Roll. No.								

B.E. / B. Tech (Full-Time) DEGREE END SEMESTER EXAMINATIONS, NOV/DEC 2011

AGRICULTURAL AND IRRIGATION ENGINEERING

SEVENTH SEMESTER (REGULATIONS 2008)

AI 9402 – SOIL AND WATER CONSERVATION

Time : 3 hr **Max Marks : 100**

Instructions: i) Draw neat sketches wherever necessary.
ii) Graph sheet and tables are provided with.

PART - A **(10x2 = 20 Marks)**

Answer ALL Questions

1. Sketch the typical sections of a contour bund and an outward sloping bench terrace stating the differences.
2. Calculate the number of spurs required to minimize water erosion along one side of a stream bank having a length of about 200m. It is given that the total length of the spur is 9m and the angle of projection is 30^0 from the vertical.
3. Establish the relationship between Shear stress and Normal stress in the case of a (a) pure clay (b) pure sand and (c) a moist soil.
4. List the recommendations made by Heed towards the construction of temporary structures used for the control of gully erosion.
5. A moist sand sample has a volume of 400 cm^3 and a wet mass of 780 gm. If the particle density is 2.65 g/cm^3 and the dry mass is 740 gm, determine the void ratio.
6. State the behaviour of principal planes in the case of active and passive Rankine pressures.
7. List out the two types of surface storage structures with examples.
8. Write down any two empirical methods used for the determination of basin yield.
9. How the specific speed value is used in pump manufacturing?
10. The water table levels noted down in two observation wells 300 m apart are +210.5m and 205m respectively. If the hydraulic conductivity and porosity of the aquifer are 12.5 m/day and 15%, find the actual velocity of flow in the aquifer.

PART - B **(5x16 = 80 Marks)**

11. A graded broad-based terrace is to be designed for a land with sandy soil and a surface slope of 8%. Taking into account the soil conditions, it is recommended that the velocity in the terrace channel should be less than 1.5 m/s. The intensity of 1 hr rainfall likely to occur in the area at 10-yr recurrence interval is 7.5 cm/h. The length of the terrace is required to be kept as 300m. Take C = 0.3.Design the terrace and sketch the section. *(Refer tables)* (16)

12. a) (i) Explain the factors affecting wind erosion and its adverse effects. (8)

(ii) Discuss the concept of wind erosion control and explain the vegetative control measures. (8)

OR

b) (i) State the design criteria for the construction of a grassed diversion ditch. (4)

(ii) Design a grassed waterway which is to be constructed as an outlet for a flow from a graded bund system. The expected runoff is $3m^3$/sec. The type of grass to be used is Bermuda grass. The slope of the parabolic channel is kept as 3%. (12)

13. a) (i) A Standard Proctor Compaction Test carried out on a sandy soil yielded the following results.

Bulk density (Kg/m^3)	1600	1750	2000	1850	1700
Moisture content (%)	4.8	9.5	13.2	18.4	22.6

Plot the curve for dry density Vs moisture content and hence find the maximum dry density and critical moisture content. (*use the graph sheet*) . (10)

13. a) (ii) Explain a laboratory test that would help to develop a Mohr's envelope. (6)

OR

13. b) (i) In a 20 ha catchment, the soil erosion is to be evaluated. The following information for the catchment is available. R = 1000 t-m/ha mm/h; K = 0.25 t/ha/R; LS = 0.1; vegetative cover factor = 0.5; Contour farming is practiced in 12 ha (P=0.6) and strip cropping is practiced in the remaining area (P=0.3). (i) Calculate the soil loss using USLE and (ii) Calculate the annual soil loss when no such conservation measure is being taken up. (4)

13. b) (ii) Explain the method of stream flow discharge measurement used during floods. (12)

14. a) Give the layout of a farm pond and explain the steps involved in the design. (16)

OR

14. b) State the different techniques of water harvesting and explain the types of short-term runoff harvesting techniques. (16)

15. a) Explain the criteria that warrants the selection of pumps used for irrigating the crops. (16)

OR

15. b) (i) A centrifugal pump 0.06 cumec capacity operates at 1500 rpm against a total head of 22m. If the impellor diameter of the prototype and the model is 0.75m and 0.25m respectively, determine the discharge and head of the model, if the model runs at 3000 rpm; ignoring the efficiency. (6)

b) (ii) Elucidate the types of wells and the impact of pumping on groundwater. (10)

Recommended Slopes for Graded Terraces

Land Slope (%)	Vertical Interval (m)	Horizontal Interval (m)
1	0.75	75
2	0.90	45
3	1.05	35
4	1.20	30
5	1.35	27
6	1.50	25
7	1.65	23.7
8	1.80	22.5
9	1.95	21.6
10	2.10	21.0

Based on the recommendations of US Soil Conservation Service (1953)

Variable Grades for the Four Parts of the Terrace Channel Length

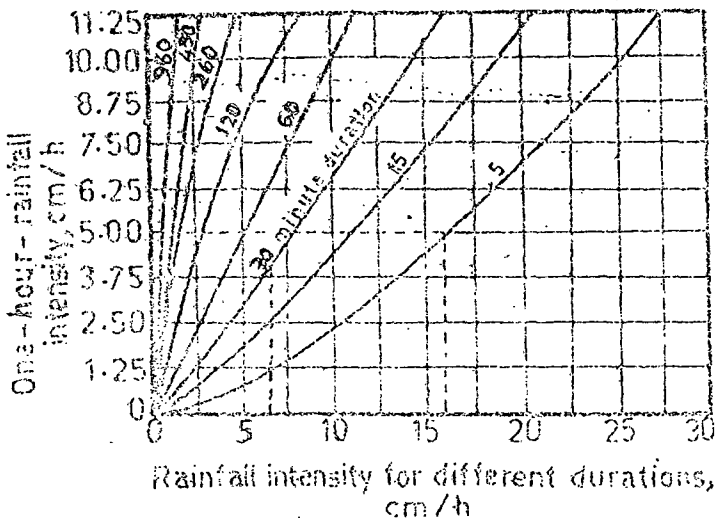
Terrace Length (m)	Channel Grade starting from the Outlet			
	First 1/4	Second 1/4	Third 1/4	Fourth 1/4
30-120	0.30	0.30	0.20	0.20
121-149	0.35	0.30	0.20	0.20
150-240	0.40	0.30	0..20	0.20
241-359	0.45	0.35	0.25	0.20
>or equal to 360	0.50	0.40	0.30	0.20

Based on the recommendations of US Soil Conservation Service (1953)

Recommended Dimensions for Graded Terraces

Land Slope (%)	Ridge Height at Terrace Length				Recommended Slope Ratio		
	60 cm	120 cm	180 cm	320 cm	Channel back slope	Ridge front slope	Ridge back slope
2	21	27	30	36	10:1	10:1	10:1
4	21	27	30	33	6:1	8:1	8:1
6	21	24	27	30	4:1	8:1	8:1
8	21	24	27	30	4:1	6:1	6:1
10	18	24	27	30	4:1	6:1	6:1
12	18	24	27	30	4:1	4:1	4:1
14	18	24	27	30	4:1	4:1	9:1

Based on USDA Agri. Handbook - 57



Relationship between one-hour rainfall intensities and rainfall intensities of different durations (Redrawn from Trans. Am. Soc. Civil Engrs. 110:709, 1945).