

Syllabus for mechanical/Automobile

Applied mechanics

Concept of engineering mechanics definition of mechanics, statics, dynamics, application of engineering mechanics in practical fields, definition, basic quantities and derived quantities of basic units and derived units, different systems of units, laws of forces, definition of force, measurement of force in SI units, its representation, types of force: point force/concentrated force & uniformly distributed force, effects of force, characteristics of a force, different force systems, free body diagram, equilibrant force and its determination Lami's theorem, concept of moment, moment of a force and units of moment, principle of moment and its applications, definition and concept of friction, types of friction, definition of effort, velocity ratio, mechanical advantage and efficiency of a machine and their relationship, law of machines, simple and compound machine, reversible and self locking machine, effort lost in friction, determination of maximum mechanical advantage and maximum efficiency.

Material science and metallurgy

Classification: metals and non-metals, ferrous and non-ferrous metals and their alloys, composition and uses of cast iron and plain carbon steels, crystalline and non-crystalline structures; unit cells, Bravais space lattices, cubic closed pack structures, coordination number, miller indices, crystallographic planes and directions, composition, properties, and uses of special steels such as high speed steel, stainless steels, silicon steels, heat resistant steels, spring steel, heat treatment: iron-carbon diagram, objectives of heat treatment, iron carbon equilibrium diagram, T-T-T diagram, bearing metals: requisite qualities. Composition, properties and uses of white metal bearing, copper based bearing metals, definition, classification of plastics, composite materials, heat insulating materials, sound insulating materials, protective coating material, smart materials, powder metallurgy and mechanical working of metals.

Principles of thermal engineering

Concept of thermodynamics, heat, temperature, intensive and extensive properties, path, process, system, surroundings, enthalpy, internal energy and thermodynamic work, Boyle's law, Charle's

law, Joule's law, characteristic gas equation, gas constant, laws of thermodynamics, zeroth law of thermodynamics, irreversible process, first law of thermodynamics, second law of thermodynamics, Carnot cycle, Otto cycle, diesel cycle, reciprocating air compressor, centrifugal compressor, rotary air compressor - its types. Working of single stage and double stage compressor and applications, super charging, modes of heat transfer – conduction, convection, radiation, Fourier's law, refrigeration and air conditioning.

Strength of materials

Mechanical properties of materials such as elasticity, plasticity, ductility, brittleness, toughness, hardness, fatigue, malleability, stiffness etc. definition of stress and strain, axial loading, different types of stresses and strains, Hooke's law, stress-strain curve for ductile and brittle material, factor of safety, stress and strain in straight, stepped bars and taper bar of circular cross section, stress and strain on composite section under axial loading, stress and strain due to temperature variations in homogeneous and composite bars, shear load, shear stress and strain, modulus of rigidity, lateral strain, Poisson's ratio, volumetric strain, bulk modulus. Relation between modulus of elasticity, modulus of rigidity and bulk modulus, shear force and bending moment, theory of simple bending, concept of strain energy, determination of slope and deflection by Macaulay's method, moment area of method, pure torsion, torsion equation, springs, helical springs closed coiled and open coiled helical springs subjected to axial load, thin cylinder and spheres, types of rivets joints strength of the riveted joints, efficiency of riveted joints, columns and struts : types of column buckling load, crushing load slenderness ratio. Euler's formula for long columns ends restraints, effective length for different end conditions.

Measurement, instrumentation and control

Definitions and concept of accuracy, precision, calibration, threshold, sensitivity, hysteresis, repeatability, classification of errors, hall effect sensors, transducer conditioning, transducer, introduction to strain gauges, gauge materials, measurement of force, torque, shaft power, speed and acceleration, resistance thermometers, thermocouple, law of thermocouple, pyrometer, electric and electronic comparators- principles. LVDT, pneumatic comparators, angular measurements, bevel protractor, determination of count and measurement of time; definition, types, need of automation, introduction of control system terminology introduction to numerical control, basic concepts of NC, CNC and DNC, vernier calipers, micrometers. Slip gauges, Indian standards of slip gauges, construction and use of instruments for angular measurements: bevel

protector, sine bar, angle gauges, clinometers, measurements of screw threads and gears, limits, fits and tolerances.

Machine element design

Design failure for static loading, brittle and ductile behavior of the materials, causes of failure, maximum principal stress theory, maximum shear stress theory, distortion energy theory, design equation for impact loading, design for cyclic loading, design of shaft, design of key, design of joints, design of screw, nut, bolt and thread, form of thread (ISO), type of nut heads, type of threads and their nomenclature.

Operations management

Operations management defined, history of development, functions of OM, scope & applications of OM, production functions, productivity, factors affecting productivity, measurement of productivity, causes of decrease in productivity, plant location, layout and material handling, definition and scope of work study; areas of application of work study in industry, role of work study in improving productivity, objectives, process symbols, charts and diagrams, application of engineered time standards and work sampling, ergonomics, concept and advantages, production planning and control, process planning, routing, scheduling, dispatching and follow up, routing purpose, route sheets, scheduling, production control in job order, batch type and continuous type of productions, quality control, statistical quality control, process capability, control charts for variables - X and R chart, control chart, for fraction defectives (P CHART), control chart for number of defects (C CHART), concept of ISO 9000, ISO 14000 and TQM, quality circles, plant location and plant layout.

Hydraulics and hydraulic machines

Fluid, types of fluid; properties of fluid its mass density, weight density (specific weight), specific volume, capillarity, specific gravity, viscosity, compressibility, Pressure and its Measurement, Types of fluid flow, continuity equation of flow; Bernoulli's theorem and its applications, Discharge measurement with the help of venture meter, orifice meter and pitot tube, Notches and Weirs Flow through orifices Flow through pipes Description, operation and application of hydraulic machines Concept of a turbine, types of turbines –impulse and reaction. Construction and working of pelton wheel, Francis turbine and Kaplan turbine. Concept of

hydraulic pump. Construction working and operation of reciprocating pump and centrifugal pump.

Garage equipment

Hand tools/measuring tools, classification and use of screw drivers, spanners and wrenches, pliers, hammers, chisels, files, hacksaw, tools for tubes flaring, taps and dies, reamers, feeler gauge, cylinder dial gauge, use of bench grinder, air compressor, hydraulic and electric hoists, fire extinguisher, turning and testing equipment, use of vacuum gauge, compression gauge (pressure gauge), r.p.m. spark plug cleaner and tester, fuel injector tester, fuel consumption tester. Torque wrench, pneumatic wrench piston ring compressor reconditioning/testing equipment for chassis, body construction, brake efficiency tester (chassis dynamometer) or brake testing equipment, jacks – mechanical, hydraulic.

Earth moving equipment

Function, classification, constructional features and applications of the earth moving machinery, description of hoist winch, part lines, hoisting chains, slings, fork-lift truck, cranes, types of rollers, type of engines used for rollers. Chassis, power transmission, steering, braking and other features, function and salient features of pneumatic tools-rock drill, hammer, chipper. Air operated grease gun and spray gun

Motor vehicle act and transport management

Garage location, layout and types, and change work procedure and records, garage stores, insurance of vehicle, driving and highway code, transport management, motor vehicle act.

Automotive engine

Layout and working of an internal combustion engine, constructional details, phenomenon of combustion in CI engines and SI engines, types of auto engine fuels, properties of conventional fuels (petrol and diesel), concept of ignition system, battery ignition system, necessity of cooling system, air cooling, water cooling system, necessity of lubrication, types of lubricants, lubricant rating, oil additives, effect of engine conditions on consumption of lubricant oil, crank case

ventilation, pressure lubrication system, splash lubrication, engine testing & performance, engine pollutants & its control.

Suspension, steering & braking

Suspension system, front axle, power steering - necessity, types, steering mechanism, front wheel geometry-caster, camber, steering axis inclination, toe in and toe out, wheels – types, hub attachment, wheel specification, tyres - classification and types. Construction of pneumatic tyres, composition of covers, tread breaker, bead and casing, comparison of cross-ply and radial-ply tyres. Causes of excessive tyres wear. Tyre care and maintenance. Static and dynamic balance. Tubeless tyres, run flat tyres, retreading of tyres, purpose of brakes, types of brakes- mechanical, hydraulic, power, brake fluid and its characteristics, brake liner, hand brake, antilock brake systems.

Auto electrical and electronics equipment

Batteries, Construction, working, elements, types, materials used, Charging System, dynamo and alternator, Starting System, Ignition System Spark Plugs: Constructional details of spark plugs, Lighting System.

Dynamics of machines

Degree of freedom, types of joints, single slider crank chains and its inversion, four bar chain and its inversion, flywheel, function and type of flywheel, governors and its classification, its effort and power, classification of cams, followers and their classification, power transmission device (belt, rope, chain etc), gear drive, classification of gears, need of balancing , concept of static and dynamics balancing, type of vibration, vibration isolation and transmissibility.

Manufacturing technology

Fits, limits and tolerances and their applications, unilateral and bilateral tolerances, gauges, gauge tolerances, use of micrometer, vernier, height gauges, dial comparator, straight edge, surface plate. Metal cutting, metal shear, metal sawing, metal bending processes, Necessity of metallic and non-metallic coatings, patterns, pattern materials, cores and core boxes, core materials, types of moulding, types of moulds, defects in moulds and their remedies, casting defects and their remedies, types of lathes, specifications, description and functions of lathe

parts, feed mechanism, drives and transmission, work holding devices, turning tools, Lathe operation, Shaper,

Design of automotive parts

Designing of IC engine parts, design of cylinder, piston, connecting rod, crank shafts, cam shaft, valves, rocker arms, design of flat belts, V belts design of pulleys design of chain drives, different types of braking systems, braking materials, design of clutches, types of clutches, function of flywheel, selection of rolling contact bearing.

Entrepreneurship development and management

Schemes of assistance by entrepreneurial support agencies at national, state, district level: NSIC, NRDC, DC:MSME, SIDBI, NABARD, commercial banks, SFC'S TCO, KVIB, DIC, technology business incubator (TBI) and science and technology entrepreneur parks (STEP), market survey and opportunity identification, functions of management: importance and process of planning, organizing, staffing, directing and controlling, principles of management (HENRI FAYOL, F.W. TAYLOR), concept and structure of an organization, qualities and functions of a leader, theories of motivation (MASLOW, HERZBERG, MCGREGOR), human resource management, material and store management, ABC analysis and EOQ, elementary knowledge of income tax, sales tax, excise duty, custom duty and VAT.

CNC Machines and automation

basic concepts of NC, CNC and DNC, introduction to CAM, basic elements of automation, features of NC machines, NC part programming, stepping motor, feedback device, interpolator, control of NC system, CIM, CAD/CAM, concept of mechatronics, robotics and intelligent manufacturing.
