

## AGRICULTURAL ENGINEERING - I (Optional)

Standard : Degree

Total Marks : 200

Nature : Conventional

Duration : 3 Hours

Note :

- (i) Answers must be written in English.
- (ii) Question No. 1 is **Compulsory**. Of the remaining questions, attempt **any four** selecting one question from **each section**.
- (iii) Figures to the **RIGHT** indicate marks of the respective question.
- (iv) Use of log table, Non-Programmable calculator is permitted, but any other Table/Code/Reference book are not permitted.
- (v) Make suitable assumptions, wherever be necessary and state the same.
- (vi) Number of optional questions upto the prescribed number in the order in which they have been solved will only be assessed. Excess answers will not be assessed.
- (vii) Credit will be given for orderly, concise and effective writing.
- (viii) Candidate should not write roll number, any name (including their own), signature, address or any indication of their identity anywhere inside the answer book otherwise he/she will be penalised.
- (ix) For each slab of 10 and 15 marks, the examinee is expected to write answers in 125 and 200 words respectively.

1. Answer **any four** of the following questions :

- (a) Describe the operating principle of an air screen cleaner with a neat sketch. **10**
- (b) Differentiate between shallow and deep bin. Describe the steps with formulae to be used to calculate lateral pressure in case of a cylindrical shallow bin. **10**
- (c) A two bottom 30 cm mould board plough was operated in a field of size 40 m long and 25 m wide. The speed of operation was 5 km/h. During operation there was an overlap of 4 cm. The turning loss was found to be 5 second per turn. The time lost in adjustment and repair was 50 min/ha. Calculate the field efficiency of the plough. **10**

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| (d) Discuss the factors affecting the selection of optimum size of solar water heater. | 10           |
| (e) How the sprayers are classified ? Explain the working of a knapsack sprayer.       | 10           |

**SECTION - A**

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| 2. (a) Define 'Equilibrium Moisture Content (EMC)'. Describe the different methods used for determination of EMC. | 10 |
| (b) Describe with neat sketch the working principle of a Louisiana State University (LSU) dryer.                  | 10 |
| (c) Explain the procedure for determination of thermal conductivity of grain.                                     | 10 |
| (d) Show different components of a belt conveyor in neat sketch and write its design principle.                   | 10 |
| 3. (a) What is a psychrometric chart and how it is used for heating and drying process ?                          | 10 |
| (b) Explain different types of dryer used for grain drying.   | 10 |
| (c) Explain different thermal properties of bio-materials used for design purpose.                                | 10 |
| (d) Derive an expression for terminal velocity of a spherical particle.   | 10 |

**SECTION - B**

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| 4. (a) Describe 'High Temperature Short Time (HTST)' method of pasteurization in a neat sketch showing necessary controls.  | 10 |
| (b) Differentiate between controlled atmospheric (CA) and modified atmospheric (MA) storages and explain how these methods can be used for storage of horticultural crops ? | 10 |
| (c) Explain step by step procedure for design of a deep litter type of poultry house for 1000 birds.  | 10 |
| (d) Explain Kicks, Rittengers and Bonds law for estimation of energy requirement during size reduction.   | 10 |

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| 5. (a) What is homogenization ? Describe with neat sketch the working principle of a single value homogenizer. | 10    |
| (b) Explain various methods used for freezing of food commodities.   | 10    |
| (c) Explain step by step procedure for design of a dairy barn for 50 cows.                                     | 10    |
| (d) Explain with neat sketch working principles used for size reduction in case of hammer mill and ball mill   | 10    |

### SECTION - C

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| 6. (a) Derive the expression for efficiency of air standard Otto cycle.  | 10 |
| (b) Define centre of gravity (C.G) of a tractor. Name different methods of determining C.G. of a tractor. Explain the method of determining C.G. of a tractor by weighing method.  | 15 |
| (c) How do you define farm mechanization ? Why the farm mechanization is not picking up in eastern parts of the country ? Give your views on future prospects of farm mechanization in our country.  | 15 |
| 7. (a) Derive the expression for efficiency of air standard Diesel cycle.  | 10 |
| (b) A four wheel rubber tyre tractor is moving with a speed of 8 km/h up a slope of $12^\circ$ . The tractor is pulling a 3-bottom, 40 cm mould board plough whose line of pull makes an angle of $20^\circ$ with the ground and is at a distance of 37.50 cm from rear wheel contact point. Calculate the drawbar pull and drawbar horse power at the limiting case i.e., the tractor is about to topple on rear wheels. Assume the weight of the tractor is 1800 kg, wheel base is 2.20 m, radius of rear wheel is 70 cm, radius of front wheel is 35 cm and weight carried by the front wheels on level ground is 630 kg. | 15 |
| (c) Derive an expression for determining the accelerating force at the knife head of a reaper.   | 15 |

## SECTION - D

8. (a) A belt drive consists of two V-belts in parallel, on grooved pulleys of the same size. The angle of the groove is  $30^\circ$ . The cross-sectional area of each belt is  $750 \text{ mm}^2$  and the co-efficient of friction between the belt and pulley groove is 0.12. Density of the belt material is  $1200 \text{ kg/m}^3$  and the maximum safe stress in the material is 7 MPa. Calculate the power that can be transmitted between pulleys 300 mm diameter rotating at 1500 rpm. 15
- (b) State the design considerations of an animal drawn groundnut planter. 10
- (c) State the factors affecting bio-digestion. Name different components of a KVIC model bio-gas plant. State the advantages of KVIC model over Janata model bio-gas plant. 15
9. (a) State the ergonomical parameters to be considered in design of hand tools to reduce human drudgery. 15
- (b) Show the major forces acting on a mould board plough and state their effect on the performance of a plough. 10
- (c) State the factors to be considered for site selection of wind mill. Explain the working principle of a horizontal axis wind mill. 15