Price:-Rs.10/-

॥ अंतरी पेट्‌वू ज्ञानज्योत ॥

North Maharashtra University, Jalgaon

Syllabus for Forth Year Engineering Degree Course (B.E.)

MECHANICAL

w.e.f. July, 2001

NORTH MAHARASHATRA UNIVERSITY, JALGAON.

B.E. (MECHANICAL ENGINEERING)

(1998 COURSE)

FIRST - TERM   **W.E.F. : JULY 2001.**

Sr. No.	Code	Subject	Teaching Scheme (Hours Per Week)			Examination Scheme			
						Maximum Marks			
			Lect	Pract	Duration Paper (Hrs.)	Theory	Term Work	Pract	Oral
1.		Elective – I	04	02	03	100	25	—	—
2.		Machine Design – III	04	02	04	100	25	—	25
3.		Refrigeration and Air Conditioning	04	02	03	100	25	—	25
4.		Project and Financial Management	04	02	03	100	25	—	25
5.		Project	—	02	—	—	50	—	—
6.		Seminar	—	02	—	—	—	—	50
		Total :	16	12	—	400	150	—	125
		grand total :	28			675			

B.E. (MECHANICAL ENGINEERING)

SECOND - TERM

Sr. No.	Code	Subject	Teaching Scheme (Hours Per Week)			Examination Scheme			
						Maximum Marks			
			Lect	Pract	Duration Paper (Hrs.)	Theory	Term Work	Pract	Oral
1.		Elective – II	04	02	03	100	25	—	—
2.		$$ CAD & CAM	04	04	04	100	25	—	25
3.		$$ Tribology	04	02	03	100	25	—	25
4.		Mechanical Vibration	04	02	03	100	25	—	25
5.		Project	—	04	—	—	50	—	50
6.		Technical Visits	—	—	—	—	50	—	—
		Total :	16	14	—	400	200	—	125
		grand total :	30			725			

NOTE : $$ = Common to Mechanical & Production Engg.
Total of Maximum marks of term I & II = 1400 .

(B.E. Mechanical)

Elective -I

Non-conventional Energy Sources
M/c. Tool Design
Operation Research
Robotics
Auto mobile Engineering-I
Mechanical Estimation & costing.
Reliability Engineering

Elective-II

Power Plant Engineering.
Management information System.
Materials Management
Energy Conservation & Management
Auto mobile Engineering-II
Production, Planning & Control.
Analysis & Synthesis of Mechanism.

B.E. (MECHANICAL)
MACHINE DESIGN III

Teaching scheme (Per week)

Lectures : 4 brs.
Practical : 4 hrs. (2 hrs on Computer)

Examination scheme
Duration : 4 hrs.
Theory : 100 marks
Oral : 25 marks
T/W : 25 marks

Unit - I : DECISION MAKING

9 Hrs.

1.1. Introduction to Decision Making : Characteristics of a decision problem, objectives and alternatives in Engg. Decision, Factors relavent to Engg. Decision, Rational decision making producere.

1.2 Optimization : Introduction to optimization problem, optimization by differential calculus, use of dual variable, langrangian multipliers , Linear programming, Numerical methods of optimization.

1.3 Probability : Knowledge of future events, Principle insufficient reasons, Basic rules of probability & application, Expected values, Variance and standard deviations and its estimation.

1.4 Reliability: Exponential reliability Curve, Weibull distribution, Mechanical reliability & factor of saftey.

weightage : 20 marks

Unit - II : OPTIMIZATION BY JOHNSON METHOD.

9 Hrs.

Introduction to Optimum Design for Mechanical Elements. Adequate & optimum design. Johnson's method of Optimum design. Simple problems in optimum design like axially loaded member. Shaft subjected to torsional & bending moments and other machine elements. Optimum design with problems on optimum design for normal & Redundant specification for simple elements like axially loaded bar, simply supported beam with point load & with UDL, torsion bar spring.

weightage : 20 marks

Unit III : PRODUCT DESIGN :-

9 Hrs.

Introduction to product design, A simon's model , strength consideration in product design, design for stiffness and rigidity, Design for production (metal parts) . Optimisation in design, Economic factors influencing design.

weightage : 20 marks

Unit IV : SYSTEM APPROACH :-

9 Hrs.

Systems approach to design Mathematical model - Lumped system Dynamic response to a distributed system and lumped system — modelling the masses, Elasticities, Inertias, Damping and Friction, Mathematical model for shock analysis, CAM systems, Value engineering approach to design problems.

weightage : 20 marks

Unit V : CAM

9 Hrs.

3,4,5, cam, 4,5,6 cam, displacement velocity, acceleration, jerk, cycloidal cam, sine acceleration cam, Forces on cam, Mathematical model with elasticity, jump phenomenon, ramp of the cam - precam, polydyne cam.

weightage : 20 marks

TERM WORK :

The term work shall consist of :
A) ONE design project based on the above syllabus. the design project consisting of two imperial size sheets - one involving assembly drawing with a part list and overall dimensions and the other sheet involving drawings of the individual components. Manufacturing tolerances, surface finish symbols and geometric tolerances should be specified so as to make it a working drawing. A design report giving all necessary details of calculations of the design of components and assembly should be submitted in a separate file.

B) FIVE design assignments of problems based on the topics of the syllabus out of which at least three shall be solved with the help of the Computer. (Use of visual C++)

No computer based design is to be asked in theory paper.

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

REFERENCE BOOKS :

1. Mechanical Engineering design by J.E. Shigley , 2nd Ed., McGraw Hill Publications.
2. Mechanical design analysis by M.F. Spotts - Prentice Hall Publication.
3. Design Engineering - Dixon - Tata MCgraw Hills.
4. Optimum design - R.C. Johnson
5. Product design & manufacturing - Chitale & Gupta, Prentice Hall.
6. Machine Design & CAD – Farajdak Haideri, Nirali Prakashan, Pune
7. Theory of machine - Rattan, Tata McGraw Hills.
8. Mechanical Vibration - V.P. Singh, Dhanpat Rai & Co. Pvt. Ltd.
   P.S.G. Design Data Book .

REFRIGERATION & AIR CONDITIONING
(B.E. MECH.)

Teaching scheme (Per week)

Lectures : 4 hrs.
Practical : 2 hrs.

Examination scheme
Duration : 3 hrs.
Theory : 100 marks
Termwork : 25 marks
Oral   : 25 marks

UNIT I : 9 Hrs.

    1.1. Introduction , standard rating of refrigerating machine, coefficient of performance of refrigerator and heat pump.

1.2 Reversed Carnot cycle & its limitations, reversed Brayton cycle, application to air craft refrigeration, Bootstrap refrigeration cycle, reduced ambient air coooling system , regenerative air cycle system.

1.3 Vapour compression refrigeration system study of theoretical and actual vapour compression cycle, use of p-h and T-s charts, effect of evaporator and condenser pressure and temperature on the performance of the refrigeration cycle, effect of sub cooling and super heating.

weightage : 20 marks

UNIT II : 9 Hrs.

    2.1 Compound vapour compression system with inter cooling, flash chamber, multi compressor and multi evaporators systems.

2.2 cascade refrigration system, production of dry ice , Joule Thomson coefficient, inverse curve, liquifaction of air and gases.

2.3 Designation of refrigerant, selection of refrigerant, chemical, physical and thermodynamic requirements of refrigerants , lubricant in refrigerating system, secondary refrigerant, azeotropes and its uses.

weightage : 20 marks

UNIT III 9 Hrs.

    3.1 Vapour absorbtion refrigeration simple & modified vapour absorption refrigeration systems, Electrolux refrigerator.

3.2 Desirable properties of solvent, absorbent & refrigerant combinations, aqua ammonia & lithium bromide refrigeration system, use of enthalpy concentration charts.

weightage : 20 marks

UNIT IV : · 9 Hrs.

    4.1 Introduction to industrial & comfort air conditioning, human requirements of comfort, effective temperature & comfort chart.

4.2 Psychrometric- properties of moist air, psychromotric chart & process, mixing of air

stream, bypass factor, sensible heat factor, roomd psychrometry.

5.2 Distribution of air through ducts systems and design of ducts.

5.3 Window & central air condition system, year round air conditioning. Direct and chilled water refrigeration system.

weightage : 20 marks

LIST OF PRACTICAL :-

Any eight out of the following are to be performed with minimum three trials.

1. Trial on Vapour Compression Refrigeration system.
2. Trial on ice plant/Domestic refrigeration system.
3. Study & trial on Vapour absorbtion refrigeration system..
4. Study & trial on Window/central air conditioner.
5. Study of Construction of hermatically sealed compressor and actually viewing of a cut model of the same.
6. Evacuation and charging of refrigeration plant.
7. Trial on vapour compression air conditioning test rig.
8. Study of various types of air conditioning system & its specification
9. Study & trial on cooling towers.
10. Study of thermostat & humidistat.
11 Study of expansion devices & solenoid valve.
12. Study of pressure cutouts relays and oil separators.

RECOMMENDED BOOKS. :-

1. C.P.Arora - Refrigeration & Air conditioning - Tata McGraw Hill, New Delhi
2. Jordan & Priester - Refri geration & Air Conditioning : Prentice Hall India New Delhi. 3. Domkundwar & Arora- Refrigeration & Air Conditioning : Dhanpat Rai & Sons, New Delhi.
4. P.L. Ballaney- Refrigeration & Air conditioning : Khanna Publishers, New Delhi.

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

(B.E. MECHANICAL)
PROJECT & FINANCIAL MANAGEMENT

Teaching scheme (Per week)	Examination scheme
	Duration : 3 hrs.
Lectures : 4 hrs.	Theory : 100 marks
Practical : 2 hrs.	Termwork: 25 marks
	Oral : 25 marks

UNIT I :   9 Hrs.
a) Introduction : Basic concept of project management. Introduction to project formulation, scheduling, monitoring, control benefits.

b) Basic Tools and Teachniques For Project Scheduling : Calender schedule, Bar chart , life cycle, curves, line and balance.

weightage : 20 marks

UNIT II :   9 Hrs.
NETWORK MODELS : Introduction to PERT & CPM, Fundamental concept & network models and construction of network diagrams. PERT activity, time estimates, critical path and project time duration, Probability & completing the project on or before specified time, float of an activity. Optimisation of project time & cost in PERT network, Updating a project, Resource allocation & load smoothing.

weightage : 20 marks

UNIT III :   9 Hrs.
FINANCIAL MANAGEMENT:

a) THE FIRM & ENVIRONMENT - Form & business ownership, Economic & Regulatory
environment , Incidence of Taxation, Personnel & Corporate Taxation. Tax Planning, sources of
financial information, Corporate planning & financial information, Market forces and Pricing
decisions.

b)   CAPITAL   STRUCTURE   AND   DIVIDEND   POLICIES-   Theory   of   capital
structure,planning   the capital structure, Dividend policy & Share, Valuation, Industrial sickness &
Rehabilitation, Privatisation & Public enterprises.

                                                                        weightage : 20 marks
UNIT IV :   9 IIrs.
TOOLS   OF FINANCIAL ANALYSIS -   Fund flow analysis - sources & uses of funds, balance
sheet and profit & loss statements, measurement of cash flows, Revenue costs, Profits relationship,
Break-even analysis,Ratio analysis, Analysis of operating & financial leverage, long term & short
term cost-output relationship.Techniques of financial analysis

                                                                        weightage : 20 marks
UNIT V ·   9 Hrs.
FINANCIAL PLANNING & BUDGETING :-

Financial forecasting, Forecasting techniques, criteria for Investment decisions, Capital dgeting,
Capital relationing, Sources of raising capital, Procedure for Negotiation with Financialinstution for
raising fixed and working capital. Management of working capital, Internal financing , Balances
capital structure, Dividend policy cost of capital, Problems of financial planning & budgeting in
ublic sector undertaking.

                                                                        weightage : 20 marks

TERM WORK :-
Minimum eight assignment on the above topics, each assignment should have case
studies or problems of the related topic.

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

RECOMMENDED BOOKS.:

1. Financial Management- M.Y.Khan & P.K. Jain - T.M.H., New Delhi.
2. Operation Research - Hira, Gupta, S.Chand Publication.
3. Operation Research - S.D.Sharma, Kedarnath Rannath Co.,Meerut
4. Financial Management - I. M. Pandey
5. Fundamentals of Financial Management- Prasanna Chandra, T.M.H, New Delhi.
6. Management of System - Dr. A.K.Chitale, Kashyap Publishing House, Index.
7. Quantity Techniques in Mgt. - N.D. Vohra, T.M.H, New Delhi.

SEMINAR
(B.E. MECH. / PROD. / AUTO.)

Teaching Schedule :
Practicals   : 2 hrs/week

Examination Schedule:
Oral   : 50 Marks

Student individually will independently study a topic assigned to them and submit a report and deliver a short seminar/lecture on that topic.

Seminar should be based on deep study of any topic related to mechanical/production/ automotive engineering.

e.g. :-

a)   Advanced Manufacturing Processes.
b)   Latest materials and their manufacturing properities.
c)   Socio-economic impact of manufacturing activities.
d)   Environmental problems involved in manufacturing.

TERM- WORK :-

Two copies of bound report should be submitted to the Institute/Department (One for university and one for college) and one should remain with every student in a group.

The report will contain the summary of information colleected by the students.   The reports will be of A-4 size, bound and should contain all the necessary charts, drawings, references, etc.

ORAL :

The presentation should be around 10-15 minutes, followed by 10 minutes question/answer session in the presence of external examiner, fellow students and guide and teachers in the department.

CAD / CAM
(B.E. MECHANICAL / PRODUCTION)

Teaching Schedule :
Lectures   : 4 hrs/week
Practicals   : 4 hrs/week
    (2 hrs c++
    2 hrs ideas,anasys, etc.)

Examination Schedule:
Theory Paper   : 100 Marks
Term work   : 25 Marks
Oral   : 25 Marks
Paper Duration   : 4 Hrs.

UNIT - I : Basics of CAD/CAM :
9 Hrs.

Definition, Concept, product life cycle and CAD/CAM Reasons for implementing CAD systems. Computer Aided Design process and various steps in it. Application of CAD for design process. Benefits of CAD.   Integration of CAD/CAM, Necessity.   Automation, Types of automation, Application of CAD./CAM, CAD modeling Surface modeling. Wireframe modeling, Solid modeling. Introduction to rapid prototyping or layered manufacturing technology. Concurrent Engineering.

weightage : 20 marks

UNIT-II : Interactive Computer Graphics :
10 Hrs.

Defination, Concept, Two dimensional transformations, scaling, translation,   rotation, Matrix representation and homogenoous coordinates. Three dimensional geometric   transformations. Translation,   Rotation,   scaling.   Composite transformations.   Curves   and   surfaces. Parametric   and   Nonparametric representation of curves and surfaces. Analytic and synthetic curves and surfaces. Hermite cubic spline curve, Bezier curve, B-spline curve.   Bicubic surfaces such as Hermite surface Bezier surface, B-spline surface. (Generation of all above curves and surfaces using C++ programmes) (Programming is restricted for practical class only).

weightage : 20 marks

UNIT-III: FEM Analysis and its application.
9 Hrs.

Introduction: Process of Finite Elements Analysis, Physical problems, Mathematical models and the finite element solution. Finite element analysis as an integral part of computer aided diesign. Heat Transfer Analysis Governing heat transfer equations Incremental equations.
FEM analysis of rolling and extrusion processes 2-D analysis .

weightage : 20 marks

UNIT-IV : FMS , GT (CAM)

8 Hrs.

Components of computer integrated manufacturing systems. Building blocks of flexible manufacturing systems. FMS in job, batch and mass proudction. Machining systems of FMS. Tool management systems. Workpiece handling systems. Flexible Manufacturing Cell. Means to achieve, various types of flexibilities such as machine., process, material handling, product, production flexibility.

Group Technology :

Models and algorithms, visual methods, coding method, cluster analysis method, matrix formulation, mathematical programming formulation, graph formulation. Concept of cellular manufacturing, types of cell manual and robotized, method of cell formation, advantages of cellular manufacturing.

weightage : 20 marks

8 Hrs.

UNIT - V :

ROBOTS:

Components, classification, selection, sensor technology, Robot arm trajection, arm dynamics, trajectory planning, robot grippers.Robot Kinematics object location, transformations (2d & 3d), direct & inverse kinematics, manipulator motion, Mathematical model of servo system.

REVERSE ENGG.:

Basic steps in reverse engg., such as Data Capture, Preprocessing, Segmentation Surface fitting 3D CAD model creation. Application of Reverse Engg.

weightage : 20 marks

TERM WORK : (ANY FIVE)

1. Design of any of the subsystem of compressor , condensor or evaporator.
2. Design of any of the following : Piston Cylinder, Connecting Rod, Crankshaft, Valves etc. with the help of "C" language.
3. Drafting of any one of the following components Rotors & Stator blades, casing bearing , etc.
4. Use of generative manufacturing processes for rapid prototyping using I-deas/Pro-E/ etc.
5. Use of software packages like I-deas/Pro-E/catia,unigraphics,surfcam,master cam. etc. for solid modeling of any Engg Component.
6. Reverse Engg. of any simple geometric model.
7. Problems of FEM (Gears) by using I-deas/Ansys/etc. software.
8. Problems for transformations - Translation, rotation, scaling.
9. Assignment on Robot Programming (Compulsory, Practical purpose only)
10. Assignment on FMS group technology (Compulsory).

ORAL :

Oral will be based on above termwork only. Scope of programming should be restricted to practicals only.

Note : Use of any suitable software package can be done for performing above said termwork.

REFERENCE BOOKS.:

1. CAD / CAM   by Ibrahim Zeid
2. CAD / CAM   by Ramamurti
3. CAD / CAM   by Groover, Zimmer
4. Introduction to FEM by N. S. Ottoson.

TRIBOLOGY
(B.E. MECH.& PROD.)

Teaching scheme (Per week)
Lectures : 4 hrs.
Practical : 2 hrs.

Examination scheme
Theory : 100 marks
Termwork: 25 marks
Oral : 25 marks
Duration: 3 hrs.

UNIT I :-   9 Hrs.
1.   Tribology : Introduction, Tribology in design, Tribology in industry, Economic consederations.

2.   Mechanics of Rolling motion : Introduction, Free rolling , Microslip in rolling, tyre Road contacts.

3.   Friction : Introduction, Laws of Friction, Kinds of friction, cause of friction, friction measurement, theory of friction, variables in friction, friction in Stability - Characteristics of friction variations, analysis of stick-slip oscillations and its elimination.

4.   Wear : Types of wear, Various factors affecting wear, measurement of wear, wear between metal to metal and metal to flowing liquids .

weightage : 20 marks

UNIT II :-   9 Hrs.
1.   Hydrostatic bearings : Basic concepts, operations, advantages & limitations. Hydrostatic step bearing, conical & spherical bearings, load carrying capacity & flow of lubricants, controlling of flow through restricters. Influence of restictors on

weightage : 20 marks

UNIT III :-   9 Hrs.
1.   Hydrostatic bearings : Basic concepts, operations, advantages & limitations. Hydrostatic step bearing, conical & spherical bearings, load carrying capacity & flow of lubricants, controlling of flow through restricters. Influence of restrictors on performance, Bearing power & film thickness, bearing temperature & power. ydrostatic lifts - Lubkin Solution.

2.   Hydrodynamic bearings : Theory of Hydrodynamic lubrications, mechanism of pressure development in oil film. Infinite tapered shoe slider bearing. Sommerfield & Boyd solution for an infinite journal bearings. Short bearing theory applied to journal bearing. Practical design considerations.

weightage : 20 marks

UNIT IV :-   9 Hrs.
1.   Friction & power losses in Journal Bearing : Evaluation of friction loss in concentric & eccentric journal bearing & quantity of oil flow with circumferential groove & hole, source for heat balance.
2.   Hydrodynamic thrust bearing : Introduction, flat plate, thrust bearming, step thrust bearing, tapered land thrust bearing, tilting pad thrust bearing, spring mounted thrust bearing, hydrodynamic, pocket thrust bearing.

weightage : 20 marks

UNIT V :-   9 Hrs.
1.   Hydrostatic squeeze film, circular and rectangular plates, impact conditions between lubricated solids, applications to journal bearing.
2.   Air lubricated bearings : Tilting pad bearings, Magnetic recording disks with flying head hydrostatic. hydrodynamic thrust bearing with air lubrications.
3.   Lubrication practice, Quality control & Management : Characteristics of Lubricating method, lubricating devices and systems, organising & plant lubrication programme. Typical industrial systems. Service application chart.

weightage : 20 marks

TERM WORK : (Assignemnts based on) :

1. Design of hydrostatic and hydrodynamic bearing.
2. Squeez film lubrication of piston pin.
3. Heat balance in bearings.
4. Reyonolds equation.

PRACTICAL ON (Any Four) :

1. Journal bearing apparatus.
2. Tilting pad thrust bearing apparatus.
3. Friction in journal bearing.
4. Four ball tester.
5. Coefficient of friction using pin on disk type friction monitor .
6. Brake line friction test rig.

NOTE : Oral will be based on the prescribed termwork presented in the form of
certified journal.

RECOMMENDED BOOKS. :

1. Basic lubrication theory - A. Cameron.
2. Theory & Practice of lubrication of Engineer - D.D. Fuller, John Wiley & Sons 1984.
3. Fundamentals of friction & wear of materials - American Society of Metals.
4. The Design of Aerostatic Bearings - J. W. Powell
5. Gas Bearings - Hrassam & Powel.
6. Principles of Tribology - Edited by J. Halling.
7. Friction, Wear, Lubrication-Tribology Handook-Edited by Prof.I.V. Kragelsky.
8. Friction & wear : PUGH B.
9. Tribology Handbook : Neal M. J. Butterworth.
10. Introduction to tribology & bearings - Majumdar,A H. Wheeler & Co.Pvt.Ltd.

MECHANICAL VIBRATION
(B.E. MECH.)

Teaching scheme (Per week)
Lectures : 4 hrs.
Practical : 2 hrs.

Examination scheme
Theory : 100 marks
Duration: 3 hrs.
Termwork: 25 marks
Oral : 25 marks

UNIT I :-   9 Hrs.
Damped and Undamped Vibration :-
Introduction, Definitions, Vector method of representing harmonic motion, addition of two S.H.M.
of the same frequency, beats phenomenon, Complex method of representing harmonic vibration,work
done by a harmonic force on a harmonic,
Fourier series & harmonic analysis.
Undamped free vibration of single degree of freedom systems: dervation & solution of differential
equation torsional vibration, equivalent stiffness of a spring combination, springs in series & parallel,
energy method.
weightage : 20 marks

UNIT II :-   9 Hrs.
Damped free vibration of single degree of freedom system :
Different types of damping, free vibration with viscous damping logarithm decrement, viscous
dampers, dry friction or coulomb damping, Solid or structural damping, slip or interfacial damping.
Forced Vibration of single degree of freedom systems :-
Forced vibration with constant harmonic excitation & with rotating & reciprocating unbalance ,
forced vibration due to excitation of the support, energy dissipated by damping, forced vibration with
coulomb damping & with structural damping, etermination of equivalent viscous damping from
frequency response curves, vibration measuring instruments.
weightage : 20 marks

UNIT III :- 9 Hrs.

Two degrees of freedom systems: - Principle modes of vibration, combined rectilinear and angular modes, system with damping, undamped forced vibration with harmonic excitation, vibration absorbers.

Critical speed of shaft :- of a light shaft having a single disc without damping & with damping, critical speed of shaft having multiple disc, secondary critical speed of a light cantilever shaft with large heavy disc at its end.

weightage : 20 marks

UNIT - IV 9 Hrs.

Multiple degree of freedom systems: Free viberation equation of motions, influence coefficients, generalised co-ordinated & co-ordinated coupling, natural frequenciese and mode shapes, rthogonal properties of normal modes, matrix inversions, torsional vibration of multi rotor systems, gear system continuous systems, Rayleigh method Dunkerley method, Stodola method, Rayleigh-Ritz method, Holzer method, metric iteration.

weightage : 20 marks

UNIT - V 9 Hrs.

Transient & Non linear Vibration - Laplace transformations, response to a impulsive input to a step input & to a pulse input, phase plane methods, shock spectrum, examples of a non linear spring forces perturbation method, forced vibration with non linear spring, Self excited vibration.

weightage : 20 marks

TERM WORK :

Term work shall consists of any FIVE following experiments. And Three assignments

1)   To Determine the natural frequency of damped vibration of single degree freedom system & to find its damping coefficient.

2)   To verify natural fre

ORAL :

Oral shall be based on prescribed Term-work certified in the form of journal.

RECOMMENDED BOOKS.:-

1. Mechanical Vibrations : Grover
2. Mechanical Vibrations : Church A. H.
3. Mechanical Vibrations : Tse Moarse & Hinkle.
4. Mechanical Vibrations : V.P. Singh, Dhampat Rai & Co. Pvt. Ltd. .

NON CONVENTIONAL ENERGY SOURCES
(B.E. MECHANICAL) - 402048 : ELECTIVE - I

Teaching Schedule :	**Examination Schedule:**
Lectures : 4 hrs/week	Theory Paper : 100 Marks
Practicals : 2 hrs/week	Term work : 25 Marks
	Paper Duration : 3 hrs

UNIT - I :   8 Hrs.

1. Solar Energy : Availability, Limitations, energy by efficiency by 1st & 2nd law of thermodynamics. Use of solar energy.
2. Solar Radiation: Physics of the sun. Energy radiated by the sun. Geometry of solar radiation. Measurement of solar radiation, Computation of solar radiation on inclined surface.

weightage : 20 marks

UNIT - II :   10 Hrs.

3. Flat plate collectors : Energy balance for a flat plate collector. Simple equation and performance curves. Selection of flat plate collector, Collector efficiency factor, Collector heat removal factor, material for collectors.
4. Solar concentrator : Limitations of flat plate collectors. Various concentration their advantage, simple thermal energy balance equations. Parabolic, parabolic through, heliostats. Selection of various materials for concentration

weightage : 20 marks

UNIT - III :   9 Hrs.

5. Solar heating systems.: Solar water and heating systems. Types of solar water
6. heater, Passive solar heating systems. Solar heating economices.
    Solar distillation systems.: Various solar stills. Design and selection.
7. Solar electric power and process heat : Solar photovoltanic system. Materials used and their performance.
    Solar thermal power plant : Fluid need, temperature required, various systems used and their performance.

weightage : 20 marks

UNIT - IV :   8 Hrs.

8. Wind energy.: Availability of wind: Various types of winds & their peformance.
9. Geothermal Energy : Various types of geothermal power plants.
10. Ocean thermal energy.: Comparison of various plans. Principle working of OTEC

weightage : 20 marks

UNIT - V :   9 Hrs.

11. Tidal, energy : Tidal energy available in India. Suitable locations. Study of various tidal energy power plants. Characteristics of turbines required.
12. Bio gas: Chemistry of biogas generation variables affecting simple gas plants. Use of bio-gas for diesel engine.

weightage : 20 marks

TERM WORK : Eight assignments based on above syllabus.

BOOKS :

1. Krietn and Krieder : Principles of Solar Engineering. McGraw Hill Book Co.
2. S. P. Sukhatme : Solar Energy
3. G. D. Rai : Solar Thermal Engineering
4. Wakil : Power Plant engineering.
5. H.P. Garg and J. Prakash : Solar energy , Tata McGraw Hill Book. Co.

MECHANICAL ESTIMATING AND COSTING
(B.E. MECH.) ELECTIVE - I

Teaching Schedule :
Lecturers   : 4 hrs/week
Practicals   : 2 hrs/week
Drawing   :

Examination Schedule:
Theory Paper   : 100 Marks
Term work   : 25 Marks
Paper Duration   : 3 Hrs.

UNIT - I :
9 Hrs.

Process estimation : Introduction, Importance & objectives of estimation, constituents of estimate forms.

Process of costing : Difference between estimating and costing. Advantages of costing, elements of costing, methods of costing, methods of calculating depreciation. Grouping of cost elements. Numerical on above topic.

weightage : 20 marks

UNIT – II :
9 Hrs.

Mensuration in estimating : Calculations of the volume & weight of the machine parts as per finished dimension. Estimation of rough casting, calculations of weight of casting, calculations of costing (material, labour, machining cost etc.) considering all types of allowances. All types of numerical for calculating cost of finished cast iron parts & calculation procedures.

weightage : 20 marks

UNIT – III :
9 Hrs.

Estimation of forged parts : Introduction, losses in forging, length of stroke, claculations of actual volume of forged product. Calculations for length of stroke required for finished forged product. Such as bolts, revets etc. considering all losses.

Estimation of welded job : Febrications, welding procedures, welding costs. Powerconsumption and Welding rates. Calculation procedure and numerical on cost estimation of welding jobs.

weightage : 20 marks

UNIT – IV :
10 Hrs.

Mechanical time calculations : Introduction, set-up time, operation, time, tear down time, personal allowance, fatigue allowance. travel of tools, feed, depth of cut, rpm, cutting speed. Calculations for machining time for turning, boring, chamfering, drilling, reaming, threading, tapping, grinding of finished product.

Estimation of wood work : Furniture & Patterns, patterns material pattern allownace, estimation of wood for pattern & furniture. Estimation of cost of pattern & furniture. Numericals are included.

weightage : 20 marks

UNIT – V :
9 Hrs.

Estimation of sheet material works : Operations in sheet metal works, calculation of blank size, blank layout, sheet metal joint, types of presses capacity of a press, estimation of time Numerical.

Methods of wages payments : Time or day rate method, unit or piece rate method, combination method, incentive wage system. premium bonus plans.

weightage : 20 marks

TERM WORK :
Mimium eight assignments on the above topics. Each assignment should have problems of the related topics.

Recommended Books:

1.   Mechanical estimation & costing - B P Sinha
2.   Estimating & Costing for mecahanical students - Mukherjee
3.   Mechanical Estimating & Costing - Banga Sharma
4.   Estimating and costing – By D. M.Mukharjee.

AUTO MOBILE ENGINEERING - II(ELECTIVE II)
(B.E. PROD. / MECH.)

Teaching Schedule :
Lectures   : 4 hrs/week
Practicals   : 2 hrs/week

Examination Schedule:
Theory Paper   : 100 Marks
Term work   : 25 Marks
Paper Duration : 3 hrs

9 Hrs.

UNIT - I :
Introduction :
Classification of automobiles, layout of automobile vehicle. Chasis and frame, subframe, bumbers, doors, articulate vehicle and trailers. Working cycle of petrol diesel & duel cycle, comparision between them. Ignition system - battery ignition system, magnetic ignition system.

weightage : 20 marks

UNIT - II :
9 Hrs.
Carburation & fuel supply system - Air fuel mixture requirements of SI engines under various operating conditions, various types of a carburetors used in automobiles. Types of fuel pump and injectors, governors and timing devices, derating of fuel pump.

weightage : 20 marks

UNIT - III :
9 Hrs.
Engine cooling and lubrication system - Temp, variation in CI engines, necessity of cooling, methods of cooling, compenents of cooling system, effect of thermosts, trouble shooting of cooling system. Different types of lubricants, properties of lubricants, systems used on automobiles, trouble shooting of lubricantion.

weightage : 20 marks

UNIT - IV :
9 Hrs.
Transmission devices - Clutches-requirements of clutches, single plate, multiplate, cone, centrifugale, semicentrifugale, fluid coupling, Trouble shooting of clutches.
Gear box - construction, sliding mesh, constant mesh, synchromesh, epicyclic and troque convertor, Trouble shooting of gear box, propeller shaft, differential axle.

weightage : 20 marks

UNIT - V :
9 Hrs.
Suspension & steering system -
Spring - Types of spring ,coil & helical, Leaf, transerverse leaf spring, Independant suspension, rubber, suspension, self levelling suspension, pneumatic suspension, Troubleshooting of suspension system. Steering system - Function & geometry, castor & camber, toe-intoe-out, steering linkage & gear , differential steering system, power steering.

weightage : 20 marks

TERM - WORK :

1. Different types of clutches & assembly & dismentaling of two & four wheelers clutches.
2. Classification of gearbox & assembly & dismentaling of gear box.
3. Assembly & dismentalling of propeller shaft and differential axle.
4. Assembly & dismentalling of suspension system.

REFERENCES :

1. Automotive Mechanics - Crouse Vol 1 to Vol 4.
2. Automotive Engg. - Narang.
3. Automotive Engg. - Kripalsingh Vol 1 & Vol 2.

MACHINE TOOL DESIGN
(B.E. MECH) ELECTIVE - I

Teaching Schedule :
Lectures   : 4 hrs/week
Practicals   : 2 hrs/week

Examination Schedule:
Theory Paper   : 100 Marks
Term work   : 25 Marks
Paper Duration   : 3 hrs

UNIT - I :   9 Hrs.

Different consideration and trends in designing machine tools. Introduction to estimation of forces for design analysis for different machining operations such as turning, drilling, milling, grinding, broaching, shaping etc. and power required for machining operations.

Kinematics of machine tools : Design , principles of different driving system. determination of speed range, selection of cutting speed, mechanical regulation & stepped drives.

Design of gear boxes : Graphical representation structure diagrams, ray diagrams, speed charts, gear teeth calculations, deviation diagram.

Stepless regulation : Classification of stepless systems, mechanical friction drives and pressure variators, self tightening drives. etc.

weightage : 20 marks

UNIT - II :   9 Hrs.

Design of machine tool beds and coloumns : Design features of various types of beds, force acting on the table of a vertical lathe, coloumn design of milling machine and drilling machine.

Machine tool slideways & guides : Classification of guides, wear, accuracy and materials, calculation of pressure distribution on guides, frictional behaviour of machine tool guides, Hydrostatic hydrodynamic lubrication of guides.

Design of power screws for machine tools : Classification, design features, and materials, calculation of strength of lead screw . efficiency of lead screw, ball, recirculating power screw assemblies, static load-efficiency of them, compensation of backlash, vertical roller feed screw.

weightage : 20 marks

UNIT - III   9 Hrs.

Design of machine tool spindles : Special features, materials construction, spindle , support, calculation of sleeve bearing, roller bearing, spindle bearing lubrication in machine tools, Frictional conditions of working, static and dynamic rigidity of machine tools structure, joints slidways, spindles.
Design against vibrations and chatter in machine tools : forced vibrations, shock absorbers, chatter, forced and damped vibration, stick-slip vibration, vibration isolated tool holders.

weightage : 20 marks

UNIT - IV :   9 Hrs.

Control system and electrical equipments in machine tools : Design of controlling system and electrical equipment in machine tools, design of hydraulic control system. Installation, maintenance & testing of machine tools according to ISI standards.

weightage : 20 marks

UNIT - V :   9 Hrs.

Concept of unit head machines and SPM : Introducton of modern machine tools, construction, operations , tooling , advances and special development related to CAD, CAM systems, FMS, use of microprocessor in machine tools.

weightage : 20 marks

TERM - WORK :
1. Indentification of various machine tool elements.
2. Design & working drawing of gear box.
3. Preparation of standards testing of machine tool.
4. Design of SPM.
5. Maintances of CNC & CAM systems.
6. Introduction to all machine tool elements.

RECOMMENDED BOOKS :
1. Machine tool design by N. K. Mehta .
2. Principles of machine tools by Sen & Bhattacharya.
3. Design of machine tools by BASU PAL.
4. Machine tool design Handbook by CMIL

RELIABILITY ENGINEERING
(B.E. MECH.) : ELECTIVE - I

Teaching Schedule	:		Examination Schedule:	
Lectures	: 4 hrs/week		Theory Paper	: 100 Marks
Practicals	: 2 hrs/week		Term work	: 25 Marks
			Paper Duration	: 3 Hrs.

UNIT - I :
9 Hrs.

A. Elements Of Probability :

Introduction, Probability Concept, Impossible and Certain Events, Rule for Addition of Probabilities, Complementary Events, Further Comments of Probability, Kolmogorov Axioms, Reliability Definition

B. Failure Data Analysis :

Introduction, Failure Data, Mean Failure Rate, Mean Time to Failure (MTTF), Mean Time Between Failures (MTBF), MTTF in Terms of Failure Density, Generalization, Realiability in Terms of Hazard Rate and(I) Failure Density (II) Hazard rate and Failure Density (in Integral From), Mean Time to Failure in IntegralForm, Reliability in other situation.

weightage : 20 marks

UNIT - II :
9 Hrs.

A. Hazard Model :

Introduction, Constant Hazard, Linearly Increasing Hazard, The Weibull Model, On Density Function and distribution Function, Distribution Functions and Reliability Analysis, Some Important Distributions, Choice of Distribution, Expected Value, Standards Deviation and Variance, Theorems Concerning Expectation and variance.

B. Conditional Probability :

Introduction, Conditional Probability, Multiplication Rule, Independent Events, Venn diagrams - Probability Calculation by Venn diagrams, Summary of Probability Rules, Structural Reliability, Hazards Rate as Conditional Probability, Baye's Theorem.

weightage : 20 marks

UNIT - III :
9 Hrs.

A. system Reliability :

Introduction, Series, Parallel and Mixed configuration, Application to specific Hazard Model, An r-out-of-n Structure, Complex system, Systems not reducible to mixed configurations, MTTF systems, Logic Diagrams and Markov models and Probability Laws.

B. Reliability Improvement :

Improvement of components, Elements, Unit Standby redundancy, Redundancy, Optimization and Reliability Cost Trade-Off.

weightage : 20 marks

UNIT - IV :
9 Hrs.

A. Fault - Tree Analysis and other techniques.

Introduction, Fault Tree construction and Reliability from Fault - Tree, TIE-SET and CUT-SET models. Use of Boolean Algebra - Basic operations, Truth Tables, De- Morgan's theorem Application to Reliability analysis and Probability Calculations.

B. Maintainability and Availability :
Introductio, Maintainability, Availability, System down time, reliability and
Maintainability Trade-off.

weightage : 20 marks

9 Hrs.

UNIT - V :
A. Repairable system :
Instantaneous Repair Rate, Mean Time to Repair (MTTR), Reliability and Availability
Functions.
B. Reliability Allocations :
Reliability Allocations for a series system, application of Reliability to Marine power plants,
Computer systems, Nuclear power plants, Failure Mode and Effect analysis (FMEA).

weightage : 20 marks

TERM WORK :

Should consist of minimum Five Assignments on the above Syllabus.

REFERENCE BOOK :
1. Reliability Engineering by Balagurusamy.
2. Reliability Engineering by L.S. Srinath, East West Press Pvt. Ltd.
3. Quality Control and Reliability Analysis by Dr. Brijendra Singh,
   Khanna Publishers, New Delhi.

MANAGEMENT INFORMATION SYSTEM
(B.E. MECH.) ELECTIVE - II

Teaching Schedule :		Examination Schedule:	
Lecturers.	: 4 hrs/week	Theory Paper	: 100 Marks
Practicals	: 2 hrs/week	Term work	: 25 Marks
Drawing	:	Paper Duration	: 3 Hrs.

8 Hrs.

UNIT - I :
MIS : Introduction to Management information system (MIS) , MIS pyramid, components of total MIS,
developing a long range information system, management reporting system, information retrival,
systematic analysis of information.

weightage : 20 marks

8 Hrs.

UNIT - II :
MIS : Mis & Organisation Chart : Mis approach to organisation, transaction processing system,
marketing, inventory, manufacturing, financial planning, decision concept, control/feedback system.

weightage : 20 marks

8 Hrs.

UNIT - III :

SYSTEM ANALYSIS : Structure of system analysis, identification of need, feasibility study,
economic analysis, technical analysis, role of system analyst, skills of system analyst.

weightage : 20 marks

8 Hrs.

UNIT - IV :
DATABASE SYSTEM : Introduction to database, purpose of database system, database administrator,
ER model, recoverability from failure, concurrency, serialiability.

weightage : 20 marks

8 Hrs.

UNIT - V :
SOFTWARE DEVELOPMENT : Different approaches to software development, classic methods,
prototyping, sprial model, SGL, software myths, software testing, software maintenance, DFD, CASE.

weightage : 20 marks

TERM WORK :

Minimum eight assignment on the above topics ; each assignment should have case studies of the
related topic. Minimum one assignment should be from each unit.

RECOMMENDED BOOKS :—

1.   Management Information System   by Davis, McGraw Hill, New York.
2.   Information System for ModernManagement.   by Mudrick, Ross; PHI, New Delhi.
3.   Management Information System   by Jawadekar, Venus Prakashan, Pune.

OPERATION RESEARCH
(B.E. MECH) ELECTIVE - I

Teaching Schedule :   Examination Schedule:
Lecturers   : 4 hrs/week   Theory Paper   : 100 Marks
                                            Term work   : 25 Marks
                                            Paper Duration : 3 Hrs.

UNIT - I :   9 Hrs.
Introduction to O.R., models in O.R. , scope, phases, O.R. in decision making.
Linear Programming : Model formulation, Graphical methiod, simplex method, concept of quality & its applications. Sensitivity analysis.

weightage : 20 marks

UNIT - II :   9 Hrs.
QUEUING THEORY : Queuing System, Kendall notation, single channel queueing model, multichannel queueing theory, finite capacitor model, cost model, advance queueing model, series queues, two stations service model with zero queues capacity, K-station model with Infinite queue-simmulation : basic concept, monte carlo simulations, advantages & limitations.

weightage : 20 marks

UNIT - III :   9 Hrs.
- DYNAMIC PROGRAMMING : Introduction, basic concept & applications, characteristics of D.P., Dynamic programming aproach.
- Special techniques of L.P. such as transportation model, assignment model, travelling salesman, transshipment problem.

weightage : 20 marks

UNIT - IV :   9 Hrs.
- REPLACEMENT MODEL : Deterministics & Probabilistics considerations. Replacement of old equipment by the most efficient by the sudden failure items, failure tress, Examples of failure trees.

weightage : 20 marks

UNIT - V :   9 Hrs.
- DECISION THEORY : Decision trees, Classes of decision model, utility, decision under certaintly, uncertainity and risk.
- GAMES THEORY :   Theory concept , characteristics, maximum and minimum principles, saddle point, domainance basic concept and terminology of two persons zero sum games, MXZ & ZXN games, subgames method, graphical method.

weightage : 20 marks

BOOKS RECOMMENDED :

1. Quantitative Techniques in Management by Vohra.
2. Quantitative Techniques Vol. 1 & II by L.C. Jhamb.
3. Operational Research by Handy Taha; (PHI. Pvt. Ltd. Delhi.)
4. PERT & CPM principles & applications by I.S. Srinath
5. Operational Research by Heera & Gupta (S. chand & Co.)
6. Introduction of O.R. by Hallies & Libriman .
7. Operational Research by Prof. A.K. Chitale & Negi (Jain Publication).
8. Operational Research by J.K. Sharma (Mcmillan India Ltd.)

ROBOTICS
(B.E. MECH. / PROD.) ELECTIVE - I

Teaching Schedule :
Lectures   : 4 hrs/week
Practicals   : 2 hrs/week .

Examination Schedule:
Theory Paper   : 100 Marks
Term work   : 25 Marks
Paper Duration   : 3 hrs

UNIT - I :   9 Hrs.
Planner mechanics : Advanced synthesis of planner mechanics for ISP and FSP Burmester theories and analytical techniques, applications.

Mechanics dynamics : Newtonian and Lagrangian techniques, energy methods, spatial mechanisms, axodes, kinematics of open and closed loop mechanicsm .
                                        weightage : 20 marks

UNIT - II :   9 Hrs.
Basic concept in robotics, automation and robotics, robot anatomy, basic structure of robotics, resolution, accuracy and repeatability, classificiation and structure of robotics systex, point to point and contineous path system, control loop of robotics system, the manipulators , the wrist motion and gripper.
                                        weightage : 20 marks

UNIT - III :   9 Hrs.
Drives and control system : Hydrulic, DC servo motors, basic control system, concept and models, control system analysis, robot activation and feed back components, positional and velocity sensors, actuators, power transmission system, robot joint control design. Application of robot in manufacturing .
                                        weightage : 20 marks

UNIT - IV :   9 Hrs.
Robot arm kinematic and dynamics, the direct kinematic problem, the inverse kinematic solution, Langrange Euler's formation, generalise D'Alembert's equation of motion, Denovit-Hartenberg convertion and its application.
Sensors in robotics : Tactile sensors, proximity and range sensor, force and torque sensors, use of sensors in robotics, vision system.
                                        weightage : 20 marks

UNIT - V :   9 Hrs.
Robot programming : Methods of robot programming, lead through programming methods, a robot programme as a path in space, motion interpolation, WAIT, SIGNAL, AND DELAY commands.
Robot Languages : The textural Robot Languages, generation of robot programming languages, Robot language structure, constants, variables motion commands, end effector and sensor commands.
                                        weightage : 20 marks

TERM - WORK :
The termwork should consist of minimum five assignment

RECOMMENDED BOOKS :
1. Groover - Industrial, Robotics - Mc Graw Hill Pub. Co-Ltd.
2. Robot J. Schilling - Fundamentals of Robotics.
3. POVOV - Robotics, Mir Pub. Co. Ltd

POWER PLANT ENGINEERING
ELECTIVE - II - (B.E. MECH. & PROD.)

Teaching Schedule :
Lectures   : 4 hrs/week
Practicals   : 2 hrs/week

Examination Schedule:
Theory Paper   : 100 Marks
Term work   : 25 Marks
Paper Duration : 3 hrs

UNIT - I :   9 Hrs.
Thermal stations : Main parts of working of stations thermodynamics cycles, fuel handling, combustion & combustion equipment, problem of ash disposal, circulating water scheme & supply of make up water.
Choice of pressure of steam, generation & steam temperature, selection of appropiate vaccum economiser, air preheater, feed water heaters & dust collection, characterstices of turbo alternatcor, steam power plant heat balance & efficiency.

weightage : 20 marks

UNIT - II :   9 Hrs.
Hydro electric power plant : hydrograph flow duration curves. Types of hydroelectric plants & their field of use. Capacity calculation for hydro power. Dam, head water control, penstock, water turbines, specific speeds, governors, hydro plant auxilliaries plant layout automatic & pumped storage project cost of hydroelectric project.

weightage : 20 marks

UNIT - III :   9 Hrs.
Nuclear and Diesel power Plant :
Elements of Nuclear power plant, nuclear reactor & its types, fuels moderators, coolants,control rod classification of nuclear power layout stations cost of nuclear power, Waste disposal Diesel power plants : Diesel engine performance & operation plant layout, logsheet, application, selection of engine size.

weightage : 20 marks

UNIT - IV :   9 Hrs.
Gas turbine plants :
Plant layout mehtod of improving output and performance fuel & fuel systems method of testing open and closed cycle plants, operating characterstics, application, free piston engine plant, limitation & application, combined cycle plants, advantage need of generation power plant in power system based load station & peek load station.

weightage : 20 marks

UNIT - V :   9 Hrs.
MAJOR ELECTRICAL EQUIPMENT IN POWER STATION - generator and excitors, earthing of power system power & unit transformer circuit breakers , protective equipments, control board equipments elements of instrumentation plant layout, Switch gear for power station auxiliaries. Recent developments in methods of power generation, Introduction to magneto hydrodynamic (MHD) fuel cells genthermal, Solar power, tidal power .

weightage : 20 marks

TERM WORK :

Termwork consists of following study experiment :

1. To draw layout diagram of thermal, hydro and nuclear power plant.
2. Comparison of thermal, hydro and nuclear plant.
3. Study of major electrical equipment in power station.
4. Study of various high pressure bioler .
5. Study of diesel power plant and gas turbine power plant.
6. Study of cooling system, lubrication system and I.C. Engine.
7. Study of MHD,solar power & tidal power.

RECOMMENDED BOOKS :

1. Power Plant Engg. by V. M. Domkundwar
2. Power plant Engg. by Wakil E.L.
3. Power Plant Engg. by P. K. Nag.
4. Elements of electrical Power station design by M. V. Deshpande.
5. Water power Engg. by Pandekar M. M.

ANALYSIS AND SYNTHESIS OF MECHANISMS
(B.E. Mech.) ELECTIVE - II

Teaching Schedule :		Examination Schedule:	
Lectures	: 4 hrs/week	Theory Paper	: 100 Marks
Practicals	: 2 hrs/week	Term work	: 25 Marks
		Paper Duration	: 3 Hrs.

UNIT - I :
9 Hrs.

Introduction to mechanisms : Geometry of motion, plane and space mechanicsm, terminology, definations and assumptions, Relative motion, degree to freedom, kinematic inversion, mechanical advantage.

weightage : 20 marks

UNIT - II :
9 Hrs.

Kinematic Analysis ofPlane Mechanisms : Position & displacement analysis - position of point, graphical & complex - algebra methods for displacement, Rotational and translation displacement. Velocity analysis - relative motion, linear and angular velocity, relative velocity, instant centers, aronhold kennedy therom of three cornters, angular velocity ratio Frendenstein's therom, Velocity analysis by analytical method, graphical method, vector algebra and complex numbers - acceleration analysis - linear and angular acceleration, acceleration difference, relative acceleration and coriolis acceleration, instant centre of acceleration. Accleration analysis by graphical methods.

weightage : 20 marks

UNIT - III :
9 Hrs.

Curvature Theory : Fixed and moving centroids, envelop - velocity and acceleration, inflection circle. Eular savary equation, bobillier's theorm, return circle, cusp points, cubic of stationery curvature, Balls points.

weightage : 20 marks

UNIT - IV :
9 Hrs.

Kinematic Sythesis of Plane Mechanisms : Type , number and dimensional systhesis, function. generation and path generation, chebychev spacing - three, four & five points synthesis, Burmester point theory, synthesis by analytical and graphical method. Computer aided kinematic synthesis.

weightage : 20 marks

UNIT - V :
9 Hrs.

Spatial Mechanism : Position, velocity and accleration analysis of RGGRT mechanism, Eulerian angles, theorm on angular velicities and accelerations. Application of spatial mechanisms to robotics, Kinematic analysis of an industrial robot.

weightage : 20 marks

TERM WORK :

Term work consist of Two assignments on each units from UNIT-II to UNIT-V .

REFERENCE BOOK :

1. Theory of Machines and Mechanisms.
   - By J.E. Shigley & J.J. Vicker International Students Edition McGraw Hill.
2. Mechanisms Design - Analysis and synthesis, Vol. I and Vol. II
   - By G.N. Sandor and A.G. Erdman Prentice Hall of India Pvt. Ltd.
   (Eastern Economic Edition.)
3. Theory of Mechanisms and Mechines.

- By A. Ghosh and A.K. Mallik (East West Press Pvt. Ltd.)
4. Kinematic and Linkage Design .
   - By A.S. Hall (Prentice Hall of India (Pvt. Ltd.)
5. Kinematic Synthesis of Mechanisms.
   - By R. Beyer McGrawhill Book Co. New York (1963).
6. Kinematic Synthesis of Linkages
   - By R. S. Hartenberg and J. Donavit
   Donavit (McGraw Hill Book Co.
7. Analysis Of Mechanisms and Robort Manipulators
   - By J. Duffy.
   (Edward arnold (Publishers) Ltd. London 1980).
8. Mechanics and Machine Theory
   - Rao J.S. and R.V. Dukkapati
   John wiley .

ENERGY CONVERSION AND MANAGEMENT
(B.E. MECHANICAL) ELECTIVE - II

Teaching Schedule :
Lectures   : 4 hrs/week
Practicals   : 2 hrs/week

Examination Schedule:
Theory Paper   : 100 Marks
Term work   : 25 Marks
Paper Duration   : 3 hrs

8 Hrs.
UNIT - I :
Global and Indian market . Energy scenario in various sector and Indian economy. Need and importance of energy conservation and management pay back period.   Return on Investment (R.O.I.), life cycle Cost, sanyes Diagrams, Specific energy consumption. Load Management.

weightage : 20 marks

9 Hrs.
UNIT - II :
Energy Auditing :- Methodology, analysis and reporting, Portable and on-line instruments. Costing of utilities like steam, compressed air, electricity and water. Energy System modelling analysis - general concepts, classification of maodels and use of digital computers in modelling and analysis.

weightage : 20 marks

8 Hrs.
UNIT -III :
Steam and condensate systems Boilers (including packaged boilers), efficiency testing, exc systems : Demand control, Power Factor improvement its benefits and ways of improvement, load scheduling Electric motors, lowers, efficiency, energy efficient types of electrical motors for energy conservation, motor speed control variable speed drive .
Lighting :   Illumination levels, Fixtures, tiemrs, energy efficient illumination.

weightage : 20 marks

8 Hrs.
UNIT - V :
Energy conservation compressed air systems, refrigeration and air conditioning systems, and water systems. Elementary converage of energy conversaion in pumps and fans co-generation-concept, options (Steam/gas turbine/D C T based) selection criterio.

weightage : 20 marks

TERM WORK :-

Term mark should consist of eight assignment based on above syllabus.

RECOMMENDED BOOKS :-

1. Prof. Henderson : India the Energy sector, oxford University press.

2. L. J. Nagrath : System Modelling and Analysis Tata McGraw Hill press.

3. D. A. Ray : Industrial Energy conservatin Pergamon press.

4. IGC Drydin. editor : The efficient use of energy (Butter worths)

5. W. C. Turner editor: Energy Management Handbook (Wiley)

6. Patrick steven R, Patric Dake R, Fordo Stephen : Energy conservation guide book fairmont Press Inc.

7. Energy conservation related booklets published by National productivity Concil (N P C)S Petroleum conservation Reserach Assn (PCRA)

8. F. William Payne & Richard E. Thompsion : Efficient Boiler Operation Source Book.

MATERIAL MANAGEMENT
(B.E.MECHANICAL) : ELECTIVE – II

Teaching Schedule :		Examination Schedule:	
Lectures	: 4 hrs/week	Theory Paper	: 100 Marks
Practicals	: 2 hrs/week	Term work	: 25 Marks
		Paper Duration	: 3 hrs

UNIT - I :
9 Hrs.

Definition, objectives, scope, function & importance of Materials Management. Need for integrated materials concept. Materials planning &   Budgeting. Techniques of Materials requirement Planning. Role of Materials Management in increasing Profitability of an organisation. Vendor & Vendor selection, training & development of vendors, vendor rating.Organisation for Materials in a company.

weightage : 20 marks

UNIT - II : Purchasing
9 Hrs.

Goals and objectives of purchasing. Purchase system, Purchase cycle, Purchasing methods, Purchase documents,Purchasing policies, Purchasing of seasonal commodities, Capital Equipment & Purchasing' under uncertainities. Purchase budget. Role of Purchasing in Business, Purchasing role in new Production development. Pricing Principals.

weightage : 20 marks

UNIT - III : International Purchasing
9 Hrs.

Need of International Purchasing & nature of documents in International Purchasing. Import substitution, Export-Import policies. Export promotion incentives & subsides. Problems associated with International Procurement. Import cycle, Indentifying & Qualifying, Potential International suppliers.

weightage : 20 marks

UNIT - IV : Inventory Management :
9 Hrs.

Definition of Inventory, types of Inventories, Relevant costs in Inventory, Static Inventory models, Signal order Inventory model, Dynamic Inventory control model under certainity. Probabilistic Inventory control models. Selective Inventory control. ABC analysis. Use of Computers in inventory control. Value analysis.

weightage : 20 marks

UNIT - V : Stores Management
9 Hrs.

Function, layout & organisation for stores. Waste, obsolete, surplus and scrap management. Stores system & Procedures. New development in storing material. Codification, classification, vendor codes, computer application in materials management such as Materials Planning, vendor rating. Selective control of inventories, Stock control etc. Stores accounting and stock verification.

weightage : 20 marks

TERM WORK :

1. Minimum SIX assignments on the above topic.
2. Two assignments of Computer application in materials management.
   (Use of FOXPRO Language for developing practicals applications.)

RECOMMENDED BOOKS :

1. Purchasing & Inventory Control function - K.S. Menon.
2. Integrated Material Management - Gopal Krishna & Sundersan.
3. Purchasing - Dobler.

PRODUCTION PLANNING & CONTROL
(B.E. MECHANICAL) - ELECTIVE - II

Teaching Schedule :

Lectures   : 4 hrs/week

Practicals   : 2 hrs/week

Examination Schedule:

Theory Paper   : 100 Marks

Term work   : 25 Marks

Paper Duration : 3 hrs

UNIT - I :   9 Hrs.

1.   Introduction : Meaning, scope, objectives & function of Production Planning & control. Role of PPC in the organisation. Types of PPC organisations.

2.   Production Forecasting · Types of forecast, Various type of forecasts, method   Comparative study, verifying and controlling the forecasting.

weightage : 20 marks

UNIT -II :   10 Hrs.

3.   PRODUCTION PLANNING : Planning functions, routing, schedulling, loading,types of production and their charaterstic , Contineous, Intermittent production. etermination of capacity. Division of capacity. Sequential load statements. Schedulling. Machine capacity, make or buy decision. Production Plans.

4.   Process Engineering : Information required, Product analysis assembly chart, flow chart, creatically examining alternate process. determining areas use for proceeding ,identification of operation. Dimensional and tolerance analysis.

weightage : 20 marks

UNIT -III :   9 Hrs.

5.   a) Routing : Process charts, job cards, route cards, operation charts, set-up instructions.
     b) Scheduling : Defination, need and objectives of scheduling, principal factors affecting meeting delivery charts.
     c) Loading : Machine load charts, Gantt chart, Master schedule, Scheduling techniques, Line of balance, Analysis Scheduling, Linear Programming.

weightage : 20 marks

UNIT -IV :   9 Hrs.

6.   Production Control : Definition, dispatching, follow-up and coordination with various department,
     a) Dispatching : Job orders & Issue systems.
     b) Follow - up : Progressing, types of feedback systems,Preventing production delays, causes of dalays.
     c) Evaluation : Definition, need, importance & advantages of evaluation.

weightage : 20 marks

UNIT - V :   9 Hrs.

7.   Co-ordination : Co-ordination of manafacturing planning, facility planning, sales planning, production planning, Quality planing, Inventory planning, manpower planning and financial planning activity.
     Computer assisted production planning and control applied to machine capacity and utilisation, labour productivity measurment, material requirement planning , scheduling & procurement and inventory control.

weightage : 20 marks

TERM WORK:

Term-work consist of Eight assignments of the above syllabus and emphasis will be on case studies wherever possible.

RECOMMENDED BOOKS:-

1. Production Planning & Control - Samuel Elion.
2. Production Planning & Control - L. C. Jhamb Everst Publication.
3. Forecasting Production Planning & Control - Mc Niece
4. Production and Operation Management - P.C. Moore & T.E. Hendrick
5. Production Management – Mayer.

AUTOMOBILE ENGINEERING – II
(B.E. MECH.) ELECTIVE - II

Teaching Schedule :		**Examination Schedule:**
Lecturers	: 4 hrs/week	Theory Paper	: 100 Marks
Practicals	: 2 hrs/week	Term work	: 25 Marks
Drawing	:	Paper Duration	: 3 Hrs.

8 Hrs.

UNIT - I :

AUTOMOTIVE ELECTRICALS : Batteries, their capacities, merits and demerits of 6,12 & 24 V batteries, Battery maintenance, construction and use of storage batteries. Battery charging equipments, cutouts and regularators, electrical system for different vehicles, Ignition system, magnetos, spark plugs, induction coils, contact brakers, etc. Firing order, distributor, vacuum controller distributor, Starter motors, generators and alternators.

weightage : 20 marks

8 Hrs.

UNIT – II :

AIR-CONDITIONING SYSTEM : Definition of basic terms of psychometry such as DBT, WBT, RH, etc. Human comfort conditions, temperature control system, insulation methods in auto air conditioner. Study of typical auto air conditioning system, location of window air-conditioner. Study of typical auto air conditioning systems, various parts of system, compressor performance and its effect on overall engine performance.

weightage : 20 marks

8 Hrs.

UNIT - III :

DASH BOARD INSTRUMENTS : Warning and indicating devices, Horn circuit, Head lamps types – switches, flashing indicators, electrical wipers, wiper motors and blades. wind screen washing system, fuel, temperature and pressure guage, fuel indicator, speedometer, techograph.
MAINTENANCE : Maintenance of various systems and components in automobiles, speed limiting devices, wedge breaks, collapsible steering.

weightage : 20 marks

8 Hrs.

UNIT - IV :

BRAKING SYSTEM : Types of brakes, retraders, regenerative braking system, brake liners, master and wheel cylinders, dual brake system, fail safe brakes, antilock brakes, electrical brakes, stopping distance and time braking efficiency. Brake effectiveness, factors controlling and stop of an automobile. Self energization and serve action of brake, characteristics and hydraulic brake fluid bleeding of hydraulic brakes.

weightage : 20 marks

8 Hrs.

UNIT - V :

WHEEL, TYRES AND TUBES : Construction & types of wheels, wheel dimensions, types of tyres, tyres properties, tyre materials, specification of tyre size ply rating, class ply, radial ply, considerations in tread design, wheel and tyre trouble shooting. Retreading of tyre, process, precautions, controls, conventional and procured retreading processes. Tubes, natural rubber and butyl flops. Rims, types and maintenance.

weightage : 20 marks

TERM WORK :

Minimum eight assignment on the above topics ; minimum one assignment should be from each unit.

RECOMMENDED BOOKS :

1.	Automotive Mechanics .	by Crouse
2.	Automotive Engineering .	by Narang
3.	Automotive Engg. 1 & II .	by Kripal Singh
4.	Automotive Mechanics .	by Heitner.
5.	Automobile Engineering	by Dr. K. M. Gupta.

PROJECT
(B.E. MECH. / PROD. / AUTO.)
(SEMESTER I & II)

OBJECTIVE :   To provide an oppurtunity to students to work independently on a topic/problem/experiment selected by them and encourage them to think independently of their own to bringout the conclusion under the given circumstances of the curriculum period in the budget provided with the guidance of the teachers. To encourage creative thinking process. This helps 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.

NUMBER OF STUDENTS IN A BATCH : Project may be taken up by an individual or in a group. A batch of not more than 10 students (per branch) shall work under the guidance of a teaching staff member. Project can be offered by the guide or the students can suggest the topic of their interest.

TOPICS : Project work shall be based on any of the folowing topics.

1. Fabrication of model/ products, testing set up or setting up of an experimentation unit/ apparatus/small equipment individually or in a group. Software development related to mechanical engineering.
2. Extensive numerical analysis of some problem may be carried out using computer.
3. A report on the complete design,process charts, costing of a product / machine / prototype .
4. Experiment verification of principles used in Mech/Prod/Auto Engg. Applications.
5. Design of equipment / project / gadget device and its fabrication.
6. Extensive survey of industrial problems / systems / SSI units / Entrepreneurs based on actual field visits and consulation with experts.

7. Projects / Problems related to the area of creative design to solve the problems reffered to by the industries around.

FORMAT OF PROJECT REPORT :

The Project report should be typed with double space on A-4 size bond paper should be not more than 70 pages and not less than 25 pages and figuers, graphs,annexures, etc. The project report should be written in the following format.

1. Title sheet.
2. Certificates
3. Acknowledgement
4. Contents
5. Abstract
6. List of figure / photographs / graphs. tables (Xeroxing of illustrative matter such as the photographs, figures, tables, and other data from handbook etc. must be acknoledged on the appropriate pages of the report.)
7. Introduction.
8. Literature survey / Theory .
9. Design / Experiment / Fabrication/ Production / Actual work carried out of the same.
10. Observations / Results.
11. discussions of results and conclusion.
12. References .
    These references should be given in the standard format as that of international technical journals.
13. Annexures, Appendices, etc. if any

Two copies of hard bound report shall be based on the project report submitted and presentation of the project may be made with the help of charts, photographs, blackboard, slide, overhead projector, etc. by the student of his work. The presentation should be around 15-20 minutes, followed by question /answer session in the prsence of fellow students and guide and teachers in the department. HOD , two senior most staff member should work as co-ordinator for a class for uniform assessment of presentation of all students to avoid variation in project termwork marks.

Distribution of termwork marks (project work)

70% marks shall be given by the guide, 10% marks for first presentation (progress) and 20% marks for final presentation shall be given by the co-ordinating staff committee including based on the presentation of the project in class by the student as mentioned above.

College should submit detailed progressive assessment report of the students getting more than 90% marks in termwork alongwith the marksheets.

Viva-voice or oral examination (as university examination) shall be conducted by the guide and one external examiner appointed by the University in the college campus.

Note : College should send the project list to the university for acceptance in second week after the starting of 7th semester.

FIRST TERM :-

Teaching Schedule :
Lecturers   : 2 hrs/week

Examination Schedule:
Term work   : 50 Marks

The project will be selected in the first semester. Initial layout, design and theoretical determination of all the main paramaters will be finalised in the first semester. Student should submit the termwork in the first semester shall assist of :-

    i)   Synopsis
    ii)   Detail planning of Project work
    iii)   Literature of work done in project in first term.

SECOND TERM :-

Teaching Schedule :
Lecturers   : 4 hrs/week

Examination Schedule:
Term work   : 50 Marks
Oral   : 50 Marks

Fabrication and complition of the project work, & submission of the report & project .

SEMINAR
(B.E. MECH. / PROD. / AUTO.)

Teaching Schedule :
Practicals   : 2 hrs/week

Examination Schedule:
Oral   : 50 Marks

Student individually will independently study a topic assigned to them and submit a report and deliver a short seminar/lecture on that topic.
Seminar should be based on deep study of any topic related to mechanical/production/ automotive engineering.

e.g. :-
a) Advanced Manufacturing Processes.
b) Latest materials and their manufacturing properities.
c) Socio-economic impact of manufacturing activities.
d) Environmental problems involved in manufacturing.

TERM- WORK :-

Two copies of bound report should be submitted to the Institute/Department (One for university and one for college) and one should remain with every student in a group.

The report will contain the summary of information colleceted by the students. The reports will be of A-4 size, bound and should contain all the necessary charts, drawings, references, etc.

ORAL :

The presentation should be around 10-15 minutes, followed by 10 minutes question/answer session in the presence of external examiner, fellow students and guide and teachers in the department.

TECHNICAL VISITS
(B.E. MECH. / PROD. / AUTO.)

Teaching Schedule :

Examination Schedule:
Term work   : 50 Marks

Minimum one industrial visit should be arranged by the college in any three industries (1-Large scale + 1-Medium scale + 1-Small scale) and a report regarding the same should be prepared and submitted in the form of journal at the end of semester – 8 .

Certificate of HRD manager or equivalent authority should be enclosed in the journal.
One staff member should accompany with every 30 students.

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