

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.

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**

1. (a) What are the major farm operations performed in an irrigated mechanized wheat production system? Enlist the major farm equipments used to carry out these operations. 8
- (b) Write short notes on the following :
- (i) Mechanical efficiency of IC engine
  - (ii) Desirable characteristics of lubricants used in tractor
  - (iii) Power take-off shaft of tractor
  - (iv) Tractive efficiency 8
- (c) Write the difference between the following :
- (i) Conventional tillage and Conservation tillage
  - (ii) Sowing and Transplanting operation
  - (iii) Compressed natural gas and Compressed biogas
  - (iv) Biodiesel and Bioethanol 8
- (d) Write about the effect of the following :
- (i) Overlapping of discs on field capacity of disc plough
  - (ii) Liquid pressure in a sprayer on nozzle characteristics
  - (iii) Level of oil in an oil-bath type air cleaner
  - (iv) Drive wheel tyre pressure on tractive performance 8
- (e) Enlist different types of fixed-bed biomass gasifiers and discuss different zones with temperature profiles. 8
2. (a) The line of pull of a 1.2 m width cultivator is inclined at 20° with horizontal and acting on the vertical plane along the direction of motion. If the pull required by the prime mover at 3 km/h forward speed is 10 kN, determine the drawbar power. 10
- (b) Write short notes on the following :
- (i) BLDC motor
  - (ii) Different renewable cooking fuels
  - (iii) Working principle of a wind turbine 15
- (c) Write the functions of the following :
- (i) Timing gear of an engine
  - (ii) Flywheel of an engine
  - (iii) Fluted roller type mechanism
  - (iv) Differential unit of a tractor
  - (v) Straw walker of a combine harvester 15

3. (a) Write about different adjustments of standard disc plough and mould board plough for effective field operation. 10
- (b) (i) Name different machines used for earth moving and land development operations.
- (ii) Explain the working of a tractor operated post-hole digger for horticultural and forestry plantation. 5+10=15
- (c) Describe the methods of estimating cost of operation of a tractor-plough combination. 15
4. (a) Write the effect of the following on biogas production from a cow manure-based biogas plant :
- (i) Manure-water ratio
- (ii) Ambient temperature
- (iii) Total solid content in manure
- (iv) pH of slurry
- (v) Ammoniacal nitrogen in slurry 15
- (b) Write the operating principle of a photovoltaic cell. Mention the efficiency of different types of silicon PV cells. 10
- (c) (i) Write about the principle of threshing for different types of threshing cylinders.
- (ii) Explain the working of water cooling system of a tractor engine. 7+8=15

#### SECTION—B

5. (a) Explain the improved paddy parboiling method developed by CFTRI and mention its advantages. 8
- (b) Find out the evaporation rate in a drum drier for the data given. The steam temperature is 160 °C. The vaporization temperature of milk is 105 °C. The overall heat transfer coefficient is 1200 kcal/h m<sup>2</sup> °C. The drum diameter is 0.7 m. The length of the drum is 105 cm. The latent heat of vaporization is 540 kcal/kg. The product is scrapped at 80% of the revolution of the drum. 8
- (c) Explain about Random Access Memory (RAM) and Read Only Memory (ROM) in a computer. 8

- (d) Write the principle of operation of the following and mention their input and output variables :
- (i) Thermocouple
  - (ii) Resistance strain gauge
  - (iii) Hot wire anemometer
  - (iv) Resistance thermometer 8
- (e) Explain the components of a wheat mill. 8
6. (a) Mention the ingredients of ice cream and describe in detail its preparation. 15
- (b) If the volume of milk flow in a homogenizer is 1000 L/h, at a pressure of  $250 \text{ kg/cm}^2$ , calculate the horsepower required for homogenization. 10
- (c) Write short note on precision, resolution and threshold of an instrument. 8
- (d) Explain the major characters of computers that made them powerful and useful in agriculture. 7
7. (a) Derive the effectiveness of screen in a grader through material balance. 15
- (b) In wheat milling, it was found that to grind 4.33 mm sized grains to pass sieve of 0.351 mm opening, the power requirement was 8 kW. Calculate the power requirement for milling of the wheat using Rittinger's law and Kick's law by the same mill to pass sieve of 0.157 mm opening. The feed rate of milling is 200 kg/h. 10
- (c) Explain freeze drying system and its merits. 8
- (d) Explain the Central Processing Unit (CPU) of a computer. Also explain the main operations accomplished using CPU cycle. 7
8. (a) Discuss the use of U-tube manometer. What are the desirable characteristics of manometric fluid? 8
- (b) Explain the process of extracting crude bran oil through batch type solvent extraction method. 12
- (c) Define Equilibrium Moisture Content (EMC) and its usefulness. Mention Henderson's equation for determining EMC. 10
- (d) Discuss the techniques involved in standardization of milk. 10

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