

CS-81/06
AGRICULTURAL ENGINEERING
Paper-II

Time : 3 Hours]

[Full Marks : 300

- Note :** (1) Candidates should attempt Question No. 1 from Section-A and Question No. 5 from Section-B which are compulsory, and any **three** of the remaining questions, selecting at least one from each Section.
- (2) All questions carry equal marks.

SECTION – A

1. Answer any **three** of the following out of (a), (b), (c) and (d).
- (a) What are the different sources of farm power available in India ? What is the economic importance of draught animals ? Describe the role of mechanical power in Indian agriculture. **20**
- (b) An open V-belt drive transmits 12 kW from a 255 mm pitch diameter sheave operating at 1800 RPM to a 635 mm diameter flat pulley. The center distance between the input and output pulleys is 1000 mm. The V-belt sheave groove angle is 40° . The coefficient of friction for the belt and sheave is 0.2 while coefficient of friction between the belt and the flat pulley is 0.2. The cross section of the belt is 38 mm at the top and 19 mm at the bottom with 25 mm deep. Each belt weighs 1086 N/m^3 and has an allowable tension of 900 N. Calculate the power transmitted by belt and number of belts required. **20**
- (c) What are the forces acting upon a tillage tool ? Illustrate the force representation for a disk blade. **20**
- (d) A four cylinder, four cycle diesel tractor engine has a cylinder bore of 90 mm and piston stroke as 100 mm. The engine develops 43.5 kW at 2300 RPM when coupled to a dynamometer. At the same speed and with the fuel shut off, the tractor engine required 7.5 kW to motor it. During the test, when 43.5 kW was developed, the engine used 15.5 litre per hour of diesel that contain heat energy of 45 NJ/kg with fuel density of 0.835 kg/litre. Determine indicated mean effective pressure and engine thermal efficiency. **20**

2. (a) Describe the working principles of internal combustion engines based on Otto cycle and Diesel cycle. 20
- (b) A power tiller costing Rs. 1,30,000 is expected to have a useful life of 10 years. Calculate the depreciated value after 5 years by different methods, assuming the trade value as 10% of initial cost. 20
- (c) A tractor with rubber tyre is pulling a plough at 6.5 km/hour speed on level ground. The plough hooks large boulders and the unit stops suddenly. The coefficient of friction is 0.60 and the maximum possible drawbar power is 18 kW. The rear and front wheels weigh 14,700 N and 7,350 N. Calculate the kinetic energy to be absorbed in stopping the tractor. If the tractor is stopped in 15 cm by a drawbar spring without declutching, what is the increase in the drawbar pull above the maximum tractive ability? 20
3. (a) What are the seed metering devices? Differentiate seed drill from planter. Describe the different steps for calibration of a seed drill. 20
- (b) A hydraulic sprayer fitted with hollow cone nozzles is required to be calibrated for an application rate of 150 litres/ha. The sprayer speed is 6.5 km/h and the nozzle spacing is 50 cm. The orifice diameter of 0.787 mm nozzle is rated at 0.473 litre/minute at 275 kPa pressure. Calculate the nozzle flow rate, pressure required to produce the desired nozzle flow rate and the droplet size at the desired flow rate, if the nozzle produces a VMD of 200 μ m at 1000 kPa. 20
- (c) Define alignment and registration of a cutter bar. Describe the kinematics of a reaper with suitable diagram and notations. 20
4. (a) Design a suitable biogas plant for cooking and lighting of a rural family of 4 adults and 2 minors. 20
- (b) A tractor having wheel base of 2.5 m, radius of rear wheel as 72 cm, radius of front wheel as 34 cm and width of rear wheel as 26 cm has a weight of 1800 kg. The weight carried by the front wheel is 650 kg. The weight carried by the front wheel when lifted to 46 cm from the ground is 540 kg. Calculate the centre of gravity of the tractor. 20
- (c) Describe the prospects and constraints of solar energy utilization in agriculture sector in India. Illustrate the working of a multi rack solar crop dryer. 20

SECTION – B

5. Answer any **three** of the following out of (a), (b), (c) and (d) :
- (a) With the help of flow diagram explain the various unit operations involved in processing of cereals and pulses also explain the importance of unit operations in agricultural process engineering. 20
 - (b) Explain why the cleaning and grading are called first and most important post harvest operations ? With the help of figures explain various types of screen openings are available for cleaning and grading of the seeds. 20
 - (c) What do you mean by the term psychrometric ? Describe psychrometric chart with the help of neat sketch also explain the different parameters that can be measured with the help of psychrometric chart. 20
 - (d) What do you mean by material handling ? What are the points you will keep in mind while selecting a proper conveying system ? Explain with the help of neat diagram construction and working principle of a screw conveyor. 20
6. (a) Differentiate between drying and dehydration. With the help of neat sketch explain the construction and working principle of LSU dryer. 20
- (b) Explain the generalized measuring system with neat sketch. How instrumental error can be avoided ? 20
- (c) Write the importance of temperature measurement in agricultural process engineering. Explain how the thermocouple is used in the measurement of temperature for food products ? 20
7. (a) Explain the working principle of hot wire anemometer, bimetallic strip, hair hygrometer and link type load cell. For what purpose they are used and also explain their application in post harvest technology ? 20
- (b) Write the importance of physical properties in post harvest technology. Name the different types of physical properties used in the measurement of food products also write the procedure used for the measurement of these properties. 20
- (c) Explain the different methods of washing and grading of fruits and vegetable. What are the advantages of these methods ? 20
8. (a) Differentiate between pasteurization and sterilization for processing of milk. Describe in brief the different methods of milk pasteurization. 20
- (b) What are the different by-products obtained from paddy ? Write their utilization patterns. 20
- (c) With the help of flow diagram explain the various unit operations involved in processing of oil seeds. Explain the mechanical process of oil extraction. 20