

4 ELECTIVE-III

2. MICRO-ELECTRO-MECHANICAL SYSTEMS (MEMS)

Teaching Scheme:
Lecturers: 3 Hrs/ Week
Practicals: 2 Hrs/ Week

Examination Scheme:
Theory: 100 Marks
Term work: 25 Marks

Course Objective:

To understand the concepts and context of MEMS .

1. **Introduction:** Micro-Electro-Mechanical Systems (MEMS), Microsystems and their products, miniaturization, applications, mechanical MEMS, thermal MEMS, micro-opto electro-mechanical systems, magnetic MEMS, radio frequency (RF) MEMS **(4)**
2. **Micro Fabrication Processes & Materials:** Materials for MEMS – substrate and wafers, silicon as a substrate material, crystal structure, single crystal and polycrystalline, mechanical properties, silicon compounds, silicon piezo-resistors, gallium arsenide, quartz, piezo-electric crystals, polymers, packaging materials; **Fabrication Processes** – Bulk micromanufacturing, photolithography, photoresists, structural and sacrificial materials, X-ray and electron beam lithography, Thin film deposition – spin coating, thermal oxidation, chemical vapour deposition (CVD), electron beam evaporation, sputtering; Etching – wet etching, dry etching; Surface micromachining, bulk vs. surface micromachining; LIGA process and applications **(9)**
3. **Microsensors and Actuators:** Sensing and actuation, Chemical sensors, Optical sensors, Pressure sensors, Thermal sensors – thermopiles, thermistors, micromachined thermocouple probes, thermal flow sensors, MEMS magnetic sensor, magnetic actuators – optical switches and bidirectional microactuators, Piezoelectric material as sensing and actuating elements – capacitance, piezomechanics, Piezoactuators as grippers, microgrippers, micromotors, microvalves, microaccelerometers, shape memory alloy based optical switch, thermally activated MEMS relay, microspring thermal actuator, data storage cantilever. **(9)**
4. **Microsystem Design:** Design considerations, Design constraints and selection of materials, selection of manufacturing process, selection of signal transduction technique, Simulation based Microsystem design, need of simulation tool, use of finite element method, various simulation platforms, **(6)**
5. **Micro Fluidic Systems (MFS):** Devices, applications, considerations for MFS, fluid actuation methods, microfluid dispensers- microneedle, microfluid gates, micropumps, **(4)**
6. **Microsystems Packaging:** Mechanical packaging of microelectronics, Microsystem packaging – considerations and levels, interfaces in Microsystem packaging, packaging technologies, three dimensional packaging, Assembly of microsystems, **(6)**

TERM WORK

It shall consist of **EIGHT** exercises based on the syllabus.

REFERENCE BOOKS:

1. Bharat Bhushan (Ed.), (2004), Handbook of Nanotechnology, Spinger-Verlag Berlin Heidelberg New York, ISBN 3-540-01218-4
2. Hsu, Tai-Ran, (2003), MEMS & MICROSYSTEMS: Design & Manufacture, TMH, ISBN:0-07-048709-X
3. Mahalik, N. P., (2007), MEMS, TMH, ISBN: 0-07-063445-9
4. Mahalik, N.P. (Ed.) (2006), Micromanufacturing & Nanotechnology, Springer India Pvt. Ltd., ISBN: 978-81-8128-505-8 (Distributed by New Age International, New Delhi)

COURSE CODENO. **SUBJECTCODE NO.**

B.E. (MECHANICAL) PART-II (W.E.F. 2010-11 From July 2010)

4. ELECTIVE-III
3. MACHINE TOOL DESIGN

Teaching Scheme:
Lecturers: 3 Hrs/ Week
Practicals: 2 Hrs/ Week

Examination Scheme:
Theory: 100 Marks
Term work: 25 Marks

SECTION-I

1 General Principles Of Machine Tool Design: 07
General requirements of machine tool design, Engineering design process applied to machine tools, Layout of machine tools, Mechanical/hydraulic transmission elements, Working and auxiliary motions in machine tools.

2 Design Of Machine Tool Drives: 06
Types of Speed and feed regulation, Classification of speed and feed boxes, Design of feed box, Speed box, Development of gearing diagram.

3 Design Of Machine Tool Structures: **05**
Functional requirements of machine tool structures, Design criteria & procedure for machine tool structures, Materials for machine tool structures, Design of beds, columns and housings and other parts of machine tools.

4 Design of Guideways: 03
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 Antifriction slideways

SECTION-II

5 Design Of Spindles And Spindle Supports: **07**
Functions of spindle unit and requirements, Materials, Machine tool compliance & machining accuracy, Design calculations of spindles, Bearings for spindles.

6 Dynamics Of Machine Tools: **05**
Forced vibrations of machine tools, Dynamic characteristics of elements and systems, Stability analysis.

7 Electrical drives and their control for machine tools 03

8 Control Systems In Machine Tools: **06**
Functions, requirements and classification, Control systems for speeds and feeds, various motions etc. Manual & automatic control systems.

TERM WORK

1 Any one problem on

(a) Design of a spur/helical gear box for machine tool - Report containing all calculations, Sketches for design of a typical gear box.

(b) Two sheet of A_2 size containing drawing of details and assembly for a typical gear box as per (i)

2 Any two assignments on the following
(a) Selection of belts for a machine tool.
(b) Selection of electric motor for a machine tool.
(c) Hydraulic system in a machine tool.
(d) Design of guideways based on wear resistance and stiffness.

*Standard Design data books for all above experiments should be used.

REFERENCE BOOKS:

1 Machine tool design and numerical control by N.K.Mehta, Tata Mc- Graw Hill Publication
2 Mechanical Vibration by G. K. Grover, Published by Nemchand & Brothers, Roorkee
3 Mechanical Vibration by Dr. V. P. Singh, Published by S. Chand & Sons New Delhi.
4 Design of Machine Tools by S.K.Basu, Oxford and IBH publishing, New Delhi
5 Principals of machine Tools by Sen. and Bhattacharya, New age central book agency
6 Principals of machine Tools by Koenigs-Berger
7Machine Design by T H Wentzell Cengage Learning

COURSE CODENO. **SUBJECTCODE NO.**

B.E. (MECHANICAL) PART-II (W.E.F. 2010-11 From July 2010)

4. ELECTIVE-III
4. COMPUTATIONAL FLUID DYNAMICS

Teaching Scheme:
Lecturers: 3 Hrs/ Week
Practicals: 2 Hrs/ Week

Examination Scheme:
Theory: 100 Marks
Term work: 25 Marks

SECTION I

1 Basic Concepts: 05

Thermodynamics laws and relation, Energy equation, Continuity equation, Momentum equation, Mach number, Mach angle, Various regions of flow.

2 One Dimensional Isentropic Flow: 05

Adiabatic flow and reference speed, Relation between M and M, Fllegnerl's formula, Impulse function, Gas tables and charts, Performance of convergent- divergent nozzle.

3 Normal Shock: 06

Fanno process, Rayleigh process, Formation of shock wave, Prandtimeyer relation, pressure and temperature ratios across the shock, Stagnation pressure loss and increase in entropy, Supersonic diffusers.

4 Oblique Shocks: 05

Introduction, Governing equations, Prandtl relation, oblique shock relation, Mach angle and Mach waves, The shock polar.

SECTION II

5 Flow with Friction: 05

Governing equation, Fanno equation, Change in entropy, isothermal flow.

6 Flow with Heat Transfer: 05

Governing equation, Rayliegh equation, Maximum enthalpy point, Maximum entropy point, Valuation of fluid properties, Maximum heat.

7 Equations Of Motion: 06

Equation of motion in cartesion co-ordinates, continuity equation, momentrim equation, Vorticity components, radial and tangential accelerations, Velocity potential, Stream function and its equation.

8 Measurement Techniques: 05

Wind tunnel, Suction tunnel, Supersonic tunnel, Shock tube, Flow visualization, Smoke techniques, Liquid film method, Measurement of Velocity, Measurement of Flow.

TERM WORK

1 1 Study of Wind tunnels
2 Test on Wind tunnel for elementary objects like aerofoil.
3 Study of shock tubes
4 Test on convergent – divergent nozzle.
5 Study of flow visualization techniques.
6 Study of hot wire anemometer
7 Study of methods of pressure measurement in gas flow.

Note: For external exam, the programs must be given and then the assessment of students to be done.

TEXT BOOKS

1. Elementary Gas Dynamics – S.M. Yahya
2. Elementary Gas Dynamics – Hurain Z.
3. Gas Dynamics and Jet Population – S.L. Somsundaram
4. Introduction to gas Dynamics – Patel, Lolwal, Bhavsar
5. Gas Dynamics Vol. I – Shapiro
6. Incompressible Flow – Penton Willey India

COURSE CODENO. **SUBJECTCODE NO.**

B.E. (MECHANICAL) PART-II (W.E.F. 2010-11 From July 2010)

5. ELECTIVE-IV
1. INDUSTRIAL AUTOMATION AND ROBOTICS

Teaching Scheme:
Lecturers: 3 Hrs/ Week
Practicals: 2 Hrs/ Week

Examination Scheme:
Theory: 100 Marks
Term work: 25 Marks

SECTION I

1. Introduction: Automated manufacturing systems, fixed /programmable /flexible automation, Need of automation, Basic elements of automated systems- power, program and control. **03**
2. Advanced automation functions, Levels of automation; Industrial control systems in process and discrete manufacturing industries, Continuous and discrete control; Low cost automation, Economic and social aspects of automation. **05**
3. Assembly Automation: Types and configurations, Parts delivery at workstations- Various vibratory and non-vibratory devices for feeding and orientation, Product design for automated assembly. **05**
4. Transfer Lines: Fundamentals, Configurations, Transfer mechanisms, storage buffers, control, applications; Analysis of transfer lines without storage buffers. **06**

SECTION II

5. Fundamentals of Industrial Robots: Specifications and Characteristics, Criteria for selection. **02**
6. Robotic Control Systems: Drives, Robot Motions, Actuators, Power transmission systems; Robot controllers, Dynamic properties of robots-stability, control resolution, spatial resolution, accuracy, repeatability, compliance, work cell control, Interlocks **05**
7. Robotic End Effectors and Sensors: Transducers and sensors- sensors in robotics & their classification, Touch (Tactile) sensors, proximity and range sensors, force and torque sensing, End Effectors- Types, grippers, Various process tools as end effectors; Robot-End effector interface, Active and passive compliance, Gripper selection and design. **06**
8. Robot Programming: Lead through method, Robot program as a path in space, Methods of defining positions in space, Motion interpolation, branching; Textual robot programming languages-VAL II. **04**
9. Robot Applications: Material transfer, machine loading unloading and processing applications. **03**

TERM WORK

1. Two Programming exercise on lead through programming.
2. Two Programming exercises using various commands of VAL II.
3. One Industrial visit for Robot application
4. One Industrial visit for Industrial automation

REFERENCE BOOKS:

1. Groover, M.P., (2004), "Automation, Production Systems & Computer Integrated Manufacturing" 2/e, (Pearson Edu.) ISBN: 81-7808-511-9
2. Groover, M.P.; Weiss, M.; Nagel, R.N. & Odrey, N.G. "Industrial Robotics, Technology, Programming & Applications", (McGraw Hill Intl. Ed.) ISBN:0-07-024989-X
3. Fu, K.S.; Gonzalez, R.C. & Lee, C.S.G. "Robotics-Control, Sensing, Vision and Intelligence", (McGraw Hill Intl. Ed.) ISBN:0-07-100421-1
4. Keramas, James G. (1998), " Robot Technology Fundamentals",(Thomson Learning-Delmar) ISBN: 981-240-621-2
5. Noff, Shimon Y. "Handbook of Robotics", (John Wiley & Sons)
6. Niku, Saeed B. (2002), "Introduction to Robotics, Analysis, Systems & Applications", (Prentice Hall of India)
7. Koren, Yoram "Robotics for Engineers", (McGraw Hill)
8. Schilling, Robert J.(2004), "Fundamentals of Robotics, Analysis & Control", (Prentice Hall of India), ISBN: 81-203-1047-0
9. Introduction To Robotics Mechanics & Control 3e by J J Craig Pierson Education
10. Applied Robotics Volume I & II by Edwin Wise Cengage Learning.

COURSE CODENO. **SUBJECTCODE NO.**

B.E. (MECHANICAL) PART-I (W.E.F. 2010-11 From July 2010)

5. ELECTIVE-IV
2. ENTERPRISE RESOURCE PLANNING

Teaching Scheme:
Lectures: 3 Hrs. / Week
Practical: 2 Hr. / Week

Examination Scheme:
Theory Paper : 100 Marks
Term work: 25 Marks

Objective :

- To understand evolution, implementation and advantages of ERP.
- To understand different ERP modules and case studies.

1. Introduction to ERP: (3)

Introduction, Evolution, Reasons for the growth of ERP market, Advantages, Reasons for failure of ERP.

2. ERP and related technologies: (5)

Business Process Reengineering (BPR), Management Information System (MIS), Supply Chain Management (SCM), Decision Support Systems (DSS), Executive Information Systems (EIS).

3. ERP – A manufacturing perspective : (4)

CAD/CAM, MRP, MRP II, Distribution Requirement Planning (DRP), JIT and Kanban, Production Data Management (PDM), .

4. ERP Modules: (10)

Introduction to finance, Mfg. and Production planning, Plant maintenance, quality and material management modules to be explained except finance.

5. Benefits of ERP: (6)

Reduction of lead time, On time shipment, reduction in cycle time, improved resource utilization, better customer satisfaction, input supplier performance, increased flexibility, Reduced quality cost, improved information accuracy and decision making capability.

6. ERP Implementation life cycle: (7)

Introduction, Pre-evaluation Screening, Package evaluation, Project planning, Gap analysis, Re-engineering, Configuration, Team training, Testing, End user training and post-implementation phases.

7. ERP market and case studies: (5)

Brief account of ERP market, various ERP packages like SAPAG, Oracle, PeopleSoft, etc, Case studies based on implementation of ERP for various industries in mfg., marketing and other business.

TERM WORK

1. Minimum six assignments based on above topics.
2. Detailed study of implementation of ERP and analysis and review of its benefits for any suitable application.

REFERENCES:

1. Enterprise Resource planning, Alexis Leon, Tata McGraw Hill Publication, ISBN 0-07-463712-6.
2. Enterprise Resource Planning, Bret Wagner, Delmar Learning, International edition, ISBN – 10 : 1439081085, ISBN – 13 : 978-1439081082
3. Modern ERP : Select, Implement and Use Marianne Bradford, H&M Books, lulu.com, ISBN : 978-0-557-01291-6.
4. Enterprises Resource Planning By Venkateshswara SCITECH publication(Pb)
5. Enterprises Resource Planning By Venkateshswara SCITECH publication(Hb)
6. Entrepreneurship by Chris Boulton , Patric Turner Willey India
7. Enterprises Resource Planning By E.F. Monk, B.J.Wanger Cengage Learning
8. Enterprises Resource Planning By A R Singla Cengage Learning

COURSE CODENO. **SUBJECTCODE NO.**

B.E. (MECHANICAL) PART-II (W.E.F. 2010-11 From July 2010)

5. ELECTIVE-III

3. CRYOGENICS

Teaching Scheme:
Lecturers: 3 Hrs/ Week
Practicals: 2 Hrs/ Week

Examination Scheme:
Theory: 100 Marks
Term work: 25 Marks

Section I

1 Introduction to Cryogenic: 02
History and development it's importance, cryogenic temperature scale.

2 Behaviour of materials at low temperature : 04
Low temperature properties of materials, Mechanical
properties Thermal properties, electric and magnetic properties,Properties of cryogenics& fluids.

3 Gas Liquification Systems: 07
Introduction- production of low temperature , Liquefaction systems for N2, Neon, Hydrogen, He etc.(Numerical Treatment)

4 Cryocoolers: 08
Sterling, G-M and pulse tube cryocoolers.

Section II

5 Gas Separation And Purification Systems: 05

Thermodynamically ideal separation systems- properties of
mixtures , principles of gas separation Rectification column- Linde single and double column system of air separation.

6 Measurement Systems For Low Temperatures: 05
Measurement of different parameters at low temperature like temperature, pressure level mass flow rate etc.

7 Cryogenic Fluid Storage And Transfer Systems: 05
Dewar vessel, insulation types and importance. Components of transfer system with importance. Importance of vacuum and it's measurement.

8 Application Of Cryogenic Systems: 06
Applications in mechanical, electrical, food preservation, biological and medical, space technology etc.

REFERENCE BOOKS:

1 .Cryogenics systems – Randall Barron – Mc Graw Hill Book Co
2 .Cryogenic Engineering – R.B.Scott – Van Nosfrand Co.
3 .Cryogenic Engineering –J.H.Bell – Prentice Hall
4 Cryogenic Engineering – R.W.Vance – John Welley.
5 Cryocoolers - Walkers – Prentice Hill Publication

Term Work:
1 Study of cryogenic system.
2 Study of gas liquification system
3 Study of gas separation and purification.
4 Study of various measuring techniques used in cryogenics
5 Study of cryogenic fluid storage system
6 Study of insulating materials and their applications in cryogenics
7 Study and applications of cryogenic system
8 Visit to cryogenics plant industry (compulsory).

COURSE CODENO. **SUBJECTCODE NO.**

B.E. (MECHANICAL) PART-II (W.E.F. 2010-11 From July 2010)

5. ELECTIVE-IV
4. PLC & SCADA PROGRAMMING

Teaching Scheme:
Lecturers: 3 Hrs/ Week
Practicals: 2 Hrs/ Week

Examination Scheme:
Theory: 100 Marks
Term work: 25 Marks

Objective :

- To expose students to fundamentals of PLC.
- To enable students to apply PLC programming and SCADA.

SECTION – I

1. Basics of PLC Programming: **(6)**
Hardwired logic Vs Programmed logic, symbols used in ladder logic, guidelines for ladder drawing, Relay type instructions, logical instructions, data comparison instructions, data computation instructions.

2. Basic Relay Instructions: (3)
NONC, Instructions BIT instructions output & output latching instruction, Negated output Instruction and one shot instruction

3. Timer & Counter Instructions: **(8)**
Introduction, types, timer instructions, counter instructions, applications, implementation of timers and counters for industrial problem solving.

4. Programme Control Instructions: **(3)**
Master Control and Zone control instructions, jump instructions and subroutine. Applications of above in PLC programming.

SECTION – II

5. Supervisory Control And Data Acquisition (SCADA): **(4)**
Concept of SCADA, its industrial significance and applications.

6. Interfacing of SCADA with PLC: **(6)**
Steps, methodology, procedure of implementation and protocols.

7. Applications of SCADA: **(5)**
Applications of SCADA in process control, industrial automation and various manufacturing systems.

8. Effecting Control using SCADA: **(5)**
Effecting control using data generated through SCADA, Analysis of data for various MIS related tasks.

TERM WORK

1. Two experiments on ladder applications using basic programming.
2. Four experiments on timer and counter applications.
3. Two assignments on SCADA applications for simple problems.

REFERENCE BOOKS:

1. "Programmable Logic Controller – Principles and Applications", 5/e, J. W. Webb, R.A. Reis; Prentice Hall of India Ltd. ISBN 81-203-2308-4.
2. "Programmable Logic Controller – Principles and Applications, by NIIT; Prentice Hall Publications Pvt.Ltd. India, ISBN 81-203-2525-7.
3. "Programmable Logic Controller – Programming methods and Applications", Hackworth John R. and Hackworth Frederick D. Jr.; Pearson Education LCE, ISBN 81-297-0340-8.
4. Introduction to PLC – Gary Dumming – Delmar Pub.
5. Various PLC manufacturers catalogue.
6. Programmable Logic Controller – FESTO Pneumatics, - Bangalore
7. SCADA, Stuart A. Boyer (ISA Publi.) ISBN 1-55617-660-0.
8. Practical SCADA for industry, David Bailey, (Elsevier Publi.) ISBN 0-7506-5805-3.
9. website : http://www.dpstele.com/dpsnews/press-releases/scada-sensor-tutorial-white-paper.php

COURSE CODENO. **SUBJECTCODE NO.**

B.E. (MECHANICAL) PART-II (W.E.F. 2010-11 From July 2010)

6. PROJECT

Teaching Scheme:
Practicals: 5 Hrs/ Week

Examination Scheme:
Term work: 100 Marks
Oral/ P.O.E: 75 Marks

1. To provide an opportunity to students do work independently on a topic/ problem/ experimentation selected by them and encourage them to think independently on their own to bring out the conclusion under the given circumstances of the curriculum period in the budget provided with the guidance of the teachers.
2. To encourage creative thinking process to help them to get confidence by planning and carrying out the work plan of the project and to successfully complete the same, through observations, discussions and decision making process.

Project Load:

Maximum 9-10 students in one batch, involving 03 groups Maximum 9-10students shall work under one Faculty Member Group of one student is not allowed under any circumstances.

Project Definition:

Project work shall be based on any of the following:

1. Fabrication of product/ testing setup of an experimentation unit/ apparatus/ small equipment, in a group.
2. Experimental verification of principles used in Mechanical Engineering Applications.
3. Projects having valid database, data flow, algorithm, and output reports, preferably software based.

Project Term Work:

The term work under project submitted by students shall include and assessment of Term work should be as below

1 Work Diary: 25 Marks

Work Diary maintained by group and countersigned by the guide weekly.
The contents of work diary shall reflect the efforts taken by project group for

1. Searching suitable project work
2. Brief report preferably on journals/ research or conference papers/ books or literature surveyed to select and bring out the project.
3. Brief report of feasibility studies carried to implement the conclusion.
4. Rough Sketches/ Design Calculations, etc.

PROJECT REPORT FORMAT

Project Report:

Project report should be of 60 to 70 pages. For standardization of the project reports the following format should be strictly followed.

1	Page size	:	Trimmed A4
2.	Top Margin	:	1.00 Inches
3.	Bottom Margin	:	1.32 Inches
4.	Left Margin	:	1.5 Inches
5.	Right Margin	:	1.0 Inches
6.	Para Text	:	Times New Roman 12 point font
7.	Line Spacing	:	1.5 Lines
8.	Page Numbers	:	Right aligned at footer. Font 12 point Times New Roman

9. Headings : New Times Roman, 14 point, Boldface

10. Certificate :All students should attach standard format of Certificate as described by the Department. Certificate should be awarded to batch and not individual student Certificate should have signatures of Guide, Principal, and External Examiner. Entire Report has to be documented as one chapter.

11 Index of Report:

i) Title Sheet
ii) Certificate
iii) Acknowledgement
iv)Table of Contents
v)Synopsis
vi)List of Figures
vii)List of Photographs/ Plates
viii)List of Tables
1. Introduction
2. Literature Survey/ Theory
3. Design/ Experimentation/ Fabrication/ Production/ Actual work carried out for the same.
4. Observation Results
5. Discussion on Results and Conclusion

12 References : References should have the following format

For Books:

"Title of Book"; Authors; Publisher; Edition;

For Papers:

"Title of Paper"; Authors; Conference Details; Year.

2 Presentation: 30 Marks on the Basis of Continuous assessment

A) For report :15 Marks

B) The group has to make a presentation before the faculties of department **30 Marks**

SUGESTED MEANS OF CENTRALISED ASSESMENT OF PROJECT WORK FOR SINGLE INSTITUTION

Suggestions for seminar & project assesment

- Seminar should clubbed with project.
- Interim presentation of seminar.
- Evaluation of seminars by 3 to 4 faculty members.
- Teacher should give seminar topic.
- Proper literature survey.
- Seminar & Project copies should be handwritten & then should be typed.
- Project diary should be maintained.
- Before in plant training orientation should be given.
- Evaluation of projects can be done by Industry person.
- Common platform for project evaluation.
- If projects will complete before March then evaluation / rational assessment will be done by university. Also for students who are getting more than 90% marks in the term work.
- Project report should be submitted before 31st March.
- Common guidelines for evaluation of projects are to be decided which are as follows
    - Scope & contents.
    - Relevance.
    - Literature Survey.
    - Executation.
    - Experimentation.
    - Results & Discussions.
    - Innovations.
    - Recognition – Industry sponsored.
    - Eco friendly.
    - Further scope.

Shivaji University, Kolhapur

EQUIVALENCE SUBJECT FOR PRE-REVISED SYLLABUS WHICH IS W.E.FROM ACADEMIC YEAR 2004-2005 B.E. (MECH.) PART-I & PART-II IN REVISED SYLLABUS WHICH IS W.E.FROM ACADEMIC YEAR 2010-2011

B.E. (MECHANICAL) PART-I

Sr. No.	SUBJECT IN OLD SYLLABUS PRE-REVISED W.E.FROM WHICH IS W.E.FROM A.C.YEAR 2004-2005	EQUIVALANCE SUBJECT IN NEW SYLLABUS REVISED W.E.FROM A.C. 2001--2011
1.	Mechatronics	Mechatronics at B.E.(MECH) PART-II
2.	Machine Design-III	Mechanical System Design at B.E.(MECH) PART-I
3.	I.C. Engines	I.C. Engines at T.E. (MECH) PART-II
4.	Elective-I Production Management	Production Management at B.E.(MECH) PART-II
5.	Elective-I Experimental Stress Analyses	Experimental Mechanics at BE(MECH) PART I
6.	Elective-I Gas Turbine	Automobile Engineering at BE(MECH) PART I
7.	Elective-I Operation Research	**A Paper is to be set**
8.	Elective-II Entrepreneurship Development and Project	Enterprise Resource Planning at B.E.(MECH) PART-II
9.	Elective-II Total Quality Management	Total Quality Management at BE(MECH) PART I
10.	Elective-II Fluid Dynamics	Computational Fluid Dynamics at B.E.(MECH) PART-II
11.	Elective-II Finite Element Method	Finite Element Analysis at BE(MECH) PART I

B.E. (MECHANICAL) PART-II

Sr. No.	SUBJECT IN OLD SYLLABUS PRE-REVISED W.E.FROM WHICH IS W.E.FROM A.C.YEAR 2004-2005	EQUIVALANCE SUBJECT IN NEW SYLLABUS REVISED W.E.FROM A.C. 2001--2011
1	Industrial Engineering	Industrial Engineering at BE(MECH) PART II
2	Power Plant Engineering	Power Engineering at BE(MECH) PART II
3	Refrigeration & Air Conditioning	Refrigeration &Air Conditioning at BE(MECH) PART I
4	Elective- III Automobile Engg.	Automobile Engg. at BE(MECH) PART I
5	Elective-III Materials management	**A Paper is to be set**
6	Elective-III Costing And cost Optimization	**A Paper is to be set**
7	Elect Elective-III Mechanical Vibration	Noise & Vibration at BE(MECH) PART I
8	Elective-IV Marketing Management	**A Paper is to be set**
9	Elective-IV Cryogenics	Cryogenics at BE(MECH) PART II
10	Elective-IV Machine Tool Design	Machine Tool Design at BE(MECH) PART II
11	Elective-IV Advanced Manufacturing Techniques	Industrial Automation & Robotics at BE(MECH) PART II

Shivaji University, Kolhapur

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