CSM – 13/21
Agricultural Engineering
Paper – II

Time : 3 hours

Full Marks : 300

The figures in the right-hand margin indicate marks.

*Candidates should attempt Q. No. 1 from Section – A and Q. No. 5 from Section – B which are compulsory and any **three** of the remaining questions, selecting at least **one** from each Section.*

SECTION – A

1. Answer any **three** questions of the following : 20×3 = 60

   (a) What is an air standard cycle ? Why is it considered in calculating the thermal efficiency of an internal combustion engine ? With neat diagram, derive an expression for thermal efficiency of Otto and

Diesel cycle in terms of compression ratio of engine.

(b) Write down the advantages of fixed dome type over floating dome type biogas plant. Find out the total energy available per day and power generated from a 2 m^3, 40-days retention period biogas plant with the following information.

(i) The gas will be used solely for cooking in a stove with a burner efficiency of 45 percent

(ii) The density of biogas is 0.94 kg/m^3 with a heating value of 20 MJ/kg

(c) What are the different methods used for locating the Centre of Gravity (C. G.) of a tractor ? A tractor having 130 cm tread width, travels a 30-meter diameter path. The centre of gravity of tractor is at the height of 0.85 meter from the ground surface. Calculate the

speed of tractor at which it will experience sideways overturning.

(d) A new tractor is purchased with an amount of Rs. 6,00,000 and its life is assumed to be 15 years. Assume salvage value as 10% of purchase price. Calculate the remaining value of tractor afetr 6 years by following the different methods of depreciation such as straight line, declining balance and sum of years' digits methods.

2. (a) What is the necessity of a clutch ? Write down the principle of a friction clutch and the working of a single plate clutch with a neat diagram. 20

(b) What are the various human factors considered in design of modern tractors ? Briefly explain their importance. 20

(c) Write down the advantages and limitations of zero tillage. Describe the components and

working of tractor drawn zero till drill with neat sketch. 20

3. (a) Write down the necessities of cooling system in internal combustion engine. Discuss the components and working of forced circulation water colling system in IC engine with neat sketch. 20

(b) Name different types of dynamometers used for engine testing along with their merits and demerits. With neat sketch, describe the components and working of prony brake dynamometer. 20

(c) What is the necessity of power bucket in earth moving and land development work. With neat sketch, describe the components and working of power bucket. 20

4. (a) Write down the procedure for calibrating a sprayer. Determine the speed of travel in operating sprayer having 0.4 litres per minute

nozzle discharge rate and 50 cm width of coverage. The active pesticide is to be applied 0.8 kg per hectare and 1 kg of pesticide is required to make 120 litres of spray solution. 20

(b) What are the advantages of horizontal axis wind mill over vertical axis wind mill. With neat sketch, describe the components and working of horizontal axis wind mill. 20

(c) What do you understand by periodic maintenance of a tractor ? Write the items for maintenance of agricultural tractor after 8-10 engine working hours. Write the steps to be taken while storing and removing a tractor from store. 20

SECTION – B

5. Answer any **three** questions of the following : 20×3 = 60

(a) Write down the pulse dry milling process with a flow diagram and also describe the different uses of rice husk and bran.

(b) Describe the unit operations of a milk processing plant.

(c) Differentiate between modified atmospheric packaging, controlled atmospheric packaging and active packaging. What is blanching ? Mention the advantages of blanching.

(d) With a neat sketch, explain the working principle of full-wave bridge rectifier and derive the expression for efficiency and output voltage.

6. (a) Explain generalized instrumentation system. 20

(b) With a neat sketch, explain the working principle of LVDT. 20

(c) A horizontal screw conveyer mounted on a 4 cm diameter shaft has screw pitch and diameter both equal to 30 cm. Estimate its actual capacity in tonne/h of conveying

wheat weighing 850 kg/m^3 while operating at 150 rpm. Assume loading efficiency to be 0.4. 20

7. (a) Explain the working principle of an evaporator. An evaporator has a rated evaporation capacity of 200 kg/h of water. What will be the rate of production of concentrated juice containing 40% at total solids from a raw juice containing 10% solids. 20

(b) Define transducer. List the different types of transducers with example. 20

(c) Draw the K-map for the function 'F' and reduce it into a SOP form $F = \sum_m (0, 1, 4, 5, 3, 2, 11, 10)$ 20

8. (a) With neat sketch, describe the components and working principle of a spray dryer. 20

(b) Describe the solvent extraction process from oil seed. Calculate the absolute humidity of

air at 50°C and 15% relative humidity at atmospheric pressure. Saturation vapour pressure of water at 50°C is 12.35 kPa. 20

(c) Write the programming of microprocessors and data acquisition and control of agricultural engineering process. 20