

SCHEME OF EXAMINATION
B.TECH. 2nd Year Mechanical Engineering (Auto) -4th Semester

S. No	Code	Subject Name	Teaching Schedule (Hrs)				Examination Schedule (Marks)			Total Marks	Duration of Exam
			L	T	P/D	Total	Sessional	Theory	Practical/ Viva-Voce		
1	HUM 201 E/ MATH- 201E	Basics of Economics & Management / Mathematics-III	3	1	-	4	50	100	-	150	3
2	MEA 202 E	Basics of Automobile Engineering	3	1	-	4	50	100	-	150	3
3	MEA-204 E	Hydraulic and Pneumatic systems	4	1	-	5	50	100	-	150	3
4	ME 202 E	Production Technology-II	3	1	-	4	50	100	-	150	3
5	ME 206 E	Strength of Materials – II	3	1	-	4	50	100	-	150	3
6	ME 210 E	Dynamics of Machine	3	1	-	4	50	100	-	150	3
7	MEA 220 E	Hydraulic and Pneumatic systems Lab	-	-	3	3	25		25	50	3
8	ME 212E	Production Technology Lab	-	-	4	4	50	-	50	100	4
9	ME 216 E	Dynamics of Machine Lab	-	-	3	3	25	-	25	50	3
	TOTAL		19	6	10	35	400	600	100	1100	--

Note: Students will be allowed to use Non-Programmable scientific calculator. However, sharing of calculator will not be permitted.

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B. Tech. (Fourth Semester) Mechanical Engineering(Auto)
Basics of Economics & Management
HUM 201 E

L T P
3 1 -

Sessional : 50 Marks
Theory : 100 Marks
Total : 150 Marks
Duration of Exam 3 Hrs.

NOTE: In the semester examination, the paper setter will set 8 questions in all, two questions from each unit, and students will be required to attempt only 5 questions, selecting at least one from each unit.

UNIT-I

Meaning of Industrial Economics, production function, its types, least cost combination, law of variable proportions, law of returns: increasing, constant & diminishing.

Fixed & variable costs in short run & long run, opportunity costs, relation between AC & MC, U-shaped short run AC curve.

Price & output determination under monopoly in short run & long run, price discrimination, price determination under discrimination Monopoly, comparison between Monopoly & perfect competition.

UNIT-II

Meaning of management, characteristics of management, management Vs administration, management-Art, Science & Profession, Fayol's principles of management, Human relations approach, functions of management

UNIT – III

Planning & organizing: planning, steps in planning, planning premises, difference between planning policy & strategy, authority & responsibility, centralization & decentralization.

UNIT – IV

Staffing, Directing & Controlling-Manpower planning, recruitment & selection, styles of leadership, communication process and barriers, control process and steps in controlling.

TEXT BOOKS:

1. "Modern Economic Theory" Dewett, K.K., S. Chand & Co.
2. "Economic Analysis" K.P. Sundharam & E.N. Sundharam (Sultan Chand & Sons).
3. "Micro Economic Theory" M.L. Jhingan (Konark Publishers Pvt. Ltd.).
4. "Principles of Economics" M.L. Seth (Lakshmi Narain Aggarwal Educational Publishers – Agra).
5. "An Introduction to Sociology", D.R. Sachdeva & Vidya Bhusan.
6. "Society – An Introductory Analysis", R.M. MacIver Charles H. Page.
7. "Principles and Practices of Management : R.S. Gupta; B.D. Sharma; N.S. Bhalla; Kalyani.

REFERENCE BOOKS

1. "Organization and Management: R.D. Aggarwal, Tata McGraw Hill.
2. Business Organization and Management: M.C. Shukla

B. Tech. (Fourth Semester) Mechanical Engineering (Auto)**Mathematics-III****MATH 201 E**

L	T	P	Sessional	: 50 Marks
3	1	-	Theory	: 100 Marks
			Total	: 150 Marks
			Duration of Exam.	: 3 Hrs.

NOTE: In the semester examination, the paper setter will set 8 questions in all, two questions from each unit, and students will be required to attempt only 5 questions, selecting at least one from each unit.

UNIT – I

Fourier series: Euler's Formulae, Conditions for Fourier expansions, Fourier expansion of functions having points of discontinuity, change of interval, Odd & even functions, Half-range series. Fourier Transforms: Fourier integrals, Fourier transforms, Fourier cosine and sine transforms. Properties of Fourier transforms, Convolution theorem, Parseval's identity, Relation between Fourier and Laplace transforms, Fourier transforms of the derivatives of a function, Application to boundary value problems.

UNIT-II

Functions of a Complex Variables: Functions of a complex variable, Exponential function, Trigonometric, Hyperbolic and Logarithmic functions, limit and continuity of a function, Differentiability and analyticity. Cauchy-Riemann equations, Necessary and sufficient conditions for a function to be analytic, Polar form of the Cauchy-Riemann equations, Harmonic functions, Application to flow problems, Conformal transformation, Standard transformations (Translation, Magnification & rotation, inversion & reflection, Bilinear).

UNIT-III

Probability Distributions : Probability, Baye's theorem, Discrete & Continuous probability distributions, Moment generating function, Probability generating function, Properties and applications of Binomial, Poisson and normal distributions.

UNIT-IV

Linear Programming : Linear programming problems formulation, Solution of Linear Programming Problem using Graphical method, Simplex Method, Dual-Simplex Method.

Text Book:

Higher Engg. Mathematics: B.S. Grewal
Advanced Engg. Mathematics: E. Kreyzig

References:

1. Complex variables and Applications: R.V. Churchill; Mc. Graw Hill
2. Engg. Mathematics Vol. II: S.S. Sastry; Prentice Hall of India.
3. Operation Research: H.A. Taha

**B. Tech. (Fourth Semester) Mechanical Engineering (Auto)
Basics of Automobile Engineering**

MEA 202 E

L	T	P/D	Total
3	1	-	4

Sessional: 50 Marks
Theory : 100 Marks
Total : 150 Marks
Duration of Exam: 03 Hrs

NOTE: In the semester examination, the paper setter will set 8 questions in all, two questions from each unit, and students will be required to attempt only 5 questions, selecting at least one from each unit.

Unit-I

Introduction: Classification of two wheelers, and four wheeled vehicles, application & capacity, study of main specifications. Parts of an automobile – engine, functions & layout, - frames, axles, frameless construction, steering system, suspension system, braking system, power train & drives, clutch, gear box, final drive, Propeller shaft, differential, U joints, vehicle body, wheels, tyres & tubes. Selection of engine for two wheeler & four wheeled vehicles, constructional & working details of two stroke & four stroke petrol & diesel engines.

Unit -II

Clutches and transmission: Necessity of clutch, working of clutch, types of clutches- single plate, multiple plate, automatic diaphragm clutch assembly, constructional & working details, friction disc, clutch lining materials. Transmission: Introduction, functions of transmission, necessity of transmission, manual transmission, sliding mesh gearbox, constant mesh gear box, synchromesh gear boxes, awareness of automatic transmission, their constructional & working details. Fuel System : Ignition system, starting system, charging system, lightning system, cooling system, lubrication system. Introduction to M.P.F.I, CRDi, D.T.S.S.I

Unit-III

Steering system and suspension system: Steering system requirements, front axle details & geometry, Castor, Camber, Toe in, Toe out, steering geometry, steering linkages, different types of steering gear boxes, their constructional & working details. Need of suspension system, types of suspension, constructional detail & characteristics of leaf, coil springs. Introduction to independent suspension, front & rear suspension systems of vehicle, shock absorbers. Wheels: Wheel requirements, types of wheels, their constructional & working details, rims & their types.

Unit-IV

Braking Systems: Classification of brakes, drum brakes and disc brakes, constructional & working details, Introduction to hydraulic brake & parking brake, vacuum assisted Hydraulic Brakes, compressed air assisted hydraulic brakes, leading & trailing brake shoes; self energizing brakes; working of master cylinder, wheel cylinders, tandem master cylinders, Characteristics of brake fluid. Introduction to ABS. Tyres: Introduction, types of tyres, tyre selection, ordinary, radial tyres tubeless tyres, their constructional details and their comparison & application, wheel balancing.

Text Books:

1. Automobile Engineering Vol 1 by Dr. Kripal Singh, Standard Publishers Distributors Delhi.
2. Automotive Technology by Sethi, TMH, New Delhi.
3. Automobile Engineering by K.K Ramalingam, Scitech Publication, Chennai – 2001.

4. Automotive Chassis & body by P.L Kohli, TMH, New Delhi.
- 5.

Reference Books:

1. Motor Vehicle by Newton Steeds and Garrot, Butterworths, London – 2000.
2. Mechanism of the Car by Judge A.W, Chapman and Halls Ltd., London – 1986.
3. Automobile Engg. By K.K Jain, R.B. Asthana, TMH – 2002.
4. Automobile Engg (Vol-1) by Dr. Kripal Singh, Standard Publisher Distributors

B. Tech. (Fourth Semester) Mechanical Engineering (Auto)**Hydraulic and Pneumatic systems****MEA 204 E**

L	T	P	Sessional	: 50 Marks
3	1	-	Theory	: 100 Marks
			Total	: 150 Marks
			Duration of Exam	: 3 Hrs

NOTE: In the semester examination, the paper setter will set 8 questions in all, two questions from each unit, and students will be required to attempt only 5 questions, selecting at least one from each unit.

UNIT-I

BASIC CONCEPT AND PROPERTIES: Fluids, distinction between solid and fluid: units and Dimensions: Properties of fluids: density, specific weight, specific volume, specific gravity, temperature, viscosity, compressibility, vapour pressure, capillary and surface tension - Fluid statics: concept of fluid static pressure, absolute and gauge pressure measurements by manometers and pressure gauges, problems.

FLUID KINEMATICS AND FLUID DYNAMICS: Fluid Kinematics : Flow visualization, lines of flow, types of flow -velocity field and acceleration, continuity equation (one and three dimensional differential forms) : Equation of streamline, stream function : velocity potential function, circulation, flow net, equations of motion- Euler's equation along a streamline, Problems.

UNIT-II

DIMENSIONAL ANALYSIS: Dimensional numbers, their application, Buckingham's π theorem, applications, similarity laws and models numerical problems.

INCOMPRESSIBLE FLUID FLOW: Viscous flow, Navier Stoke's equation (statement only) :Shear stress, pressure gradient relationship laminar flow between parallel plates ; Laminar flow through circular tubes (Hagen Poiseulle's), Hydraulic and energy gradient ; flow through pipes, Darcy-Weisback's equation, pipe roughness, friction factor, Mody's diagram, minor losses, flow through pipes in series and in parallel, power transmission,

UNIT-III

HYDRAULIC TURBINES: Impact of jet on flat, curved and moving plates, Fluid machines, definition and classification, exchange of energy, Euler's equation for turbo machines, Construction of velocity vector diagram's, head and specific work, component of energy transfer, degree of reaction, performance curves.

HYDRAULIC PUMPS: Pumps, definition and classifications, Centrifugal pump: classifications, working principles, velocity triangles, specific speed, efficiency and performance curves; reciprocating pump: classification, working principles, indicator diagram, work saved by air vessels and performance curves; cavitations in pumps rotary pumps: working principles of gear and vane pumps.

UNIT-IV

COMPRESSOR AND FANS: Definition, Classification difference, efficiency, performance curves special application in Auto mobile Industries, working and construction of reciprocating, volumetric efficiency, performance curves, inter-cooling, two stage

compression optimum inter-cooling pressure, applications of compressors and fans in automobile industry.

Text Books:

1. Fluid Mechanics – Streeter V L and Wylie E B, Mc Graw Hill
2. Mechanics of Fluids – I H Shames, Mc Graw Hill

References Books:

1. Introduction to Fluid Mechanics and Fluid Machines – S.K. Som and G. Biswas, TMH
2. Fluid Mechanics and Fluid Power Engineering – D.S. Kumar, S.K. Kataria and Sons
3. Fluid Mechanics and Machinery – S.K. Agarwal, TMH, New Delhi
4. Fluid mechanics and Hydraulic machine by S.S rattan, Khanna publisher
5. Heat Engineering – V P Vasandani and D S Kumar, Metropolitan Book Co Pvt Ltd

B. Tech. (Fourth Semester) Mechanical Engineering (Auto)
Production Technology-II
ME 202 E

L T P
3 1 -

Sessional: 50 Marks
Theory : 100 Marks
Total : 150 Marks
Duration of Exam: 3 Hrs.

NOTE: In the semester examination, the paper setter will set 8 questions in all, two questions from each unit, and students will be required to attempt only 5 questions, selecting at least one from each unit.

UNIT I

Kinematics of Machine Tools.

Drives in machine tools for rotation movement, stepped and step less drives, mechanical and hydraulic drives, Individual and group drives, selection of extreme values of spindle speed on a lathe, principle of stepped regulation, Layout of spindle speeds. A.P., G.P. and Logarithmic progressions, Kinematics advantage of G. P. for gear box design, selection of common ratio, Number of steps in a given speed range, design of all geared head stock.

UNIT II

Manufacturing Methods

Characteristics of turret Lathes, turret-indexing mechanism, tooling equipment for turrets, tool Layout or turrets. Classification of gear production methods, gear generation, gear hobbling gear shaping, gear finishing methods; shaving, burnishing grinding, Lapping gear shaping, gear finishing methods; shaving, burnishing grinding, honing.

UNIT III

Unconventional Machining Processes & Press Working Tools

Need for unconventional processes, Ultrasonic machining, electrochemical machining, electrochemical grinding, Laser beam machining their process parameters, principle of metal removal, applications advantages and limitations.

Introduction, classifications of presses and dies, hear, action in die cutting operations, center of pressure, mathematical calculation of center of pressure, clearances, cutting forces, punch dimensioning.

UNIT IV

Machine Tools Vibration and Dynamometry

Introduction, effects of vibration no-machine tools, cutting conditions, work piece and tools life, source of vibration, machine tool chatter, Need for measuring forces, basic requirements of measuring techniques, design requirements of dynamometers, 3-divisional turning dynamometer and its calibration, drill dynamometers.

Suggested reading:

1. Manufacturing science: Ghosh and Malik, E.W. Press
2. Principles of metal cutting: Sen and Bhattacharya, New Central Book.
3. Metal cutting principles: Shaw, MIT Press Cambridge
4. Manufacturing analysis: Cook, Adisson-Wesley
5. Modern machining processes: Pandey and Shan, Tata McGraw Hill Publications

B. Tech. (Fourth semester) Mechanical Engineering (Auto)
Strength of Materials-II
ME 206 E

L	T	P
3	1	-

Sessional : 50Marks
 Theory : 100 Marks
 Total : 150 Marks
 Duration of Exam: 3Hrs.

NOTE: In the semester examination, the paper setter will set 8 questions in all, two questions from each unit, and students will be required to attempt only 5 questions, selecting at least one from each unit.

Unit I

Strain Energy & Impact Loading: Definitions, expressions for strain energy stored in a body when load is applied (i) gradually, (ii) suddenly and (iii) with impact, strain energy of beams in bending, beam deflections, strain energy of shafts in twisting, energy methods in determining spring deflection, Castigliano's & Maxwell's theorems, Numerical. Theories of Elastic Failure: Various theories of elastic failures with derivations and graphical representations, applications to problems of 2- dimensional stress system with (i) Combined direct loading and bending, and (ii) combined torsional and direct loading, Numericals.

Unit II

Unsymmetrical Bending: Properties of beam cross section, product of inertia, ellipse of inertia, slope of the neutral axis, stresses & deflections, shear center and the flexural axis Numericals. Thin Walled Vessels : Hoop & Longitudinal stresses & strains in cylindrical & spherical vessels & their derivations under internal pressure, wire wound cylinders, Numericals.

UNIT III

Thick Cylinders & Spheres : Derivation of Lamé's equations, radial & hoop stresses and strains in thick, and compound cylinders and spherical shells subjected to internal fluid pressure only, wire wound cylinders, hub shrunk on solid shaft, Numericals. Rotating Rims & Discs: Stresses in uniform rotating rings & discs, rotating discs of uniform strength, stresses in (I) rotating rims, neglecting the effect of spokes, (ii) rotating cylinders, hollow cylinders & solids cylinders. Numericals.

UNIT IV

Bending of Curved Bars : Stresses in bars of initial large radius of curvature, bars of initial small radius of curvature, stresses in crane hooks, rings of circular & trapezoidal sections, deflection of curved bars & rings, deflection of rings by Castigliano's theorem stresses in simple chain link, deflection of simple chain links, Problems. Springs: Stresses in open coiled helical spring subjected to axial loads and twisting couples, leaf springs, flat spiral springs, concentric springs, Numericals.

Text Books:

1. Strength of Materials – G.H.Ryder, Third Edition in SI Units 1969 Macmillan, India. 2. Mechanics of Materials – (Metric Edition): Ferdinand P. Beer and E. Russel Johnston, Jr. Second Edition, McGraw Hill.

Reference Books :

1. Book of Solid Mechanics – Kazmi, Tata Mc Graw Hill
2. Strength of Materials – D.S. Bedi - S. Chand & Co. Ltd.
3. Advanced Mechanics of Solids and Structures – N. Krishan Raju and D.R.Gururaje-Narosa Publishing House.
4. Strength of Materials – Andrew Pytel and Fredinand L. Singer Fourth Edition, Int. Student Ed. Addison – Wesley Longman.

B. Tech. (Fourth Semester) Mechanical Engineering (Auto)
Dynamics of Machine
ME 210 E

L T P
 3 1 -

Sessional: 50 Marks
 Theory : 100 Marks
 Total : 150 Marks
 Duration of Exam: 3 Hrs.

NOTE: In the semester examination, the paper setter will set 8 questions in all, two questions from each unit, and students will be required to attempt only 5 questions, selecting at least one from each unit.

UNIT I

Static force analysis, Static equilibrium, free body diagram, Analysis of static forces in mechanism. D'Alembert's principle, Equivalent offset inertia force, Dynamics of reciprocation parts, Piston effort, Crank effort, Equivalent dynamical systems, and Inertia force in reciprocating engines by graphical and analytical method. Turning moment and crank effort diagrams for single cylinder and multi-cylinder engines, coefficient of fluctuation of energy, coefficient of fluctuation of speed, flywheel and its function.

UNIT II

Types of gears, terminology, condition for correct gearing, cyclical and involutes profiles of gear teeth, pressure angle, path of contact, arc of contact, Interference, undercutting, minimum number of teeth, number of pairs of teeth in contact, helical, spiral, worm and worm gear, bevel gear. Gear trains; simple, compound, reverted, and epicyclical, Solution of gear trains, sun and planet gear, bevel epicyclical gear, compound epicyclical gear, pre-selective gear box, differential of automobile, torque in gear trains.

UNIT III

Types of brakes, friction brakes, external shoe brakes, band brakes, band and block brakes, internal expanding shoe brake, dynamometers; absorption, and tensional. Types of governors; watt, Porter, Proell, spring loaded centrifugal, Inertia, Sensitiveness, Stability, Isochronism's, Hunting, Effort and power of governor, controlling force, Static and dynamic balancing of rotating parts, balancing of I. C. Engines, balancing of multi-cylinder engine; V-engines and radial engines, balancing of machines.

UNIT IV

Gyroscope, Gyroscopic couple and its effect on craft, naval ships during steering, pinching and rolling, Stability of an automobile (2-wheeled), Introduction, open and closed loop control, terms related to automatic control, error detector, actuator, amplification, transducers, lag in responses, damping, block diagrams, system with viscous damped output, transfer functions, relationship between open-loop and closed loop transfer function.

Suggested reading:

1. Theory of machines: S. S. Rattan, Tata McGraw Hill Publications.
2. Theory of Mechanism and Machines: Jagdish Lal, Metropolitan Book Co.
3. Mechanism synthesis and analysis: A.H. Soni, McGraw Hill Publications.
4. Mechanism: J.S. Beggs.
5. Mechanics of Machines: P.Black, Pergamon Press.
6. Theory of Machines: P.L.Ballaney, Khanna Publisher.

B. Tech. (Fourth Semester) Mechanical Engineering (Auto)
Hydraulic and Pneumatic systems Lab
MEA 220E

L	T	P	Sessional	: 25 Marks
-	-	3	Practical	: 25 Marks
			Total	: 50 Marks
			Duration of Exam	: 3 Hrs

1. To determine the friction factor for the pipes.
2. To determine the minor losses due to sudden enlargement, sudden contraction and bends.
3. To study and perform test on the Pelton wheel and to plot curves Q, P Vs N at full, three fourth gate opening.
4. To study and perform test in the Francis Turbine and to plot curves Q, P Vs N at full, three- fourth gate opening.
5. To study and perform test on the Kaplan Turbine and to plot curves Q, P Vs N at full, three- fourth half opening.
6. To study and perform test on Centrifugal Pump and to plot curves η , Power Vs Q
7. To study and perform test on a Hydraulic Ram and to find its Rankine, Aubussion η .
8. To study and perform test on a Reciprocating pump and to plot the P and η Vs H
9. To verify the Bernoullis Theorem.
10. To find critical Reynolds number for a pipe flow.
11. Velocity control of single and double acting hydraulic and pneumatic cylinders.

Note: At least eight experiments should be performed from the above list. Remaining two experiments may either be performed from the above list or designed & set by the concerned institute as per the scope of the syllabus.

B. Tech. (Fourth Semester) Mechanical Engineering (Auto)
Production Technology Lab
ME 212E

L T P
- - 4

Sessional : 50 Marks
Practical : 50 Marks
Total : 100 Marks
Duration of Exam : 04 Hrs.

List of Experiments:

Introduction to milling machines its types functions applications etc.

1. Practice of slab milling on milling machine.
2. Practice of slotting on milling machine.
3. To cut gear teeth on milling machine using dividing head.
4. Introduction to gear hobber, demonstration of gear hobbing and practice.
5. Introduction to various grinding wheels and demonstration on the surface grinder.
6. Introduction to tool and cutter grinder and dynamometer.
7. Study the constructional detail and working of CNC lathes Trainer.
8. To carry out welding using TIG/MIG welding set.
9. Introduction, demonstration & practice on profile projector & gauges.
10. To make a component on lathe machine using copy turning attachment.
11. To cut external threads on a lathe.
12. To cut multi slots on a shaper machine.
13. To perform drilling and Boring operation on a Component.

Note: At least eight experiments should be performed from the above list. Remaining two experiments may either be performed from the above list or designed & set by the concerned institute as per the scope of the syllabus.

B. Tech. (Fourth Semester) Mechanical Engineering (Auto)
Dynamics of Machine Lab
ME 216E

L	T	P	Sessional	: 25 Marks
-	-	3	Practical	: 25 Marks
			Total	: 50 Marks
			Duration of Exam	: 03 Hrs.

LIST OF EXPERIMENT

1. To determine experimentally, the moment of inertia of a flywheel and axle compare with theoretical values.
2. To find out critical speed experimentally and to compare the whirling speed of a shaft with theoretical values.
3. To find experimentally the Gyroscopic couple on motorized gyroscope and compare with applied couple.
4. To perform the experiment of balancing of rotating parts and finds the unbalanced couple and forces.
5. To determine experimentally the unbalance forces and couples of reciprocating parts.
6. To calculate the torque on a planet carrier and torque on internal gear using epicyclic gear train and holding torque apparatus.
7. To study the different types of centrifugal and inertia governors and demonstrate any one.
8. To study the automatic transmission unit.
9. To study the differential types of brakes.
10. To find out experimentally the corolis component of acceleration and compare with theoretical values.

Note: At least eight experiments should be performed from the above list. Remaining two experiments may either be performed from the above list or designed & set by the concerned institute as per the scope of the syllabus.