ANNEXURE-II - SYLLABUS

ELECTRICAL ENGINEERING

Section –A Total 80 Marks

1.Electrical Materials :

Electrical Engineering Materials, crystal structures and defects, ceramic materials, insulating materials, magnetic materials– basics, properties and applications; ferrites, ferro-magnetic materials and components; basics of solid state physics, conductors; Photo-conductivity; Basics of Nano materials and Superconductors.

2. Electric Circuits and Fields:

Circuit elements, network graph, KCL, KVL, Node and Mesh analysis, ideal current and voltage sources, Thevenin's, Norton's, Superposition and Maximum Power Transfer theorems, transient response of DC and AC networks, Sinusoidal steady state analysis, basic filter concepts, two-port networks, three phase circuits, resonance, Magnetically coupled circuits, Gauss Theorem, electric field and potential due to point, line, plane and spherical charge distributions, Ampere's and Biot-Savart's laws; inductance, dielectrics, capacitance; Maxwell's equations.

3. Electrical and Electronics Measurements:

Principles of measurement, accuracy, precision and standards; Bridges and potentiometers; moving coil, moving iron, dynamometer and induction type instruments, measurement of voltage, current, power, energy and power factor, instrument transformers, digital voltmeters and multi-meters, phase, time and frequency measurement, Q-meters, oscilloscopes, potentiometric recorders, error analysis, Basics of sensors, Transducers, basics of data acquisition systems.

4.Analog and Digital Electronics:

Operational amplifiers – characteristics and applications, combinational and sequential logic circuits, multiplexers, multi- vibrators, sample and hold circuits, A/D and D/A converters, basics of filter circuits and applications, simple active filters; Microprocessor basics- interfaces and applications, basics of linear integrated circuits; Analog communication basics, Modulation and de-modulation, noise and bandwidth, transmitters and receivers, signal to noise ratio, digital communication basics, sampling, quantizing, coding, frequency and time domain multiplexing, power line carrier communication systems.

5. Systems and Signal Processing:

Representation of continuous and discrete-time signals, shifting and scaling operations, linear, time-invariant and causal systems, Fourier series representation of continuous periodic signals, sampling theorem, Fourier and Laplace transforms, Z transforms, Discrete Fourier transform, FFT, linear convolution, discrete cosine transform, FIR filter, IIR filter, bilinear transformation.

6.Control Systems:

Modeling of physical systems, Principles of feedback, transfer function, block diagrams and signal flow graphs, steady-state errors, transforms and their applications; Routh-hurwitz criterion, Nyquist techniques, Bode plots, root loci, lag, lead and lead-lag compensation, stability analysis, transient and frequency response analysis, state space model, state transition matrix, controllability and observability, linear state variable feedback, PID and industrial controllers.

7.Electrical Machines:

Single phase transformers, three phase transformers - connections, parallel operation, auto-transformer, energy conversion principles, DC machines - types, windings, generator characteristics, armature reaction and commutation, methods of excitation, starting and speed control of motors, Induction motors - principles, types, performance characteristics, starting and speed control, Synchronous machines - performance, regulation, parallel operation of generators, motor starting, characteristics and applications, servo and stepper motors.

8. Power Systems:

AC and DC transmission concepts, transmission line models and performance, cable performance, insulation, corona and radio interference, power factor correction, Per unit quantities, symmetrical components, analysis of symmetrical and unsymmetrical faults, Switchgear Protection: Principles of over current, differential and distance protections, various types of circuit breakers and their functions, Relays, Protection for Generator, Transformers, feeder and Bus bars, Grounding, Protection against Over Voltages. functions of Radial and ring-main distribution systems, concept of power system stability, swing curves and equal area criterion. Power System Operation & Control, Matrix representation of power systems, load flow analysis, voltage control and economic operation, HVDC transmission and FACTS concepts, Concepts of power system dynamics, smart grid concepts. Batteries and battery chargers.

09. Power Plant Engineering:

Basic power generation concepts, Steam Power Plants with Sub- critical, critical and super critical technology, Combustion Process, Gas Turbine Plant, Direct Energy Conservation, Hydro Electric Power Plant , nuclear & Power from Non-conventional sources, Introduction to Quality management and Environmental protection. Power plant economics-Capital cost, Investment of fixed charges, operating cost, arrangements for power distribution, load curves, connected load, maximum demand, demand factor, average load, load factor, diversity factor, Environmental considerations- Effluents from Power Plants and impact of environment, Pollution and pollution standards-Methods of pollution control , Power plant components-their theory and design, types and applications.

10. Power Electronics and Drives:

Basics of Semiconductor diodes and transistors and characteristics, Junction and field effect transistors (BJT, FET and MOSFETS), Triacs, GTOs and IGBTs - static characteristics and principles of operation, triggering circuits, phase control rectifiers, bridge converters - fully controlled and half controlled, principles of choppers and inverters, basic concepts of adjustable speed DC and AC drives, DC-DC switched mode converters, DC-AC switched mode converters, resonant converters, high frequency inductors and transformers, power supplies.

11. Thermodynamics:

Thermodynamic systems and processes; properties of pure substance; Zeroth, First and Second Laws of Thermodynamics; Entropy, Irreversibility and availability; analysis of thermodynamic cycles related to energy conversion: Rankine, modified Rankine, Otto, Diesel and Dual Cycles; ideal and real gases; compressibility factor; Gas mixtures.

12. Heat-Transfer:

Modes of heat transfer; one dimensional heat conduction, resistance concept and electrical analogy, heat transfer through fins; unsteady heat conduction, lumped parameter system, Heisler's charts; thermal boundary layer, dimensionless parameters in free and forced convective heat transfer, heat transfer correlations for flow over flat plates and through pipes, effect of turbulence; heat exchanger performance, LMTD and NTU methods; radiative heat transfer, Stefan- Boltzmann law, Wien's displacement law, black and grey surfaces, view factors, radiation network analysis.

Section –B Total 20 Marks.

General Awareness and Numerical Ability:

i) Analytical & Numerical Ability
ii) General Awareness
iii) English
iv) Telangana Culture, Movement. Post formation development of Telangana State.
v) Basic knowledge of Computer for handling office works such as MS Office etc.

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MECHANICAL ENGINEERING

Section –A Total 80 Marks

1.Engineering Mechanics:

Free-body diagrams and equilibrium; friction and its applications including rolling friction, belt-pulley, brakes, clutches, screw jack, wedge, vehicles, etc.; trusses and frames; virtual work; kinematics and dynamics of rigid bodies in plane motion; impulse and momentum (linear and angular) and energy formulations; Lagrange's equation.

2.Mechanics of Materials:

Stress and strain, elastic constants, Poisson's ratio; Mohr's circle for plane stress and plane strain; thin cylinders; shear force and bending moment diagrams; bending and shear stresses; concept of shear centre; deflection of beams; torsion of circular shafts; Euler's theory of columns; energy methods; thermal stresses; strain gauges and rosettes; testing of materials with universal testing machine; testing of hardness and impact strength.

3.Theory of Machines:

Displacement, velocity and acceleration analysis of plane mechanisms; dynamic analysis of linkages; cams; gears and gear trains; flywheels and governors; balancing of reciprocating and rotating masses; gyroscope.

4. Vibrations:

Free and forced vibration of single degree of freedom systems, effect of damping; vibration isolation; resonance; critical speeds of shafts.

5. Thermodynamics:

Thermodynamic systems and processes; properties of pure substance; Zeroth, First and Second Laws of Thermodynamics; Entropy, Irreversibility and availability; analysis of thermodynamic cycles related to energy conversion: Rankine, modified Rankine, Otto, Diesel and Dual Cycles; ideal and real gases; compressibility factor; Gas mixtures.

6. Fluid Mechanics:

Fluid properties; fluid statics, forces on submerged bodies, stability of floating bodies; control-volume analysis of mass, momentum and energy; fluid acceleration; differential equations of continuity and momentum; Bernoulli's equation; dimensional analysis; viscous flow of incompressible fluids, boundary layer, elementary turbulent flow, flow through pipes, head losses in pipes, bends and fittings; basics of compressible fluid flow.

7. Heat-Transfer:

Modes of heat transfer; one dimensional heat conduction, resistance concept and electrical analogy, heat transfer through fins; unsteady heat conduction, lumped parameter system, Heisler's charts; thermal boundary layer, dimensionless parameters in free and forced convective heat transfer, heat transfer correlations for flow over flat plates and through pipes, effect of turbulence; heat exchanger performance, LMTD and NTU methods; radiative heat transfer, Stefan- Boltzmann law, Wien's displacement law, black and grey surfaces, view factors, radiation network analysis.

8. Engineering Materials:

Structure and properties of engineering materials, phase diagrams, heat treatment, stress-strain diagrams for engineering materials.

9. Casting, Forming and Joining Processes:

Different types of castings, design of patterns, moulds and cores; solidification and cooling; riser and gating design. Plastic deformation and yield criteria; fundamentals of hot and cold working processes; load estimation for bulk (forging, rolling, extrusion, drawing) and sheet (shearing, deep drawing, bending) metal forming processes; principles of powder metallurgy. Principles of welding, brazing, soldering and adhesive bonding.

10. Machining and Machine Tool Operations:

Mechanics of machining; basic machine tools; single and multi-point cutting tools, tool geometry and materials, tool life and wear; economics of machining; principles of non-traditional machining processes; principles of work holding, jigs and fixtures; abrasive machining processes; NC/CNC machines and CNC programming.

11. Metrology and Inspection:

Limits, fits and tolerances; linear and angular measurements; comparators; interferometry; form and finish measurement; alignment and testing methods; tolerance analysis in manufacturing and assembly; concepts of coordinate-measuring machine (CMM).

12. Computer Integrated Manufacturing:

Basic concepts of CAD/CAM and their integration tools; additive manufacturing.

13. Production Planning and Control:

Forecasting models, aggregate production planning, scheduling, materials requirement planning; lean manufacturing.

14. Inventory Control:

Deterministic models; safety stock inventory control systems.

15. Operations Research:

Linear programming, simplex method, transportation, assignment, network flow models, simple queuing models, PERT and CPM.

16. IC Engines, Refrigeration and Air conditioning:

SI and CI Engines, Engine Systems and Components, Performance characteristics and testing of IC Engines; Fuels; Emissions and Emission Control. Vapour compression refrigeration, Refrigerants and Working cycles, Compressors, Condensers, Evaporators and Expansion devices, other types of refrigeration systems like Vapour Absorption, Vapour jet, thermoelectric and Vortex tube refrigeration. Psychometric properties and processes, Comfort chart, Comfort and industrial air conditioning, Load calculations and Heat pumps.

17. Power Plant Engineering:

Basic power generation concepts, Steam Power Plants with Sub- critical, critical and super critical technology, Combustion Process, Gas Turbine Plant, Direct Energy Conservation, Hydro Electric Power Plant, nuclear & Power from Non-conventional sources, Power plant economics-Capital cost, Investment of fixed charges, operating cost, arrangements for power distribution, load curves, connected load, maximum demand, demand factor, average load, load factor, diversity factor, Environmental considerations- Effluents from Power Plants and impact of environment, Pollution

and pollution standards-Methods of pollution control , Power plant components-their theory and design, types and applications.

18. Design of Machine Elements:

Design for static and dynamic loading; failure theories; fatigue strength and the S-N diagram; principles of the design of machine elements such as riveted, welded and bolted joints. Shafts, Spur gears, rolling and sliding contact bearings, Brakes and clutches, flywheels.

19.Basic Electrical Engineering:

Electrical Circuits-Basics, Ohm's Law, Kirchhoff' Law, Inductive & Capacitive Networks, Series & Parallel Circuits, Star & Delta Transformers, Instruments-Basic Principles of indicating instruments, PMMC & Moving Iron Instruments, DC Machines-DC Generator, DC motors and their applications, Transformers-Operation, EMF Equation, Losses, efficiency & Regulation, AC Machines-Operation of Synchronous and Induction motors, their Characteristics & applications, Basics of batteries and their uses.

Section –B Total 20 Marks.

General Awareness and Numerical Ability:

i) Analytical & Numerical Ability
ii) General Awareness
iii) English
iv) Telangana Culture, Movement. Post formation development of Telangana State.
v) Basic knowledge of Computer for handling office works such as MS Office etc.

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CIVIL ENGINEERING

Section –A Total 80 Marks

1.Engineering Mechanics:

System of forces, free-body diagrams, equilibrium equations; Internal forces in structures; Frictions and its applications; Centre of mass; Free Vibrations of undamped SDOF system.

2. Solid Mechanics:

Bending moment and shear force in statically determinate beams; Simple stress and strain relationships; Simple bending theory, flexural and shear stresses, shear centre; Uniform torsion, Transformation of stress; buckling of column, combined and direct bending stresses.

3. Structural Analysis:

Statically determinate and indeterminate structures by force/ energy methods; Method of superposition; Analysis of trusses, arches, beams, cables and frames; Displacement methods: Slope deflection and moment distribution methods; Influence lines; Stiffness and flexibility methods of structural analysis.

4. Building Materials & Construction Management:

Stone, Lime, Glass, Plastics, Steel, FRP, Ceramics, Aluminum, Fly Ash, Basic Admixtures, Timber, Bricks and Aggregates: Classification, properties and selection criteria.

Cement: Types, Composition, Properties, Uses, Specifications and various Tests; Lime & Cement Mortars and Concrete: Properties and various Tests; Design of Concrete Mixes: Proportioning of aggregates and methods of mix design.

Construction Management: Types of construction projects; Project planning and network analysis - PERT and CPM; Cost estimation.

5. Fluid Mechanics, Open Channel Flow, Pipe Flow:

Fluid properties; Dimensional Analysis and Modeling; Fluid dynamics including flow kinematics and measurements, CFD Analysis, orifices and mouthpieces, notches and weirs, impact of jets; Flow net; Viscosity, Boundary layer and control, Drag, Lift, Principles in open channel flow, Flow Patterns, Flow controls. Hydraulic jump; Surges; Pipe networks.

6. Hydraulic Machines and Hydro power:

Various pumps, Air vessels, Hydraulic turbines – types, classifications & performance parameters; Power house – classification and layout, storage, pondage, control of supply.

7. Hydrology and Water Resources Engineering:

Hydrological cycle, Ground water hydrology, Well hydrology and related data analysis; Streams and their gauging; River morphology; Flood, drought and their management; Capacity of Reservoirs.

Water Resources Engineering: Multipurpose uses of Water, River basins and their potential; Irrigation systems, water demand assessment; Resources - storages and their yields; Water logging, canal and drainage design, Gravity dams, falls, weirs, Energy dissipaters, barrage Distribution works, Cross drainage works and head-works and their design; Concepts in canal design, construction & maintenance; River training, measurement and analysis of rainfall.

8. Water Supply Engineering:

Sources, Estimation, quality standards and testing of water and their treatment; Rural, Institutional and industrial water supply; Physical, chemical and biological characteristics and sources of water, Pollutants in water and its effects, Estimation of water demand; Drinking water Standards, Water Treatment Plants, Water distribution networks.

9. Waste Water Engineering:

Planning & design of domestic waste water, sewage collection and disposal; Plumbing Systems. Components and layout of sewerage system; Planning & design of Domestic Waste-water disposal system; Sludge management including treatment, disposal and re-use of treated effluents; Industrial waste waters and Effluent Treatment Plants including institutional and industrial sewage management.

10. Solid Waste Management:

Sources & classification of solid wastes along with planning & design of its management system; Disposal system, Beneficial aspects of wastes and Utilization by Civil Engineers.

11. Air Pollution:

Types of pollutants, their sources and impacts, air pollution control, air quality standards, Air quality Index and limits.

12. Geo-technical Engineering:

Soil exploration - planning & methods, Properties of soil, classification, various tests and inter- relationships; Permeability, Capillarity & Seepage, Compressibility, consolidation and Shearing resistance, Earth pressure theories and stress distribution in soil; Properties and uses of geo-synthetics.

13. Foundation Engineering:

Types of foundations & selection criteria, bearing capacity, settlement analysis, design and testing of shallow & deep foundations; Slope stability analysis, Earthen embankments, Dams and Earth retaining structures: types, analysis and design, Principles of ground modifications.

14. Surveying:

Classification of surveys, various methodologies, instruments & analysis of measurement of distances, elevation and directions; Field astronomy, Global Positioning System; Map preparation; Photogrammetry; Remote sensing concepts; Survey Layout for culverts, canals, bridges, road/railway alignment and buildings, Setting out of Curves.

15. Transportation Engineering:

Highways - Planning & construction methodology, Alignment and geometric design; Traffic Surveys and Controls; Principles of Flexible and Rigid pavements design.

Tunneling - Alignment, methods of construction, disposal of muck, drainage, lighting and ventilation. Railway Systems – Terminology, Planning, designs and maintenance practices; track modernization. Harbors – Terminology, layouts and planning.

16. Design of Steel Structures:

Principles of Working Stress methods, Design of tension and compression members, Design of beams and beam column connections, built-up sections, Girders, Industrial roofs, Riveted and welded joints, Principles of Ultimate load design.

17. Design of Concrete and Masonry structures:

Limit state design for bending, shear, axial compression and combined forces; Design of beams, Slabs, Lintels, Foundations, Retaining walls, Tanks, Staircases; Principles of pre-stressed concrete design including materials and methods; Earthquake resistant design of structures; Design of Masonry Structure.

18. Power Plant Engineering:

Basic power generation concepts, Steam Power Plants with Sub- critical, critical and super critical technology, Combustion Process, Gas Turbine Plant, Direct Energy Conservation, Hydro Electric Power Plant, nuclear & Power from Non-conventional sources, Power plant economics-Capital cost, Investment of fixed charges, operating cost, arrangements for power distribution, load curves, connected load, maximum demand, demand factor, average load, load factor, diversity factor, Environmental considerations- Effluents from Power Plants and impact of environment, Pollution and pollution standards-Methods of pollution control , Power plant components-their theory and design, types and applications, Basics of batteries and their uses.

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ELECTRONICS ENGINEERING

Section –A Total 80 Marks

1.Networks, Signals and Systems:

Circuit analysis: KCL, KVL, Node and mesh analysis, superposition, Thevenin's theorem, Norton's theorem, reciprocity.

Sinusoidal steady state analysis: phasors, complex power, maximum power transfer. Time and frequency domain analysis of linear circuits: RL, RC and RLC circuits, solution of network equations using Laplace transform. Linear 2-port network parameters, wye-delta transformation.

Continuous-time signals: Fourier series and Fourier transform, sampling theorem and applications.

Discrete-time signals: DTFT, DFT, z-transform, discrete-time processing of continuous-time signals. LTI systems: definition and properties, causality, stability, impulse response, convolution, poles and zeroes, frequency response, group delay, phase delay.

2. Electronic Devices:

Energy bands in intrinsic and extrinsic semiconductors, equilibrium carrier concentration, direct and indirect band-gap semiconductors.

Carrier transport: diffusion current, drift current, mobility and resistivity, generation and recombination of carriers, Poisson and continuity equations. P-N junction, Zener diode, BJT, MOS capacitor, MOSFET, LED, solar cell, Laser, photo diode, Photo-resister and their characteristics, Basics of Fiber Optics.

3.Analog Circuits:

Diode circuits: clipping, clamping and rectifiers. BJT and MOSFET amplifiers: biasing, accoupling, small signal analysis, frequency response. Current mirrors and differential amplifiers.

Op-amp circuits: Amplifiers, summers, differentiators, integrators, active filters, Schmitt triggers and oscillators.

4. Digital Circuits:

Number representations: binary, integer and floating-point-numbers.

Combinatorial circuits: Boolean algebra, minimization of functions using Boolean identities and Karnaughmap, logic gates and their static CMOS implementations, arithmetic circuits, code converters, multiplexers, decoders.

Sequential circuits: latches and flip-flops, counters, shift-registers, finite state machines, propagation delay, setup and hold time, critical path delay. Data converters: sample and hold circuits, ADCs and DACs.

Semiconductor memories: ROM, SRAM, DRAM.

Computer organization: Machine instructions and addressing modes, ALU, data-path and control unit, instruction pipelining.

Microprocessor: 8086/8088 and Micro controller: 8051.

5. Control Sytems:

Basic control system components; Feedback principle; Transfer function; Block diagram representation; Signal flow graph; Transient and steady-state analysis of LTI systems; Frequency response; Routh-Hurwitz and Nyquist stability criteria; Bode and root-locus plots; Lag, lead and lag-lead compensation; State variable model and solution of state equation of LTI systems.

6. Communications:

Random processes: autocorrelation and power spectral density, properties of white noise, filtering of random signals through LTI systems.

Analog communications: Amplitude modulation and demodulation, angle modulation and demodulation, spectra of AM and FM, super heterodyne receivers.

Information theory: Entropy, mutual information and channel capacity theorem.

Digital communications: PCM, DPCM, digital modulation schemes (ASK, PSK, FSK, QAM), bandwidth, inter-symbol interference, MAP, ML detection, matched filter receiver, SNR and BER. Fundamentals of error correction, Hamming codes, CRC.

7. Electro magnetics:

Maxwell's equations: differential and integral forms and their interpretation, boundary conditions, wave equation, Poynting vector.

Plane waves and properties: reflection and refraction, polarization, phase and group velocity, propagation through various media, skin depth.

Transmission lines: equations, characteristic impedance, impedance matching, impedance transformation, S-parameters, Smith chart. Rectangular and circular waveguides, light propagation in optical fibers, dipole and monopole antennas, linear antenna arrays.

8. Basic Electrical Engineering:

Electro-magnetism, Faraday's & Lenz's laws, induced EMF and its uses; Single-phase AC circuits; Transformers, efficiency; Basics-DC machines, induction machines, and synchronous machines , Basics of batteries and their uses.

9. Materials Science:

Electrical Engineering materials; Crystal structure & defects; Ceramic materials-structures, composites, processing and uses; Insulating laminates for electronics, structures, properties and uses; Magnetic materials, basics, classification, ferrites, ferro/para-magnetic materials and components; Nano materials-basics, preparation, purification, sintering, nano particles and uses; Nano-optical/magnetic/electronic materials and uses; Superconductivity, uses.

10. Power Plant Engineering:

Basic power generation concepts, Steam Power Plants with Sub- critical, critical and super critical technology, Combustion Process, Gas Turbine Plant, Direct Energy Conservation, Hydro Electric Power Plant, nuclear & Power from Non-conventional sources, Power plant economics-Capital cost, Investment of fixed charges, operating cost, arrangements for power distribution, load curves, connected load, maximum demand, demand factor, average load, load factor, diversity factor, Environmental considerations- Effluents from Power Plants and impact of environment, Pollution and pollution standards-Methods of pollution control, Power plant components-their theory and design, types and applications.

11. Electrical & Electronic Measurements:

Static and dynamic characteristics of Measurement Systems. Error and uncertainty analysis. Statistical analysis of data and curve fitting. Bridges and potentiometers, measurement of R, L and C. Measurements of voltage, current, power, power factor and energy. A.C & D.C current probes. Extension of instrument ranges. Q-meter and waveform analyzer. Digital voltmeter and multi meter. Time, phase and frequency measurements. Cathode Ray Oscilloscope. Serial and parallel communication. Shielding and grounding. Transducers and their applications to the measurement of non-electrical quantities like temperature, pressure, strain, displacement liquid level. Measurement of pH, conductivity, viscosity and humidity.

Section –B Total 20 Marks.

General Awareness and Numerical Ability:

i) Analytical & Numerical Ability
ii) General Awareness
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