

# 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.*

*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.*

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

## SECTION A

- Q1.** (a) Briefly write about different sources of farm power used in Indian agriculture. 8
- (b) Define the following : 8
- (i) Indicated horse power of IC Engine
  - (ii) Field efficiency of an implement
  - (iii) Lift and drag forces related to wind energy
  - (iv) Solar still
- (c) Write short notes on the following : 8
- (i) Compression ratio of IC Engine
  - (ii) Timing gears of IC Engine
  - (iii) Harvesting methods for cereal crops
  - (iv) Capacity of biogas plants
- (d) Differentiate between the following : 8
- (i) Disc plough and Disc harrow
  - (ii) Floating drum biogas plant and Fixed dome biogas plant
  - (iii) Up-draft gasifier and Down-draft gasifier
  - (iv) Global radiation and Diffused radiation
- (e) Enlist the factors influencing the following : 8
- (i) Selection of a tractor
  - (ii) Specific fuel consumption of IC Engine
  - (iii) Threshing efficiency of a grain thresher
  - (iv) Anaerobic digestion
- Q2.** (a) With line diagram of each event, explain the working of a four-stroke compression ignition engine. 10
- (b) Explain the construction and working of a tractor-drawn seed drill. 15
- (c) Briefly write about different devices and components of a solar photo-voltaic system. Write about the applications of solar dryer. 15

- Q3.** (a) (i) What are the different methods of biomass conversion for energy generation ? Enlist different processes of energy conversion under each method. 10+5
- (ii) Name the different components of biomass gasifier-based electric power generation system. 10+5
- (b) Explain the working principle and uses of the following components of tractor power train : 15
- (i) Clutch
- (ii) Gear Box
- (iii) Differential
- (iv) Final Drives
- (v) Power Take-off
- (c) Determine the hourly cost of depreciation (Straight line method) and hourly interest cost on investment for a tractor costing Rupees six lakhs (₹ 6,00,000.00) having useful life of 12 years with 1000 hours of annual usage. Consider rate of annual interest as 12% and salvage value as 10%. 10
- Q4.** (a) Explain the fuel supply system of a compression ignition engine using a block diagram. 10
- (b) Using a neat diagram, explain the construction and working of KVIC-type biogas plant. 15
- (c) A track-type tractor with two tracks each of 300 mm width and 1500 mm length weighs 30 kN. While pulling an implement at a forward speed of 3.6 km/h, the tractor experiences a rolling resistance of 3 kN.
- Calculate :
- (i) Gross traction coefficient.
- (ii) Drawbar power in kW.
- Consider soil cohesion as 8 kPa and angle of internal friction as 30°. 7+8

## SECTION B

- Q5.** (a) What are the design considerations for air screen grain cleaner ? 8
- (b) What are the different parameters which can be determined using psychrometric chart ? Give four common uses of psychrometric chart in analysis of the drying process. 8
- (c) Explain the working principle of screw conveyor with a neat drawing. List various shapes of screw conveyor trough. 8
- (d) Differentiate between the following : 8
- (i) Analog Signal and Digital Signal
  - (ii) Force and Torque
  - (iii) Accuracy and Precision
  - (iv) Stress and Strain
- (e) Explain various steps involved in developing a programme using a computer. 8
- Q6.** (a) Differentiate between the following : 10
- (i) Thin layer drying and Deep bed drying
  - (ii) Bulk density and True density
  - (iii) Rittinger's law of size reduction and Bond's law of size reduction
  - (iv) Pneumatic separation and Gravity separation
  - (v) Modified Atmosphere packaging and Controlled Atmosphere packaging
- (b) (i) What are the different methods of stabilization of rice bran ?
- (ii) Explain the process of extraction and refining of rice bran oil. 8+7
- (c) What are common types of heat exchangers used in the food industry ? How are heat exchangers classified based on relative direction of motions of fluid flow ? 15

- Q7.** (a) (i) Explain about homogenization. Calculate the horse-power (hp) required for homogenization.  
Given value of Q is 1000 l/h and p is 250 kg/cm<sup>2</sup>. 10
- (ii) Describe In-bottle sterilization of milk. 5
- (b) What is spray drying and what are its main advantages in food processing industries ? Explain spray dryer with the help of a schematic diagram. 15
- (c) Why is freezing of cream done ? Explain any two methods of cream freezing. 10
- Q8.** (a) (i) Write in brief about the instrumentation used in measurement of temperature. 5
- (ii) Calculate the steam requirement during the initial stage of heating of 120 l of cream in a pan, if the initial temperature of the cream is 18°C and the steam used is at 2.00 kg/cm<sup>2</sup> abs. pressure.  
Heating surface area of pan is 1 m<sup>2</sup> and overall heat transfer coefficient is 250 kcal/m<sup>2</sup>-h-°C.  
Given data from steam tables are :  
Saturation temperature of steam = 119.6°C  
Latent heat = 526 kcal/kg at 2 kg/cm<sup>2</sup> abs. pressure. 5
- (b) Explain with the help of neat figures : 5+5
- (i) Orificemeter
- (ii) Venturimeter
- (c) Write the working principles involved in hydraulic load cell and pneumatic load cell in force measurements. 10
- (d) Explain the role of digital marketing using multimedia and audio-visual aids in Agro/Food Processing Industry. 10

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