AGRICULTURAL ENGINEERING

PAPER-I

SECTION A

1. Answer any four sub-parts not exceeding 150 words for each sub-part:

(a) Discuss the different types of soil movement due to wind erosion. What type of soil particles are involved in each movement?

(10)

(b) A gully with a drop of 3 misused to carry a peak discharge of 3.33 m3/s from the watershed. An earthen embankment with a pipe spillway is constructed to create temporary storage and 50% of the peak flow is required to be discharged through the spillway as pipe flow. The base width of the embankment is 12.5 m. determine the size of the pipe. Entrance loss coefficient for the square entrance = 0.50 and friction loss coefficient Ke = 0.15 Length of the pipe may be taken 20% more than the base width of the embankment.

(10)

(c) Design an inward sloping 5% bench terrace for a sandy loam soil with an average slope of 16%. The entire width (not less than 6 m) of the terrace acts as a channel with a slope of 0.6%. The following details are given:

Peak discharge = 0.144 m3/s,
Riser side slope = 1:1,
Shoulder bund height = 30 cm,
Bottom width = 75 cm,
Side slope = 2:1,
Manning's n = 0.04.

(10)

(d) List ten aims of watershed management.

(10)

(e) What is the purpose of a shelterbelt? Give the layout of a shelterbelt for achieving better result. Give a formula for the distance of full protection by a shelterbelt.

(10)

2 (a) Determine the dimensions of a graded bund in a sandy loam soil for the following conditions: Length of bund = 600 m, average land slope = 2.5%, V.1. = 1.5 m, grade of bund = 0.18%. Rainfall intensity for the time of concentration and for the recurrence interval = 16.5 cm/hr, maximum depth of water near the bund = 0.3 m, n = 0.04, runoff coefficient = 0.3, stable side slope = 1.5:1, slope of seepage line = 5: 1.

(25)

(b) Define water harvesting. Enlist six essential requirements of water harvesting ponds.

(10)

(c) Explain basin listing and ridge planting.

(5)

3. (a) Distinguish between large and small scale. Why do both large and small scale maps exist?

(4 + 4)

(b) Conceptually explain two methods of setting up your database such that the data in the following 3 tables could be used together. Which method would be most space efficient? Why?

(7 + 5)

(c) With the help of a sketch, derive an expression for the depth of water that will be stored behind a contour bund in terms of excess rainfall and vertical interval. Explain how the total height and other dimensions of the bund are decided.

(15+5)

4. (a) Briefly explain the following:

(i) Radiometric and geometric corrections

(8)

(ii) Spatial filtering and low pass and high pass filter

(8)

(b) Under what situation is a chute spillway preferred as a gully control structure? Name the different parts of the spillway and discuss their functions.

(8)

(c) Discuss four different types of tillage practices used to control water erosion.

(16)

SECTION B

5. Answer any four sub-parts not exceeding 150 words for each sub-part:

(a) What are the components of a submersible pump and explain how are they assembled and installed in a well?

(10)

(b) Maize is growth in a soil having field capacity of 25% and apparent specific gravity of 1.60. Before irrigation, 4 moisture samples were collected upto the root zone depth of 1.20m at equal interval and the following data were obtained. Determine the depth of irrigation required.

(10)

Soil Depth, cm

0-30 30-60 60-90 90-120

Wet weight, gm 98.0 110.0 1160 118.0

Dry weight, gm 84.0 93.4 96.6 99.8

(c) In a subsurface drainage system, the drains are located at spacing of 30m and the drainage line is 300 in long with a slope of 0.25%. What size of tiles will be required if he drainage coefficient is 3 cm? Take Manning's n = 0.011. (10)

(d) Explain briefly the use of the following water control and diversion structures: (10)

(i) check gate

(ii) check dam

(iii) turnout

(iv) spiel

(e) Distinguish between a shallow tube well and a deep tube well. (10)

6. (a) A centrifugal pump is required to lift 1200 liters of water per minute from a well with pumping water level 6 m below G.L. to an overhead tank located at a height of 10 m from G.L. The suction and delivery pipe diameters should be selected from the available size in the market to limit the velocities in the suction and delivery pipes within 2 and 3 m/s respectively. The lengths of suction and delivery pipes are 10 m and 40 m respectively. The suction pipe is fitted with a foot valve & strainer and the delivery pipe is fitted with one gate valve and a 90° long radius elbow. Find the power of the pump if overall efficiency is 50%. Given that the kinematics viscosity of water = 1.15 × 10-6 m2/s, friction factor 4f 0.0032 + 0221/Re

0.237 where Re = Reynolds number. Equivalent length for head losses in foot valve & strainer, gate valve and elbow can be taken as 7 m, 5 m and 8 m length of the delivery pipe respectively. (30)

(b) Write 5 advantages and 5 disadvantages of parshall flume for measurement of discharge in an irrigation channel. (10)

7. (a) Write six functions of sand in concrete and mortar. (6)

(b) State the procedures to determine the stresses in various members of a framed structure by Method of Sections. What is the advantage of this method over others? (6)

(c) Using m = 10, compute the moment of resistance of a rectangular section of width 1000 mm and overall depth 300 mm reinforced with 5 number of 20 mm diameter bars. Effective cover to the reinforcement is 50 mm. The tensile stress of concrete in lower fibre of the section is limited to 2 N/mm2. (8)

(d) A drainage ditch constructed in alluvial soil is used to carry a peak discharge of 1.4 m3/s. Determine the efficient trapezoidal section of the ditch taking a longitudinal slope of 1/3000 and a side slope of 1.5:1, Manning's n = 0.020, Check the permissible velocity. (20)

8. (a) Write the advantages of loose housing barn compared to the stall barn. (12)

(b) Discuss the relative merits and demerits of horizontal and upright silos. (10)

(c) Mention the dimensions of modular bricks in terms of nominal and actual size. What is English bond in brick-work and what is its advantage? (6)

(d) With suitable sketches, explain different types of Net Positive Suction Heads (NPSH) of centrifugal pumps. (12)

PAPER-II
SECTION A

1. Write short notes exceeding 150 words each, on any Four of the following
(a) Air Cleaners (10)
(b) Gearbox (10)
(c) Solar Still (10)
(d) Tillage (10)
(e) Animal drawn land leveling equipment. (10)

2. (a) Discuss the importance of solar energy in agriculture sector. Explain any two solar powered equipment other than solar still, with the help of good sketches. (25)

(b) Explain different types of water cooling systems used in L.C. engines. Draw neat sketches of the systems. Discuss the reasons as to why water cooling is preferred in our tractors. (15)

3. (a) What are different types of sprayers? Explain manually operated air compression and hydraulic compression sprayers. Discuss the differences between them. (25)

(b) With the help of a neat diagram, explain the construction and operation of a wheat thresher. Discuss the reasons for the popularization of threshers among the farmers. (15)

4. (a) Write about a tractor drawn mould board plough using neat sketch for each part. Discuss the differences in the construction and operation of mould board plough and disc plough. (25)

(b) What is the function of a governor in an I.C.engine? What are the common types of governors used? Explain any one of them with the help of a neat sketch. (15)

SECTION B

5. Write short notes not exceeding 150 words each, on any four of the following:-
(a) Hammer mill (10)

(b) Air Screen Cleaner

(10)

(c) Homogenizer

(10)

(d) Rice bran

(10)

(e) Crystal oscillator.

(10)

6. (a) What is meant by single effect and multiple effect evaporation ? Illustrate with neat line diagrams and neat sketches explaining any two types of evaporators.

(25)

(b) Explain the frictional, thermal and aerodynamic properties of agricultural materials. Discuss their application in agricultural processing.

(15)

7. (a) Discuss about the different packaging materials used in dairy industry. Explain the importance of packaging of fruits and packaging materials used for them. Indicate the various economic factors involved in packaging processes.

(25)

(b) Write about the hardware components of a computer system.

(15)

8. (a) What is the function of a rectifier? With the help of neat circuit diagrams, explain the principle of operation of different types of rectifiers. Discuss their advantages and disadvantages.

(25)

(b) Explain the construction and operation of a drum dryer using neat sketch. Discuss the merits and demerits of drum drying over spray drying of milk.

(15)