

CSM—11/24
PART—II/PAPER—VII
AGRICULTURAL ENGINEERING
PAPER—II

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Time : 3 Hours

Full Marks : 250

*The question paper contains **18 (Eighteen)** questions in **GROUP—A, (12)** and **GROUP—B, (06)** together.*

GROUP—A

*Candidates to attempt **10 (ten)** questions within word limit of **250**.*

*Each question carries **15** marks.*

1. Describe the operation of 4-stroke internal combustion engine with suitable illustrations. Explain how fuel injection is done in Compression Ignition (CI) engines. In what way electronics are applied in modern fuel injection systems?
2. Discuss the kinematic principles of tractor-implement combination and illustrate the various forces acting on a tractor pulling an implement. Derive the weight transfer within the tractor in rest condition and when the implement is attached and pulled.
3. Explain the interrelationship between wheel slip at a drawbar pull, tractive coefficient and tractive efficiency. When a tractor was tested at no-load and load, the distance covered by the rear wheel was 55.8 m and 46.2 m respectively. Calculate the wheel slip in this case.
4. A tractor attached with a cultivator of 3.5 m width is used to cultivate 50 ha of field at a travel speed of 5.0 km/h. Determine the time taken to complete the operation and also theoretical field capacity of the cultivator. Assuming the tractor operator reports a time loss of 0.75 h per 10 h of field operation, what is the effective field capacity?

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5. Describe briefly the principle of operation and applications of solar greenhouse dryer in agriculture. Enumerate the steps involved in designing a solar tunnel dryer for a coconut farmer producing copra.
6. Describe the features of a photovoltaic generator. What are the methods of tracking the Sun for the generator? Explain the thermo-hydraulic tracking principle.
7. Describe the relationship between drying rate and grain moisture content in grain drying. What is the role of critical moisture content in drying kinetics? A bin holding 2000 kg of wet grain containing 500 kg of water is to be dried to a final moisture content of 14% (w.b.). What are the initial and final moisture contents of the grain? How much water is removed during drying?
8. Describe the characteristic features of a bucket elevator. Calculate the power required for a bucket elevator to convey 0.5 tonnes of paddy per min to a height of 11 m. Consider an allowance of 20% for frictional and transmission losses in the power train.
9. Enumerate the advantages of bulk storage of grain compared to bag storage. What is meant by CAP storage? State its importance in grain handling in India. List the biotic and abiotic factors affecting stored grain in warehouses.
10. Outline the process involved in the milling of pulses using a flowchart. What are the equipments required in setting up of such a mill?
11. What are the types of thermocouples used in temperature measurement? Graphically explain the effect of temperature on the e.m.f. produced in thermocouples. Explain Seebeck, Peltier and Thomson effects in instrumentation with thermocouples.
12. What are the advantages of operational amplifiers over discrete devices? State the typical specifications of a general-purpose operational amplifier. Explain the following terminologies :
 - (a) Input offset voltage
 - (b) Input offset current
 - (c) Slew rate

GROUP—B

Candidates to attempt **05 (five)** questions within word limit of **300**.

Each question carries **20** marks.

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- 13.** Graphically illustrate the performance characteristics of an internal combustion engine in terms of speed, torque and power. With the aid of a diagram, explain the differences between theoretical and actual air standard cycles. Enumerate the reasons for deviation of actual air standard cycles from ideal ones.
- 14.** A 4-bottom 30 cm mouldboard plough is drawn by a tractor at a speed of 5 km/h. The soil resistance is 0.7 kg/cm^2 . The working depth is 15 cm. Find **(a)** the centre of resistance from the wing of the first bottom for this 4-bottom 30 cm mouldboard plough and **(b)** the horsepower needed to pull the plough.
- 15.** Discuss the applications of gasifiers for the conversion of biomass and agricultural residues. What are the essential parameters affecting gasification? Describe the construction and working operation of an updraft gasifier highlighting the formation of different zones within the biomass.
- 16.** What is meant by pasteurization of milk? Explain the thermal destruction kinetics in terms of D-value and Z-value. With the aid of a schematic, explain the features of a batch pasteurizer.
- 17.** Give a brief outline of improved postharvest practices that can be adopted in handling fresh fruits and vegetables. Explain the significance of precooling of horticultural commodities. What is the fundamental physiological principle of Controlled Atmosphere (CA) storage in prolonging the shelf life of fruits and vegetables?
- 18.** Explain the design of a full-wave bridge rectifier. What is meant by ripple effect? Explain the role of smoothing capacitor in a rectifier circuit.

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SPACE FOR ROUGH WORK

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