IFS Agricultural Engineering 2005

PAPER - I

SECTION A

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

(a) What is meant by run-off? How is it produced? Discuss various factors on which it depends. (10)

(b) At the beginning of a certain week, the depth of water in an evaporation pan of 1.2 m diameter was 7.75 cm. During the week, the rainfall was 3.8 cm and 2.5 cm of water was removed from the pan to keep the depth of water in it within a fixed range. At the end of the week, the gauge indicated a depth of 8.32 cm of water in the pan. Using pan coefficient as (0.7), estimate the evaporation during the week from the surface of a reservoir under similar atmospheric conditions.
(10)

(c) Design the notch dimensions of a wooden slab dam to carry a peak flow of 0.8 cum/sec. The notch has rectangular opening. Width of gully channel is 2.8 m. Assume necessary data.
(10)

(d) What are the basic components of permanent soil conservation structures and explain their functions in brief.
(10)

(e) Classify various sources of sediment in reservoirs and write down three main types of bed load samplings commonly used for estimating sediment flow rates.
(10)

2. (a) On a 20% hill slope, it is proposed to construct terraces. If the vertical interval is 2 m, calculate

(i) length per hectare,

(ii) volume of earth work and

(iii) area lost both for vertical cut and for batter slope of 1 : 1.

The cut should be equal to fill. (15)

(b) Write short notes on:

(i) Contour trenching.

(ii) Stone terracing. (10)

(c) Explain mechanics of wind erosion and mention the factors influencing it. (15)

3. (a) What is the Universal Soil Loss Equation. Explain in detail the various elements involved in the equation. Explain in brief the factor affecting the soil loss.

(b) What are various criteria to be considered before proposing a project on watershed management? (15)

(c) Write short notes on -

(i) Farm pond.

(ii) Process of gully development.

(iii) Spurs. (15)

4. (a) What do you mean by aerial photography and how it can be used in watershed management programme? (10)

(b) List out 10 main functions of command area development projects. (10)

(c) Define the following terms:

(i) Rain gauge.

(ii) Time of concentration.

(iii) Antecedent moisture condition.

(iv) Runoff hydrograph.

(v) Plane method.
(20)
SECTION B
5. Answer any four sub-parts not exceeding 150 words for each sub-part.
(a) (i) A wall penetrating into an unconfined aquifer having a saturated thickness of 100 meters. The discharge is 250 lit/mm at 12m draw down. Assuming equilibrium flow conditions and a homogeneous aquifer, estimate discharge at 18th draw down. The distance from the well where the draw down influences is not appreciable may be taken to be equal for both the cases.
(ii) Define following terms:
(i) Semi-confined.
(ii) Perched aquifer.
(iii) Unconfined aquifer.
(7 + 3 =10)
(b) Explain different types of irrigation efficiencies used to evaluate irrigation water management practices.
(10)
(c) (i) In a tile drainage system used for an irrigated area, tile drains of 0.2 m dia, are to be used. The depth for the drains is 2 m below the soil surface. Hydraulic conductivity of the soil is 1 m/day (uniform). The area is irrigated once in 15 days and it is estimated that the losses are 30 mm in 15 days so that the average discharge of the drainage system is 2 mm/day. Calculate the required drain spacing if the water table is to be kept at 1.5 m from the ground surface (take S = 80 m for d = 4 m and equivalent depth = 3.55 m)
(ii) What are the benefits of dub-surface drainage in agricultural lands?
(10)
(d) Discuss briefly the design principles involved in the design of a strainer type of a tube-well.
(10)
(e) (i) What are the source of water supply to farmsteads? Mention the criteria to be considered while designing a storage tank.
(ii) Determine size of an overhead water tank for a farmstead demanding a maximum of about 40,000 lit. of water per hour for 3 hours during noon and only about 30,000 lit.

per hr. during rest of the period. The tube well is capable of supplying at the rate of only 25,000 lit/hr.
(4 + 6 = 10)
6. (a) Write down few conditions where sprinkler can be used advantageously. Specify its advantages over surface irrigation methods and also list out its limitations.
(10)
(b) Write short notes on:
(i) Silos
(ii) Bukhari
(iii) Surkhi
(iv) Curing
(v) Finishing
(vi) Morai.
(30)
7. (a) Eight grams of sodium chloride has been dissolved in 4 lit, of water. Express the salt concentration in ppm, in ohms, millimhos, micromhos/cm and m eq/lt.

(b) What are the methods recommended for reclamation of alkali and saline soils?
(10)
(c) Explain various causes of water logging and mention approaches to solve the drainage problems of a location.
(10)
(d) Write short notes on:
(i) Drainage Coefficient.
(ii) Exchangeable sodium.
(10)
8. (a) Describe the principle of operation of centrifugal pumps and list out few common troubles while operating the pumps.
(20)
(b) Differentiate between:
(i) Shallow tubewell and deep tubewell.
(ii) Infiltration and percolation.
(iii) Specific storage and storability.
(iv) Hydraulic conductivity and intrinsic permeability.
(v) Aquiclude and aquitard.
(20)

PAPER - II
SECTION A
1. Answer any four of the following, each not exceeding 150 words
(a) A tractor weighing 1600 kg is climbing up a slope of 10.05 per cent with a drawbar pull of 274.1 kg parallel to the slope. The travel speed along the slope is 3 kmph and the coefficient of rolling resistance is one per cent. Determine the power required for moving up of the tractor.
(10)
(b) A cultivator has a draft of 270 kg and operating speed of 5 kilometers per hour. Total width of the cultivator is 180 cm and its field efficiency is 80 per cent. Calculate the following:
(10)
(i) Horsepower
(ii) Time to till one hectare.
(c) Write general energy equation. With specific reference to internal combustion engines, find an expression for energy change of a constant volume process.
(10)
(d) Define or explain briefly the following:
(10)
(i) Torque rise
(ii) Power factor
(e) Write down the following:
(10)
(i) Minimum wind velocity for working of a windmill
(ii) Material used to make solar cells
(iii) Upper safe exposure level to noise for continuous operations
(iv) Furrow opener suitable for mulching
(v) Main combustible constituent of biogas
2. (a) Describe type of furrow cross- sections obtained while using—
(i) moldboard ploughs;

(ii) disk ploughs;
(iii) indigenous ploughs.
(15)
(b) Explain the complete procedure for calibrating a seed drill. State reasons for calibration necessary for a seed drill before use. Write function of a combination drill.
(15)
(c) Describe some common motor troubles and their remedies. Give points of considerations for the selection of electric motors.
(10)
3. (a) Suggest improved farm machines to harvest (i) Maize, (ii) Wheat, (iii) Potato, (iv) Napier grass, (v) Lucern, (vi) Jowar (Sorghum). Explain the reasons for your recommendations.
(15)
(b) Explain with the help of a diagram, the working principles of fuel supply. Write importance of a fuel mixture and air cleaner,
(15)
(c) With a neat sketch, describe the construction of a DC generator. How does it differ from that of DC motor?
(10)
4. (a) Describe various devices used in seed metering. How is the seed metered in-
(i) a seed drill;
(ii) a planter;
(iii) the seeding attachment of the cultivation?
(15)
(b) A farmer has to harvest 2.5 hectares of grass by means of a 2 m mower being operated at 4 kmph. How much time it will take to harvest the same if the field efficiency of mower is taken as 80 per cent? Explain the terms registration and alignment as applied to the cutter bar of a mower, and state how these adjustments are done.
(15)
(c) Describe the construction and operation of a shunt motor starter. Draw a diagram of all its internal connections.
(10)
SECTION B
5. Answer any four of the following, each not exceeding 150 words:
(a) Draw a block diagram of operations for a rice-processing center from receiving up to final storage. Label the diagram and the processes clearly.
(10)
(b) List the main components of a cream separator. Explain the process of cream separation with two most important precautions for good cream separation.
(10)
(c) Write down the following:
(10)
(i) Instrument used to measure acceleration
(ii) Quantity measured with stroboscope
(iii) Expression to define decibel (db)
(iv) Henderson’s equation for grain isotherm
(v) The maximum recommended angle of inclination for bucket elevator.
(d) Using a microprocessor and appropriate circuits, it is proposed to build on- board control system for operation of a grain combine. The control is to maintain a constant rate of crop harvesting by controlling forward speed and height of cutting at a fixed moisture content of

the grains. In case the grain moisture exceeds the limit, the combine is to sound a warning and stop forward movement. Show the schematic design, including elements of the control system. To elaborate on the working of the design, a block diagram may be used to show the functioning of the system.
(10)
(e) Define or briefly explain the following:
(10)
(i) Equilibrium moisture content

(ii) Pasteurization.
6. (a) Explain falling rate period of drying process including rate of heat transfer of material and falling rate drying mechanism.
(15)
(b) With a neat diagram, explain the deep - bed drying arrangements and Psychrometric Chart used for drying.
(15)
(c) Explain program transfer and problem analysis in Agricultural Engineering.
(10)
7. (a) Explain properties of agricultural materials used in solving different processing problems in grain.
(15)
(b) Describe indirect dryers with separate collector and drying chamber. Give expression for the efficiency of solar energy collector.
(c) Explain basic laws for operating solar dryers and solar energy utilization in crop drying.
(10)
8. (a) Explain solar grain drying system. Show the working of a double air pass solar grain dryer. Give points of consideration in the selection of solar energy dryers.
(15)
(b) Explain the characteristics of any three of the following:
(15)
(i) Oscillators
(ii) Multi-vibrators
(iii) Amplifiers
(iv) Rectifiers.
(c) Explain methods of size reduction. Give different laws for energy requirement in size reduction.
(10)