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.

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.

*Answers must be written in **ENGLISH** only.*

SECTION A

Q1. (a) Briefly write about different sources of farm power used in Indian agriculture. *8*

(b) Define the following : *8*

(i) Indicated horse power of IC Engine

(ii) Field efficiency of an implement

(iii) Lift and drag forces related to wind energy

(iv) Solar still

(c) Write short notes on the following : *8*

(i) Compression ratio of IC Engine

(ii) Timing gears of IC Engine

(iii) Harvesting methods for cereal crops

(iv) Capacity of biogas plants

(d) Differentiate between the following : *8*

(i) Disc plough and Disc harrow

(ii) Floating drum biogas plant and Fixed dome biogas plant

(iii) Up-draft gasifier and Down-draft gasifier

(iv) Global radiation and Diffused radiation

(e) Enlist the factors influencing the following : *8*

(i) Selection of a tractor

(ii) Specific fuel consumption of IC Engine

(iii) Threshing efficiency of a grain thresher

(iv) Anaerobic digestion

Q2. (a) With line diagram of each event, explain the working of a four-stroke compression ignition engine. *10*

(b) Explain the construction and working of a tractor-drawn seed drill. *15*

(c) Briefly write about different devices and components of a solar photo-voltaic system. Write about the applications of solar dryer. *15*

Q3. (a) (i) What are the different methods of biomass conversion for energy generation ? Enlist different processes of energy conversion under each method.

(ii) Name the different components of biomass gasifier-based electric power generation system. *10+5*

(b) Explain the working principle and uses of the following components of tractor power train : *15*

(i) Clutch

(ii) Gear Box

(iii) Differential

(iv) Final Drives

(v) Power Take-off

(c) Determine the hourly cost of depreciation (Straight line method) and hourly interest cost on investment for a tractor costing Rupees six lakhs (₹ 6,00,000.00) having useful life of 12 years with 1000 hours of annual usage. Consider rate of annual interest as 12% and salvage value as 10%. *10*

Q4. (a) Explain the fuel supply system of a compression ignition engine using a block diagram. *10*

(b) Using a neat diagram, explain the construction and working of KVIC-type biogas plant. *15*

(c) A track-type tractor with two tracks each of 300 mm width and 1500 mm length weighs 30 kN. While pulling an implement at a forward speed of 3·6 km/h, the tractor experiences a rolling resistance of 3 kN.

Calculate :

(i) Gross traction coefficient.

(ii) Drawbar power in kW.

Consider soil cohesion as 8 kPa and angle of internal friction as 30°. *7+8*

SECTION B

Q5. (a) What are the design considerations for air screen grain cleaner ? *8*

(b) What are the different parameters which can be determined using psychrometric chart ? Give four common uses of psychrometric chart in analysis of the drying process. *8*

(c) Explain the working principle of screw conveyor with a neat drawing. List various shapes of screw conveyor trough. *8*

(d) Differentiate between the following : *8*

(i) Analog Signal and Digital Signal

(ii) Force and Torque

(iii) Accuracy and Precision

(iv) Stress and Strain

(e) Explain various steps involved in developing a programme using a computer. *8*

Q6. (a) Differentiate between the following : *10*

(i) Thin layer drying and Deep bed drying

(ii) Bulk density and True density

(iii) Rittinger's law of size reduction and Bond's law of size reduction

(iv) Pneumatic separation and Gravity separation

(v) Modified Atmosphere packaging and Controlled Atmosphere packaging

(b) (i) What are the different methods of stabilization of rice bran ?

(ii) Explain the process of extraction and refining of rice bran oil. *8+7*

(c) What are common types of heat exchangers used in the food industry ? How are heat exchangers classified based on relative direction of motions of fluid flow ? *15*

Q7. (a) (i) Explain about homogenization. Calculate the horse-power (hp) required for homogenization.

Given value of Q is 1000 *l*/h and p is 250 kg/cm^2. *10*

(ii) Describe In-bottle sterilization of milk. *5*

(b) What is spray drying and what are its main advantages in food processing industries ? Explain spray dryer with the help of a schematic diagram. *15*

(c) Why is freezing of cream done ? Explain any two methods of cream freezing. *10*

Q8. (a) (i) Write in brief about the instrumentation used in measurement of temperature. *5*

(ii) Calculate the steam requirement during the initial stage of heating of 120 *l* of cream in a pan, if the initial temperature of the cream is 18°C and the steam used is at 2·00 kg/cm^2 abs. pressure.

Heating surface area of pan is 1 m^2 and overall heat transfer coefficient is 250 kcal/m^2-h-°C.

Given data from steam tables are :

Saturation temperature of steam = 119·6°C

Latent heat = 526 kcal/kg at 2 kg/cm^2 abs. pressure. *5*

(b) Explain with the help of neat figures : *5+5*

(i) Orifice meter

(ii) Venturimeter

(c) Write the working principles involved in hydraulic load cell and pneumatic load cell in force measurements. *10*

(d) Explain the role of digital marketing using multimedia and audio-visual aids in Agro/Food Processing Industry. *10*