IFS Agricultural Engineering 2006

PAPER - I

SECTION A

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

(a) What are the different stages in the development of gully? Describe them briefly.
(10)

(b) Calculate the cross-section of a contour bund used to store 24-h excess rainfall of 10 cm. Annual rainfall is about 120 cm with a high intake rate and there is low coverage of crops over the land. The land slope is 4%. Use Cox's formula for VI of contour bund.
(10)

(c) Design a 150 m long inward sloping (5%) bench terrace for a sandy loam soil with an average slope of 15%. The entire width of the terrace acts as a channel which is provided with a uniform grade of 0.6%. Rainfall intensity for the return period and time of concentration is 20 cm/h. VI =1.06 m. Area of terrace = 0.09 ha, runoff coefficient = 0.3, riser side slope = 1: 1, shoulder bund height 30 cm, bottom width = 75 cm, side slope = 1: 1, Manning's n = 0.04.
(10)

(d) Define critical slope length. How is it related to the land slope?
(10)

(e) What is runoff inducement in relation to water harvesting? Discuss briefly five methods of runoff inducements.
(10)

2. (a) Design the dimensions of a weir used to discharge excess runoff through a contour bund for the following conditions

Land slope = 1.5%, top width of bund 45 cm, height of bund = 60 cm, height of crest above GL 30 cm, side slope of bund = 2: 1, VI =1 m, length of bund = 400 m. Intensity of rainfall for the return period and time of concentration 12 cm/h. During the peak rainfall, constant infiltration rate 2.5 cm/h. No water is stored behind the bund before the peak rainfall occurs. Determine the volume of water stored behind the bund before it starts flowing.
(30)

(b) Define neutral slope of a pipe outlet mathematically and give the discharge equation of a drop inlet spillway for pipe flow condition. Explain the terms.
(10)

3. (a) Indicate the correct answer by writing the appropriate alphabet :
(5)

(i) The main effects of the atmosphere on electromagnetic radiation are
(A) cloud and rain
(B) reflection and refraction
(C) scattering and absorption

(ii) The problem generally encountered in aerial photographs is
(A) colour and shading
(B) tilt and relief displacement
(C) camera and height

(iii) Orthophoto can be defined as
(A) overlapped maps
(B) corrected photos
(C) overlapped photos

(iv) Atmospheric window allows light

(A) transmission
(B) reflection
(C) scattering
(v) Remote sensing sensors are sensitive to
(A) reflected and emitted energy
(B) eye and camera
(C) film
(b) Define the term ‘image processing’ and list its main steps.
(5)
(c) Briefly explain supervised classification and unsupervised classification.
(6)
(d) Write briefly about Spatial resolution and Temporal resolution of remote sensing satellites. Write the spatial resolution of LISS HI and PAN sensors onboard IRS ID Satellite.
(3 + 1)
(e) Discuss the different types of soil movement by wind erosion.
(15)
(f) Give a formula for computing the distance of full protection from a shelterbelt. Explain the terms.
(5)
4. (a) A pond dyke rests on a permeable foundation. With the help of an explanatory sketch, give a formula for determination of seepage loss through the dyke.
(10)
(b) A rectangular pond (50 m x 100 m) has top dyke width of 3 m, side slope 2:1 on both sides and a height of 5 m. The depth of water in the pond is 4.5 m and the depth of impermeable bed below the ground level is 5 m. Coefficient of permeability of dyke material 0.5 mm/mm and that of the foundation 0.1 mm/mm. Determine the seepage loss through the pond dyke in m3 per day.
(15)
(c) Enlist ten points to be considered for selection of a suitable site for farm pond.
(15)
SECTION B
5. Answer any four sub-parts not exceeding 150 words for each sub-part:
(a) For steady radial flow in unconfined aquifer, derive an expression for discharge.
(10)
(b) With the help of characteristic curves, explain the method of selection of centrifugal pumps.
(10)
(c) Potato with 60 cm effective root zone depth is grown in a soil with field capacity and permanent wilting point of 22 and 8% respectively. Irrigation is applied after 40% depletion of the available moisture. Apparent sp. gr. of soil 1.60. Calculate the depth of irrigation required if a pump delivers 10 us discharge, how much time it will take for the irrigation of 1.0 ha assuming no loss of water? (10)
(d) List ten conditions for installation of weirs.
(10)
(e) Runoff water from a watershed enters into a drainage area for 8 hours at the rate of 3 m3/s. The total rainfall during 24-hour period is 12 cm and the total infiltration during the period is 4 cm. If the total drainage area is 200 ha and the crop can tolerate a pounding of 10 cm, calculate the drainage coefficient of the land.
(10)
6. (a) Design a most economical trapezoidal channel section to carry a discharge of 15 m3/s in a bed

slope of 1 in 3500. The side slope is 1.5:1 and Manning's n = 0.02.
(20)
(b) List five specific advantages of submersible pumps over turbine pumps.
(10)
(c) Explain manometric head and gross head of centrifugal pump.
(10)
7. (a) A rectangular farm of 10 ha (500 m 200 m) is to be fenced by barbed wires with concrete poles. Estimate the cost of fencing with six rows of barbed wire. Assume suitable values for spacing of posts and different prices.
(15)
(b) Enlist ten conditions under which a sprinicler irrigation is more suitable than surface method.
(10)
(c) What are the advantages of using fertilizer with irrigation water in a sprinkler system? With the help of a sketch, explain the method of adding fertilizer through the suction side of a centrifugal pump.
(15)
8. (a) Design a drainage channel in sandy loam soil to drain 800 ha of land. Maximum permissible velocity in the sandy loam soil is 0.60 cm/s and the drainage coefficient is 2.0 cm. Side slope of channel = 2:1 Manning's n = 0.02. The channel gradient is 1/3500.
(20)
(b) Discuss briefly the following
(20)
(i) Relief wells
(ii) Mole drains
(iii) Vertical drains
(iv) Buried drains

PAPER - II

SECTION A

1. Answer any four of the following each not exceeding 150 words:
(a) What are various sources of Farm Power? Explain briefly their status in India with their advantages and disadvantages.
(10)
(b) Describe the working principle of Carburetor in IC engine with the help of neat sketch. Explain as how the choke valve helps in starting the engine.
(10)
(c) Elaborate the working principle of the Centrifugal Governor in a Tractor. How does it help to maintain speed under overloading situation during actual work?
(10)
(d) What would be the maximum safe turning speed of a four wheel tractor having weight 2T, centre of gravity 1 m ahead the rear axle and 75 cm above the ground? Wheel base is 2.2 m and wheel spacing is 1.6 m. The distance between centre of rotation and centre of gravity is 4 m.
(10)
(e) An engine operates a thresher at 810 rev/mm requiring a torque of 7 kg-m. Calculate the threshing load in hp/h on the engine.
(10)
2. (a) Draw a neat sketch of Tractor Transmission System. Elaborate the function of differential along with design details.

(10)
(b) Describe the functioning of strain gauge type drawbar dynamometer.
(10)
(c) Calculate the horsepower of a four stroke four cylinder IC engine having diameter of the cylinder 120 mm and length of the stroke 150 mm. The engine is running at 1000 rev/mm at mean effective pressure of 7 kg/cm2.
(10)
(d) Determine the theoretical maximum drawbar pull of a track type tractor weighing 3500 kg with tracks 35 cm wide and.1.65 m long. Soil parameters may be assumed as follows
Cohesion = 0.15 kg/cm2
Angle of internal friction, $\varphi = 30°$
Cohesive modulus of deformation, KC = 3
Friction modulus of deformation, $K\varphi = 0.5$
Coefficient of wheel sinkage, n = 0.2
Assume that the lugs of tractor to be such that the soil is sheared off in a plane area at the ends of the lug.
(10)
3. (a) What are the basic differences in fuel supply system of petrol engine and diesel engine? Support your answer with neat sketch.
(10)
(b) A three bottom 40 cm M.B. Plough costs Rs. 11000.00 and two bottom 40 cm M.B. Plough costs Rs. 9000.00. The operating speed of both the ploughs is 4.5 kmph and expected field performance efficiency is 80 per cent. If the cost per hectare for tractor unit remains same, what would be the size of land for which both the ploughs will be equally economical? Take labour charge as Rs. 50 per. day of 8 hours. Make necessary assumptions wherever required.
(15)
(c) A power tiller costing Rs. 1,20,000 is expected to have useful life of 10 years and trade in value of 10% of the initial cost. Calculate the depreciated value after six years by all four methods,
i.e.
(i) straight line method
(ii) declining balance method
(iii) sum of the digits method and
(iv) sinking fund method.
(15)
4. (a) What do you mean by Valve timing diagram of a four stroke IC engine. Describe the occurrence of events in a four cylinder four stroke engine in a tabular form having standard firing order for proper balancing.
(10)
(b) A farmer purchased a 35 hp tractor at the cost of Rs. 3,40,000.00 with an annual interest of 12%. Considering the life of the tractor as 10 years and annual use as 1000 hours, calculate cost of use of tractor per hour if it is engaged for hiring purpose.
(15)
(c) What are the theoretical field capacity in hectare per hour and per cent time loss for 4 and 6 row corn planter st for 600 mm rows. The row length is 400 m and forward speed of each is 6 km/h. Assume the time losses of 5 second per row for turning at each end and 60 second for filling the seed and fertilizer cans at every second round.
(15)
SECTION B

5. Answer any four of the following each not exceeding 150 words.
(a) Explain agricultural processing with its objectives and major operations performed on various crops.
(10)
(b) Show basic components of an extruder and explain extrusion process.
(10)
(c) Explain screening and factors that affect screening performance.
(10)
(d) What are the various input devices of the computer? What is difference between OCR and OMR?
(10)
(e) Draw the basic block diagram of a temperature measurement system for a dryer using microprocessor. Briefly describe its different sections.
(10)
6. (a) Describe the main components of a power thresher used for threshing wheat. What are the recommended speed of threshing drum (m/s) for wheat and paddy? Elaborate safety precautions for the power thresher.
(10)
(b) Describe the various hardware used in assembling of the CPU of a computer (P-IV) along with their specification. Also elaborate the various memory devices used in the computer.
(10)
(c) Explain the objectives, advantages and disadvantages of parboiling of paddy.
(10)
(d) Explain different methods of grain drying. What do you understand by thin layer drying and deep bed drying?
(10)
7. (a) Explain the process involved in making the milk powder.
(10)
(b) What are the different types of scanners used as an input device? Explain each of them briefly.
(10)
(c) With necessary process flow chart, explain the refining process of crude rice bran oil. Also give in detail the utilization of dc-oiled cake as by-product.
(10)
(d) Elaborate about resistance wire strain gauge. How gauge factor affects the performance of the strain gauge.
(10)
8. (a) It is found that the energy required to reduce particle from a mean diameter of 1 cm to 0.3 cm is 11 kJ kg-1. Estimate the energy required to reduce the same particles from a diameter of 0.1 to 0.01 cm assuming
(i) Kick's law
(ii) Bond's law
(15)
(b) What do you understand by the term 'Hardware' and 'Software' of the computer? What is their significance? Elaborate various types of software.
(10)
(c) During evaluation of an air screen grain cleaner with 2 screens the following were observed.
(i) The impurities present in feed were 6.5%.
(ii) The impurities present in clean grain were 0.5% seed.

(iii) The outflow of blower contained 0.2% clean
(iv) The overflow of the 1st screen contained 1.0% clean seed.
(v) The underflow contained 0.5% clean seed. Compute the cleaning efficiency of the cleaner and suggest how the efficiency can be improved.
(15)