

# 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) Explain the working and importance of the thermostat valve in the cooling system of an I.C. engine. 8
- (b) Explain the working principles of a centrifugal governor with neat sketch diagram. How is the speed maintained constant under varying load conditions in an I.C. engine ? 8
- (c) What are the different types of threshing cylinders/drums employed on mechanical threshers for different crops ? Explain them briefly with the help of sketches. 8
- (d) Explain with the help of labelled diagram, the construction details of single reflector box solar cooker. What are the limitations of solar cookers ? 8
- (e) A high speed diesel engine running at 2000 rev/min has a single cylinder. During compression stroke, the fuel injection starts  $20^\circ$  before top dead centre and ends at the top dead centre. Calculate the duration (in seconds) of the fuel injection that takes place in the cylinder. 8
- Q2.** (a) What is the purpose of traction aids in wheeled tractors ? Discuss the different types of traction aids used in a wheeled tractor. 10
- (b) What do you mean by valve timing diagram of a four-stroke I.C. engine ? Describe the occurrence of events in a four-cylinder four-stroke engine in a tabular form, having standard firing order. 15
- (c) What do you understand by draft sensing in hydraulics of a tractor ? Discuss with the help of suitable diagram, the automatic position control systems on tractors. 15
- Q3.** (a) Draw a neat sketch showing the basic components of a tractor mounted hydraulic sprayer having mechanical agitation. Explain the different factors that affect the amount of spray liquid applied per hectare by a field sprayer. 10
- (b) What are different types of rotors of windmill ? Describe the different components of wind-electric generating system with the help of suitable diagram. 15
- (c) What are the different adjustments in the front wheels of tractors ? Discuss with the help of suitable diagram. 15

- Q4. (a) A multi-plate clutch is to be designed for a vehicle whose engine develops maximum torque of 13 Nm at 3500 r.p.m. The external diameter of the clutch facings is limited to 100 mm and the inner diameter may be assumed to be 0.2 times the external diameter. The maximum intensity of pressure may be taken as 80 kPa and  $\mu = 0.3$ . Calculate the number of plates. Assume uniform wear. 10
- (b) With the help of suitable diagram, show the different components of floating dome type biogas plant. Compare the advantages and disadvantages of floating dome and fixed dome type digesters in a biogas plant. 15
- (c) What are the functions of Combine harvester ? Discuss the different types and sources of grain losses. 15

## SECTION B

- Q5.** (a) State Bond's Law of Crushing. What is Work Index ? State the principle of operation of a jaw crusher. 8
- (b) What is the importance of dehydration in processing of food ? State the principle of operation of a tray dryer. 8
- (c) What is rice husk ? Describe how energy can be generated from rice husk. 8
- (d) State how microprocessors can be utilised in acquisition of data and can subsequently be used in agricultural engineering. 8
- (e) What is meant by strain ? Draw the typical stress – strain curve showing linear, necking and eventual break regions. What is the principle of operation of a metal strain-gauge ? 8
- Q6.** (a) Among the two types of conveyors — belt and screw, which type consumes more power and why ? With a diagram, explain the operation of a screw conveyor. 15
- (b) What is boiling point elevation ? State the principle of operation of a falling film evaporator. Why is this type of evaporator preferred for concentrating heat-sensitive materials like fruit juice and milk ? 15
- (c) Orange juice needs to be concentrated using an evaporator from an initial moisture content of 80% (wet basis) to a final moisture content of 45% (dry basis). Calculate the amount of moisture to be removed from 100 kg of orange juice. 10
- Q7.** (a) Why is homogenisation of milk important in the dairy industry ? With the help of a neat diagram, describe the operation of a cream separator. 15
- (b) Describe how milk powder can be produced from liquid milk slurry in a spray dryer. 15
- (c) State why freezing can be considered as a method of preservation of food. What are the advantages and disadvantages of quick freezing ? 10
- Q8.** (a) What is the basic difference between sensors and transducers ? For what purpose is a rotameter used in fluid flow ? How does it operate ? 15
- (b) Differentiate between the working principles of sequential and combination systems of digital circuits. 15
- (c) What is Seebeck effect ? Find the Seebeck emf, in mV, for a material with  $\alpha = 60 \mu\text{V}/^\circ\text{C}$  if the junction temperatures are  $30^\circ\text{C}$  and  $100^\circ\text{C}$ , where  $\alpha$  is a proportionality constant. 10