

This question paper contains 8+2 printed pages]

CODE : FRO-2017

AGRICULTURAL ENGINEERING

Roll No.

Time : 3 Hours

Maximum Marks : 200

Note :— (1) Question paper consists of two parts viz. Part I and Part II. Each part contains four questions. The paper as a whole carries eight questions. Question Nos. 1 and 5 are compulsory. The candidates are required to attempt *three* more questions out of the remaining six questions taking at least *one* question from each part i.e. this is in addition to the compulsory question of each part. Attempt *five* questions in all. *All* questions carry equal marks. The parts of a question are to be attempted at one place in continuation. Answers should be brief and to the point.

(2) Parts of same question must be attempted together and not to be attempted in between the answers to other questions.

P.T.O.

- (3) Make necessary assumptions wherever required or for any missing data.

Part I

1. (A) What are the major functions envisaged for the command area development projects ?
 - (B) Enlist the factors causing land degradation. Explain with schematic diagram about different land-forms subjected to water erosion.
 - (C) What are the components of the hydrologic cycle ? With proper illustrations explain about the hydrologic cycle.
 - (D) Explain in brief :
 - (i) Unit hydrograph
 - (ii) Infiltration indices
 - (iii) Parshall flumes
 - (iv) Permeability.
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2. (A) (i) Differentiate between natural remote sensing and artificial remote sensing.

- (ii) Briefly explain about the uses of remote sensing in precision farming.
 - (iii) Differentiate between Rayleigh scattering and Mie scattering.
- (B) Write short notes on :
- (i) Temporal resolution
 - (ii) Crop water stress index (CWSI)
 - (iii) GIS
 - (iv) NDVI.
- (C) What are the types of platforms used to mount remote sensors ? Explain in brief the advantages and disadvantages of these platforms.
- (D) What are the factors affect spectral reflectance of plants ? Explain in brief how spectral reflectance differentiate between crop species and cultivars.
3. (A) Determine the outflow from 250 m length of tiles spaced 15 m apart laid at a depth of 2 m above the impervious layer, if the water table is maintained

at a height of 5 m from the impervious layer. Assume soil's hydraulic conductivity as 20 cm per hour.

- (B) Calculate the coefficient of permeability of a soil sample of 6 cm in height and 50 cm² in cross-sectional area, if a quantity of water equal to 430 ml passed down in 10 minutes under an effective constant head of 40 cm.
- (C) What are the different steps involved for design of a sprinkler irrigation system ? Describe in brief how the sprinklers are selected in the design process ?
- (D) Write short notes on :
- (i) Drop structures
 - (ii) Air vents
 - (iii) Corrugation method of irrigation
 - (iv) Drainage coefficient.
4. (A) Design a farmhouse for the owner having a family of four members with appropriate floor plan for providing maximum utility and comfort to the inmates.

- (B) What is the importance of farm fencing ? How do you classify wire fencing in a farm stead ?
- (C) What are the types of commonly used poultry houses ? Explain in detail the advantages and disadvantages of different types of poultry houses.
- (D) Work out the economical diameter and depth of a silo to store sufficient quantity of silage for a herd of 400 dairy cows having an average body weight of 450 kg each. The cows are fed silage for 200 days of a year.

Part II

5. (A) Determine the hourly cost of operating a Sonalika tractor costing Rs. 6,50,000/-. The tractor is owned by a farmer and expected to have a useful service life of 12 years, when operated about 1000 hours every year. The tractor develops 35 bhp and consumes 8 litres of fuel per hour at 3/4th load. Assume that there is no overhead charge on the tractor. Make other necessary assumptions to compute hourly cost.

P.T.O.

(B) (a) While testing a two bottom tractor drawn mould board plough the following observations were noted :

(i) Total draft indicated by the dynamometer is 1200 kg

(ii) Distance moved by the tractor while ploughing is 50 meters.

(iii) Time taken to move 50 meter by the tractor is 30 seconds.

Calculate the drawbar horsepower developed and forward speed in kmph.

(b) A 3 row seed-drill is set to deliver 100 kg wheat per ha. The distance between two furrow openers is 22 cm. The wheel diameter is 42 cm. How much seed will be dropped by the machine during 50 wheel revolutions ?

(C) List the forces acting upon a tillage implement with neat sketch. Establish the relationship between pull, side force, vertical component and horizontal components.

- (D) Differentiate between :
- (i) Registration and Alignment
 - (ii) Disc angle and Tilt angle
 - (iii) Knapsack sprayer and compression sprayer
 - (iv) Spike tooth cylinder and Syndicator type cylinder
6. (A) Briefly describe the advantages of renewable energy over non-renewable energy. What are the main renewable sources of energy used in India ? Give an overview of the potential uses of renewable energies in India.
- (B) (i) If a solar water heater heats 100 litres of water from 20°C to 60°C in 5 hr, compute the save in electrical energy by this operation.
- (ii) A farmer wishes to operate his 5 bhp diesel pumpset on biogas, by replacing 75 to 80% oil for 4 hours a day. He has two pairs of bullocks, one buffalo and 100 poultry birds. Design a biogas plant with appropriate size. Make suitable assumptions.

- (C) What are the major sub-systems of a wind mill water pump ? Explain the functioning of a windmill water pump with a neat sketch.
- (D) List the technologies for effective utilization of Agro wastes. Explain in detail how these technologies are helpful for environmental protection.
7. (A) A bucket elevator is designed to be used for lifting vertically maize grains weighing 750 kg/m^3 upto a height of 25 m. Buckets having volume of 3500 cc each are spaced 40 cm apart on a belt while the center to center distance between head and foot wheels is 25-30 meters. The head pulley is 30 cm in dia and rotates on a shaft of 5 cm dia. The belt and empty buckets weigh on an average, 5 kg per meter length. Find the speed and power required to lift 4 tonnes of maize per hour. Assume degree of filling as 80 per cent and the coefficient of friction as 0.4 at the axle of pulley.
- (B) What are the basic concept and principles of parboiling ? List the advantages of parboiling of paddy.

- (C) Why is seed processing important ? Explain in detail about the unit operations in seed processing.
- (D) Briefly explain :
- (i) Chilling and freezing
 - (ii) Rubber roller Sheller
 - (iii) Non-mixing type columnar grain dryer
 - (iv) Rectangular grain bin.
8. (A) What are commonly used absorption dynamometers ? Explain in detail about the functioning of any absorption dynamometer with neat sketch.
- (B) Write short notes on :
- (i) Doppler effect
 - (ii) Fly-ball tachometers
 - (iii) Venturimeter
 - (iv) Thermocouples.
- (C) A venturi tube of throat diameter 50 mm has a discharge coefficient of 0.98 and with a flow rate of $1 \text{ m}^3/\text{s}$, the pressure differential is 12.5 N/m^2 .

Determine the flow rate when an orifice of 50 mm is used in the same pipe. The discharge coefficient of orifice is 0.6 and pressure differential is same.

- (D) What do you mean by humidity ? Briefly explain how relative humidity is different from absolute humidity. What types of instruments are used for measuring the humidity directly ?

