महाराष्ट्र वनसेवा मुख्य परीक्षा - 2012

SOO

2012

AGRICULTURAL ENGINEERING (Optional) 100176

कृषि अभियांत्रिकी (वैकल्पिक)

Time : 3 hours **Maximum Marks : 200**

Note :

(i) *Answer must be written in English.*

(ii) *Question no. **1** is **compulsory**. Of the remaining questions, attempt **any Four** selecting one question from **each** section.*

(iii) *Figure to the **RIGHT** indicates marks of the respective questions.*

(iv) *Number of optional questions upto the prescribed number in the order in which they have been solved will only be assessed. Excess answers will not be assessed.*

(v) *Candidates should not write roll number, any name (including their own), signature, address or any indication of their identity anywhere inside the answer book otherwise they will be penalised.*

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1. Attempt ***any four*** of the following :

(a) (i) A four stroke, four cylinder internal combustion engine was found to develop 22 bhp at 1000 rpm. If the mechanical efficiency is 60%, bore 10 cm and stroke 15 cm, find the mean effective pressure of the cylinder. **5**

(ii) What are the advantages and disadvantages of different sources of farm power. **5**

(b) Determine the peak runoff rate for a return period of 25 years to design a gully control structure in a catchment area of 10 km^2. The slope of the catchment is 0.5%, average runoff coefficient of catchment is 0.45 and longest length of water course is 1000 m. The maximum depth of rainfall during 25 - years return period is as follows : **10**

Rainfall duration (min)	5	10	20	30	40	50	60
Rainfall depth (mm)	20	25	40	70	85	100	115

(c) Derive an expression for estimating the transmissibility of confined aquifer in steady state condition and convert in the form of draw down. **10**

(d) Explain the following :

(i) Multiple effect evaporator **4**

(ii) HTST pasteurisation process for milk **3**

(iii) Spray dryer **3**

(e) (i) What is hydrograph ? How is the hydrograph shape affected by rainfall intensity, duration, distribution, direction and type of storm ? **5**

(ii) Define soil loss and explain Universal Soil Loss Equation (USLE) for predicting the soil loss. **5**

P.T.O.

SECTION - A

2.	(a)	(i)	Discuss scope of farm mechanization in India.	5
		(ii)	Describe tractor drawn disc plogh.	5
		(iii)	Explain the functional units of a mechanical cotton picker.	5
	(b)	(i)	Describe the engine components of a tractor.	5
		(ii)	Explain the transmission system of a wheel type tractor.	5
	(c)	(i)	Describe solar water heater.	5
		(ii)	What is a bio gas plant ? Explain its components.	5
		(iii)	Explain improved stoves.	5
3.	(a)	(i)	Describe the components of a tractor drawn seed drill.	5
		(ii)	Write about sugarcane combine harvester.	5
		(iii)	Explain the various operations performed by a mechanical potato harvester.	5
	(b)	(i)	Write about differential system of a tractor.	5
		(ii)	What are all functional components of a Power tiller.	5
	(c)	(i)	What is a wind mill ? Explain its construction and working principle.	5
		(ii)	Define bio fuel crop and explain its role in energy production.	5
		(iii)	Explain how agricultural and forest residue waste serves as a fuel.	5

SECTION - B

4.	(a)	(i)	Write the procedure to decide the type of terraces to be used.	5
		(ii)	A 15% hilly land is proposed for constructing the bench terrace. Calculate the following parameters of the bench terrace using 2.5 m as vertical interval and 1 : 1 as better slope : (1) width (2) length per hectare (3) earthwork and (4) area lost	5
		(iii)	Explain the design steps of graded terrace.	5
	(b)	(i)	Write the procedure to determine the pond's capacity.	5
		(ii)	List the various modes of failure of permanent structures. Explain the failure due to piping.	5
	(c)	(i)	Define Watershed and Differentiate between small and large watersheds.	5
		(ii)	Define remote sensing and GIS and explain their use in the watershed management.	5
		(iii)	Define the capability and explain the various limitations considered for capability classification.	5

5. (a) (i) Define broad base terrace and write its classification. 5

(ii) Calculate the spacing of graded terrace, assuming the slope of land as 50% and values of 'a' and 'b' as 0.4 and 2 respectively. 5

(iii) Describe the construction and maintenance of terrace system. 5

(b) (i) List the types of failure of earthen dam and describe the hydraulic failure. 5

(ii) Explain the layout of gully control structures. 5

(c) (i) Write the procedure to determine the priority watersheds. 5

(ii) Write the advantages and disadvantages of Arial and satellite photographs. 5

(iii) Define watershed coding and explain its procedure. 5

SECTION - C

6. (a) Write different categories of water measuring devices used on the form. Write necessary precautions in the use of weirs to get reliable results in measurement. What are the advantages of Parshall Flume over weirs ? 15

(b) Design a trapezoidal shaped concreate lined channel to carry a discharge of 100 cumecs at a slope of 25 cm/km, the side slopes of the channel are 1.4 : 1. The value of B may be taken as 0.016. Assume the limiting velocity as 1.5 m/sec. 15

(c) Define drainage and drainage coefficient. Write purpose of providing drainage, also explain need of drainage in arid and semi arid areas. 10

7. (a) Discuss different Techniques of measuring soil moisture in-situ and laboratory. 15

(b) (i) Determine the system capacity for a sprinkler irrigation system to irrigate 16 hectares of wheat crop. Design moisture use rate is 5 mm/day. Gross depth of irrigation is 7.0 cm. Irrigation period is 10 days in a 12 days interval. The system is to be operated for 20 hours per day. 7.5

(ii) An irrigation stream of 24 liters per second is diverted to a check basin of size 10 m × 8 m. The water holding capacity of the soil is 13%. The average moisture content in the crop root zone prior to applying water is 6%. How long should the irrigation stream be applied to the basin to replenish the root zone moisture to its field capacity, assuming no loss due to percolation. The average depth of root zone of crop is 1.2 meter. The apparent specific gravity of the root zone soil is 1.5 meter. 7.5

(c) Design a drainage canal to drain 550 hectares of land having a drainage coefficient of 2.5 cm. The soil is silt loam. Maximum permissible slope of channel bed is 0.10 percent. 10

SECTION - D

8.	(a)	(i)	State the different laws of size reduction.	5
		(ii)	State the names of different types of grain storage structures used in India. Explain the construction of any modern/improved grain storage structure.	10
	(b)	(i)	Differentiate between mechanical and rheological properties with suitable examples for fruits and vegetables.	5
		(ii)	Differentiate between chilled cold storage and freezing.	5
		(iii)	Explain the different methods for sorting of fruits and vegetables.	5
	(c)	(i)	Briefly explain about the important considerations for selection of a site for animal housing.	5
		(ii)	Briefly describe the loose housing barn and stanchion barn with their relative advantages and disadvantages.	5
9.	(a)	(i)	What is equilibrium moisture content ? Explain the Henderson's equation for determination of equilibrium moisture content.	5
		(ii)	Name the different types of mixers for food materials. Explain any specific type of mixer used for solid mixing.	10
	(b)	(i)	What is blanching ? State the advantages of blanching of fruits and vegetables.	5
		(ii)	Explain the different methods of preservation of fruits and vegetables.	10
	(c)	(i)	Describe the different types of poultry houses with their important features.	5
		(ii)	What are the different types of farm fences ? Explain any one of them.	5

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