### ANNEXURE – II

NOTIFICATION NO.09/2018

SCHEME AND SYLLABUS FOR RECRUITMENT TO THE POSTS OF ASSISTANT EXECUTIVE ENGINEERS IN VARIOUS ENGINEERING SERVICE

SCHEME FOR SCREENING TEST

WRITTEN EXAMINATION (OBJECTIVE TYPE)

BACHELOR’S DEGREE STANDARD

<table>
<thead>
<tr>
<th>S.No</th>
<th>Paper</th>
<th>Subject/Branch</th>
<th>Marks</th>
<th>No.of Questions</th>
<th>Total</th>
<th>Duration of time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Part-A</td>
<td>General Studies &amp; Mental Ability</td>
<td>50 Marks</td>
<td>50 Questions</td>
<td>150 Questions and 150 Marks</td>
<td>150 Minutes</td>
</tr>
<tr>
<td></td>
<td>Part-B</td>
<td>Civil &amp; Mechanical Engineering (Common) (or) Electrical Engineering</td>
<td>100 Marks</td>
<td>100 Questions</td>
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</tbody>
</table>

**NB:** The candidate has to appear for Papers of his / her subject of study at Engg. Degree. i.e B.E / B. Tech (concerned Subject)

1. NEGATIVE MARKS: As per G.O. Ms. No.235 Finance (HR-I, Plg & Policy) Dept., Dt.06/12/2016, for each wrong answer will be penalized with 1/3rd of the marks prescribed for the question.

SYLLABUS FOR SCREENING TEST TO THE POST OF ASSISTANT EXECUTIVE ENGINEERS IN CIVIL, MECHANICAL AND ELECTRICAL ENGINEERING

### PART - A

50 QUESTIONS 50 MARKS

GENERAL STUDIES AND MENTAL ABILITY

1. Events of national and international importance.
2. Current affairs- international, national and regional.
3. General Science and it applications to the day to day life Contemporary developments in Science & Technology and information Technology
4. Social- economic and political history of modern India with emphasis on Andhra Pradesh.
5. Indian polity and governance: constitutional issues, public policy, reforms and e-governance initiatives with specific reference to Andhra Pradesh.
6. Economic development in India since independence with emphasis on Andhra Pradesh.
7. Physical geography of Indian sub-continent and Andhra Pradesh.
9. Sustainable Development and Environmental Protection
10. Logical reasoning, analytical ability and data interpretation.
11. Data Analysis:
   a) Tabulation of data
   b) Visual representation of data
   c) Basic data analysis (Summary Statistics such as mean, median, mode, variance and coefficient of variation) and Interpretation
1. Strength of Material:
Thin & Thick Cylinders and Spherical shells: Thin seamless shells – formula for longitudinal and circumferential stresses and max shear stresses – hoop, longitudinal and volumetric strains – changes in diameter, and volume of thin shells.

2. Fluid Mechanic and Machinery
Fluid dynamics: Surface and body forces – Euler’s and Bernoulli’s equations for flow along a stream line and its applications, momentum equation and its applications. Flow measurement devices – Grass measurement: Venturimeter, Orificemeter, Turbine flow meters, Rotameters; Pressure measurement: Pitot tubes, hot wire/film anemometer, their measurement principles and sources of errors; calibration.
Closed conduit flow: Reynolds experiment – Major and Minor losses in pipes-pipes in series and pipes in parallel-total energy line-hydraulic gradient line, water hammer. Boundary Layer Concepts: Definition, thicknesses, characteristics along thin plate, laminar and turbulent boundary layers boundary layer in transition, separation of boundary layer, submerged objects – Drag and lift.
Hydraulic Directional Control – Check Valves, Shuttle Valves, two- three- and four-Way Directional Control Valves, Directional Control Valve Actuation. Hydraulic Pressure Control – Pressure Relief Valves, Unloading Valves, Pressure Reducing Valves, Sequence Valves,

SYLLABUS FOR SCREENING TEST TO THE POST OF ASSISTANT EXECUTIVE ENGINEERS IN
ELECTRICAL ENGINEERING BRANCH

PART - B


6. 3-Phase Induction Motors: Principle of operation – Cage and Slip ring motors – torque slip characteristics – methods of speed control.


14. Generating Stations: Location and types, types of hydroelectric power stations, layout of a hydro-power plant, types of turbines used – Pumped storage installations – Layout of thermal electric power stations, types of turbines used, condensers, cooling towers, boiler feed pump; energy flow diagram of steam power plant. Nuclear power generation; Nuclear fission – types
of nuclear power reactors – Principle of a fast breeder reactor.


SCHEME FOR THE MAIN EXAMINATION

WRITTEN EXAMINATION (OBJECTIVE TYPE)

BACHELOR’S DEGREE STANDARD

| PAPER 1: General Studies & Mental Ability | 150 Marks | 150 Questions | 150 Minutes |
| PAPER 2: Civil & Mechanical Engineering (Common) | 150 Marks | 150 Questions | 150 Minutes |
| PAPER 2: Electrical Engineering | 150 Marks | 150 Questions | 150 Minutes |
| PAPER 3: Civil Engineering (For Post Code No.1,2,4 & 8) | 150 Marks | 150 Questions | 150 Minutes |
| PAPER 3: Mechanical Engineering (For Post Code No. 5 only) | 150 Marks | 150 Questions | 150 Minutes |
| PAPER 3: Civil & Mechanical Engineering (Common) (For Post Code No. 6 & 7) | 150 Marks | 150 Questions | 150 Minutes |
| PAPER 3: Electrical Engineering (For Post Code No. 3 only) | 150 Marks | 150 Questions | 150 Minutes |
| Total | 450 Marks |

NB: 1. The candidate has to appear for Papers of his / her subject of study at Engg. Degree, i.e. B.E / B. Tech (concerned Subject)
2. In respect of Paper-3, (Post Code No. 6 & 7) the Examination will be conducted in different session.
3. NEGATIVE MARKS: As per G.O. Ms. No.235 Finance (HR-I, Plg & Policy) Dept., Dt.06/12/2016, for each wrong answer will be penalized with 1/3rd of the marks prescribed for the question.
1. Events of national and international importance.
2. Current affairs - international, national and regional.
3. General Science and it applications to the day to day life Contemporary developments in Science & Technology and information Technology.
4. Social- economic and political history of modern India with emphasis on Indian national movement.
5. Indian polity and governance: constitutional issues, public policy, reforms and e-governance initiatives.
6. Economic development in India since independence.
7. Physical geography of India sub-continent.
9. Sustainable Development and Environmental Protection.
10. Logical reasoning, analytical ability and data interpretation.
11. Data Analysis:
   a) Tabulation of data
   b) Visual representation of data
   c) Basic data analysis (Summary Statistics such as mean and variance coefficient of variation etc.) and interpretation.

PAPER 2
COMMON TO CIVIL AND MECHANICAL ENGINEERING
(For Post Codes 1, 2, 4, 5, 6, 7, 8)

1. Strength of Material:
   Forces, moments, Equilibrium: Applying the Equation of Equilibrium, Planar Trusses; Friction.
   Shear Force (S.F) and Bending Moment (B.M): Definition of beam – Types of beams –Concept of shear force and bending moment – S.F and B.M for cantilever, simply-supported and overhanging beams subjected to point loads, U.D.L., Uniformly varying loads and combination of these loads –Point of contraflexure –Relation between S.F., B.M and rate of loading at a section of a beam.
   Shear Stresses: Derivation of formula – Shear stress distribution across various beam sections.
   Principal Stresses and Strains: Stresses on an inclined section of a bar under axial loading – Compound stresses – Normal and tangential stresses on an inclined plane for biaxial stresses – Two perpendicular normal stresses accompanied by a state of simple shear –Mohr’s circle of stresses – Principal stresses and strains – Analytical and graphical solutions. Different theories of Failure: Various theories of failure. Columns and struts – Euler’s column theory – types of end conditions; critical load on the column - derivations – Rankin’s formula for columns. Lifting machines, definitions, Law of machine, study of important lifting machines; virtual work principal.
   Thin & Thick Cylinders and Spherical shells: Thin seamless shells – Formula for longitudinal and circumferential stresses and max shear stresses – hoop, longitudinal and volumetric strains – changes in diameter, and volume of thin shells.

2) Fluid Mechanic and Machinery

1-D flow. Rotational and irrotational motion, Velocity potential, stream function, flow net.

Fluid dynamics: Surface and body forces –Euler’s and Bernoulli’s equations for flow along a stream line and its applications, momentum equation and its applications. Flow measurement devices – Gross measurement: Venturi meter, Orifice meter, Turbine flow meters, Rotameters; Pressure measurement: Pitot tubules, Hot wire/film anemometer, their measurement principles and sources of errors; calibration.

Closed conduit flow: Reynolds experiment - Major and Minor losses in pipes-pipes in series and pipes in parallel-total energy line-hydraulic gradient line, water hammer. Boundary Layer Concepts: Definition, thicknesses, characteristics along thin plate, laminar and turbulent boundary layers boundary layer in transition, separation of boundary layer, submerged objects – Drag and lift.


PAPER-2

ELECTRICAL ENGINEERING
(For Post Code No. 3 only)


6. 3-Phase Induction Motors: Principle of operation – Cage and Slip ring motors – torque slip characteristics – methods of speed control.


1. BUILDING MATERIALS: Timber: Different types and species of structural timber, density – moisture relationship, strength in different directions, defects, preservations, and plywood. Bricks: Types, Indian standard classification, absorption, saturation factor, strength in masonry, influence of mortar strength on masonry strength. Cement: Compounds of different types, setting times, strength. Cement mortar: Ingredients, proportions, water demand, mortars for plastering and masonry. Concrete: Importance of w/c ratio, strength, ingredients including admixtures, workability, testing for strength, mix design methods, non-destructive testing.

2. STRUCTURAL ANALYSIS: General theorems: theorems relating to elastic structures, principles of virtual work, strain energy in elastic structures, complementary energy, Castigliano’s theorem, Betti’s and Maxwell’s reciprocal theorems. Analysis of determinate structures – Deflection of determinate beams by double integration Macaulay’s moment area and conjugate beam methods. Analysis of indeterminate skeletal frames-Moment distribution, Slope deflection, Kani’s, Stiffness and force methods, Energy methods. Plastic analysis of indeterminate beams and simple portal frames.


6. HYDRAULICS, AND WATER RESOURCE ENGINEERING: Open Channel flow: Types of flows - Type of channels – Velocity distribution – Energy and momentum correction factors, uniform flow and calculation of uniform flow, most economical section, Specific energy, critical flow conditions, critical depth computation, Non-Uniform flow: Assumptions and Equation for Gradually varied flow, types of channel bottom slopes, classification of surface profiles, Rapidly varied flow, hydraulic jump, energy dissipation. Hydraulic Similitude: Dimensional analysis-Rayleigh’s method and Buckingham’s pi theorem – Geometric, kinematic and dynamic similarities - dimensionless numbers – model and prototype relations. Distorted and non-distorted models. Hydrological cycle and its components, Precipitation and related data analysis, Evaporation and transpiration; S-hydrograph, Unit hydrographs. Floods and their management, Probable maximum flood; Streams and their gauging; Routing of floods; Capacity of reservoirs. Multipurpose uses of water; Soil-Plant-Water relationships, Irrigation systems, Water demand assessment; Storages and their yields, Ground water yield and well Hydraulics; Water logging, drainage design. Design of rigid boundary canals, Lacey’s and tractive force concepts in canal design, Lining of Canals, Sediment transport in canals, Non-overflow and overflow section of gravity dams and their design, Energy dissipators, tail water rating; Design of head works, Distribution works, Falls, Cross-drainage works, Outlets, River training.


9. SURVEYING AND TRANSPORT ENGINEERING: Classification of surveys, Scales, Accuracy, Measurement of distances, Direct and indirect methods, Optical and electronic devices, Measurement of directions, Prismatic compass, Local attraction, Theodolites, Types, Measurement of elevations, Spirit and trigonometric leveling, Contours, Digital elevation modeling concept, Establishment of control by triangulations and traversing, Measurement and adjustment of observations, Computation of coordinates, Field astronomy, Concept of global positioning system, Map preparation by plane tabling and by photogrammetry, Remote sensing concepts, Map substitutes.


Paper 3
MECHANICAL ENGINEERING
(For Post Code No. 5 only)

1. Thermodynamics
Definition of system & control volume, properties and state of a substance, units of mass, length, time, force, energy and work; Equality of temperature, Zeroth Law; Properties of Pure Substances – Pure substance; phase change and phase equilibrium; properties tables and diagrams; Ideal gas law, deviation from ideal law and compressibility factor; Work & Energy – Definition of work and energy; First Law of Thermodynamics; internal energy, enthalpy and specific heat of gases, liquids and solids; energy analysis of closed system; mass and energy analysis of control volumes; Second law of Thermodynamics – Thermal efficiency and coefficient of performance; Kelvin-Planck and Clausius statements and their equivalence; reversibility and its departure; Carnot cycle; thermodynamic temperature scale; Entropy – Clausius inequality; entropy change for pure substance; entropy generation and principle of entropy increase; entropy change for reversible process; entropy change for ideal gases; Energy – Work potential of energy; reversible work and irreversibility; Second Law efficiency; Energy change of a system; Energy transfer by heat, work and mass; Energy balance for closed system and control volumes; Power & Refrigeration Cycles – Air standard power cycles; Otto Cycle, Diesel Cycle, Stirling & Ericsson Cycle; Brayton Cycle and its variants; Second law analysis of gas power cycles; Rankine Cycle and its variants; Vapour Compression Cycle; Second law analysis of vapour power cycles.

2. Heat Transfer
Steady state conduction in one and two-dimensional systems – one dimensional unsteady state conduction; analytical and numerical methods. Extended surface heat transfer (Fins), Convection: Basic equations, Dimensional analysis, Boundary layers; Forced convections; External and internal flows, correlations, Natural convection and Mixed convection. Design of heat exchangers: LMTD and NTU methods. Radiation heat transfer: Basic laws, properties of surfaces, view factors, network method and enclosure analysis for grey – diffuse enclosures containing transparent media, engineering treatment of gas radiation; boiling and condensation.

3. Refrigeration and Air Conditioning
Refrigerating machines, heat pump, vapour compression system, second law efficiency of vapour compression cycle, refrigerants – selection of a refrigerant; thermodynamic, chemical and physical requirements, substitutes of CFC refrigerants; Multi-stage systems, components of a refrigerant – Compressor, condensers, expansion devices, evaporators; Gas cycle refrigeration; Vapour absorption.

4. Turbomachines
Dimensional analysis – incompressible and compressible fluid analysis, performance characteristics for low and high speed machines, cavitation; 2D Cascades – cascade geometry, flow characteristics, forces, performance, turbine cascades; Axial flow turbines – mean line analysis, velocity vector diagram, thermodynamic analysis, multi-staging and losses per stage of axial turbines; effect of reaction on efficiency, turbine blade cooling; axial compressor – mean line analysis, velocity diagram, thermodynamic analysis, multistage analysis, high Mach number compressors, stall and surge phenomenon; Centrifugal Pumps,
fans and compressors – their definitions and differences, Thermodynamic analysis, diffusion performance, slip factor, Performance analysis, checkup in a compressor; Hydraulic Turbines – Pelton, Francis and Kaplan turbines, cavitation.

5. **Theory of Machines**
   

6. **Machine Design**
   
   Design consideration – limits, fits, tolerances, and standardization, a brief introduction to strength of materials, modes of failure, failure theories, design of shafts under static and fatigue loadings, design of springs – helical, compression, tension, torsional and leaf springs, design of joints – threaded fasteners, preloaded bolt joints, welded and glued joints, design and analysis of sliding and rolling contact bearings, analysis and applications of power screws and couplings, analysis of clutches and brakes, design of belt and chain drives, design of spur and helical gears.

7. **Machine Drawing and Solid Modelling**
   
   Principle of drawing, Introduction to machine drawing, production drawing, assembly drawing, Different sectional views, Fits, limits, tolerances and surface finish. Introduction to computer aided design, fundamentals of computer graphics; geometric modelling of synthetic curves: Hermite, Bezier, B-spline, NURBS. Parametric representation of surfaces: plane, ruled, revolution; Part modelling techniques: wireframe, surface and solid modelling, data representation and exchange formats, geometry and topology. Three-dimensional transformations and projections. Solid modelling of different machine elements. Example, threads, bolts and nuts, welded and riveted joints, shafts, keys, cotter and pin joints; couplings and clutches, springs, belts and pulleys; bearings, gears. Assembly of different components of IC engine.

8. **Engineering Materials**
   
   Concepts of metallurgy and materials science, types of materials (metals, ceramics, polymers, hybrids), material properties (structural and functional), application orientated material design, some case studies: biomaterials, automotive, aerospace, etc. Structure of metals, Determination of structure and chemical composition, concepts of alloys, phase and phase diagrams. Imperfections in crystals-point defects, dislocations and voids, theory of dislocations, strengthening mechanisms, diffusion in solids, heat treatments and phase transformations, mechanical response and microstructure-property relationship.

9. **Manufacturing Science**
   
   Introduction to Manufacturing and its evolution, Net and near-net shape manufacturing; Metal Casting: Solidification of Alloys and its mechanism, Gating System Design and Estimation of Solidification time, Riser Design and Riser Placement, Process Variations, Defects and Product Design; Metal Forming: Mechanism of plastic deformation, fundamentals of plasticity, Introduction to Force equilibrium method, State of Stress and boundary conditions in Upsetting/forging, Rolling, Wire and tube drawing, Extrusion and Deep Drawing, Defects, Load estimation for one plane strain and one axisymmetric bulk deformation processes, Analysis of Deep Drawing and Bending, Introduction to High velocity forming processes; Powder Processing (Metals and Ceramics), Polymer Part Manufacturing, Introduction and properties of polymer melts and Visco-elasticity, Processing of Thermoplastics (Extrusion, Injection Molding, Blow Molding, Rotational Molding) and Thermosets (compression and transfer molding), Tool and product design principles; Rapid Manufacturing; Need for Rapid Prototyping/Rapid Tooling/Rapid Manufacturing, Introduction to Processes for Prototyping, Tooling and Manufacturing; Joining and Welding; Introduction, Solid State and Fusion Joining, Brazing and Soldering, Mechanical and Adhesive Joining, Metal and nonmetal joining; Metrology: Tolerancing (Dimensional and Geometric) principles and their measurements (Geometrical tolerances using point data), Interferometry – principles, flatness testing using optical flat, optical interferometers. Conventional Removal and Finishing Processes: Importance of Material Removal and allied processes, classification; Chip Formation; Types of Chips; Tool Specification: Coordinate and Orthogonal Systems; Mechanics of Metal Cutting; Merchant’s Circle Diagram, Stress, Strain and Strain Rate, determination of Shear Plane Angle; Tool Wear and Tool Life; Variables affecting Tool Life; Practical Machining Operations; Turning, drilling, milling; Finishing Operations; Grinding (MRR estimation, Wheel Specifications, Wheel Wear) and other processes; Economics of machining: Minimum Production Cost Criterion, Maximum Production Rate and Maximum Profit Rate Criteria; Unconventional Removal and Finishing
Processes: Abrasive Jet Machining, Ultrasonic Machining; Electro Discharge Machining; Abrasive Jet Machining; Electron Beam Machining; Laser Beam Machining, Finishing processes (AFM and other variants); Miniaturization and its importance, Micro-Manufacturing Processes (Additive, formative and Removal), Scaling laws with emphasis on micro-Manufacturing.

10. **Computer Integrated Manufacturing**
Current developments in CAD- feature based modeling, design by feature, function, feature linkages, application of feature based models, parametric modeling; Computer Aided Manufacturing; fundamentals of part programming, path generation, post processing and verification; Group Technology, Computer aided process planning (CAPP), computer aided inspection and reverse engineering, manufacturing process simulation, virtual and distributed manufacturing, computer integrated manufacturing.

11. **Industrial Engineering**

12. **Modelling and Simulation**
Introduction to modelling and simulation, introduction to symbolic and numerical computations, degrees of freedom, modelling in dependent and independent coordinates, Lagrange equations, state space formulation, Newton-Raphson method, explicit integrator, implicit integrator, dynamics of constrained mechanical systems as differential algebraic equations, Baumgaartne stabilization, Gauss principle, and inverse problems.

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**Paper-3**

**COMMON TO CIVIL AND MECHANICAL ENGINEERING**

(For Post Code No. 6 & 7)

1. **ENGINEERING DRAWING:**

2. **Environmental science:**
Definition, Scope and Importance – Need for Public Awareness. Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation– Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems - Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources. - Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, - Energy resources: Growing energy needs, renewable and non-renewable energy sources use of alternate energy sources. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification, Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.


5. SOLID WASTE MANAGEMENT: Causes, effects and control measures of urban and industrial wastes. - Role of an individual in prevention of pollution.

6. DISASTER MANAGEMENT: Floods, earthquake, cyclone and landslides.


9. PRINCIPLES OF ELECTRICAL AND ELECTRONIC ENGINEERING:
   iii. P-N Junction Diode - Diode equation, Energy Band diagram, Volt- Ampere characteristic, Temperature dependence, Static and dynamic resistances, Equivalent circuit, Diffusion and Transition Capacitances.
   vi. Rectifiers and Linear ICs: PN junction diode applications as Half wave, full wave and Bridge Rectifiers, characteristics of Op-Amp, Application of Op – Amps (Inverting, Non – Inverting, Differentiator and Integrator).


5. Generating Stations: Location and types, types of hydroelectric power stations, layout of a hydro-power plant, types of turbines used – Pumped storage installations – Layout of thermal electric power stations, types of turbines used, condensers, cooling towers, boiler feed pump; energy flow diagram of steam power plant. Nuclear power generation; nuclear fission – Types of nuclear power reactors – Principle of a fast breeder reactor.


