

6. AUTOMOBILE ENGINEERING

1. **Mechanics:** Statics of Particles, Equilibrium of Particles and Rigid Bodies, Distributed forces, Properties of surfaces and Solids, Kinematics- Kinetics and the Dynamics of particles and rigid bodies, Friction and Element of Rigid Body Dynamics, Impact and Momentum – Basics of Mechanism, Kinematics of Linkage Mechanism, Kinematics of Cam Mechanism, Gears and Gear Trains, Friction and Work principles, Force Analysis, Balancing and Vibration.
2. **Strength of Materials and Design:** Stress and strain, elastic constants, Poisson's ratio; Mohr's circle for plane stress and plane strain; thin cylinders; SFD and BMD; Stresses in Beams; deflection of beams; torsion of circular shafts; columns. Displacement, velocity and acceleration analysis of plane mechanisms; dynamic analysis of linkages; cams, gears and gear trains. Failure theories; fatigue strength and the S-N diagram; design of machine elements such as bolted, riveted and welded joints, shafts, gears, rolling and sliding contact bearings, brakes and clutches.
3. **Thermodynamics:** Basic concepts and First Law, Second Law, Entropy and Availability, Heat pump, Properties of Steam, Air standard cycles, Otto, Diesel and Dual cycles, Air compressors, Rankine cycle, Brayton cycle, Steam Turbines, Gas Turbine – Steam Nozzle, Refrigeration and air Conditioning, Refrigeration Cycles, Refrigerants, System Components, VAR, Psychrometry, Air Conditioning system, Dryness fraction, Fourier law of Conduction, Phase Change Heat Transfer and heat Exchangers, Radiation, Calculations.
4. **Production Technology:** Foundry Technology, Hot and Cold Working, Forging, Principles and Application of Joining Process, Centre Lathe and Special purpose Lathes, Reciprocating Machines, Milling Machines and Gear Cutting, CNC Machine Tools, Part Programming.
5. **Automotive Chassis:** Vehicle frame: Functions, Types. Front axle: Functions, Types. Stub axles: Functions, Types. Front wheel geometry. Condition for true rolling motion. Ackermann and Davis steering mechanisms. Steering systems: Types. Propeller shaft. Universal joints and Constant velocity joints. Hotchkiss drive, torque tube drives. Final drive: Functions, Types. Rear axle: Functions, Types. Differential: Functions, Types. Suspension system: Functions, Types. Wheels and Tyres: Functions, Types. Braking system: Functions, Types. Modern systems: Antilock Braking System, Traction Control System, Electronic Stability Control.
6. **Automotive Transmission:** Construction and operation of different types of clutches – Clutch design. Different types of gear boxes – Gearbox design. Hydrodynamic transmission - Fluid couplings and torque converters. Hydrostatic drive systems – hydraulic pump and motors – Janny hydrostatic drive. Continuously Variable Transmission (CVT) - Electric drives.
7. **Vehicle Body Engineering:** Car, Bus Body Engineering. Commercial Vehicle Body Design. Body optimization techniques for minimum drag. Aerodynamic drag, lift forces and moments. Flow visualization techniques, Wind tunnel. Automotive Ergonomics, Ergonomics in Vehicle Design, styling in automotive design. Anthropometry. Rolling

resistance, cornering properties of tyres. Directional stability of vehicle, spring rate calculation. Vehicle ride model, Load distribution.

8. **Automotive Electrical and Electronics:** Automotive batteries – types, principle, construction, operation, ratings. Starting system – starter motor construction, working and control circuits. Charging system – generation of electrical energy, alternator characteristics and voltage regulation for charging systems. Electronic ignition systems, programmed ignition, distributorless and direct ignition, spark plugs and types of solid-state ignition systems and their operation. Automotive lighting technology – instrument clusters, wiper and washer systems, electric horns. Automotive electronics – semiconductor devices, electronic components, microcontrollers and microprocessor-controlled devices in automobiles, signal processing and data processing. Automotive sensors – position, speed, acceleration/vibration, force/torque, flow meters, gas concentration sensors, EGO (λ), TPS, knock, IAT, MAF and temperature sensors. Automotive actuators – electromechanical and fluid-mechanical actuators and electrical machines. Vehicle networking – data transfer in automotive electronics, network topology, communication protocols, CAN, LIN, bus systems and onboard diagnosis systems.
9. **Pollution and Control:** Effect of emissions on human and environment, governing equations, and Emission formation in SI and CI Engines. Effects of design and operating variables, controlling techniques in SI and CI engines, and constant volume sampling systems. Measurement techniques of HC, CO, NO_x, CO₂, O₂ and Smoke emission. Partial and full Dilution Tunnel, Noise pollution, Sound level meters, SHED test, Indian and global emission standards, drive cycles, and Homologation.
10. **Alternate Fuels:** Properties alcohols, vegetable oils, biogas natural gas LPG and hydrogen as engine fuels methods of using all the fuels in SI and CI engines. Performance, emission and combustion behaviour of the fuels in SI and CI engines. Carbon-Neutral Synfuels, Hydrogen & Ammonia Combustion, high-pressure direct injection and fuel cell (FC) technologies. Next-Generation Biofuels using non-food, lignocellulosic feedstocks and algae. Advanced Combustion Modes for biofuel combustion such as RCCI, HCCI and SPCCI engines. Advanced EV Concepts.

Prof. Anurag Kumar
12/03/2026

HEAD OF THE DEPARTMENT
Professor and Head
Department of Automobile Engineering
Madras Institute of Technology,
Anna University,
Chromepet, Chennai-600 044.