

Course contents

Category	Title	Code	Credits-4C			
DC6	Vehicle Dynamics	MMAE-201	L	T	P	
			3	1	0	

UNIT I BASIC OF VIBRATION

Classification of vibration, definitions, mechanical vibrating systems, mechanical vibration and human comfort. Modeling and simulation studies. Single degree of freedom, free, forced and damped vibrations. Magnification factor and transmissibility. Vibration absorber. Vibration measuring instruments. Two degree of freedom system. modal analysis.

UNIT II TYRES

Tire forces and moments, rolling resistance of tires, relationship between tractive effort and longitudinal slip of tyres, cornering properties of tyres, ride properties of tyre.

UNIT III PERFORMANCE CHARACTERISTICS OF VEHICLE

Equation of motion and maximum tractive effort. Aerodynamics forces and moments. Power plant and transmission characteristics. Prediction of vehicle performance. Braking performance.

UNIT IV HANDLING CHARACTERISTICS OF VEHICLES

Steering geometry. Steady state handling characteristics. Steady state response to steering input. Transient response characteristics. Directional stability of vehicle.

UNIT V DYNAMICS OF SUSPENSION SYSTEM

Requirements of suspension system. Spring mass frequency, wheel hop, Wheel wobble, wheel shimmy, choice of suspension spring rate. Calculation of effective spring rate. Vehicle suspension in fore and aft, Hydraulic dampers and choice of damping characteristics. Compensated suspension systems. Human response to vibration, vehicle ride model. Load distribution. Stability on a curved track, banked road and on a slope.

TEXTBOOK:

1. Rao J.S and Gupta. K "Theory and Practice of Mechanical Vibrations", Wiley Eastern Ltd., 2002.
2. J.Y.Wong, 'Theory of ground vehicle', John Wiley and Sons Inc., Newyork, 1978
3. Dr. N. K. Giri, "Automobile Mechanics", Seventh reprint, Khanna Publishers, Delhi, 2005

REFERENCES:

1. Groover, "Mechanical Vibration", 7th Edition, Nem Chand & Bros, Roorkee, India, 2003.
2. W.Steeds, 'Mechanics of road vehicle' Illiffe Books Ltd, London 1992
3. JG.Giles, 'Steering, Suspension tyres', Illife Books Lid London 1975
4. P.M.Heldt, 'Automotive chassis', Chilton Co ., Newyork, 1982
5. J. R. Ellis, 'Vehicle Dynamics', Business Books, London, 1969.

Course contents

Category	Title	Code	Credits-4C			
DC7	Automotive Electrical and Electronics Control	MMAE-202	L	T	P	
			3	1	0	

UNIT I BATTERIES AND STARTING SYSTEM

Different types of Batteries – Principle, Construction and Electrochemical action of Lead – Acid battery, Electrolyte, Efficiency, Rating, Charging, Testing and Maintenance. Starting System, Starter Motors – Characteristics, Capacity requirements. Drive Mechanisms. Starter Switches.

UNIT II CHARGING SYSTEM, LIGHTING SYSTEM AND ACCESSORIES

D.C. Generators and Alternators their Characteristics. Control cutout, Electrical, Electro-mechanical and electronic regulators. Regulations for charging. Wiring Requirements, Insulated and earth return system, details of head light and side light, LED lighting system, head light dazzling and preventive methods. Lighting design, Dash board instruments, Horns, wiper, Trafficators, Warning system and safety devices.

UNIT III ELECTRONIC IGNITION AND INJECTION SYSTEMS

Spark plugs, Advance mechanisms. Different types of electronic ignition systems - variable ignition timing, distributor less ignition. Spark timing control. Electronic fuel injection systems. Engine mapping.

UNIT IV SENSORS IN AUTOMOBILES

Basic sensor arrangement. Types of sensors – Oxygen sensor, fuel metering/Vehicle speed sensor, mass air flow sensor, temperature sensor, altitude sensor, pressure sensor and detonation sensor. Various actuators and its application in automobiles.

UNIT V MICROPROCESSOR IN AUTOMOBILES

Microprocessor And Microcomputer controlled devices in automobiles such as instrument cluster, Voice warning system, Travel information system, Keyless entry system, Automatic Transmission. Environmental requirements (vibration, Temperature and EMI).

TEXTBOOK:

1. Judge. A.W., Modern Electrical Equipment of Automobiles, Chapman & Hall, London, 1992.
2. William B. Ribbens -Understanding Automotive Electronics, 5th edition- Butter worth Heinemann, 1998
3. Young. A.P., & Griffiths. L., Automobile Electrical Equipment, English Language Book Society & New Press, 1990.

REFERENCES:

1. Vinal. G.W., Storage Batteries, John Wiley & Sons inc., New York, 1985.
2. Crouse.W.H., Automobile Electrical Equipment, McGraw Hill Book Co Inc., New York, 1980.
3. Spreadbury.F.G., Electrical Ignition Equipment, Constable & Co Ltd., London, 1962.
4. Robert N Brady Automotive Computers and Digital Instrumentation, Prentice Hall, Eagle Wood Cliffs, New Jersey, 1988.
5. Kohli P L., “Automotive Electrical Equipment”, Tata McGraw Hill Publishing Co., Delhi,

Course contents

Category	Title	Code	Credits-4C			
DC8	Vehicle Safety & Maintenance	MMAE-203	L	T	P	
			3	1	0	

UNIT I SAFETY CONCEPTS

Design of the body for safety, engine location, deceleration of vehicle inside passenger compartment, deceleration on impact with stationary and movable obstacle, concept of crumple zone, safety sandwich construction. Active safety: driving safety, conditional safety, perceptibility safety, operating safety- passive safety: exterior safety, interior safety, deformation behaviour of vehicle body, speed and acceleration characteristics of passenger compartment on impact.

UNIT II SAFETY EQUIPMENTS

Seat belt, regulations, automatic seat belt tightener system, collapsible steering column, tiltable steering wheel, air bags, electronic system for activating air bags, bumper design for safety, antiskid braking system, regenerative braking system, speed control devices.

UNIT III COLLISION WARNING, COMFORT AND CONVENIENCE SYSTEM

Collision warning system, causes of rear end collision, frontal object detection, rear vehicle object detection system, object detection system with braking system interactions, driver fitness detection. Steering and mirror adjustment, central locking system, Garage door opening system, tyre pressure control system, rain sensor system, environment information system, manual and automated wiper system, satellite control of vehicle operation for safe and fast travel.

UNIT IV MAINTENANCE TOOL, SHOP, SCHEDULE, RECORDS

Standard tool set, torque wrenches, compression and vacuum gauges, engine analyzer and scanner, computerized wheel alignment and balancing, gauges for engine tune up and pollution measurement, spark plug cleaner, cylinder re boring machine, fuel injection calibration machine. Importance of maintenance. Schedule and unscheduled maintenance. Scope of maintenance. Equipment downtime. Vehicle inspection. Reports. Log books. Trip sheet. Lay out and requirements of maintenance shop.

UNIT V POWER PLANT REPAIR AND OVERHAULING

Dismantling of power plant and its components. Cleaning methods. Inspection and checking. Repair and reconditioning methods for all engine components. Maintenance of ignition system, fuel injection system, cooling system, lubrication system. Power plant trouble shooting chart, Maintenance, servicing and repair of clutch, fluid coupling, gearbox, torque converter, propeller shaft. Maintenance of front axle, rear axle, brakes, steering systems. Tyre maintenance.

REFERENCES:

1. Stator Abbey, Automotive steering, braking and suspension overhaul, pitman publishing, London, 1971.
2. Frazee, fledell, Spicer,-Automobile collision Work, American technical publications, Chicago,
3. John Dolce, Fleet maintenance, McGraw Hill, Newyork, 1984
4. A.W.Judge, Maintenance of high speed diesel engines, Chapman Hall Ltd., London, 1956.
5. V.L.Maleev, Diesel Engine operation and maintenance, McGraw Hill Book CO., Newyork,
6. Vehicle servicing manuals.
7. Ernest Venk., Edward spicer, Automotive maintenance and trouble shooting, D.B. Taraporevala Sons, Bombay, 1963
8. S. Abbey, Automotive Transmission servicing and overhaul, Sir Issac Pitman, London, 1971.
9. J.Powloski - "Vehicle Body Engineering" - Business books limited, London –
10. Ronald.K.Jurgen - "Automotive Electronics Handbook" - Second edition- McGraw-Hill Inc.,
11. ARAI Safety standards

Course contents

Category	Title	Code	Credits-4C			
DC9	Automotive Simulation & Testing	MMAE-204	L	T	P	
			3	1	0	

Unit I: INTRODUCTION TO MODELING AND SIMULATION: Modeling and simulation methodology, system modeling, concept of simulation; gaming; static, continuous and discrete event simulation; 3D modeling and dynamic simulation.

Unit II: VERIFICATION AND VALIDATION: Design of simulation experiments, preparation of causal loop diagrams and flow diagrams, validation of experimental models, testing and analysis. Simulation languages comparison and selection, study of simulation software

UNIT III SI ENGINE SIMULATION WITH ADIABATIC COMBUSTION

Introduction, Engine details, temperature drop due to fuel vaporization, full throttle operation, work output and efficiency calculation, part-throttle operation, engine performance at part throttle, super charged operation, SI Engines simulation with progressive combustion

UNIT IV . SI ENGINE SIMULATION WITH GAS EXCHANGE PROCESS

Introduction, gas exchange process, Heat transfer process, friction calculation, compression of simulated values, validation of the computer code, engine performance simulation, pressure crank angle diagram, brake power, brake thermal efficiency, effect of speed on performance, simulation of two stroke SI Engine.

UNIT V SI & CI Engine Testing

Morse Test, Motoring Test, Retardation Test, Willan's Line Method, Engine Indicators, Brake Power Testing, Fuel Consumption Measurement, Air Consumption Measurements, Emission Testing, Flame Temperature Measurement, Performance Parameters and Characteristics of Engines

TEXTBOOK:

1. Benson.R.S., Whitehouse.N.D., "Internal Combustion Engines", Pergamon Press, oxford, 1979
2. Ganesan.V. "Computer Simulation of spark ignition engine process", Universities Press (I) Ltd, Hyderabad, 1996.

REFERENCES

1. Ramoss.A.L., "Modelling of Internal Combustion Engines Processes", McGraw Hill Publishing Co., 1992.
2. Ashley Campbel, "Thermodynamic analysis of combustion engines", John Wiley & Sons, New York, 1986.

Course contents

Category	Title	Code	Credits-4C			
DC10	Automobile Design	MMAE-205	L	T	P	
			3	1	0	

UNIT I

Engineering Design, Steps in Design, Design Process, Properties of Engineering Materials, Standardization & Interchangeability of Machine Elements, Design of major engine components.

UNIT II

Design procedure of theoretical analysis, design considerations, material selection & actual design of components – cylinder block design, cylinder head design & piston pin design, piston ring design, connecting rod design, crank shaft design, flywheel design, design of valve mechanism.

UNIT III

Engine balancing, firing order, longitudinal forces, transverse forces, pitching moments, yawing moments, Engine layout, major critical speed & minor critical speed, design of engine mounting, design of cooling system, design principals of exhaust & inlet systems.

UNIT IV

Determination of engine power. Engine selection, swept volume, stroke, bore& no. of cylinders, arrangement of cylinder stroke to bore ratio, Primary design calculation of major dimensions of fuel injection system.

UNIT V

Basic concepts of CAD: Introduction, Graphics Standards, Two Dimesional transformation, Three Dimesional transformation Three Dimensional Geometric Transformation, Multiple Transformations, Rotation about an arbitrary axis in space, Matrix equations for Orthographic Projection.

Reference Books

1. I.C.Engine & Air pollution – E.F.Obert, Harper& Raw Publishers, New York
2. Engine design – Giles J.G., Lliffe Book Ltd.
3. Engine Desgn – Crouse, Tata Mcgraw Publication, Delhi.
4. I.C.Engine by Maleev V.L., Mcgeaw hill Book, co.
5. I.C.engine – Litchy
6. SAE Handbooks

Course contents

Category	Title	Code	Credits-6C			
DC	Lab III Design Practice	MMAE-206	L	T	P	
			0	0	6	

PRACTICAL /LAB WORK

STUDENT IS REQUIRED TO SUBMIT A JOURNAL/REPORT FOR THE SAME

Design of automobile components:

- 1 Chassis
- 2 Frame
- 3 Axle
- 4 Suspension
- 5 Cylinder
- 6 Piston
- 7 Connecting rod.
- 8 Valves
- 9 Crank shaft
- 10 Cam shaft

REFERENCES:

- 1 Engine design – Giles J.G., Lliffe Book Ltd.
- 2 Engine Desgn – Crouse, Tata Mcgraw Publication, Delhi.
- 3 I.C.Engine by Maleev V.L., Mcgeaw hill Book, co.
- 4 Dean Aaverns, " Automobile Chassis Design ", Illiffe Books Ltd, 1992.
- 5 Richard Stone, "Introduction to Internal Combustion Engines", McMillan. London, 1985.
- 6 Bosch, "Automotive HandBook" 6th edition, SAE, 2004.
- 7 Heldt.P.M., " Automotive Chassis ", Chilton Co., New York, 1992.
- 8 Giles.J.G., Steering, " Suspension and tyres ", Illiffe Books Ltd., London, 1988.

Course contents

Category	Title	Code	Credits-4C			
DC	Lab IV Electrical and Electronics Control	MMAE-207	L	T	P	
			0	0	6	

PRACTICAL /LAB WORK

STUDENT IS REQUIRED TO SUBMIT A JOURNAL/REPORT FOR THE SAME

LIST OF EXPERIMENTS:

1. Timer
2. Seven segment displays
3. Characteristics of load cells
4. Characteristics of thermocouples
5. Characteristics of resistance thermometers
6. Characteristics of piezoelectric pressure transducers
7. Characteristics of LVDT
8. Characteristics of Strain gauges
9. Programming of microprocessor.
10. Programming of microcontroller.
11. Interfacing of microprocessors,
12. Interfacing of micro controllers.

REFERENCES:

- 1 Judge. A.W., Modern Electrical Equipment of Automobiles, Chapman & Hall, London, 1992.
- 2 William B. Ribbens -Understanding Automotive Electronics, 5th edition- Butter worth Heinemann, 1998
- 3 Young. A.P., & Griffiths. L., Automobile Electrical Equipment, English Language Book Society & New Press, 1990.
- 4 Vinal. G.W., Storage Batteries, John Wiley & Sons inc., New York, 1985.
- 5 Crouse.W.H., Automobile Electrical Equipment, McGraw Hill Book Co Inc., New York, 1980.
- 6 Spreadbury.F.G., Electrical Ignition Equipment, Constable & Co Ltd., London, 1962.
- 7 Robert N Brady Automotive Computers and Digital Instrumentation, Prentice Hall, Eagle Wood Cliffs, New Jersey, 1988.
- 8 Kohli P L., "Automotive Electrical Equipment", Tata McGraw Hill Publishing Co., Delhi, 2004