Scheme of Examination
for the State Engineering Services (Assistant Engineer) Combined
Competitive Examination

1. Scheme of Examination: - The Competitive Examination will be held in two successive stages:-
   (i) Preliminary Examination
   (ii) Main Examination

   (i) Preliminary Examination: the preliminary Examination will consist of two papers, i.e. one
       compulsory paper and one optional paper, which will be of objective type and carry a maximum of
       400 marks in the subjects mentioned in Section ‘A and B’. The Examination is meant to serve as a
       screening test only. The marks obtained in the Preliminary Examination by the candidates who
       are declared qualified for admission to the Main examination will not be counted for determining
       their final order of merit. The number of candidates to be admitted to the main Examination will
       be 15 times the total approximate number of vacancies (category wise) to be filled in the year in
       the various Services and Posts, but in the said range all those candidates who secure the same
       percentage of marks as may be fixed by the Commission for any lower range will be admitted to
       the Main Examination.

   **SECTION – A**

   **COMPULSORY PAPER**

<table>
<thead>
<tr>
<th>Subject</th>
<th>Max Marks</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>General knowledge &amp; General Science</td>
<td>200</td>
<td>2 hrs</td>
</tr>
<tr>
<td>including General knowledge of Rajasthan its Geography, Economy and culture</td>
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   **SECTION – B**

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Name of Optional Paper</th>
<th>Max. Marks</th>
<th>Time</th>
</tr>
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<tbody>
<tr>
<td>1.</td>
<td>Civil Engineering</td>
<td>200</td>
<td>2 hours</td>
</tr>
<tr>
<td>2.</td>
<td>Electrical Engineering</td>
<td>200</td>
<td>2 hours</td>
</tr>
<tr>
<td>3.</td>
<td>Mechanical Engineering</td>
<td>200</td>
<td>2 hours</td>
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<tr>
<td>4.</td>
<td>Agricultural Engineering</td>
<td>200</td>
<td>2 hours</td>
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   (ii) Main examination: - The written examination will consist of the following papers which will be
       conventional type. A candidate must take all the compulsory subjects and any one of the optional subjects
       listed below. Each of the optional subject will have two papers. The time allowed for each paper shall be
       three hours.

   **Compulsory Subject**

   | Paper – I | Hindi          | 100 |
   | Paper – II| Social aspects of Engineering | 100 |

<table>
<thead>
<tr>
<th>Optional Subject</th>
<th>Maximum Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper – III and (Any one subject to opted by a candidate</td>
<td></td>
</tr>
<tr>
<td>Paper – IV of optional subjects. Each subject will have two papers)</td>
<td>200</td>
</tr>
</tbody>
</table>

   **List of optional subjects:-**

   1. Civil Engineering
   2. Electrical Engineering
   3. Mechanical Engineering
   4. Agricultural Engineering

   2. PERSONALITY AND VIVA-VOCE EXAMINATION:-

   (i) Candidates who obtain such minimum qualifying marks in the written test of the Main
       examination as may be fixed by the Commission in their discretion shall be summoned by them
       for interview.
Provided that no candidate who fails to obtain a minimum of 35% marks in each of the two compulsory papers and a minimum of 40% marks in the aggregate shall be called by the Commission for interview which carries 72 marks.

(ii) The Commission shall award marks to each candidate interviewed by them. In interviewing the candidates besides awarding marks in respect of character, personality, address and physique, marks shall also be awarded for the candidate's knowledge of Rajasthani culture. The marks so awarded shall be added to the marks obtained in the written test or the main examination by each such candidate.

(iii) The standard of the papers will be that of Bachelor's Degree level except paper on Hindi which will be of Senior Secondary Level.

(iv) All papers unless specifically required shall be answered either in Hindi or in English, but no candidate shall be permitted to answer any one paper partly in Hindi and partly in English unless specifically allowed to do so.

(v) If a candidate's hand-writing is not easily legible, a deduction will be made on this account from the total marks otherwise accruing to him.

(vi) Credit will be given for orderly, effective and exact expression combined with due economy of words in all subjects of the examination.

(vii) It is obligatory for a candidate to appear in all the compulsory papers and in optional papers.

Syllabus and scope of papers

Preliminary Examination

Compulsory Paper

Paper - General Knowledge and General Science including General Knowledge of Rajasthan – its Geography, Economy and culture:


2. History & Culture: - Land Marks in the political and cultural history of India. Major monuments and literary works. Renaissance, struggle for freedom and national integration. History & Culture of Rajasthan with special reference to:-
   (a) The medieval background.
   (b) Socio-economic life and organisation.
   (c) Freedom movement and political awakening.
   (d) Political integration.
   (e) Dialects and Literature.
   (f) Music, Dance & theatre.
   (g) Religious beliefs, cults, saints, poets, Warrior-saints, Lok Devtas & Lok Deviyan.
   (h) Handicrafts.
   (i) Fairs and Festivals, Customs, Dresses, Ornaments with special reference to Folk & tribal aspects thereof.

3. General Science: - General Science will cover General appreciation and understanding of Science including matters of everyday observations and experiences. Candidates are supposed to be familiar with matters such as electronics tele-communications, Satellites and elements of

5. Geography and Natural Resources: -
   (I) Broad – physical features of the world important places, rivers, mountains, continents, oceans.
   (II) Ecology and wild – life of India.
Optional Paper (Preliminary Examination)

CIVIL ENGINEERING
(Each portion to have roughly equal weightage)

A. ENGINEERING MATERIALS & CONSTRUCTION TECHNOLOGY

B. SURVEYING
Generally adopted Scales, Chain and Compass surveying ; Leveling ; temporary and permanent adjustments of levels and Theodolite. Use of Theodolite, tacheometry, Trigonometrical and Triangulation survey. Traversing and Traverse Adjustment, Contours and contouring, Simple Circular Compound and Transition Curves and their setting out, Theory of erros and survey adjustment. Computations of areas and volumes.

C. SOIL/ GEOTECHNICAL ENGINEERING
Classification of soil as per I.S. code, Field identification tests for soils; water content, specific gravity, voids ratio, porosity, degree saturation; unit weight, density index etc; and their inter – relationship, determinations of various properties of soils as noted above as well as grain size distribution, consistency limits etc.

Soil permeability and its determination in the laboratory and field; Darcy's law, Flow nets, its Characteristics and uses.


Shear strength parameters and their determination Bearing capacity, local and general shear failures, design Criteria for shallow foundation, Plate load test and standerd penetration test. Earth pressures on retaining wall. Stability of simple slopes. Significant depth of exploration, design features of undisturbed sampler.

D. STRUCTURAL MECHANICS
Stress and strains, elastic constants, factor of safety, relation among elastic constants. Bending moment and shear force diagrams for cantilever, simply supported and overhanging, fixed and continuous beams subjected to static loads :- concentrated, uniformly distributed and uniformly varying. Theory of simple bending. Shear Stress, Influence lines.

Deflection of cantilever, simply supported fixed and continuous beams. Determine and Indeterminate structures and frames pin jointed, Plane and space frames.

E. STEEL STRUCTURES

F. REINFORCED CONCRETE STRUCTURES

G. FLUID MECHANICS INCLUDING HYDROLOGY AND IRRIGATION
Hydraulic pressure at a point and its measurement. total pressure and centre of pressure on plane and curved immersed surfaces, Buoyancy. conditions of equilibrium of floating bodies; fluid flow conditions, Bernoulli's, Navier-Stokes, Reynold's equations, flow through orifices venturimeter,
notches and wires, flow through pipes and open channels. Gradually and rapidly varied flow, Dimensional analysis, Momentum and angular momentum principles as applied to fluid in a control volume, applications of jets, Viscous flow, concept of drag, flow through pipes.

Engineering hydrology; Hydrology of floods and drought reservoirs and dams; overflow structures, ground water hydrology. Irrigation: canals, Kennedy's Lacey's theories, Khosla's theories for design of hydraulic structures. Ground water and well irrigation, water logging.

H. PUBLIC HEALTH ENGINEERING

Per capita requirement of water for urban and rural areas, Forecast of population. Sources. Water supply standards of purity of public water supplies with various methods of purification; House drainage system Distribution network with all the ancillaries: system of drainage. Layout of sewerage systems. Primary, secondary treatments, trickling filters, lagoons and other treatment units and their design criteria. Flushing of sewers; sewage treatment; rural water supply and sanitation.

I. HIGHWAY AND BRIDGES

Principles of highway planning; classification of road land width, building line, center line, formation width, terrain classification, pavement width, Camber, longitudinal gradient sight distance, horizontal curve, super elevation, vertical curve, lateral and vertical clearances.


Prime and tack coats, surface dressing, open graded premix carpet, semi dense carpet, build-up spray grout base course, bituminous base binder course. Asphalitic concrete, seal coats, mixed seal surfacing. Penetration macadam base/binder course, full and semi groups.

Traffic Engineering : traffic characteristics, road user characteristics, vehicular characteristics, volume, speed and delay studies origin and destination study, traffic flow characteristics, traffic capacity and parking studies, traffic regulation, traffic control devices, Intersection control.

Alignment: traffic engineering, pave design, paving materials and highway construction and maintenance of different types of roads. Need for highway drainage and arboriculture, types of bridges: choice of type of bridge, economical considerations of fixing spans culverts.

ELECTRICAL ENGINEERING


Instruments, Recording instruments. Measurement of voltage, current, power, power factor, energy, resistance, inductance, capacitance and frequency.

Transducers: strain gauge, LVDT, resistance thermometers, thermistors, piezoelectric. Measurement of non-electrical quantities (Pressure, temperature, flow rate, displacement, velocity, acceleration, strain etc.)

Digital measurements: Digital voltmeters, frequency counter, distortion meter. Telemetry and data transmission: Data recording and display, Data acquisition.


Digital Electronics: Switching circuits and Boolean algebra and logic gates. Memories sample and hold circuits, A/D and D/A converters. Logic circuits including DTL, TTL, ECL, MOS, CMOS, digital IC's (circuits).

Communication: generation and detection of AM and FM noise behaviour of AM and FM systems.


MECHANICAL ENGINEERING

1. Theory of Machines: Kinematic pairs, Kinematic chain, Mechanism and Inversion, Slider-crank chain, Displacement, velocity and acceleration of a point in mechanism and their determination, Coriolis acceleration, Mechanisms for straight line motion. Laws of friction, brakes and dynamometers, types of gears and gears trains. Types of Governors, Governor effort and power, static & dynamic balancing, Longitudinal, transverse and torsional vibration.

3. **Material Science**: Crystal structure, space lattice, crystalline and amorphous solids, Coordination number, Atomic packing factor, determination of crystal structure, imperfection in crystals, mechanism of plastic deformation, work hardening, recrystallization, Heat treatment of steel, Composition, Properties and applications, Common engineering materials, corrosion, Plastics & their properties.

4. **Manufacturing Processes**: Moulding and casting methods, Principle of arc and gas welding, Brazing & soldering, Metal forming processes, Basic machining processes and machine tools, Hot & cold working of metals, Mechanism of metal cutting, geometry of single point cutting tool and tool materials.

5. **Industrial Engineering and Management**: Types of business organization, Principles of management, elements of management, organization charts, elements of costing, Break even analysis, types of budget and budgetary control, Profit & Loss account, balance sheet, motion study, time study, plant layout, material handling, CPM, PERT, Scheduling, dispatching, routing and inventory, Materials management.

6. **Thermodynamics**: Basic concepts of thermodynamics, Laws of thermodynamics and their application to different flow and non-flow systems, Gas power cycles and vapour power cycles.

7. **Heat transfer**: Conduction, convection and radiation phenomenon, Combined modes of heat transfer, Critical insulation, Fins, Non-dimensional numbers applied to heat transfer, Thermal boundary layer, Introduction to two phase heat transfer, Heat exchangers.

8. **Environmental Engineering**: Basic air and refrigeration cycles, Vapour compression refrigeration, Vapour absorption refrigeration, Expansion devices, Refrigerants and their properties, Psychrometric chart and psychrometric processes, Air conditioning for human comfort and comfort chart, Cooling load calculation.


10. **Power Generation**: SI and CI engines, Combustion phenomenon, Fuels, carburetor and injection system, High pressure modern boilers, Steam plant layout and different accessories, Hydro power plant layout, Introduction to nuclear, MHD and biogas power plants, Economics and sharing of load techniques of different plants.

### Agricultural Engineering

1. **Surveying, Leveling and Land Development** - Linear Measurements, different surveying devices and methods, land grading and leveling, contouring and terracing, earth work estimation, land development budgeting.

2. **Soil and Water Conservation** - Precipitation, hydrologic cycle, point rainfall analysis, frequency analysis. Watershed - definition and concept, agricultural watersheds, prediction of peak runoff, factors affecting runoff, hydrograph, concepts of unit and instantaneous hydrographs. Erosion-type and factors associated with erosion, assessment of actual annual soil loss by erosion and its impact on agricultural production and productivity. Erosion control measures on various classes of lands i.e. contour cultivation, strip cropping, terracing, afforestation, pastures etc. Role of vegetation in soil and water conservation, grassed water way and design. Design of gully control measures including permanent structures i.e. chute spillway, drop spillway, drop inlet spillway, retards and stream bank erosion mechanics of wind and water erosion, wind erosion control, water harvesting structures i.e. Khadin, Tanka, Nadi and Anicut.

3. **Irrigation** - Soil-Water- Plant relationship, water requirements of different crops and irrigation scheduling, direct and indirect methods of soil moisture measurements, measurements of irrigation water. Water conveyance and control, design of field channels. Design of irrigation methods, irrigation efficiencies. Drainage - Benefits of drainage, Surface drainage, drainage of flat and sloping lands. Design and layout of surface and sub surface drains, depth and spacing of drains and drainage outlets, installation of drains and drainage wells. Pumps - Construction and performance
characteristics, selection, installation, working principle and maintenance of reciprocating pump, centrifugal pump, turbine pump, submersible pump, propellers, jet and air lift pumps. Water Resources Development and Management: Water resources of India, surface water, ground water, development of irrigation potential, canal irrigation, command area development, on farm development works, aquifer parameters, hydraulics of wells, steady and unsteady flow, well log, construction of wells, well development.

4. **Farm Power and Machinery** – Classification of Internal combustion (IC) engines terminology, Otto diesel cycle, engine components, Fuel supply system, Lubrication system, Cooling system and Governing system, steering system, hydraulic system. Types of tractors, brakes, power transmission system. Traction theory and mechanics of tractor chassis and selection of tractors. Farm Machinery: Tillage, primary and secondary tillage equipment, Selection of sowing and planting equipment and their calibration, Selection and calibration of sprayers and dusters. Principles, selection and operation of harvesting and threshing machinery. Cost analysis of farm equipment and related numerical problems.


6. **Farm electrification and rural housing**: Selection, Installation and general cares of electric motors on farms, selection of wire sizes based on Indian standards. Types of wiring, rural electrification programme. Rural Housing: Building materials and their properties, Design of Beams, Slabs, Columns and foundations, Planning and design of rural houses, farm Roads, village drainage system, waste disposal and sanitary structures, material and cost estimation in construction.