C-MNS-S-AGE

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)   Differentiate between the following in brief :   2×4=8

(i)   Naturally aspirated engine and Turbo-charged engine   2

(ii)   Centrifugal pump and Gear pump   2

(iii)   Single plate clutch system and Dual plate clutch system   2

(iv)   Wheel base and Track width   2

(b) Differentiate between the following in brief : 2×4=8

    (i)   Indigenous and Soil turning ploughs 2

    (ii)   Offset and Tandem disc harrow 2

    (iii)   Seed drill and Planter 2

    (iv)   Centre of resistance and Centre of pull 2

(c) Differentiate between the following in brief : 2×4=8

    (i)   Gas engine and Dual fuel engine 2

    (ii)   CNG and Bio-CNG 2

    (iii)   Anaerobic process and Aerobic process 2

    (iv)   Active solar heating and Passive solar heating 2

(d)   (i)   A three-bottom, 40 cm mouldboard plough is working at a depth of 16 cm. Calculate the actual field capacity when the speed of operation is 4·5 km/h and field performance index is 0·75. 2

    (ii)   Calculate the area covered (ha) in 8 hours for an animal drawn seed drill which has three furrow openers 180 mm apart. The speed of operation is 2 km/h. 2

    (iii)   A 4 m width of cut combine is travelling at 50 m/min speed. In one minute time, 50 kg of grain was collected in the grain tank and 60 kg of material was discharged at the rear of the machine. Calculate the capacity of the combine on throughput basis. 2

    (iv)   Calculate the vertical soil reaction on an implement weighing 350 kg, when a pull of 6·5 kN is exerted on it at an angle of 15° with the ground surface. 2

(e) Discuss the major differences between the following : 2×4=8

    (i)   Biogas and Producer gas 2

    (ii)   Biodiesel and Bio-ethanol 2

    (iii)   Single phase electric motor and Three phase electric motor 2

    (iv)   Downdraft gassifier and Updraft gassifier 2

Q2. (a) Draw a neat figure showing different components of a fuel supply system of a general purpose tractor and describe its working. *10*

(b) Draw a neat schematic diagram of a tractor power train and discuss the significance of each member of the power train. *10*

(c) Describe the working of an oil bath type air cleaner. *10*

(d) (i) Why do general purpose tractors have larger rear wheels and smaller front wheels ? *2*

(ii) Why is a certain amount of valve clearance provided in valves of IC engines ? *2*

(iii) Why do tractor rear wheels have lesser inflation pressure than the front wheels ? *2*

(iv) Why is a breather provided in an engine ? *2*

(v) Why does the radiator in a tractor cooling system have a pressure cap ? *2*

Q3. (a) List the different types of seed and fertilizer metering mechanisms used in modern seed-cum-fertilizer drills commonly used in India. How does the rate of application vary using these mechanisms ? *10*

(b) List the different types of nozzles used for the application of agro-chemicals in manually operated sprayers used in India. How does their spray pattern differ ? Write about their specific use in plant protection. *10*

(c) What are the modifications required to run a constant speed diesel engine on dual fuel (biogas + diesel) mode and why ? *10*

(d) Write short notes on the following : *5×2=10*

(i) Terracer blade *5*

(ii) Traction aids for wheel tractors *5*

Q4. (a) Calculate the volume of a biogas digester and power available from it assuming the following : 15

Number of animals = 8

Retention time = 20 days

Temperature of digestion = 35°C

Dry matter consumed per animal per day = 2 kg

Burner efficiency = 70%

Methane content in biogas = 70%

Density of dry matter in slurry = 50 kg/m^3

Biogas yield per unit dry mass = 0·2 m^3/kg

Heat of combustion of methane = 28 MJ/m^3 at STP

(b) Write short notes on the following : 5×3=15

(i) Solar lantern 5

(ii) Solar cooker 5

(iii) Gas engines 5

(c) Write the major differences between the following : 2×5=10

(i) Tar and Particulate matter 2

(ii) Briquetting and Charring 2

(iii) Wind mill and Water mill 2

(iv) Mechanical efficiency and Thermal efficiency 2

(v) Total solids and Volatile solids 2

SECTION B

Q5. (a) Differentiate between the following :   2×4=8

       (i) Analog and Digital signals   2

       (ii) Readability and Span   2

       (iii) True value and Accuracy   2

       (iv) Force and Torque   2

(b) Describe in brief the method of measurement calibration of the following :   4×2=8

       (i) Draft requirement of an animal drawn plough   4

       (ii) Draft requirement of a tractor drawn trailed disc harrow   4

(c) How are the following measurements done ?   4×2=8

       (i) Brake Horse Power of an engine using hydraulic brake dynamometer   4

       (ii) Calibration of a hydraulic tension dynamometer   4

(d) Differentiate between the following :   2×4=8

       (i) Osmosis and Dehydration   2

       (ii) Equilibrium moisture content and Moisture content   2

       (iii) Angle of repose and Angle of internal friction   2

       (iv) Specific heat and Thermal conductivity   2

(e) Write about the basic drying principle(s) involved in the following :   2×4=8

       (i) Mechanical drying   2

       (ii) Chemical drying   2

       (iii) Vacuum drying   2

       (iv) Freeze drying   2

Q6. (a) What are the major differences between a Hammer mill and a Roller mill ?   *10*

(b) Describe the working of a cyclone separator. How is its separation factor related to the weight of a particle ?   *10*

(c) Describe the basic methods of force measurement.   *10*

(d) Which are the by-products generated during milling of paddy ? Describe how the by-products can be profitably used.   *10*

Q7. (a) What are the common types of equipment used in grain handling ? Discuss in brief the factors considered in their selection.   *10*

(b) Name the different types of strain measuring equipment and describe in brief the techniques adopted using strain gauges.   *10*

(c) Differentiate between the working principle and application of Spray and Roller driers in Milk Powder manufacture.   *10*

(d) Describe how sugarcane bagasse can be utilized, not going as waste.   *10*

Q8. (a) How are Microprocessors used in data acquisition and control of Agricultural Engineering processes ?   *10*

(b) Describe in brief the application of Multimedia and Audio-Visual aids in propagation of forestation.   *10*

(c) Explain in brief the role of C.P.U. and memory devices in modern computers.   *10*

(d) Differentiate between the working principle of sequential and combination systems of Digital circuits.   *10*