FURTHER DETAILS REGARDING MAIN TOPICS OF PROGRAMME NO. 05/2016 (Item No. 2)

LECTURER IN AUTOMOBILE ENGINEERING (POLYTECHNICS)

TECHNICAL EDUCATION

(CATEGORY No. 427/2012)

Part I : General Knowledge, Current Affairs & Renaissance in Kerala

Salient Features of Indian Constitution

Salient features of the Constitution - Preamble- Its significance and its place in the interpretation of the Constitution.

Fundamental Rights - Directive Principles of State Policy - Relation between Fundamental Rights and Directive Principles - Fundamental Duties.

Executive - Legislature - Judiciary - Both at Union and State Level. - Other Constitutional Authorities.

Centre-State Relations - Legislative - Administrative and Financial.

Services under the Union and the States.

Emergency Provisions.

Amendment Provisions of the Constitution.

Social Welfare Legislations and Programmes

Social Service Legislations like Right to Information Act, Prevention of atrocities against

Women & Children, Food Security Act, Environmental Acts etc. and Social Welfare Programmes like Employment Guarantee Programme, Organ and Blood Donation etc.

RENAISSANCE IN KERALA

Towards A New Society

Introduction to English education - various missionary organisations and their functioning- founding of educational institutions, factories.printing press etc.

Efforts To Reform The Society

(A) Socio-Religious reform Movements

SNDP Yogam, Nair Service Society, Yogakshema Sabha, Sadhu Jana Paripalana Sangham, Vaala Samudaya Parishkarani Sabha, Samathwa Samajam, Islam Dharma Paripalana Sangham, Prathyaksha Raksha Daiva Sabha, Sahodara Prasthanam etc.

(B) Struggles and Social Revolts

Upper cloth revolts.Channar agitation, Vaikom Sathyagraha, Guruvayoor Sathyagraha, Paliyam Sathyagraha. Kuttamkulam Sathyagraha, Temple Entry Proclamation, Temple Entry Act .Malyalee Memorial, Ezhava Memorial etc.

Malabar riots, Civil Disobedience Movement, Abstention movement etc.

Role Of Press In Renaissance
Malayalee, Swadeshabhimani, Vivekodayam, Mithavadi, Swaraj, Malayala Manorama, Bhashaposhini, Mathnubhoomi, Kerala Kaumudi, Samadarsi, Kesari, AI-Ameen, Prabhatham, Yukthivadi, etc

Awakening Through Literature
Novel, Drama, Poetry, *Purogamana Sahithya Prasthanam, Nataka Prashtanam,* Library movement etc

Women And Social Change
Parvathi Nenmenimangalam, Arya Pallam, A V Kuttimalu Amma, Lalitha Prabhu.Akkamma Cheriyan, Anna Chandi, Lalithambika Antharjanam and others

Leaders Of Renaissance
Thycaud Ayya Vaikundar, Sree Narayana Guru, Ayyan Kali.Chattampi Swamikal, Brahmananda Sivayogi, Vagbhadananda, Poikayil Yohannan(Kumara Guru) Dr Palpu, Palakkunnath Abraham Malpan, Mampuram Thangal, Sahodaran Ayyappan, Pandit K P Karuppan, Pampadi John Joseph, Mannathu Padmanabhan, V T Bhattathirippad, Vakkom Abdul Khadar Maulavi, Makthi Thangal, Blessed Elias Kuriakose Chaavra, Barrister G P Pillai, TK Madhavan, Moorkoth Kumaran, C. Krishnan, K P Kesava Menon, Dr.Ayyathan Gopalan, C V Kunjuraman, Kuroor Neelakantan Namboothiripad,
Velukkutty Arayan, K P Vellon, P K Chathan Master, K Kelappan, P. Krishna Pillai, A K Gopalan, T R Krishnaswami Iyer, C Kesavan. Swami Ananda Theerthan , M C Joseph, Kuttippuzha Krishnapillai and others

Literary Figures
Kodungallur Kunhikkuttan Thampuran, KeralaVarma Valiyakoyi Thampuran, Kandathil Varghese Mappila. Kumaran Asan, Vallathol Narayana Menon, Ulloor S Parameswara Iyer, G Sankara Kurup, Changampuzha Krishna Pillai, Chandu Menon, Vaikom Muhammad Basheer. Kesav Dev, Thakazhi Sivasankara Pillai, Ponkunnam Varky, S K Pottakkad and others

GENERAL KNOWLEDGE AND CURRENT AFFAIRS
General Knowledge and Current Affairs

Part II (a): Technical Mathematics

I. Matrices – Identification of Matrices, matrix operations, adjoint and inverse.

II. Determinants – Evaluation of second and third order, minors and cofactors, solutions of simultaneous linear equation in three unknown using Cramer's rule.

III. Binomial Series – Expansions using Binomial theorem.

IV. Trigonometric functions – Signs of functions in each quadrant. Trigonometric values of angles, properties of trigonometric functions, applications of the identities sin (A ± B), cos (A ± B) and tan (A ± B).

V. Coordinate geometry – Equations to a straight line – slope-intercept form, intercept form, Angle between two lines, condition for two lines to be perpendicular, parallel.

VI. Differentiation – Limits and continuity, derivatives of functions, equation to tangents and normals. Maxima and minima of functions of one variable.

VII. Integration of functions – Integration of different types of functions.

VIII. Applications of integration – Area bounded by a curve and X or Y axis, solutions of differential equations using the method of variable separable, solutions of linear differential equations of first order.

Part II (b): Basic Civil Engineering

Materials: Brick – varieties and strength, characteristics of good brick. Cement – varieties and grade of cement and its uses. Steel – types of steel for reinforcement bars, steel structural sections. Aggregates – types & requirements of good aggregates. Concrete – grades of concrete as per IS code, water cement ratio. Workability, mixing, batching, compaction and curing.

Construction: Parts of building – foundation – types of foundations – spread footing, isolated footing, combined footing, Raft, pile and well foundations. Masonry – types rubble masonry, brick masonry, English bond and Flemish bond. (One brick wall).

Surveying: Chain surveying – principles, instruments, ranging, and chaining survey lines, field work and field book, selection of survey stations, units of land area.

Levelling: Levelling instruments, different types, bench mark, reduced level of points, booking of field notes, reduction of levels by height of collimation method (simple problem). Modern survey – instruments – Total station, Electronics theodolite, Distomat.

Part II (c): Basic Mechanical Engineering

The importance of IC Engines: Definition, classification – two stroke engines, four stroke engines, working of two stroke engines and four stroke engines with the help of line sketches, comparison between two stroke and four stroke engines, comparison between petrol and diesel engines, function of fly wheel, clutch, gearbox, propeller shaft and differential in power transmission, explain with sketch the working of differential, briefly explain power transmission of 4 wheel vehicle with line diagram.

The importance of Power Plants: Introduction, classification of power plants – working of hydroelectric power plant with schematic sketches – working of thermal (Steam and Diesel) power plant with schematic sketches – working of nuclear power plant with schematic sketches.

Part II (d): Basic Electrical Engineering

Review with discussion of electric current, potential difference, power, EMF, resistance and its laws, Ohms law and series parallel circuit, electromagnetism, generation of AC and DC supply.

Idea of Basic electrical circuit: Electrical supply and load and its functioning, division of voltage and current in a parallel and series circuit – simple problems, units of power and energy, solution of DC circuit with calculation of energy consumption in an installation.

Circuit parameters: Resistance, Capacitance and inductance. AC circuit with R, L, C. Simple solution of typical AC circuit with resistance, impedance, power and power factor.

Electrical circuit of an installation: Earthing, lightning protection.

Part II (e): Basic Electronics Engineering

Active and passive devices – review only. LED – working, applications, comparison of LED lighting and CFL lighting. Full wave rectifier – diagram and explanation, 5 V power supply – with bridge rectifier and 7805. SMPS – block diagram and advantages. Integrated circuits. SMDs – advantages. Static electricity – precautions in handling electronic circuits.

Switches: ON / OFF, push to ON, push to OFF, push to ON / OFF, SPST, SPDT, DPDT. Working and application of limit switches, proximity switches, relays.

Microcontrollers: Simple block diagram of 8 bit microcontrollers – application.

Mobile technology: CDMA and GSM. Compare – 2G and 3G technologies.

Inverter & UPS: Block diagram. Compare – inverter and UPS. Online and off line UPS – differentiate. Battery selection for UPS and inverter.

E-waste: Health hazards of e-waste.

Part III

Module I: Automobile Power Plant

Constructional Details of I. C. Engines: Cylinder block – Single cylinder and multi-cylinder, materials, Water jackets – cooling fins, cylinder liners – wet type and dry type – materials. Cylinder head – Materials, method of fixing the cylinder block, cylinder head gasket, combustion chamber of petrol engines – expansion chambers Pistons – Trunk type pistons, composite pistons – piston materials expansion control in pistons – methods and types of piston, Piston rings – Materials, method of manufacture, types of rings – compression ring, oil ring and special purpose ring. Gudgeon pin – Types of fastening, material used Connecting rod – Function, materials used big end and small end bearings Crank shaft – different shapes, different crank shaft arrangements Main bearings, Fly wheel functions Types of valves – Poppet, reed valve and disc valve, sodium vapour cooled valves, hydraulic tappet and free valve rotators Classification of engine according to valve arrangement 1-Head, L-Head, T-Head and F-Head engines - Valve operating mechanisms – side cam shaft and over head cam shaft - Inlet and exhaust valve materials, valve timing diagram Cam shaft – functions and drives, cam shaft bearings.

Fuel Systems in Engines ---- Petrol: Different fuel feed systems, A. C. mechanical pump, S U Electrical pump, petrol Filters and air Cleaners, Carburettors, Simple carburettors – parts, principle of working, compensation, mixture strength requirement, modern carburettors, float system, idle and slow speed system, high speed system, Acceleration pump and choke system. Other commercial carburettors, Su, Solex and Solex – Mikuni carburettor. Exhaust system – Manifolds, silencer types, tail pipes etc.

Diesel: Various components in Diesel fuel system – types of fuel injection – air injection and mechanical injection, common rail and unit injection system. Types of combustion chamber in Diesel engines – open, turbulent and pre-combustion chamber etc. Fuel injection – single cylinder and multi cylinder. Distributor type pump, rotary type pumps, Fuel feed pump and hand priming, diesel fuel filters. Governors – purpose, types – mechanical, pneumatic and hydraulic governors, Fuel injectors – single hole, multi hole, pintle and pintox type.

Lubrication and cooling system: Lubrication system : Properties of lubricating oil, different ratings of lubricating oil, types of engine lubrication – wet and dry sump lubrication, splash and pressure feed systems. Oil pumps – gear type, Vane type, plunger type and lobe type, pressure relief valve, oil pressure indicator Oil coolers, oil filters, oil seals, Crank case ventilation – dilution Cooling system : - air and water cooling, thermo-siphon and pump circulation system over cooling, under cooling and optimum cooling – thermostat radiators – types, pressure cap, types of coolants, pump, antifreeze solution, cooling fan – types.

Module II : Autoelectrical systems and equipments

Battery: Introduction, Types of battery. Brief description of lead acid and alkaline cell, Constructional details of lead acid cell, nickel alkaline cell, Active materials of lead acid cell, Chemical action of lead acid cell, Rating of Battery, Capacity of Battery – ampere hour and watt hour, Efficiency Battery – ampere hour and watt hour, Effect of discharge rate on voltage and capacity, Effect of temperature on voltage and capacity, Battery charging, Constant voltage, Constant current. Defects – Effect of overheating, Effect of overcharging, dislocation of active material, sulphation, Internal short circuits, Corrosion / sulphation of terminals. Testing of battery – Polarity test, State of charge, Specific gravity test by hydrometer, high rate discharge test by cell tester, Cadmium test, Lamp test Care and maintenance of battery – Topping up of Battery & other maintenance schedule, Storage of lead acid battery (in dry & wet condition), Maintenance free battery.

Generator and Alternator: Constructional details of automobile dynamo – special features of automobile dynamo, constructional details of alternator – special features of automobile alternator, charging system – Introduction – necessity, Types of regulators – circuit diagram, Cut out, Voltage regulator, current regulator – 3 stage, Electronic voltage regulator in alternators, Starter motor & its drive mechanism, Introduction, Starting of I. C. Engine (Petrol & Diesel) – motor characteristics, Terms like Engine torque – motor torque – cranking speed – motor locked torque etc, starter switch, starter motor – constructional features – special features of automobile starters, Starter Motor Drives, Necessity, Types of starter motor drives – mechanisms of – Bendix drive (inboard & outboard), Over running Clutch, Axial starter (sliding armature), Pre-engaged type

Spark Ignition System: Introduction, Types of ignition system – coil & magneto – study of coil ignition, Component study of ignition system – ignition coil, Contact breaker points, Cam angle, condenser, distributor, Spark plug – types, Spark plug specifications, Spark advance & retard mechanism (centrifugal & vacuum), Magneto ignition system – Low tension & high tension, Rotating armature & rotating magnet type, Polar inductor type C. D. ignition system, Electronic ignition systems, Magnetic pickup type & hall effect sensor type, Transistorized ignition, computer controlled ignition, Distributor-less ignition system.

Lighting system & other electrical accessories: Head light – Reflectors, lenses, Bulbs (constructional features), Dazzle and its avoidance, Focusing of head lamps, Automatic dim & bright circuit, other lights – parking light, side lamp, tail lamp, roof lamp, fog lamp, brake light, dash board light, Types of bulbs – vacuum, gas filled, halogen. Introduction, Electrical fuel pump, electric horn, wind screen wiper – types, constructional features, working, Traffic Indicator – Electrical & Electronic, gauges like, fuel level indicator, oil pressure gauge, temperature gauge, Electrically operated – power window, solenoid operated fuel cut off, wind shield washer, constructional features & working, electronically operated central locking system.

Module III : Automobile Chassis

Chassis: Introduction, constructional details, types of frame, frame for two wheeler, three wheelers and four wheeler, frame sections, bumpers, sub frames, materials used, testing of chassis – Front Axle – Introduction, types – dead & live axle, construction – material – cross section – checking the alignment of front axle, stub axle – different arrangements.

Suspension Systems: Types of front suspension for two, three and four wheeler, air suspension, hydro-elastic suspension, rear suspension system. Types – Introduction to springs and shock absorbing devices, Types leaf coil, springs & their arrangements, Helper spring, spring shackle – shackle pin, Telescopic type shock absorber, Hydraulic, gas filled type, twin tube type, Basic suspension movements – pitching, bouncing, rolling etc.

Steering System & Steering Geometry: Principles of steering, Ackerman, Davis fifth wheel, Steering gear box – types, worm & roller, worm & sector, Re-circulating ball, Rack & pinion, Steering linkages – arrangement – components, Power steering – integral – linkage type, Collapsible type steering column, Wheel alignment – factors affecting wheel alignment.

Brake Systems: Principle of operation, weight transfer principle, types of brakes – mechanical, hydraulic, pneumatic, servo brake, Air brake – vacuum brake – fail safe brake – dual brake – antilock brake, Drum and disc brake system – Internal expanding and externally contracting – Layout of brake system, mechanical components, hydraulic – master cylinder, types – working principle – wheel cylinder – brake bleeding, brake shoe. Air brake – construction details – working – details components – servo brakes – working of servo brake – types, vacuum and air – disc brake – constructional details and working of engine exhaust brake – testing of brake efficiency.

Transmission Systems: Various components in transmission required for a good transmission system, principle of friction clutches – constructional features and working of – single plate dry clutch – diaphragm clutch – cone clutch – centrifugal clutch – semi centrifugal clutch – vacuum clutch – hydraulic clutch – electromagnetic clutch – over running clutches – Multiplate clutch (dry & wet) Fluid fly wheel – clutch disc – constructional details and functions of each part, pressure plate – constructional details and functions of each part, Clutch operating mechanism.

Necessity and functions of gearbox: Gearbox constructional features & working of – Sliding mesh gearbox – Constant mesh gearbox – Synchromesh gearbox – progressive type gearbox – Epicyclic gearbox – Torque converter – Gear selector and shifting mechanism, two wheeler transmissions – Gear drive – chain drive – V matic transmission, CVT & ECVT – Automatic transmission in cars – Introduction of Propeller shaft and universal joint – Torque tube drive – Hotchkiss drive – Variable velocity joints – constant velocity joints – Front wheel drive – differential mechanism – Locking differential – limited slip differential – Rear Axles – types

Wheels & Tyres: Wheels – wire – spoked wheel, disc wheel and alloy cast wheel, composite wheel – wheel specification – Tyres – Tyre specification – Tyre construction (cross sectional details.) – Tubeless tyre – Tyre treads patterns – Inflation pressure and its effects (both over & under inflation) – Factors affecting tyre performance.

Module IV : Fuels and Combustion and Applied Thermodynamics

Fossil and non Fossil Fuels: Properties of SI and CI engine fuels – Properties and performances – LPG, CNG, Alcohol – Hydrogen and Bio-diesel – Bi-fuel and Dual fuel systems – electric cars, hybrid vehicles – fuel cell

Combustion Phenomenon in SI Engines: Stages of combustion in SI engines – the effects of engine variables – ignition lag – flame propagation – abnormal combustion – detonation, pre-ignition & surface ignition.

Combustion Phenomenon in CI Engines: Stages of combustion in CI engines – various air fuel ratios – delay period and variables affecting the delay period – Diesel Knock and its control

Super Charging & Air Conditioning System: Super charging – Effects of super charging. Methods of supercharging and turbo charging. Lean burn engines – Automobile air conditioning system – working – components and their location, Refrigerants, their properties, refrigeration controls

APPLIED THERMODYNAMICS

Thermodynamic Processes: Revision of topics like, thermodynamic system, thermodynamic properties, boundary, state, process, internal energy, flow of work, enthalpy, and entropy, first and second law of thermodynamics. Specific heats at constant volume and at constant pressure. Establish the relation between specific heats and gas constant. Derivation of formulae for work, heat, change in internal energy, relation between pressure, volume and temperature during constant volume, constant pressure, constant temperature, adiabatic and polytropic processes – problems.

Air Standard Cycles: Reversible and irreversible cycle. Available work and energy of a cycle. Theoretical thermal efficiency and air standard efficiency. Pressure-volume diagram and temperature-entropy diagram. Derivation of formulae for air standard efficiency of Carnot cycle, Otto cycle, Diesel cycle – problems to find air standard efficiency.

Power Developed in I. C. Engines: Indicator diagram and measurement of mean effective pressure. Engine indicators. Indicated power, brake power, friction power, indicated thermal efficiency, brake thermal efficiency, volumetric efficiency, specific fuel consumption, Morse test and preparation of heat balance sheet. Air compressors – uses of compressed air, classification of air compressors – working of single stage and multistage air compressors. Intercooler.

Module V: Automobile Service & Maintenance and Transport Management

AUTOMOBILE SERVICE & MAINTENANCE

Introduction to Servicing and Maintenance of Automobiles: Various signs showing the necessity of overhauling engine decarburizing, vacuum test, compression test and cylinder leakage test. Causes of excessive lubricating oil consumption. Engine dismantling and assembling. Checking of engine components – causes of cylinder wear – cylinder rebooting and honing – linear replacement. Servicing of valves. Valve adjustment and defects of valves. Piston defects and reconditioning methods. Testing of connecting rods. Defects and reconditioning methods. Measurement of bearing clearance and adjustment of connecting rod bearings. Crank shaft balancing and machining processes. Renewal of flywheel ring gear.

Servicing of Petrol Engine: Defects in coil ignition system like 'No spark', weak spark, Intermitted spark and spark at some wires. Testing of ignition system components. Setting of ignition timing. Checking of advancing units. Servicing of spark plug. Trouble shooting of fuel system. Testing of A. C. mechanical pump. Tuning of carburettor. Causes of excessive fuel consumption and defects of carburettor. Engine tuning procedure. Servicing of diesel engine – F. I. pump timing and bleeding of diesel fuel system. Testing of Nozzles. Phasing and calibration of F. I. pump. Defects of F. I. Pump and Nozzles. Troubles and diagnosis in MPFI and CRDI systems.

Servicing of Clutch Assembly: Fitting of clutch, clutch adjustments. Removal and refitting of trans-axle. Dismantling of propeller shaft and universal joint. Defects in propeller shaft. Servicing of differential and rear axle. Removal of axles in full floating, semi floating and three quarter floating types. Differential troubles and adjustments. Tube repair. Causes of tyre wear. Tyre rotation, retreading and balancing of wheels.

Servicing of Suspension System: Checking of wheel alignment. Adjustment of torsion bars. Care and maintenance of vibration dampers. Replacement of suspension rubber bushes. Play adjustment in steering gear boxes. Centralizing steering wheel. Troubles in steering system. Brake shoe removal and re-lining. Brake bleeding and adjustment. Servicing of master cylinder and wheel cylinder checking of braking efficiency. Troubles in hydraulic and air brake systems. Periodic and break down

maintenances. Maintenance schedule. Cleaning of vehicle in a service station. Equipment used in a service station.

Vehicle Body Engineering: Car body construction details, major body sections of a passenger car – front section, centre section, rear section, construction types – conventional body over frame, unitised frame and body construction. Fibre reinforced and Metal reinforced body structures. Classification of coach work, coach and bus body styles, typical layout of bus and coach body, typical layout of commercial vehicles, vehicle body materials – steel, light alloys, plastics, textiles, glass, wood, aluminium materials, adhesives and their properties, corrosion and their prevention. Hand tool study, power tool and equipment, shop safety, minor repairs – repairing plastics, hood, bumper, fender, lid, and trim service, door, roof, glass service, passenger compartment service Major body repair – frame repair, frame / body damage measurement, frame re-alignment. Paint materials, paint characteristics, refinishing process – paint removal, preparing bare metal, prime coat selection, final sanding, masking, surface cleaning. Spray guns, equipment and material preparation, spray gun setup, spray booth.

TRANSPORT MANAGEMENT

Features of M. V. Act: Definition of terms – test for drivers and conductors – registration of vehicles – duties of drivers and conductors – traffic signs – mode of staffing in a depot – site selection and facilities in a depot – M. T. O. and functional wings – organization chart – type of co-ordination and co-coordinating factors.

Bus Operation: Factors governing bus schedule – making a bus schedule – operating characteristics – trip generation and trip distribution – Number of buses required for operation – preparation of time table for bus and crew – factors governing crew scheduling – making a crew scheduling. Intermediate public transport in Indian cities (IPT) / Para transit, Characteristics of IPT modes, Light rail transit (LRT/Tram), electric trolley bus (ETB), Magnetic levitation (MAGLEV) system, container freight station, Trailer, on flat car, Automatic Guided Vehicle (AGV).
Fare collection – Route planning – Fare structure and table – trip sheet and way bill – ticket system – accident prevention – operational cost – fare methods – fare stage – organization of automotive business – marketing background – functions of marketing activities – workshop management – responsibilities of dealer – duties of workshop staff – warranty, Consignment shipment.

Importance of Roads: Traffic studies and high way planning – Road geometry – width of high way – gradient – cross section of road – super elevation and sight distance – road intersection – traffic lights – location of bus stop, bus bay, zebra crossing and parking positions – traffic census. Insurance surveying – companies – classification of policies – third party insurance – factors involved in assessing – MACT

NOTE: - It may be noted that apart from the topics detailed above, questions from other topics prescribed for the educational qualification of the post may also appear in the question paper. There is no undertaking that all the topics above may be covered in the question paper.