Faculty of Engineering & Technology
P.K.University
Shivpuri (MP)

Evaluation Scheme & Syllabus for
Department Of Mechanical Engineering

M.Tech .-(Automobile Engg.)
(I Semester)
(Effective from session 2025-26)

EVALUATION SCHEME

M.Tech AUTOMOBILE ENGG. (I SEMESTER)

STUDY AND EVALUATION SCHEME FOR M.TECH AUTOMOBILE ENGINEERING

SEMESTER-I

SUBJECT CODE	SUBJECTS NAME	STUDY SCHEME Periods/Week			Credits	MARKS IN EVALUATION SCHEME						Total Marks of Internal & External
						INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT			
		L	T	P		Th	Pr	Tot	Th	Pr	Tot	
MDESIAU101	Design of Experiments & Research Methodology	3	1	0	2	30	-	30	70	-	70	100
MAUTOAU102	Automotive Engines and Emissions	3	1	0	4	30	-	30	70	-	70	100
MTHEOAU103	Theory of Elasticity & Reliability	3	1	0	3	30	-	30	70	-	70	100
MTRANAU104	Transmission System Theory & Design	3	1	0	3	30	-	30	70	-	70	100
UFINIAU105	Finite Element Analysis	3	1	0	3	30	-	30	70	-	70	100
MSEMIAU106	Seminar -I	0	0	2	3	30	-	30	70	-	70	100
Total		15	5	8	24	180	125	305	420	125	545	850

L	T	P
3	1	0

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MDESIAU101
Design of Experiments & Research Methodology

Research Concepts:
Meaning, objectives, motivation, type of research, approaches, research (descriptive research, conceptual, theoretical, applied and experimental.

Formation of Research Task:
literature review, importance and methods, sources, quantification of cause-effect relations, discussions, wheel study, laboratory experiments, critical analysis of already generated facts, hypothetical proposal for future development and testing, selection of research task, prioritization of research.

Mathematical Modeling and Simulation:
concept of modeling, classification of mathematical models, modeling with ordinary differential equations, difference equations, partial differential equations, graphs, simulation: concept, types (quantitative , experimental, computer, fuzzy theory, statistical) processes of formulation of model based on simulation.

Experimental Modeling:
a) Definition of experimental design, examples, single factor experiments blocking and Nuisance factors, guidelines for designing experiments.
b) General model of process: I/P factors/ variables, O/P parameters /variables controllable/uncontrollable variables, dependent/independent variables, experimental validity.
c) Process optimization and design experiments methods for study of response surface, first Order design, determining optimum combination of factors, method of steepest ascent, Taguchi approach to parameter design. Analysis of results (parametric and nonparametric, descriptive and inferential data) types of data, collection of data (normal distribution, calculation of co relation coefficient) data processing, analysis, error analysis.

Different methods:
analysis of variance, significance of variance, analysis of covariance, multiple regression, testing linearity/nonlinearity of model, testing adequacy of model. Testing model / hypothesis, use of computational tools, software for research work.

Report writing:
types of report, layout of research report, interpretation of results, style manuals, layout and format, style of writing, typing, references, paginations, table, figures, conclusions, appendices, writing research paper for publication based on dissertation / research work.

Landscape of Creativity:
convergent vs divergent thinking, creativity, creativity vs intelligence, creativity abilities, creativity and madness, determination of creativity, increasing creativity, creativity achievements, techniques of creativity, collective creativity.

Reference Books:

1. Willkinsion K.P. L., Bhandarkar, "Formulation of Hypothesis", Himalaya publishing, Mumbai.
2. Schank Fr, "Theories of Engineering Experiments", Tata McGraw Hill.
3. Douglas Montgomary, "Design of Experiments"
4. "Introduction to SQC" John Willy & sons.
5. Cochran & cocks, "Experimental Design", John Willy & sons.
6. John W. Besr and James V. Kahn, "Research in Education", PHI publication.
7. Adler and Granovky, "Optimization of Engineering Experiments", MIR Publications.

L	T	P
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MAUTOAU102
Automotive Engines & Emission

Engine Basic Theory: Engine types and their operation, classification, Properties of I.C. engine, fuels, Actual cycle, air fuel cycle, combustion charts (Equilibrium), Two stroke engines, four stroke engine, characteristics of engines, air capacity of engine, valve timing diagram, supercharging, MPFI, VVT, cam less engine, Fuel Supply, Ignition,

Cooling and Lubrication Systems : Theory of carburetion and carburetors, mixture distribution, petrol injection, diesel fuel injection pumps, conventional and electronic ignition systems for SI engines, air cooling and water cooling, design aspects, forced feed lubrication system

Air Motion Combustion and Combustion Chambers: Swirl and turbulence – swirl generation, combustion in SI & CI engines, flame travel and detonation, Ignition delay,. Knock in CI engines, combustion chamber design

Air Pollution due to Automobile Exhaust: Sources of Emission, Exhaust gas constituents & analysis, Ingredients responsible for air pollution, Smoke, odor, Smog formation.

Exhaust Emission Control: Basic method of emission control, catalytic converter, After burners, reactor manifold, air injection, crank case emission control, evaporative loss control, Exhaust gas recirculation, Fuel additives .**Pollution Norms:** European pollution norms, Indian pollution norms as per Central Motor Vehicle Rules (C.M.V.R.).

Instrumentation for Exhaust Emission Measurement: Measurement procedure, Sampling Methods, Orsat Apparatus, Infrared Gas analyzer, Flame Ionization Detector (FID), Smoke meters.

Alternative Fuels: CNG, LPG, Bio-Diesel, Hydrogen, fuel cells, Eco-friendly vehicles, Electric & Solar operated vehicle Stratified Charged, Low heat rejection engine, Sankey plot, four / three valve engine, OHC engine, governing of automobile engine, New engine technology, Recent developments in I. C. engines

Reference Books

1. Introduction to Internal Combustion Engines", Richard Stone, McMillan, London
2. Vehicle and Engine Technology – Hein Heister
3. Advance Vehicle Technology - Hein Heister
4. I.C. Engine by Ganeshan V., McGraw Hill Book, Co.

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MTHEOAU103
Theory of Elasticity & Reliability

Stress – Strain:
Introduction, stress and strain sensors, strain displacement relation for plane stress and plain strain problems of elasticity, equation of equilibrium, compatibility condition, stress function, simple two dimensional problems of elasticity, Analysis of torsion of circular and noncircular sections

Fatigue and Fracture:
Introduction to fatigue and fracture mechanics of ductile and brittle fractures mechanism of fatigue failure, factors affecting fatigue, methods of improving fatigue strength, cumulative damage theories, linear elastic fracture mechanics, finite life, infinite life, design of machine components

Creep:
Mechanism of creep failure, Constant load constant temperature tests, Extrapolation of creep and creep rupture curves, Creep relaxation, influence of combined load in different Directions, design of machine element used in high temperature services.

Environmental Considerations in Design:
Corrosion, corrosion under stress, fretting corrosion and effects of other chemicals, Methods of improving corrosion resistance.

Reliability Engineering:
Concepts of reliability, Statistical Models of reliability, Reliability of hazard functions, System reliability, Redundancy techniques in system design, Failure modes, effects & criticality analysis, Fault tree analysis, Event tree analysis, Design review & validation,
Design for reliability

Reference Books

1. Advances in Engineering Vol. 4 – Fatigue Design Handbook (SAE)
2. Failure of Material in Mechanical Design – J. A. Collins
3. Experimental Stress Analysis – J.W. Bally &W. F. Riley
4. Principles of Reliability – Pierusehka
5. Practical Reliability Engineering – Patrick D.T.O. Conner
6. Reliability Based Design – S. S. Rao.

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MTRANAU104
Transmission System Theory & Design

Transmission systems:
Clutch, types of clutch, clutch design, Gear box, types of gear boxes, gear box design, overdrive gears, Fluid flywheel & torque converter, Epicyclic gear box, semiautomatic & automatic transmission Propeller shaft,

Design of Transmission systems:
propeller shaft, slip joint, universal joint, Final drive, differential, Dead & live axle, axle design, Constant velocity joints

Braking system:
Types of brakes, brake-actuating mechanisms, factors affecting brake Performance, power & power assisted brakes, Brake system design, and recent developments in transmission & braking system

Steering systems:
Front axle types, constructional details, front wheel geometry, Condition for True rolling, skidding, steering linkages for conventional & independent suspensions, turning radius, wheel wobble and shimmy, power and power assisted steering,

Tyre selection:
air resistance, rolling resistance, requirement of engine power, transmission system layout, four wheel drive, transfer case.

Reference Books :

1. The Automotive Chassis – Engineering Principle – Reimpell J.
2. Automotive Chassis – Design & Calculation – P. Lukin, G. Gasparyarts, V. Rodionov, MIR Publishing, Moskow
3. Automotive Chassis – P. M. Heldt, Chilton Co. NK
4. Mechanics for Road Vehicles – W. Steed, Illiffe Books Ltd., London.

LIST OF EXPERIMENTS:-

1. Study of clutches
2. Study of gear box.
3. Study of transmission shaft
4. Study of brakes
5. To design differential using mat-lab.
6. To design axles using mat-lab

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MFINIAU105
Finite Element Analysis

Introduction:
Basic concepts of FEM – Historical background, relevance and scope for FEM – need for approximation, weighted residual, Ritz and Galerkin method, variational, weak formation

General procedure of FEM:
Discretization, interpolation, shape function, formulation of element characteristics matrices, assembly and solution

Formulation of element characteristic matrices and vectors for elasticity problems :
One-dimensional elasticity – two dimensional elasticity – three dimensional elasticity, axisymmetric elasticity Formulation of element characteristics matrices and vectors for field problems, thermal problems – one dimensional, two dimensional and three dimensional heat transfer – axisymmetric heat transfer – torsion problems

Higher order and iso-parametric formulations:
Natural coordinates system and numerical integration – higher order one – dimensional, two – dimensional and three dimensional elements – structural beam, plate and shell elements- iso- parametric elements – iso-parametric formulation.

Computer Implementation:
An overview of FE analysis program, preprocessing, solution, post processing.
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Reference Books:

1. An Introduction to the Finite Element Method- J. N. Reddy, McGraw Hill
2. The Finite Element Method in Engineering- S. S. Rao, Pergaman Press.
3. Finite Element Analysis Theory and Practice- M. J. Fagaan, Longman Scientific and Technology.
4. Concept and Applications of Finite Element Analysis- R. D. Cook, John Wiley and sons Inc.
5. Finite Element Handbook – H. Kardestuncer
6. Rajasekaran. Finite Element Analysis in Engineering Design. Wheeler Publishing, New Delhi.
7. K. Bathe. Finite Element Procedures. Prentice-Hall of India (P) Ltd., New Delhi.