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.

Question Nos. **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.

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.

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.

Answers must be written in ENGLISH only.

SECTION—A

1. *(a)* Categorize the farmers based upon their holding size. Enlist the different types of machines suitable for each category of farmers. 8

(b) Write the basic difference between compression ignition (CI) engine and spark ignition (SI) engine. 8

(c) What are the different factors affecting the penetration of disc harrow? Define gang angle and its adjustment. 8

(d) What do you understand by global radiation and diffuse radiation? 8

(e) Determine the quantity of fuel to be injected per cycle per cylinder for a six-cylinder, 4-stroke diesel engine having brake-specific fuel consumption of 180 grams and developing 121 hp at 2500 r.p.m. 8

2. *(a)* Distinguish between the following :

(i) Wheel slip and Wheel skid

(ii) Vertical suction and Horizontal suction of MB plough

(iii) Coulter and Jointer in a plough

(iv) Trailed type and Mounted type implement

(v) Disc angle and Tilt angle of a disc plough 10

(b) Calculate the diameter and the peripheral distance between the two consecutive cells to get 20 cm seed spacing by a seed planter having speed ratio between ground wheel and rotor as 4 : 3. Assume wheel diameter as 70 cm, rotor speed for 93 percent fill as 27 m/min, and travel speed as 3·2 km/h. 15

(c) What do you understand by solar thermal energy collectors? Discuss the various design parameters affecting the performance of solar flat-plate collector. 15

3. *(a)* Write the full forms of the following : 10

(i) SAE

(ii) API

(iii) DI

(iv) IDI

(v) CRDI

(vi) ASTM

(vii) BIS

(viii) RON

(ix) MON

(x) TDC

(b) What is the composition and what are the properties of coolant used in cooling system of IC engine? Explain, with the help of labelled neat sketch, the working of forced feed cooling system of tractor engine. 15

(c) How do you classify the windmill? Discuss the different types of rotor blades used in the windmill. 15

4. (a) Enlist the different components of conventional reciprocating mower. Explain the effect of improper registration and alignment of cutter bar on its performance. 10

(b) Write about the care and maintenance during operation and storage of the following :

(i) Disc plough and disc harrow

(ii) Sprayer and duster

(iii) Rotavator 15

(c) With the help of *P-V* diagram, derive the expression for efficiency of ideal Otto cycle. 15

SECTION—B

5. (a) Write the advantages of blanching of fruits and vegetables. 8

(b) Write a short note on different quick-freezing methods. What are the advantages of frozen foods? 8

(c) Define relative humidity (RH) and humidity ratio with the help of equations. 8

(d) Explain the classification of the following analog instruments :

(i) Indicating instruments

(ii) Recording instruments 8

(e) Discuss in detail about (i) amplifiers and (ii) multivibrators. 8

6. *(a)* Estimate the steam requirement during the initial stage of heating 120 L of cream in a jacketed pan, if the initial temperature of the cream is 18 °C and the steam used is at 2 kg/cm^2 abs. pressure. The pan has a heating surface area of 1 m^2 and the overall heat transfer coefficient is assumed to be 250 kcal / m^2-h-°C.

Data given :

Saturation temperature of steam = 119·6 °C

Latent heat, $L = 526$ kcal/kg at 2 kg/cm^2 abs. pressure 10

(b) Explain the by-products generation from sugarcane in sugar and jaggery industries. Show potential utilization of sugarcane industry waste for generation of wealth from waste through process flowchart. 15

(c) What are the different components used in CPU? Explain in brief each of them. Discuss the primary memory and secondary memory units used in computers. 15

7. *(a)* Potatoes are dried from 14% total solids to 93% total solids. What is the product yield from each 1000 kg of raw potatoes assuming that 8% by weight of the original potatoes is lost in peeling? Calculate the product yield (%) along with mass balance. 10

(b) Explain the design considerations of concrete grain bin. Briefly write the steps and stages of design. 15

(c) Draw a figure of generalized measurement system and write about its functional elements. 15

8. *(a)* Write the principle of operations of thermocouple. Draw the common forms of thermocouple construction and explain. 15

(b) *(i)* Why is chilling of milk essential? Write the different types of milk chilling systems.

(ii) Write a short note on overrun in ice cream. 15

(c) Define and explain the following in relation to drying :

(i) Fuel efficiency

(ii) Thermal efficiency

(iii) Drying efficiency 10

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