MPSC

Forest Service (Mains)

Previous Year Paper

(Agricultural Engg.) 10 May, 2025

महाराष्ट्र वन सेवा मुख्य परीक्षा - 2024 दिनांक - 10 मे, 2024

2024 **U19**

BOOKLET NO.
100126

Forest Services
Agricultural Engineering

Time Allowed : Three Hours **Maximum Marks : 200**

Medium : English **Type of Paper : Conventional**

Question Paper Specific Instructions

Please read each of the following instructions carefully before attempting questions :

1. There are **EIGHT** questions divided in two Sections, out of which **FIVE** are to be attempted.
2. Questions no. 1 and 5 are compulsory. Out of the remaining questions, THREE are to be attempted choosing at least ONE question from each Section.
3. The number of marks carried by a question/sub question is indicated against it.
4. Keep in mind the word limit indicated in the question if any.
5. Wherever option has been given, only the required number of responses in the serial order attempted shall be assessed. Unless struck off, attempt of a question shall be counted even if attempted partly. Excess responses shall not be assessed and shall be ignored.
6. Candidates are expected to answer all the sub-questions of a question together. If sub-question of a question is attempted elsewhere (after leaving a few page or after attempting another question) the later sub-question shall be overlooked.
7. Any page or portion of the page left blank in the Answer Booklet must be clearly struck off.
8. Unless otherwise mentioned, symbol and notation have their usual standard meanings. Assume suitable data, if necessary and indicate the same clearly.
9. Neat sketches may be drawn, wherever required.
10. The medium of answer should be mentioned on the answer book as claimed in the application and printed on admission card. The answers written in medium other than the authorized medium will not be assessed and no marks will be assigned to them.

Note – 1. Candidates will be allowed to use Scientific (Non-programmable type) calculators.

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P.T.O.

SECTION – A

Q1. Write short notes. Solve **any five** out of seven. **(8×5=40)**

(a) Factors affecting water erosion.

(b) Types of imaging sensor systems.

(c) Performance characteristics of pumps.

(d) Classification of wire fencing.

(e) Biological measures to control soil erosion.

(f) Parshall flume.

(g) Deep litter poultry house.

Q2. (a) What is bench terracing ? What are objectives and limitations of bench terracing ? Give types of bench terraces along with its suitability.

Calculate the cross-sectional area of a parabolic shaped channel, using following information :
Hydraulic radius – 0.21
Slope – 0.2%
Catchment area – 2 ha.
Runoff intensity – 150 mm/h
Runoff coefficient – 0.60
Make rational assumptions if needed. **15**

(b) Discuss in details the basic elements of arial photography image interpretation. **15**

(c) Describe design parameters of border irrigation. What is the area commanded by a field setting a continuous supply of 0.60 m^3/s of water from a canal ? Use following data :

Depth of root zone – 1 m

Irrigation applied at 50% moisture distribution in soil

Water application efficiency – 60%

Peak water use rate – 3.5 mm/day

Assume any other data needed. **10**

Q3. (a) Discuss sprinkler suitability as per crops and soils. List out its advantages and limitations.

Design drip irrigation laterals for citrus plantation on 1 ha. area using following data :

Size of land – 100 m × 100 m

Crop spacing – 6 m × 6 m

Land slope – 0.2% (North to South)

Peak evaporation – 10 mm/day

Static head – 12 m, Equivalent length – 0.35 m per emitter

Wetted area for citrus – 0.25%

Age of orchard – 5 yrs, outlet factor = 0.35

Crop factor – 0.7

Hazen Williams constant for LDPE – 140

Make rational assumptions **15**

P.T.O.

(b) Discuss design considerations in bag storage structures for grains. Design a bag storage structure for storing 200 tonnes of paddy. Make rational assumptions. **15**

(c) What is universal soil loss equation ? How different factors in this equation are determined ? **10**

Q4. (a) Describe different types of check dams along with its suitability. Calculate the storage area required and the height of bund in medium soil having an average slope of 2%. The maximum expected rainfall during the 10 year recurrence interval is 15 cm. The infiltration capacity of the soil of the area is such that 50% of the rainfall is absorbed in the field. The horizontal interval between the contour bunds is 60 m. Assume the slope of seepage line to be 4 : 1 and side slope of bunds as 1.5 : 1. **15**

(b) Discuss causes of water logging in Indian scenario. Design the main open drain with bed slope of 0.1% for a catchment area of 6 sq. km. Using following data :

Drainage coefficient of the area – 70 mm/day

Side slope – 1.5 :1

Maximum permissible velocity – 1 m/s

Value of manning's n – 0.03

Drain depth at outlet should not exceed 1.5 m. **15**

(c) What is slump test on concrete ? Explain its significance in building construction. Describe the classification of the bricks in India. **10**

(f) What are the advantages and disadvantages of concentrating type solar collectors over flat plate collectors ?

(g) i) Define the following properties of agricultural produce.

1) Bulk density

2) Porosity

3) Angle of repose

4) Roundness

ii) Determine the sphericity of an apple using spatial dimensions or three mutually perpendicular axis of fruits as A = 85 mm, B = 58 mm and C = 41 mm.

Q6. (a) What is necessity of seed drill calibration ? Explain the sequential steps followed in seed drill calibration. **15**

(b) How do you classify the windmill ? Explain in detail about construction and operating principle of savonius rotor blades used in the windmill. **15**

(c) How many kg of each of cream having 30% fat and milk having 5% fat will be required to make 1000 kg of mixture having 10% fat ? **10**

Q7. (a) Explain the construction and working principle of screw conveyor . State the formulae to express the capacity and power requirement of screw conveyor with detail notations. Among the two types of conveyors – belt and screw, which type consume more power and why ? **15**

(b) Explain in brief the different instruments used for measurements of temperature. Write the principle of operation of thermocouple. Explain the construction of thermocouple with neat sketch. **15**

SECTION – B

Q5. Solve **any five** out of seven. **(8×5=40)**

(a) Define tillage. State its objectives. Classify implements on the basis how they are attached to the tractors.

(b) Give the classification of gasifiers as per the direction of the gas flow. Explain the working principle of updraft type gasifier with neat sketch.

(c) What do you mean by drying ? Write the formulae used for expressing moisture content on wet basis and dry basis. Two ton of wheat with 22 per cent moisture content on wet basis are to be dried to 13 per cent moisture content on dry basis. Calculate

1) Weight of bone dry matter.

2) Amount of water evaporated.

3) Final weight of grain after drying.

(d) What is Audio-visual aids ? List out its type with examples. Enumerate the advantages of Audio-visual aids.

(e) Differentiate between the followings in brief (Any four).

1) Seed drill and planter

2) Compression ignition and spark ignition engine

3) Two stroke and four stroke engine

4) Spraying and dusting

5) Disc angle and tilt angle of a disc plough.

(c) Explain the following terms with equations.

1) Theoretical field capacity

2) Effective field capacity

3) Field efficiency

Determine the horse power required to pull a four bottom 32 cm plough working to depth of 14 cm. The tractor is operating at a speed of 5.5 kmph. The soil resistance is 0.8 kg/cm^2. **10**

Q8. (a) In a wheat milling experiment, it was found that to grind 4.33 mm sized grains to pass sieve 0.351 mm opening, the power requirement was 8 kw. Calculate the power requirement for milling of wheat using Rittinger's law and Kick's law by the same mill to pass sieve 0.157 mm opening. Feed rate of mill is 200kg/hr. **15**

(b) Justify the following in brief (Any five). **15**

1) Why is the size of rear wheels of tractor larger than the front wheels ?

2) Why is the compression ratio of CI engine higher than the SI engine ?

3) Why do tractor rear wheels have lesser inflation pressure than the front wheels ?

4) Why does the radiator in a tractor cooling system have a pressure cap ?

5) Why is a differential lock provided in a tractor ?

6) Why do tractors have independent break pedals ?

(c) Enlist the factors affecting the biogas production from cattle manure. Explain the construction and working of KVIC type biogas plant using neat diagram. **10**

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