RTF

2009

AGRICULTURAL ENGINEERING - II (Optional)

100124

Standard : Degree **Total Marks : 200**

Nature : Conventional **Duration : 3 Hours**

Note :

(i) *Answers must be written in* ***English.***

(ii) *Question* ***No. 1*** *is* ***Compulsory.*** *Of the remaining questions, attempt* ***any four*** *selecting one question from* ***each section.***

(iii) *Figures to the* ***RIGHT*** *indicate marks of the respective questions.*

(iv) *Use of log table, Non-Programmable calculator is permitted, but any other Table/Code/Reference books are not permitted.*

(v) *Make suitable assumptions, wherever be necessary and state the same.*

(vi) *Numbers of optional questions upto the prescribed number in the order in which they have been solved will only be assessed. Excess answers will not be assessed.*

(vii) *Credit will be given for orderly, concise and effective writing.*

(viii) *Candidate should not write roll number, any name (including their own), signature, address or any indication of their identity anywhere inside the answer book otherwise he/she will be penalised.*

(ix) *For each slab of* ***10 and 15 marks,*** *the examinee is expected to write answers in* ***125 and 200 words*** *respectively.*

1. Answer ***any four*** of the following questions :

(a) Discuss different methods of estimating evapotranspiration from climatological data in brief. **10**

(b) Write about selection and installation of horizontal centrifugal pump in detail. **10**

(c) (i) Determine the optimum number of raingauge station required to install in the watershed of 500 sq. km area, if the normal annual rainfall of different station of watershed are as : **5**

Station :	A	B	C	D	E	F
Annual Rainfall (cm) :	800	1040	780	450	650	350

Assume the allowable error as (10%).

(ii) What are the different factors affecting evaporation process ? Explain the effect of each factor briefly. **5**

P.T.O.

Marks

(d) (i) Differentiate between contour bund and graded bund. 5

(ii) Describe briefly drop spillway and chute spillway. 5

(e) Undisturbed soil sample was collected from a field two days after irrigation when the soil moisture was near to field capacity. The inside dimensions of the core sampler were 7.5 cm in diameter and 15 cm deep. Weight of the core sampling cylinder with moist soil was 2.76 kg and the weight with oven dry soil was 2.61 kg. The weight of the core sampling cylinder was 1.56 kg. Determine the available moisture holding capacity of the soil and the water depth in centimeters per meter depth of soil. 10

SECTION - A

2. (a) (i) Discuss the benefits and ill-effects of irrigation. 5

(ii) Write an essay on history of irrigation development in India. 5

(b) A stream of 135 liters per second was diverted from a canal and 100 liters per second were delivered to the field. An area of 1.6 hectares was irrigated in eight hours. The effective depth of root zone was 1.8 m. The runoff loss in the field was 432 cu m. The depth of water penetration varied linearly from 1.8 m at the head end of the field to 1.2 m at the tail end. Available moisture holding capacity of the soil is 20 cm per meter depth of soil. Determine the water conveyance efficiency, water application efficiency, water storage efficiency and water distribution efficiency. Irrigation was started at a moisture extraction level of 50% of the available moisture. 10

(c) Drive an expression for hydraulic conductivity measurement by Inverse auger hole method. 10

(d) Define drainage and drainage coefficient. Write purpose of providing drainage also explain need of drainage in arid and semi arid areas. 10

3. (a) Discuss different techniques of measuring soil moisture in-situ and laboratory. 10

(b) Plan a suitable drip irrigation system for an orchard on a nearly flat land with medium heavy soil. The dimensions of the field are 37.5 m X 145 m. The source of water is a tube well located at the top corner of the farm. The tree spacing is 5 m X 4 m. emitters are spaced 1 m apart in each lateral. The monthly evapotranspiration rate observed with a class A pan is 240 mm. Irrigation is to be applied daily. Determine the discharge capacity of the drip irrigation system. Maximum diameter of the wetted circle formed by a dripper with discharge rate of 4 liters per second for the given condition is 2.7 m. 10

Marks

(c) Discuss hydrologic and hydraulic drainage design criteria in detail. 10

(d) In a subsurface drainage system, the laterals were laid out 50 meters apart having length of 200 m and have a grade of 0.3.

(i) If the drainage coefficient of the area is 2 cm, what size of thetiles have to be used ? 5

(ii) If the drainage coefficient is increased to 3 cm, what will be the spacing of the laterals ? 5

SECTION - B

4. (a) Derive an expression for estimating the transmissibility of unconfined aquifer in steady state condition. 15

(b) (i) Why canal lining is necessary ? Write advantage and disadvantage of canal lining. 7.5

(ii) Using Kennedy's theory, design an irrigation channel to carry a discharge of 45 cumecs. Assume N = 0.0225 and m = 1. The channel has a bed slope of 0.16 meter per kilometer. 7.5

(c) What are the function of regulators and falls on main canal ? How are these works made safe against failure by : 10

(i) piping

(ii) bed scour

5. (a) (i) Explain the term aquiclude, specific yield, storage coefficient and coefficient of transmissibility. 7.5

(ii) State and discuss assumptions and limitations of Dupuits theory. 7.5

(b) Design a trapezoidal shaped concrete lined channel to carry a discharge of 100 cumecs at a slope of 25 cm/km. the side slopes of the channel are 1.4:1. The value of B may be taken as 0.016. Assume the limiting velocity as 1.5 m/sec. 15

(c) Explain the procedure of designing Sarda type fall. 10

Marks

9. (a) Design a parabolic shaped grassed water way which is to be constructed as an outlet for flow from a graded bund system. The expected runoff is 3.5 m^3/s. The type of grass to be used is dub and needs to be maintained in an excellent way. The slope of the channel is to be kept at 3.5%. The maximum permissible flow velocity in the channel is 2.25 m/sec. **10**

(b) (i) What is gully erosion ? (Explain with different gully formation stages and classification of gully) **4+2+4=10**

(ii) Name the different vegetative and mechanical measures taken to control gully erosion.

(iii) Explain briefly any two vegetative measures taken to control soil erosion.

(c) (i) What is land capability classification and how it can control soil erosion ? **4+6=10**

(ii) Discuss the socio-economic benefits of watershed management programme.

(d) What are the various processes of electromagnetic remote sensing ? Also discuss the various platforms and remote sensing sensors used in the field of remote sensing. **10**

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Marks

SECTION - C

6. (a) (i) Below are the bearings observed in traversing with compass in a place where local attraction was suspected : **5**

Line	Fore Bearing	Back Bearing
AB	80° 30'	260° 30'
BC	351° 15'	173° 0'
CD	32° 15'	208° 0'
DE	106° 15'	287° 45'
EF	99° 0'	280° 0'
FG	209° 30'	29° 30'

At what station(s) do you suspect local attraction ? Give the corrected bearings of the lines.

(ii) Define effective and neutral pressure of a soil mass. **4+2+4=10**

(iii) Briefly discuss about the factors affecting permeability of a soil.

(iv) In a falling head permeability test, the head came down from 30 cm to 20 cm in 10 minutes. How much time it will take for the head to come down to 15 cm ?

(b) A catchment area has an area of 5.0 km^2. The average slope of the land surface is 0.006 and the maximum travel depth of rainfall in the catchment is approximately 1.95 km. The maximum depth of rainfall in the area with a return period of 25 years is tabulated below : **10**

Time duration (min) :	5	10	15	20	25	30	40	60
Rainfall depth (mm) :	15	25	32	45	50	53	60	65

Consider that 2.0 km^2 of the catchment area has cultivated sandy loam soil (C = 0.2) and 3.0 km^2 has light clay cultivated soil (C = 0.7). Determine the peak flow rate of runoff by using the Rational method.

(c) (i) Briefly discuss the role of various factors that affect soil erosion by water.

(ii) Define erosivity and erodibility.

(iii) If the soil loss from a field with 5% slope is 45 mg/ha for up and down slope. The conservation management practice factor is 0.25. What is the estimated soil loss if the field is contoured and the conservation management practice factor is 0.15. **6+4+5=15**

P.T.O.

Marks

7. (a) (i) Name the different types of chains used in chain survey along with their length. 2+3=5

(ii) The following perpendicular offsets were taken from a chain line to a hedge.

Distance (m) :	0	5	10	15	20	30	40	50
Offset (m) :	3.4	4.25	2.6	3.7	2.9	1.8	3.2	4.5

Calculate the area :

(A) Trapezoidal rule

(B) simpson's rule

(iii) What is seepage pressure ? Explain the phenomenon of 'quick condition' pertaining to seepage pressure and develop an expression for critical hydraulic gradient. 5+5=10

(iv) Explain 'active' and 'passive' earth pressure with the help of Mohr's circle.

(b) (i) Define hydrograph. Name the segments of a typical single-peaked hydrograph. 3+7=10

(ii) Derive the curve number equation used for the determination of excess runoff from its basic principles.

(c) (i) Explain briefly the different types of soil movement in wind erosion. 5+5+5=15

(ii) Define USLE with explaining all the parameters/terms.

(iii) Determine the topographic factor for a land having 12% land slope and 30 m length.

SECTION - D

8. (a) A 350 m long graded bund is to be designed for a cultivated land with sandy loam soil and a surface slope of 4%. The bund channel is to be formed by the embankment only. The horizontal distance between two bund is 50 m. Side slopes for bunds in sandy loam soil are recommended to be 1.5:1. The intensity of rainfall for the expected time of concentration is 16 cm/hr. and C = 0.3. Design the bund. The seepage slope may be taken as 4:1. Take manning's 'n' as 0.04 and the channel has a uniform slope of 0.15%. 10

(b) What are the different steps adopted in designing farm ponds ? Explain briefly. 10

(c) What is the necessity of rainwater harvesting in India. Discuss about different rainwater harvesting structures. 10

(d) Why remote sensing and GIS technology become a very useful tool in land and water management in watershed now a days ? Discuss briefly. 10