

Course No.: SWCE-355

Course Title: Water Harvesting and Soil Conservation Structures

Credits: 3(2+1)

Semester: V

Syllabus

Theory

Water harvesting - principles, importance and issues. Water harvesting techniques – classification based on source, storage and use. Runoff harvesting – short-term and long - term techniques. Short - term harvesting techniques – terracing and bunding, rock and ground catchments. Long-term harvesting techniques – purpose and design criteria. Structures – farm ponds – dug out and embankment reservoir types, tanks and subsurface dykes. Farm pond – components, site selection, design criteria, capacity, embankment, mechanical and emergency spillways, cost estimation and construction. Percolation pond – site selection, design and construction details. Design considerations of *nala* bunds. Soil erosion control structures – introduction, classification and functional requirements. Permanent structures for soil conservation and gully control – check dams, drop, chute and drop inlet spillways – design requirements, planning for design, design procedures – hydrologic, hydraulic and structural design and stability analysis. Hydraulic jump and its application. Drop spillway – applicability, types – straight drop, box – type inlet spillways – description, functional use, advantages and disadvantages, straight apron and stilling basin outlet, structural components and functions. Chute spillway – description, components, energy dissipaters, design criteria of Saint Antony Falls (SAF) stilling basin and its limitations. Drop inlet spillway – description, functional use and design criteria.

Practical

Study of different types of farm ponds. Computation of storage capacity of embankment type of farm ponds. Design of dugout farm ponds. Design of percolation pond and *nala* bunds. Runoff measurement using H-flume. Exercise on hydraulic jump. Exercise on energy dissipation in water flow. Hydrologic, hydraulic and structural design of drop spillway and stability analysis. Design of SAF stilling basins in chute spillway. Hydrologic, hydraulic and structural design of drop inlet spillway. Design of small earthen embankment structures. Practice on software's for design of soil and water conservation structures. Field visit to watershed project areas treated with soil and water conservation measures / structures.

Teaching Schedule- Theory with weightages (%)

S.N	Topic	Book No.	Article No.	Page No.	Weightage (%)
1 & 2	Water harvesting: Principles, importance and issues, Water harvesting techniques – classification based on source, storage and use.	5	14.1,14.2 14.3	523-525	20
3 & 4	Runoff harvesting: short-term and long - term techniques. Short - term harvesting techniques – terracing and bunding, rock and ground catchments.	5	14.3.1 & 14.3.1.1	525-526	
5 & 6	Long-term harvesting techniques – purpose and design criteria. Structures – farm ponds – dug out and embankment reservoir types, tanks and subsurface dykes. Flood water harvesting	5	14.3.1.2,14. 4	527-531	
7 & 8	Farm pond : components, site selection, design criteria, capacity, Numericals	3	27.1, 27.2, 27.3	539-542	20
9,10 &	Types of earthen Embankment, Rolled fill & Hydraulic fill dam , Design criteria & Design of earthen dam; Numericals	5	16.1-16.3	553-560	
	Mechanical and emergency spillways, cost estimation and construction.	4	10.15,10.16	208-212	
11&12	Percolation pond/ <u>tank</u> : site selection, design and construction details.	6	3.7.1	115-125	
13 & 14	Nalabunding: Location, Execution, Practices Adopted	1	4.3	149-151	25
15	Soil erosion control structures: introduction, classification and functional requirements.	4	9.1 & 9.2	172-173	
16, 17, & 18	Permanent structures for soil conservation and gully control : check dams, drop, chute and drop inlet spillways	1	5.3	226-232	
19 & 20	Design procedures – hydrologic, hydraulic and structural design	5	5.1,5.2, & 5.3	190-193	
21	Stability analysis (Check against Overturning, Sliding, Tension, Compression and Piping)	5 1	5.4.1 5.6	209-212 282-284	

22	Hydraulic jump and its application.	5	5.4	194-195	35
23, 24	Drop spillway : applicability, types – straight drop, box – type inlet spillways – description, functional use, advantages and disadvantages, Numericals	1	5.4	234-240	
25 & 26	Straight apron and stilling basin outlet, structural components and functions.	5	5.4	201-206	
27, 28	Chute spillway : material, functional uses, adaptability, advantages, limitations , components, Numericals	1	5.4	251-253	
29& 30	Design criteria of Saint Antony Falls (SAF) stilling basin , Numericals	5	5.6	221-223	
31& 32	Drop inlet spillway: description, functional use and design criteria, Numericals.	1	5.4	253-259	

Practical Exercises

Exercise No.	Title
1	Study of different types of farm ponds.
2	Computation of storage capacity of embankment type of farm ponds.
3-4	Design of dugout farm ponds
5	Design of percolation pond
6	Design of <i>nala</i> bunds
7	Runoff measurement using H-flume
8	Design and stability analysis of permanent structures
9	Stability analysis of drop spillway
10	Design of SAF stilling basin in chute spillway .
11	Design of drop inlet spillway
12	Design of small earthen embankment
13-14	Study of software's for design of soil and water conservation structures
15-16	Visit to watershed

Suggested readings

Text Books:

1. Singh Gurmel, C. Venkataraman, G. Sastry and B. P. Joshi. 2004, 6thed. Manual of Soil and Water Conservation Practices. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Michael, A.M. and T.P. Ojha 2003. Principles of Agricultural Engineering. Volume II. 4th Edition, Jain Brothers, New Delhi.
3. Murthy, V.V.N. 2002. Land and Water Management Engineering. 3rd Edition, Kalyani Publishers, New Delhi.
4. Schwab, G.O., D.D. Fangmeier, W.J. Elliot, R.K. Frevert. 1993. Soil and Water Conservation Engineering. 4th Edition, John Wiley and Sons Inc. New York.
5. Suresh, R. 2014. Soil and Waer Conservation Engineering. Standard Publisher Distributors, New Delhi.
6. Samra, J.S., V.N. Sharda and A.K. Sikka. 2002. Water Harvesting and Recycling: Indian Experiences. CSWCR & TI, Dehradun, Allied Printers, Dehradun.

Reference Books:

- 1) Theib Y. Oweis, DiterPrinz and Ahmed Y. Hachum. 2012. Rainwater Harvesting for Agriculture in the Dry Areas. CRC Press, Taylor and Francis Group, London.
- 2) Studer Rima Mekdaschi and HanspeterLiniger. 2013 Water Harvesting – Guidelines to Good Practice Centre for Development and Environment. University of Bern. Switzerland.