



JAIPUR ENGINEERING COLLEGE
AND RESEARCH CENTRE

JAIPUR ENGINEERING COLLEGE AND RESEARCH CENTRE
JECRC Campus ,Shri Ram ki Nangal, Via-Vatika ,Tonk Road, Jaipur
Department of Mechanical Engineering

Name of Subject: Automobile Engineering

Subject Code: 5ME5-12

Year: 3rd Year, 5th Semester



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Department of Mechanical Engineering

Vision and Mission of Institute:

Vision: To become a renowned center of outcome based learning, and work towards academic, professional, cultural and social enrichment of the lives of individuals and communities.

Mission:

M1: Focus on evaluation of learning outcomes and motivate students to inculcate research aptitude by project based learning.

M2: Identify, based on informed perception of Indian, regional and global needs, areas of focus and provide platform to gain knowledge and solutions.

M3: Offer opportunities for interaction between academia and industry.

M4: Develop human potential to its fullest extent so that intellectually capable and imaginatively gifted leaders can emerge in a range of professions.

Vision and Mission of Department:

Vision: The Mechanical Engineering Department strives to be recognized globally for outcome based technical knowledge and to produce quality human resource, who can manage the advance technologies and contribute to society.

Mission:

M1: To impart quality technical knowledge to the learners to make them globally competitive mechanical engineers.

M2: To provide the learners ethical guidelines along with excellent academic environment for a long productive career.

M3: To promote industry-institute relationship.



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PROGRAM EDUCATIONAL OBJECTIVES (PEOS)

PEO1: To equip graduates with a strong foundation in engineering sciences, with an emphasis on mechanical engineering principles, enabling them to analyze, design, and solve real-world engineering challenges.

PEO2: To prepare graduates with sound scientific and engineering fundamentals to innovate and deliver effective solutions addressing practical challenges in mechanical engineering

PEO3: To inculcate in graduates a professional and ethical attitude, effective communication and teamwork skills, a multidisciplinary approach, entrepreneurial mindset, and the ability to connect engineering solutions with societal and environmental concerns.

PEO4: To provide students with an academic environment that fosters excellence, leadership, adherence to ethical standards, and encourages self-motivated lifelong learning essential for a successful professional career in mechanical

PEO5: To prepare students to excel in industry and higher education by providing quality education grounded in strong technical knowledge and high moral values

Program Specific Outcomes (PSOs)

PSO1: Graduates will be able to design, analyze, and fabricate electric and hybrid vehicles using modern engineering tools and sustainable practices.

PSO2: Graduates will be able to apply design principles and computational techniques, including programming and data structures, to analyze and solve mechanical engineering problems.



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Program Outcomes (POs)

- PO1: Engineering Knowledge:** Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.
- PO2: Problem Analysis:** Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)
- PO3: Design/Development of Solutions:** Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)
- PO4: Conduct Investigations of Complex Problems:** Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).
- PO5: Engineering Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)
- PO6: The Engineer and The World:** Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).
- PO7: Ethics:** Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)
- PO8: Individual and Collaborative Team work:** Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.
- PO9: Communication:** Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences
- PO10: Project Management and Finance:** Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
- PO11: Life-Long Learning:** Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)



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Department of Mechanical Engineering

SYLLABUS

Common with Mechanical (5ME5-12)

Credit: 3
3L+0T+0P

Max. Marks: 100(IA:30, ETE:70)

End Term Exam: 3 Hours

SN	Contents	Hours
1	Introduction: Objective, scope and outcome of the course.	1
2	Frame & Body: Layout of chassis, types of chassis frames and bodies, their constructional features and materials.	3
	Clutches: single plate, multi-plate, cone clutch, semi centrifugal, electromagnetic, vacuum and hydraulic clutches. Fluid coupling. Brakes: Classification and function; Mechanical, hydraulic, vacuum air and self engineering brakes; Brake shoes and lining materials.	5
3	Gear Boxes: Sliding mesh, constant mesh, synchromesh and epicyclic gear boxes, Automatic transmission system; Hydraulic torque converter;	4
4	Drives: Overdrive, Propeller shaft, Universal joints, Differential; Rear axle drives. Hotchkiss and torque tube drives; Rear axle types; Front wheel and All wheel drive.	4
5	Wheels and Tyres: Tyre types, Tyre construction; Tyre inflation pressure, Tyre wear and their causes; Re-treading of the tyre,	2
	Steering system: steering gear boxes, Steering linkages, Steering mechanism, Under and Over steering. Steering Geometry, Effect of camber, caster, king pin inclination, toe in and toe out; Power steering; Integral and linkage types.	3
	Suspension system: objective and requirements, Suspension spring, front and rear suspension systems, Independent suspension system Shock absorbers.	3
6	Automotive Electrical System: Battery construction, Charging and testing, battery types, Starting and Battery Charging System: Starter motor construction, types of drive, Alternator construction, regulation and rectification.	4
	Ignition System: Magneto and coil ignition systems, System components and requirements, Automotive lighting: Wiring systems Electrical instruments; head lamp, electric horn, fuel level indicator.	4
7	Automotive Air Conditioning: Introduction, Loads, Air conditioning system Components, Refrigerants, Fault Diagnosis.	4
	Automotive Safety: Safety requirements, Safety Devices, Air bags, belts, radio ranging, NVS (Night Vision System) GPS (Global Positioning System)	4
	TOTAL	41

REFERENCE BOOKS (AE)

Automobile Engineering by R. B. Gupta

Automobile Engineering (Vol. I & II) by Kirpal Singh



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Course Plan

Name of the Course: **Automobile Engineering**

Code of the course: **5ME5-12**

Name of Faculty: **Mr. Nitin Chhabra**

Course Outcome

CO1: Understand the fundamentals of automobile systems, components, and their functions.

CO2: Analyse engine performance, fuel systems, and emission control techniques.

CO3: Apply knowledge of transmission, clutch, and braking systems for vehicle operation.

CO4: Evaluate suspension, steering, and chassis systems for stability and ride quality.

CO5: Examine recent trends in electric, hybrid, and alternative fuel vehicles.

CO6: Develop solutions to improve vehicle performance, safety, and efficiency.

Unit	Topic	Lec.	CO	Specific Objectives	Expected Outcomes	Primary Reference (R. B. Gupta)
I	Introduction to Automobile Engineering, Classification of Vehicles	1	CO1	Introduce automobile engineering and types of vehicles	Explain classifications and applications of automobiles	Ch. 1
I	Layout of Automobile and Major Components	2	CO1	Study vehicle layout and major systems	Identify major automobile components	Ch. 1
I	Chassis and Frame Construction	3	CO1	Understand chassis construction and frame types	Compare different chassis designs	Ch. 2
I	Automobile Engine Basics and Terminology	4	CO1	Explain engine terminology and working principles	Describe engine components and functions	Ch. 3
I	Four-Stroke SI and CI Engines	5	CO1	Study operating cycles of SI and CI engines	Differentiate SI and CI engines	Ch. 3
I	Two-Stroke Engines and Engine Comparison	6	CO1	Explain two-stroke engine operation	Compare two-stroke and four-stroke engines	Ch. 3
II	Fuel Supply System in SI Engines	7	CO2	Study carburetion and fuel supply	Explain SI fuel systems	Ch. 4
II	Fuel Injection System in CI Engines	8	CO2	Understand diesel fuel injection	Describe diesel injection components	Ch. 4
II	Air Intake and Exhaust Systems	9	CO2	Study intake and exhaust arrangements	Explain air and exhaust flow	Ch. 5
II	Cooling System	10	CO2	Understand engine cooling methods	Compare cooling systems	Ch. 6



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Unit	Topic	Lec.	CO	Specific Objectives	Expected Outcomes	Primary Reference (R. B. Gupta)
II	Lubrication System	11	CO2	Study lubrication methods and components	Explain lubrication requirements	Ch. 7
II	Engine Performance Parameters	12	CO2	Introduce engine performance concepts	Calculate engine performance parameters	Ch. 8
II	Emission Formation and Control Techniques	13	CO2	Study emission sources and control methods	Explain emission reduction techniques	Ch. 9
III	Clutch: Construction and Working	14	CO3	Understand clutch operation	Explain clutch types and applications	Ch. 10
III	Gearbox: Manual Transmission	15	CO3	Study manual gearbox construction	Explain gear shifting mechanisms	Ch. 11
III	Automatic and Continuously Variable Transmission (CVT)	16	CO3	Introduce automatic transmission systems	Compare manual and automatic transmissions	Ch. 11
III	Propeller Shaft and Universal Joint	17	CO3	Study power transmission components	Describe propeller shaft functions	Ch. 12
III	Differential and Final Drive	18	CO3	Understand differential operation	Explain final drive mechanism	Ch. 12
III	Braking System Fundamentals	19	CO3	Study braking principles	Explain braking requirements	Ch. 13
III	Hydraulic, Pneumatic and ABS Braking Systems	20	CO3	Study modern braking systems	Compare braking technologies	Ch. 13
IV	Suspension System: Types and Components	21	CO4	Study suspension systems	Identify suspension components	Ch. 14
IV	Leaf Spring and Coil Spring Suspension	22	CO4	Understand suspension elements	Compare spring types	Ch. 14
IV	Independent Suspension System	23	CO4	Study independent suspension	Explain advantages of independent suspension	Ch. 14
IV	Steering System Fundamentals	24	CO4	Study steering geometry	Explain steering mechanisms	Ch. 15
IV	Steering Gear Mechanisms	25	CO4	Understand steering gear operation	Compare steering gear types	Ch. 15
IV	Wheel Alignment and Wheel Balancing	26	CO4	Study alignment parameters	Evaluate alignment effects	Ch. 15
IV	Tyres, Wheels and Vehicle Stability	27	CO4	Study tyre construction and	Explain tyre influence on ride quality	Ch. 16



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Unit	Topic	Lec.	CO	Specific Objectives	Expected Outcomes	Primary Reference (R. B. Gupta)
				stability		
V	Automotive Electrical System	28	CO5	Introduce electrical systems	Explain electrical components	Ch. 17
V	Battery, Starting and Charging Systems	29	CO5	Study starting and charging circuits	Describe battery and charging operations	Ch. 17
V	Ignition System	30	CO5	Study ignition methods	Compare conventional and electronic ignition	Ch. 18
V	Electric Vehicles (EV): Introduction and Components	31	CO5	Introduce EV technology	Identify EV components	Ch. 19
V	Hybrid Electric Vehicles (HEV)	32	CO5	Study hybrid vehicle architecture	Explain hybrid powertrain configurations	Ch. 19
V	Fuel Cell and Hydrogen Vehicles	33	CO5	Introduce alternative fuel technologies	Compare alternative fuel vehicles	Ch. 20
V	CNG, LPG and Biofuel Vehicles	34	CO5	Study alternative fuels	Evaluate alternative fuel applications	Ch. 20
VI	Vehicle Safety Systems (Passive & Active)	35	CO6	Study vehicle safety features	Explain active and passive safety systems	Ch. 21
VI	Vehicle Diagnostics and Maintenance	36	CO6	Introduce diagnostic techniques	Apply basic maintenance procedures	Ch. 22
VI	Automotive Sensors and Electronic Control Units (ECU)	37	CO6	Study electronic control systems	Explain sensor and ECU functions	Ch. 22
VI	Intelligent Transportation Systems (ITS) and ADAS	38	CO6	Introduce modern automotive technologies	Explain ADAS and ITS concepts	Ch. 23
VI	Case Studies on Vehicle Performance Improvement	39	CO6	Analyse practical automotive problems	Propose solutions for performance improvement	Ch. 23
VI	Course Review, Integrated Problem Solving and Assessment	40	CO6	Review complete syllabus and applications	Integrate knowledge to solve automobile engineering problems	All Chapters

Reference Books

Automobile Engineering by R. B. Gupta

Automobile Engineering (Vol. I & II) by Kirpal Singh