

**AGRICULTURAL ENGINEERING**  
**Paper – II**

*Time Allowed : Three Hours*

*Maximum Marks : 200*

**Question Paper Specific Instructions**

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

*There are **EIGHT** questions in all, out of which **FIVE** are to be attempted.*

*Questions no. 1 and 5 are **compulsory**. Out of the remaining **SIX** questions, **THREE** are to be attempted selecting at least **ONE** question from each of the two Sections A and B.*

*Attempts of questions shall be counted in sequential order. Unless struck off, attempt of a question shall be counted even if attempted partly. Any page or portion of the page left blank in the Question-cum-Answer Booklet must be clearly struck off.*

*All questions carry equal marks. The number of marks carried by a question/part is indicated against it.*

*Answers must be written in **ENGLISH** only.*

*Unless otherwise mentioned, symbols and notations have their usual standard meanings. Assume suitable data, if necessary and indicate the same clearly.*

*Neat sketches may be drawn, wherever required.*

## SECTION A

- Q1.** (a) Define tillage. What do you understand by primary tillage and secondary tillage ? Classify implements on the basis of how they are attached to the tractor. 8
- (b) Explain the working of 4-stroke cycle diesel engine with the help of labelled sketch. 8
- (c) Define Ergonomics and Anthropometry. Describe in brief about the human factors considered in design of modern tractors. 8
- (d) What is traction ? Explain with proper equations/expressions how the traction can be improved under (i) sandy soil, and (ii) clayey soil conditions. 8
- (e) Explain the working principle of a downdraft type gasifier with a suitable diagram. 8
- Q2.** (a) What is the function of furrow opener in a seed drill ? Write down the different types of furrow openers, their construction and the soil conditions in which they are suitable. 10
- (b) What is the function of a mower ? Write down the different parts of a conventional reciprocating mower. What do you understand by Alignment and Registration of mower ? 10
- (c) Define the following : 20
- (i) Volumetric efficiency
  - (ii) Octane number
  - (iii) IHP
  - (iv) Detonation
  - (v) Ignition delay
  - (vi) Theoretical field capacity
  - (vii) Scouring
  - (viii) Centre of resistance of MB plough
  - (ix) Disc angle
  - (x) Solar constant

- Q3.** (a) What are the different phases of anaerobic digestion for bio-gas production? What are the advantages of anaerobic digestion? 10
- (b) How is power transmitted from the engine to the traction wheels and PTO shaft of two-wheel drive tractor? Explain with a suitable schematic diagram. 10
- (c) A tractor operated hydraulic sprayer has 13 nozzles at 40 cm spacing. The application rate and speed of travel are 800 lit/ha and 5 km/h, respectively. Determine the nozzle flow rate in lit/min.  
 Also determine the working pressure and power requirement of the pump if the nozzle diameter is 0.5 mm. Consider the coefficient of discharge and mechanical efficiency of the pump as 0.35 and 0.6, respectively. 20
- Q4.** (a) Explain the principle of operation of concentrating type solar collector with a suitable diagram.  
 What are the advantages and disadvantages of such collectors over flat plate solar collectors? 15
- (b) Determine the cost of operation in ₹/hour of a 45 hp tractor of ₹ 6.0 lakh purchase price following straight line method of depreciation. Consider the operational life of the tractor is 10 years and its salvage value as 10% of purchase price. Assume all other necessary parameters as and when necessary. 15
- (c) The cut-in wind speed of a horizontal axis wind generator having 8 m diameter blade span is 5.0 m/s. The wind turbine generates 4.0 kW electrical power at 6.5 m/s wind speed. Determine the overall efficiency of the wind turbine generator considering the density of air as  $1.2 \text{ kg/m}^3$ . 10

## SECTION B

- Q5.** (a) What are the reasons for fouling of heat exchangers during milk processing ? 8
- (b) Explain with a neat diagram how a diaphragm can be used for measuring pressure difference in a system. 8
- (c) What is meant by sphericity of a particle ? Write the expression for determining sphericity of a body. How does a jaw crusher work ? 8
- (d) What are the steps involved in producing alcohol from sugarcane bagasse ? 8
- (e) Name any two input devices and two output devices of a computer. What are the primary and secondary storage of a computer system ? What is the function of the central processing unit of a computer ? 8
- Q6.** (a) With a neat diagram describe the operation of a belt conveyor indicating the placement of valves and motors. 15
- (b) The mass of a material on a belt conveyor of length 20 m is 200 kg and the conveyor is moving with a speed of 2 m/min. Calculate the capacity i.e. the flow rate of material on the belt conveyor in kg/s. 10
- (c) What is Seebeck effect ? How is this principle applied in the operation of a thermocouple used for measuring temperature ? 15
- Q7.** (a) Write the basic mass and energy balance equations for a single effect evaporator, clearly defining each term. 10
- (b) What is meant by dry and wet basis calculations for moisture content in solids ? How much water must be removed from parboiled paddy with 45% moisture content (wet basis) to produce 500 kg of dry parboiled paddy with 15% moisture content (wet basis) ? 15
- (c) What is a filter aid ? Name any one material that is used as a filter aid. Describe the operation of any one batch filter used in agricultural processes. 15

- Q8.** (a) Draw the flowchart of making butter from milk in a continuous process. 15
- (b) What is the difference between sterilisation and pasteurisation ? What are the steps involved in making cheddar cheese from milk ? 15
- (c) Write the algorithm in any programming language for calculating the Reynolds number when various sets of values of diameter of a pipe ( $D$ ), linear velocity of a fluid through the pipe ( $v$ ), density of the fluid ( $\rho$ ) and viscosity of the fluid ( $\mu$ ) are given. 10

