Faculty of Engineering & Technology

P. K. University

Shivpuri (MP)

Department of Automobile Engineering
Evaluation Scheme & Syllabus for

B.Tech - Automobile Engineering

3rd year

(V to VI Semester)

(Effective from session 2025-26)

EVALUATION SCHEME

B.TECH –AUTOMOBILE ENGINEERING 5th SEMESTER

<table>
<tr><td colspan="13">STUDY AND EVALUATION SCHEME FOR B.TECH AUTOMOBILE ENGINEERING</td></tr>
<tr><td colspan="13">SEMESTER-V</td></tr>
<tr>
<td rowspan="3">SUBJECT CODE</td>
<td rowspan="3">SUBJECTS NAME</td>
<td colspan="3">STUDY SCHEME Periods/Week</td>
<td rowspan="3">Credits</td>
<td colspan="6">MARKS IN EVALUATION SCHEME</td>
<td rowspan="3">Total Marks of Internal & External</td>
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<td colspan="3">INTERNAL ASSESSMENT</td>
<td colspan="3">EXTERNAL ASSESSMENT</td>
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<tr><td>UMANAAU501</td><td>Managerial Economics</td><td>3</td><td>1</td><td>0</td><td>4</td><td>30</td><td>-</td><td>30</td><td>70</td><td>-</td><td>70</td><td>100</td></tr>
<tr><td>UMACHAU502</td><td>Machine Design -I</td><td>3</td><td>0</td><td>0</td><td>3</td><td>30</td><td>-</td><td>30</td><td>70</td><td>-</td><td>70</td><td>100</td></tr>
<tr><td>UINDUAU503</td><td>Industrial Sociology</td><td>3</td><td>0</td><td>0</td><td>3</td><td>30</td><td>-</td><td>30</td><td>70</td><td>-</td><td>70</td><td>100</td></tr>
<tr><td>UHEATAU504</td><td>Heat and Mass Transfer</td><td>3</td><td>0</td><td>0</td><td>3</td><td>30</td><td>-</td><td>30</td><td>70</td><td>-</td><td>70</td><td>100</td></tr>
<tr><td>UAUTOAU505</td><td>Automotive Engines</td><td>3</td><td>0</td><td>0</td><td>3</td><td>30</td><td>-</td><td>30</td><td>70</td><td>-</td><td>70</td><td>100</td></tr>
<tr><td>UVEHIAU506</td><td>Vehicle Transport Management</td><td>3</td><td>0</td><td>0</td><td>3</td><td>30</td><td>-</td><td>30</td><td>70</td><td>-</td><td>70</td><td>100</td></tr>
<tr><td>UHEATAU507</td><td>Heat and Mass Transfer Lab</td><td>0</td><td>0</td><td>2</td><td>1</td><td>-</td><td>25</td><td>25</td><td>-</td><td>25</td><td>25</td><td>50</td></tr>
<tr><td>UMACHAU508</td><td>Machine Design -I Lab</td><td>0</td><td>0</td><td>2</td><td>1</td><td>-</td><td>25</td><td>25</td><td>-</td><td>25</td><td>25</td><td>50</td></tr>
<tr><td>UAUTOAU509</td><td>Automotive Components Lab</td><td>0</td><td>0</td><td>2</td><td>1</td><td>-</td><td>25</td><td>25</td><td>-</td><td>25</td><td>25</td><td>50</td></tr>
<tr><td>UDESIAU510</td><td>Design and Simulation Lab</td><td>0</td><td>0</td><td>2</td><td>1</td><td></td><td>25</td><td>25</td><td>-</td><td>25</td><td>25</td><td>50</td></tr>
<tr><td></td><td>Total</td><td>18</td><td>1</td><td>8</td><td>23</td><td>180</td><td>100</td><td>280</td><td>420</td><td>100</td><td>520</td><td>800</td></tr>
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Department of Automobile Engineering
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P.K. University, Shivpuri (MP)
III Year V Semester

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UMANAAU501: MANAGERIAL ECONOMICS

UNIT I

Introduction of Engineering Economics and Demand Analysis: Meaning and nature of Economics, Relation between science, engineering, technology and economics; Meaning of Demand, Determinants of Demand, Shifts in demand, Law of Demand, Price Elasticity of Demand &Types, Income Elasticity, Cross price Elasticity, Determinants of Elasticity, uses and Importance of elasticity.

UNIT II

Concept of Supply: Law of Supply, Factors affecting Supply, Elasticity of supply.
Demand Forecasting: Introduction, Meaning and Forecasting, Methods or Techniques of Demand Forecasting, Criteria for Good Demand Forecasting, Demand Forecasting for a New Product;

UNIT III

Cost Analysis- Introduction, Types of Costs, Cost-Output Relationship: Cost Function, Cost-Output Relationships in the Short Run, and Cost-Output Relationships in the Long Run; Short run and long run, Break- Even Analysis; Production functions: laws of variable proportions, law of returns; Economies of scale: Internal and external**.**

UNIT IV

Market Structure: Market Structure Perfect Competition, Imperfect competition – Monopolistic, Oligopoly, duopoly sorbent features of price determination and various market conditions.

UNIT V

Nature and characteristics of Indian economy, concepts of LPG, elementary concepts of National Income, Inflation and Business Cycles ,Concept of N.I. and Measurement., Meaning of Inflation, Types and causes , Phases of business cycle .Investment decisions for boosting economy(National income and per capital income)

TEXT BOOKS-

1. Premvir Kapoor, Sociology and Economics for Engineers, Khanna Publishing House (Edition 2018)
2. Salvatore D, ―Principles of Microeconomics‖, Oxford University Press.
3. Koutsoyiannis A, ―Modern Microeconomic‖, Macmillan Education Ltd.
4. Dwivedi DN, ―Principles of Microeconomics‖, Pearson Education.
5. Cowell, FA, ―Microeconomic Principles and Analysis‖, Oxford University Press**.**

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UMACHAU502:
MACHINE DESIGN-I

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UNIT I

Introduction Definition, Design requirements of machine elements, Design procedure, Standards in design, Selection of preferred sizes, Indian Standards designation of carbon & alloy steels, Selection of materials for static and fatigue loads. Design for Static Load Modes of failure, Factor of safety, Principal stresses, Stresses due to bending and torsion, Theory of failure.

UNIT II

Design for Fluctuating Loads Cyclic stresses, Fatigue and endurance limit, Stress concentration factor, Stress concentration factor for various machine parts, Notch sensitivity, Design for finite and infinite life, Soderberg, Goodman & Gerber criteria. Riveted Joints Riveting methods, materials, Types of rivet heads, Types of riveted joints, Caulking and Fullering, Failure of riveted joint, Efficiency of riveted joint, Design of boiler joints, Eccentric loaded riveted joint.

UNIT III

Shafts Cause of failure in shafts, Materials for shaft, Stresses in shafts, Design of shafts subjected to twisting moment, bending moment and combined twisting and bending moments, Shafts subjected to fatigue loads, Design for rigidity.

UNIT IV

Mechanical Springs Types, Material for helical springs, End connections for compression and tension helical springs, Stresses and deflection of helical springs of circular wire, Design of helical springs subjected to static and fatigue loading.

UNIT V

Keys and Couplings Types of keys, splines, Selection of square & flat keys, Strength of sunk key, Couplings, Design of rigid and flexible couplings. Power Screws Forms of threads, multiple threads, Efficiency of square threads, Trapezoidal threads, Stresses in screws, Design of screw jack Note: Design data book is allowed in the examination

Books and References:
1. Design of Machine Elements,V.B. Bhandari, Tata McGraw Hill Co.
2. Machine Design-Sharma and Agrawal, S.K. Kataria& Sons.
3. Machine Design, U C Jindal, Pearson Eductaion.
4. Design of Machine Elements, Sharma and Purohit, PHI.
5. Design of Machine Elements-M.F. Spott, Pearson Eductaion
6. Machine Design-Maleev and Hartman, CBS Publishers.
7. Mechanical Engineering Design, 9e – Joseph E. Shigely, McGraw Hill Education.
8. Elements of Machine Component Design, Juvinal&Marshek, John Wiley & Sons.

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UINDUAU503: INDUSTRIAL SOCIOLOGY

Unit-I

Industrial Sociology: Nature,Scope and Importance of Industrial Sociology. Social Relations in Industry, Social Organisation in Industry- Bureaucracy,Scientific Management and Human Relations.

Unit-II

Rise and Development of Industry : Early Industrialism – Types of Productive Systems – The Manorial or Feudal system. The Guild system, The domestic or putting-out system,and the Factory system. Characteristics of the factory system.Causes and Consequences of industrialization.Obstacles to and Limitations of Industrialization.

Unit-III

Industrialization in India.Industrial Policy Resolutions – 1956.Science.Technology andInnovation Policy of India 2013.

Unit-IV

Contemporary Issues : Grievances and Grievance handling Procedure.

Industrial Disputes: causes, Strikes and Lockouts.Preventive Machinery of Industrial Disputes:Schemes of Workers Participation in Management- Works Committee,Collective Bargaining, Bi-partite & Tri-partite Agreement ,Code of Discipline, Standing Orders. Labour courts & Industrial Tribunals,

Text and References books:

1. GISBERT PASCAL, Fundamentals of Industrial sociology, Tata McGraw Hill Publishing Co., New Delhi, 1972.

2. SCHNEIDER ENGNO V., Industrial Sociology 2nd Edition, McGraw Hill Publishing Co., New Delhi, 1979.

3. MAMORIAC.B. And MAMORIA S., Dynamics of Industrial Relations in India.

4. SINHAG.P. and P.R.N. SINHA, Industrial Relations and Labour Legislations, New Delhi, Oxford and IBH Publishing Co., 1977.

5. NADKARNI, LAKSHMI, Sociology of Industrial Worker,Rawat,Jaipur,1998.

6. BHOWMICKSHARIT,Industry,Labour and Society,Orient,2012.

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UHEATAU504:HEAT & MASS TRANSFER

UNIT-1

Introduction to Heat Transfer: Thermodynamics and Heat Transfer. Modes of Heat Transfer: Conduction, convection and radiation. Effectof temperature on thermal conductivity of materials; Introduction to combined heat transfer mechanism.

Conduction : General differential heat conduction equation in the rectangular, cylindrical and spherical coordinatesystems.Initial and boundary conditions.Steady State one-dimensional Heat conduction :Simple and Composite Systems in rectangular, cylindrical and spherical coordinates with and withoutenergy generation; Concept of thermal resistance.Analogy between heat and electricity flow; Thermalcontact resistance and over all heat transfer coefficient; Critical radius of insulation.

UNIT-II

Fins: Heat transfer from extended surfaces, Fins of uniform cross-sectional area; Errors of measurement oftemperature in thermometer wells.Transient Conduction:Transient heat conduction; Lumped capacitance method; Time constant; Unsteady state heat conduction inone dimension only.

UNIT-III

Forced Convection: Basic concepts; Hydrodynamic boundary layer; Thermal boundary layer; Approximate integral boundarylayer analysis; Analogy between momentum and heat transfer in turbulent flow over a flat surface; Mixedboundary layer; Flow over a flat plate; Flow across a single cylinder and a sphere; Flow inside ducts;Thermal entrance region, Empirical heat transfer relations; Relation between fluid friction and heat transfer;Liquid metal heat transfer.

Natural Convection : Physical mechanism of natural convection; Buoyant force; Empirical heat transfer relations for naturalconvection over vertical planes and cylinders, horizontal plates and cylinders, and sphere, Combined freeand forced convection.

UNIT-4

Thermal Radiation : Basic radiation concepts; Radiation properties of surfaces; Black body **radiation Planck's law, Wein's displacement law, Stefan Boltzmann law, Kirchoff's law; ; Gray**

body; Shape factor; Black-body radiation;Radiation exchange between diffuse non black bodies in an enclosure; Radiation shields; Radiationcombined with conduction and convection; Absorption and emission in gaseous medium; Solar radiation; Green house effect.

UNIT-5

Heat Exchanger : Types of heat exchangers; Fouling factors; Overall heat transfer coefficient;
Logarithmic mean temperature difference (LMTD) method; Effectiveness-NTU method;
Compact heat exchangers.

Condensation and Boiling:Introduction to condensation phenomena; Heat transfer relations for laminar film condensation on verticalsurfaces and on outside & inside of a horizontal tube; Effect of non-condensable gases; Dropwisecondensation; Heat pipes; Boiling modes, pool boiling; Hysteresis in boiling curve; Forced convectionboiling.

Introduction to Mass Transfer:

Introduction; Fick's law of diffusion; Steady state equimolar counter diffusion; Steady state diffusion though a stagnant gas film.

Texts Books:

1. Fundamentals of Heat and Mass Transfer, by Incroperra& DeWitt, John Wiley and Sons
2. Heat and Mass Transfer by Cengel, McGraw-Hill
3. Heat Transfer by J.P. Holman, McGraw-Hill
4. Heat and Mass Transfer by Rudramoorthy and Mayilsamy, Pearson Education
5. Heat Transfer by Ghoshdastidar, Oxford University Press
6. A text book on Heat Transfer, by Sukhatme, University Press.
7. Heat Transfer by Venkateshan, Ane Books Pvt Ltd
8. Schaum's outline of Heat Transfer by Pitts & Sisson McGraw-Hill
9. Heat and Mass Transfer by R Yadav, Central Publishing House.

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III Year V Semester

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UAUTOAU505:AUTOMOTIVES ENGINES

Unit -I

Construction and operation: Constructional details of spark ignition (SI) and compression ignition (CI) engines. Working principles.Two stroke SI and CI engines – construction and working. Comparison of SI and CI engines and four stroke and two stroke engines. Engine classification, firing order. Otto, diesel and dual cycles.

Unit–II

SI Engines: Combustion in SI engine, Flame speed, Ignition delay, abnormal combustion and it's Control, combustion chamber design for SI engines,Carburetion, Mixture requirements, Carburetors and fuel injection system in SI Engine, Ignition system requirements, Magneto and battery ignition systems, ignition timing and spark Plug, Electronic ignition, Scavenging in 2 Stroke engines, Supercharging and its effect

Unit–III

CI Engine: Combustion in CI engines, Ignition delay, Knock and it's control, Combustion chamber design of CI engines. Fuel injection in CI engines, Requirements, Types of injection systems, Fuel pumps, Fuel injectors, Injection timings ,Exhaust emissions from SI engine and CI engine and it's control

Unit-IV

Engine Cooling and Lubrication: Different cooling systems, Radiators and cooling fans, Engine Friction, Lubrication principle, Type of lubrication, Lubrication oils, Crankcase ventilation. Different Fuels used in SI & CI Engines. Testing and Performance: Performance parameters, Basic measurements, Blow by measurement, Testing of SI and CI engines

Unit V

Compressors: Classification, Reciprocating compressors, Single and Multi stage compressors, Intercooling, Volumetric efficiency. Rotary compressors, Classification, Centrifugal compressor

, Axial compressors, Surging and stalling, Roots blower, Vaned compressor.

TEXT BOOKS:

1.Ganesan V., "Internal Combustion Engines", Tata McGraw Hill, 2007

1 Ramalingam K.K., ‒Internal Combustion Engines‖, Sci-Tech Publications, 2005

3. Mathur and Sharma "Fundamental Combustion Engines" Dhanpat Rai
and Sons, 2002 Engineering

4. A.K. Babu, Automotive Engines, Khanna Publishing House

5. I.C Engine, by R. Yadav, Central Publishing House, Allahabad

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UVEHIAU506: VEHICLE TRANSPORT MANAGEMENT

UNIT-I

Historical Back ground: Introduction, the growth of a network, trams, trolley buses, private car's subsidies The Infrastructure: Road- Approach Road. Highways National, State, District, traffic condition, relief of congestion, pedestrians, zebra lines, margins, shopping centers. Bus-stops, shelters .Bus stations. Garages layout of premises, equipment, use of machinery, conveyance of staff, facilities for passengers. Maintenance -preventive, breakdown, overhauling -major, minor.

UNIT –II

Organization and Management: Forms of ownership, principle of transport, management – internal organization, centralized condition, decentralized condition (Engineering, traffic and administration), staff administration: industrial relation, administration, recruitment and training, welfare, health and safety. Public relations divisions: Dissemination of information, maintaining goodwill- handling complaints, traffic advisory, committees- local contractors co-operation with the press news and articles- facilities for visitors- forms of publicity importance of quality -inter departmental liaison advertisements, signs, notice and directions general appearance of premises, specialized publicity.

UNIT-III

Prevention of accidents: Emphasis of safe driving-annual awards bonus encouragement vehicle design platform, layout, location of steps, scheduled route hazards records elimination of accident prone devices. Route planning: Source of traffic, town planning, turning paints, stopping places, shelters survey of route preliminary schedule test runs elimination of hazards factors affecting. Frequency direction of traffic flow estimated traffic possibility single verses double deck.

UNIT-IV

Timing, bus working and schedules: Time table layout uses of flat graph method of presentation preparation of vehicle and crew schedule preparation of the duty roster, co-operation with employers use of the vehicle running numbering determination of vehicle efficiency, checking efficiency of crew, duty arrangements. Fare collections systems: Principles of collection the way bill, bell punch system reduced ticket stocks wilk brew system T.I.M and straight M/C/S. The verometer lensonparason coach tickets exchanges, box system personal and common stock flat fare platform control.

UNIT-V

The fare structure: Basis of fares historical background effects of competition and control calculating average zone system straight and tapered scale elastic and inelastic demand coordination of fares concessions fares changes for workman. Anomalies double booking inter availability through booking and summation private hire charges. Operating cost and types of vehicles: Classification costs, average speed running costs supplementary costs depreciation

obsolescence, life of vehicles sinking fund factor affecting post per vehicles mile incidence of wages and overheads 100 seats miles basis, average seating capacity vehicles size and spread overs, types of vehicle economic considerations authorization of trolley, bus services, statuary procedure taxes and hire cars.

TEXTBOOKS:
1.   Bus operation -L.d kitchen, iliffe& sons
2.   Bus & coach operation -Rex w. fautks. butterworth version of 1987
            Hybrid Electric Vehicles, AK Babu, Khanna Publishing House .

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UHEATAU507:
HEAT & MASS TRANSFER LAB

List of practical's

1. Conduction – Experiment on Composite plane wall
2. Conduction – Experiment on Composite cylinder wall
3. Conduction - Experiment on critical insulation thickness
4. Conduction – Experiment on Thermal Contact Resistance
5. Convection - Pool Boiling experiment
6. Convection - Experiment on heat transfer from tube-(natural convection).
7. Heat exchanger - Parallel flow experiment And Counter flow experiment
8. Convection - Heat transfer through fin-(natural convection) .
9. Convection - Heat transfer through tube/fin-(forced convection).
10. Experiment on solar collector.
11. Experiment on Stefan's Law, on radiation determination of emissivity, etc.

UMACHAU508:
MACHINE DESIGN-I LAB

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List of practical's

1. Design & drawing of Cotter joint.
2. Design & drawing of Knuckle joint
3. Design of machine components subjected to combined steady and variable loads
4. Design of eccentrically loaded riveted joint
5. Design of boiler riveted joint
6. Design of shaft for combined constant twisting and bending loads
7. Design of shaft subjected to fluctuating loads
8. Design and drawing of flanged type rigid coupling
9. Design and drawing of flexible coupling
10. Design and drawing of helical spring
11. Design and drawing of screw jack

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L	T	P
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UAUTOAU509:

AUTOMOTIVE COMPONENTS LAB

LIST OF EXPERIMENTS (Minimum Ten Experiments are required to be conducted)

1. Dismantling and study of Multi-cylinder Petrol Engine

2. Assembling of Multi-cylinder Petrol Engine

3. Dismantling and study of Multi-cylinder Diesel Engine

4. Assembling of Multi-cylinder Diesel Engine

5. Study of petrol engine fuel system

6. Study of diesel engine fuel system

7. Study and measurement of light and heavy commercial

8. Vehicle Frame

9. Study, dismantling and assembling of front and rear

10. Axles

11. Study, dismantling and assembling of differential

12. Study, dismantling and assembling of Clutch

13. Study, dismantling and assembling of Gear Box

14. Study of steering system

15. Performance of CI and SI engine

16. Impact of Variable compression ratio on Performance

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III Year V Semester

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UDESIAU510:
DESIGN AND SIMULATION LAB- I

1. Design & Modeling of Cotter joint.
2. Design & Modeling of Knuckle joint
3. Design & Modeling of riveted joint applied to boiler joints.
4. Study of a FEA package and modeling stress analysis of
a. Bars of constant cross section area, tapered cross section area and stepped bar
b. Trusses,
c. Beams – Simply supported, cantilever, beams with UDL, beams with varying load etc
5. Mini Project: Will take up problems from real life applications and optimize
using modeling and analysis software

Each student will be given a real life problem for the complete design of a subsystem/system
using either manual calculation with the help of design handbook or through computer
programme or through software tools. This assignment should be done in groups, which will
be submitted at the end of the semester.

Text Books:
1. Design of Machine Elements, V.B. Bhandari, Tata McGraw Hill Co.
2. Design of Machine Elements, Sharma and Purohit, PHI.
3. Machine Design-R S Khurmi and J K Gupta, S Chand
4. Machine Design, Sadhu Singh, Khanna Publishing House
5. J N Reddy "An Introduction to finite element method" Tata Mc Graw Hill 3rd edition
6. S.S. Rao, "Finite Element Method In Engineering", Pergaman Press
7. Machine Design, Sadhu Singh, Khanna Publishing House
8. P Seshu, Finite Element Analysis, PHI publications, Delhi

Design data book: Design Data Handbook for Mechanical Engineering in SI and Metric Units – by
K. Mahadevan, and K. Balaveera Reddy

References:
1. Design of Machine Elements-M.F. Spott, Pearson Eductaion
2. Machine Design-Maleev and Hartman, CBS Publishers.
3. Mechanical Engineering Design, 9e – Joseph E. Shigely, McGraw Hill Education.
4. Design of Machine Elements, Gope PHI.
5. Finite Element Method with Applications in Engineering Y M Desai, Pearson Publication
6. Introduction to Finite Element Analysis by Tirupathi R.Chandrupatla & Ashok D Belegundu,
Pearson Publication
  6. V.Ramamurti "Finite Element Method in Machine Design"Norosa Publishing House

EVALUATION SCHEME

B.TECH –AUTOMOBILE ENGINEERING 6th SEMESTER

STUDY AND EVALUATION SCHEME FOR B.TECH AUTOMOBILE ENGINEERING SEMESTER-VI											
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	
UINDUAU601	Industrial Management	3	0	0	3	30	-	30	70	-	70	100
UAUTOAU602	Automotive Fuels and Lubricants	3	0	0	3	30	-	30	70	-	70	100
UTHEOAU603	Theory of Machines	3	1	0	4	30	-	30	70	-	70	100
UAUTOAU604	Automotive Chassis and Suspension	3	0	0	3	30	-	30	70	-	70	100
UVEHIAU605	Vehicle Dynamics	3	1	0	4	30	-	30	70	-	70	100
UAUTOAU606	Automotive Fuels and Lubricants	0	0	2	1	-	25	25		25	25	50
UTHEOAU607	Theory of Machines Lab	0	0	2	1	-	25	25	-	25	25	50
UDESIAU608	Design and Simulation Lab-II	0	0	2	1	-	25	25	-	25	25	50
UREFRAU609	Refrigeration and Air Conditioning Lab	0	0	2	1		25	25		25	25	50
	Total	15	2	8	21	150	100	250	350	100	450	700

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III Year VI Semester

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UINDUAU601: INDUSTRIAL MANAGEMENT

Unit-I
Introduction: Concept, Development, application and scope of Industrial Management.
Productivity: Definition, measurement, productivity index, types of production system, Industrial Ownership.

Unit-II
Management Function: Functions of Management, Taylor's Scientific Management Theory, Fayol's Principles of Management, Social responsibilities of Management, Introduction to Human resources management: Nature of HRM, functions and importance of HRM.

Unit-III
Work Study: Introduction, definition, objectives, steps in work study, Method study: definition, objectives, and steps of method study, Work Measurement: purpose, types of study — stop watch methods — steps — allowances — standard time calculations — work sampling, Production Planning and Control
Inventory Control: Inventory, Cost, Deterministic Models, and Introduction to supply chain management.

Unit-IV
Quality Control: Process control, SQC, Control charts, Single, Double and Sequential Sampling, Introduction to TQM.

Unit-V
Project Management: Project network analysis, CPM, PERT and Project crashing and resource Leveling

BOOKS AND REFERENCE:
1. Statistical Quality Control by Grant and Leavarworth, McGraw Hill
2. Industrial Management By O P Khan.
3. Problems in Operations Research by- Prem Kumar Gupta & D.S. Hira, S. Chand

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III Year VI Semester
UAUTOAU602
AUTOMOTIVE FUELS AND LUBRICANTS

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UNIT I-:
MANUFACTURE OF FUELS AND LUBRICANTS
Structure of petroleum refining process, classification of petroleum fuels, thermal cracking, catalytic cracking, polymerization, alkylation isomerization, blending, products of refining process. Manufacture of lubricating oil base stocks, manufacture of finished automotive lubricants.

UNIT II
PROPERTIES & TESTING OF FUELS
Thermo-chemistry of fuels, properties and testing of fuels & Lubricants, relative density, calorific value, fire point, distillation, vapor pressure, flash point, spontaneous ignition, temperature, viscosity, pour point, flammability, ignitability, diesel index. API gravity, aniline point, Viscosity index etc.

UNIT III
FUEL RATING & ADDITIVES:
Fuels for SI and CI engine, important qualities of SI and CI engine fuels, Rating of SI engine and CI engine fuels, Dopes, Gaseous fuels Additive - mechanism, requirements of an additive, petrol fuel additives and diesel fuel additives specifications of fuels, diesel knock, Cetane rating.

UNIT IV-: ALTERNATE FUELS
Use of alternate fuel in engines- LPG. CNG need for alternate fuels, availability & their properties, general use of alcohols. LPG.CNG.LNG, hydrogen, ammonia, vegetable oils, biodiesel & biogas. merits & demerits of alternate fuels. Introduction to alternate energy sources like, electric vehicle, hybrid, fuel cell & solar cars.

UNIT V LUBRICANTS
Classification of lubricating oils, properties of lubricating oils, tests on lubricants. Grease classification, properties, tests. Specific requirements for automotive lubricants, oxidation, deterioration and degradation of lubricants, additives, synthetic lubricants.

THEORY OF LUBRICANTS: Engine friction - introduction, total engine friction, effect of engine variables on friction, hydrodynamic lubrication, elasto hydrodynamic lubrication, boundary lubrication, bearing lubrication, functions of the lubrication system, introduction to design of a lubricating system.

TEXT BOOKS
1. Fuels - Solids. Liquids.Gaseous by Brame.J.S.S. and King.I .G.
2. Lubrication. Raymond G. Gunther, Chipton Book Co., 1971.
3. Fuels and Fuel Technology by Francis, W, Vol. I & II
4. Elements of Fuels and Combustion, O.P. Gupta, Khanna Book Publishing Co
5. Automotive Engines, A.K. Babu, Khanna Publishing House

Department Of Automobile Engineering
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III Year VI Semester

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UTHEOAU603 -THEORY OF MACHINES

Unit I

INTRODUCTION: DEFINITIONS: Link or element, kinematic pairs, degrees of freedom, Grubler's criterion (without derivation), Kinematic chain, Mechanism, structure, Mobility of Mechanism, Inversion, Machine Gashoff's criteria. Kinematic Chains And Inversions: Inversions of Four bar chain; Single slider crank chain and Double slider crank chain. **MECHANISMS:** Quick return motion mechanisms-Drag link mechanism, Whitworth mechanism and Crank and slotted lever Mechanism. Straight line motion mechanisms Peaucellier's mechanism and Robert's mechanism. Intermittent Motion mechanisms Geneva mechanism and Ratchet and Pawl mechanism. Toggle mechanism, Pantograph, Davis & Ackerman steering gear mechanism.

Unit II

CAMS: Types of cams, Types of followers, Displacement, Velocity and Acceleration time curves for cam profiles. Disc cam with reciprocating follower having knife-edge, roller and flat- faced follower, Disc cam with oscillating roller follower, Follower motions including SHM, Uniform velocity, uniform acceleration and retardation and Cycloidal motion.

Unit III

BALANCING OF MACHINERY: Static and Dynamic balancing, balancing of singlerotating mass in same plane and in different planes. Balancing of several rotating masses in same plane and in different planes. Balancing of reciprocating masses. Inertia effect of crank and connecting road.

Unit - IV

SPUR GEARS: Gear terminology, law of gearing, Characteristics of involute action, Path of contact, Arc of contact, Contact ratio, Interference in involute gears, Methods of avoiding: interference, Back lash, Comparison of involute and cycloidal teeth **GEAR TRAINS:** Simple gear trains, Compound gear trains for large speed reduction, Epicyclic gear trains, Algebraic and tabular methods of finding velocity ratio of epicyclic gear trains. Tooth load and torque calculations in epicyclic gear trains.

Unit V

BELTS, ROPES AND CHAINS: Introduction, Belt and Rope drives, open and crossed belt drives, action of belt on pulleys, velocity ratio, slip, law of belting, length of belt, Ratio of friction, chains, chain length and analytical, classification of chains. GOVERNORS: Types of governors; force analysis of Porter and Hartnell governors. Controlling force, stability, sensitiveness, isochronisms, effort and power.

Text Books:
1. Rattan S.S, ‒Theory of Machines‖ Tata McGraw-Hill Publishing Co. Ltd., New Delhi
2. Sadhu Singh, ‒Theory of Machines,‖ Pearson Education (Singapore) Pvt. Ltd.,
3. Mechanical Vibrations – G. K. Groover, Jain Brothers, Roorkee
4. Ambekar, AG; Mechanism and Machine Theory;PHI

Department Of Automobile Engineering
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III Year VI Semester

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UAUTOAU604: AUTOMOTIVE CHASSIS AND SUSPENSION

Unit-I

Automotive chassis: Definition; chassis layout; types of chassis layout with reference to power plant location, steering position and drive on wheels; chassis components; chassis classification; Automotive frames: Construction; functions; loads acting; materials; types; frame cross sections; frame diagnosis and service; dimensions of wheel base; wheel track; chassis overhang and ground clearance.

Unit II

Front axle & steering system: Functions, construction & types of front axle; front wheel geometry; front wheel drive; steering mechanisms; steering linkages & layout; types of steering gear boxes; power & power assisted steering; electronic steering; four-wheel steering; terminology-reversible steering, under-steering, over-steering, turning radius.

Unit III

Suspension system: Need; factors influencing ride comfort; types; suspension springs-leaf spring, coil spring & torsion bar; spring materials; independent suspension; rubber suspension; pneumatic suspension; hydraulic suspension, shock absorbers-liquid & gas filled.

Unit IV

Braking systems: Introduction, principles of braking; classification; brake actuating mechanisms; **Drum brake-** theory; principle; construction; working; Disc brake- theory, principle, construction, working; Parking brake- theory, principle; construction, types; Hydraulic system theory, principles, master-cylinder basics, wheel-cylinder basics, tubing & hoses, valves & switches, brake fluid; **Power brake-** theory, vacuum-booster basics, hydraulic-booster basics, electro-hydraulic booster basics; Advanced brake theories; Exhaust brake; abs technology; factors affecting brake performance operating temperature, area of brake lining, clearance.

Unit V

Wheel: Forces acting on wheels, construction of wheel assembly, types- spoke, disc & built-up wheels; wheel balancing; wheel alignment; Tyres: Static & rolling properties of tyres, construction details, types of tyres- pneumatic & hydraulic; types of tyre-wear & their causes; tyre rotation.

Bearings: Functions; classification of bearings; bearing materials; automotive bearings.

Books and References:

1. Automobile engineering", Dr. Kripal Singh.
2. A.K. Babu, Automotive Mechanics, Khanna Publishing House
3. Automobile engineering" K.M. Gupta.
4. Heldt P.M., "Automotive chassis", Chilton Co., New York.
5. Giles J.G., "Steering, Suspension and tyres", Iliffe Book Co., London.

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UVEHIAU605: VEHICLE DYNAMICS

UNIT-I
Definitions, Modeling and Simulation, Global and Vehicle Coordinate System, Free, Forced, Undamped and Damped Vibration, Response Analysis of Single DOF, Two DOF, Multi DOF, Magnification factor, Transmissibility, Vibration absorber, Vibration measuring instruments, Torsional vibration, Critical speed.

UNIT II
TIRES: Tire forces and moments, Tire structure, Longitudinal and Lateral force at various slip angles, rolling resistance, Tractive and cornering property of tire. Performance of tire on wet surface. Ride property of tires. Magic formulae tire model, Estimation of tire road friction. Test on Various road surfaces. Tire vibration.

UNIT III
VERTICAL DYNAMICS: Human response to vibration, Sources of Vibration. Design and analysis of Passive, Semi-active
and Active suspension using Quarter car, half car and full car model. Influence of suspension stiffness, suspension damping, and tire stiffness. Control law for LQR, H-Infinite, Skyhook damping. Air suspension system and their properties.

UNIT IV
LONGITUDINAL DYNAMICS AND CONTROL: Aerodynamic forces and moments. Equation of motion. Tire forces, rolling resistance, Load distribution for three wheeler and four wheeler. Calculation of Maximum acceleration, Reaction forces for Different drives. Braking and Driving torque. Prediction of Vehicle performance.
ABS, stability control, Traction control.

UNIT V
LATERAL DYNAMICS : Steady state handling characteristics. Steady state response to steering input. Testing of handling characteristics. Transient response characteristics, Direction control of vehicles. Roll center, Roll axis, Vehicle under side forces. Stability of vehicle on banked road, during turn. Effect of suspension on cornering.

TEXT BOOKS:
1. Singiresu S. Rao, "Mechanical Vibrations", 5th Edition, Prentice Hall, 2010
2. Wong. J. Y., "Theory of Ground Vehicles", 3rd Edition, Wiley-Interscience, 2001
3. Rajesh Rajamani, "Vehicle Dynamics and Control", 1st edition, Springer, 2005
4. Thomas D. Gillespie, "Fundamentals of Vehicle Dynamics", Society of Automotive Engineers Inc, 1992

REFERENCES:
1. Dean Karnopp, "Vehicle Stability", 1st edition, Marcel Dekker, 2004
2. Nakhaie Jazar. G., "Vehicle Dynamics: Theory and Application", 1st edition, Springer, 2008
3. Michael Blundell & Damian Harty, "The Multibody Systems Approach to Vehicle Dynamics", Elsevier Limited, 2004
4. Hans B Pacejka, "Tire and Vehicle Dynamics", 2nd edition, SAE International, 2005
5. A.K. Babu, Hybrid Electric Vehicles, Khanna Publishing House
6. John C. Dixon," Tires, Suspension, and Handling", 2nd edition, Society of Automotive Engineers Inc, 1996

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UAUTOAU606:
AUTOMOTIVE FUELS AND LUBRICANTS LAB

Minimum eight experiments out of the followings:
1. Temperature dependence of viscosity of lubrication oil by Redwood Viscometer.
2. Viscosity Index of lubricating oil by Saybott Viscometer.
3. Flash and Fire points of Diesel, K-Oil, Bio Diesel.
4. Flash and Fire points of lubricants.
5. Drop point of grease and mechanical penetration in grease.
6. Calorific value of liquid fuel.
7. Calorific value of gaseous fuel
8. Study of semi solid lubrication in various Automobile Unit & Joints
9. Study of lubrication in transmission, final drive, steering gearbox.
10. Study of analytical equipment for oil analysis.
11. To find out volatility characteristic of different fuels by ASTM distillation methods (diesel, gasoline lubricants).

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UTHEOAU607
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Note: Minimum Ten experiments out of the following:

1. Study of simple linkage models/mechanisms

2. Study of inversions of four bar linkage

3. Study of inversions of single/double slider crank mechanisms

4. Experiment on Gears tooth profile, interference etc.

5. Experiment on Gear trains

6. Experiment on longitudinal vibration

7. Experiment on transverse vibration

8. Experiments on dead weight type governor

9. Experiment on spring controlled governor

10. Experiment on critical speed of shaft

11. Experiment on gyroscope

12. Experiment on static/dynamic balancing

13. Experiment on Brake

14. Experiment on clutch

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UDESIAU608: DESIGN AND SIMULATION LAB-II

☐ Computer and Language: Students are required to refresh the basics of computer language such as C++ or MATLAB so that they should be able to write the computer program. ☐

☐ Writing Computer programme for conventional design: Students are required to write computer program and validate it for the design of machine components done in theory subject .

☐ Mini Project: Based from real life applications and optimize using modelling and analysis software

☐Students will take up a real life problem for design of a subsystem/system using modelling & Analysis software tools. This will be done as assignment in groups to be submitted at the end of the semester.

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UREFRAU609: REFRIGERATION & AIR CONDITIONING LAB

Minimum eight experiments out of the following:

1. Experiment on refrigeration test rig and calculation of various performance parameters.
2. Study of different types of expansion devices used in refrigeration system.
3. Study of different types of evaporators used in refrigeration systems.
4. To study basic components of air-conditioning system.
5. Experiment on air-conditioning test rig & calculation of various performance parameters.
6. Experiment on air washers
7. Study of window air conditioner.
8. Study & determination of volumetric efficiency of compressor.
9. Visit of a central air conditioning plant and its detailed study.
10. Visit of cold-storage and its detailed study.
11. Experiment on Ice-plant.
12. Experiment on two stage Reciprocating compressor for determination.

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