

7th Semester	RAG7D006	Design of Soil and Water Conservation Structures	L-T-P 3-0-0	3 Credits
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Module I (7 hr)

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 - bunding; Short-term harvesting techniques - terracing, rock and ground catchments; Long-term harvesting techniques - purpose and design criteria.

Module II (8 hr)

Farm pond - Structures - farm ponds - dug-out and embankment reservoir types; components, investigation for farm pond site selection, design criteria, capacity of farm pond; Embankment design of farm pond, mechanical and emergency spillways; Cost estimation and construction procedure of farm pond; Percolation pond - site selection, design and construction details; *Nala* bunds and design considerations of *nala* bunds; Tanks for rain water harvesting, design considerations; Subsurface dykes, types of sub-surface dykes, design consideration.

Module III (8 hr)

Flow in open channels- types of flow, state of flow, regimes of flow; Specific energy and specific force in open channel flow; Hydraulic jump and its types and applications of hydraulic jump; Energy dissipation due to hydraulic jump, basic characteristics of hydraulic jump, jump efficiency, relative loss of energy, height and length of jump; Hydraulic jump as energy dissipators; 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 of permanent structures for soil conservation, design components; Creep line theory, Bligh's creep theory for seepage flow, Lane's weighted creep theory, uplift pressure estimation.

Module IV (8 hr)

Stability analysis of permanent structures for soil conservation, check of safety against sliding, overturning, crushing and tension; Drop spillway - applicability, types - straight drop spillway; Box-type inlet spillways - description, functional use, advantages and disadvantages ; Straight apron and stilling basin outlet, structural components and functions and design; Chute spillway - description, components of chute spillway, functional use, adaptability, advantages and limitations.

Module V (8 hr)

Different type of energy dissipaters; Design criteria of Saint Antony Falls (SAF) stilling basin and its limitations; Drop inlet spillway - description, functional use, adaptability, advantages

and limitations, design criteria; Design of pipe spillway, construction of drop inlet spillway; Design of a project with detail project report(DPR)

Books:

1. 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.
2. Suresh, R. 2014. Soil and Water Conservation Engineering. Standard Publisher Distributors, New Delhi.
3. Samra, J.S., V.N. Sharda and A.K. Sikka. 2002. Water Harvesting and Recycling: Indian Experiences. CSWCR&TI, Dehradun, Allied Printers, Dehradun.
4. Singh Gurmel, C. Venkataraman, G. Sastry and B.P. Joshi. 1996. Manual of Soil and Water Conservation Practices. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
5. Michael, A.M. and T.P. Ojha. 2003. Principles of Agricultural Engineering. Volume II. 4th Edition, Jain Brothers, New Delhi.
6. Murthy, V.V.N. 2002. Land and Water Management Engineering. 4th Edition, Kalyani Publishers, New Delhi.
7. Theib Y. Oweis, Dieter Prinz and Ahmed Y. Hachum. 2012. Rainwater Harvesting for Agriculture in the Dry Areas. CRC Press, Taylor and Francis Group, London.
8. Studer Rima Mekdaschi and Hanspeter Liniger. 2013. Water Harvesting - Guidelines to Good Practice. Centre for Development and Environment, University of Bern, Switzerland.
9. Chow, V.T. 1985. Open-Channel Hydraulics. McGraw-Hill Book Company, Inc.
10. Sharda, V.N., Juyal, G.P., Prakash, C. and Joshi, B.P. 2007. Training Manual: Soil Conservation & Watershed Management (Vol.-II) – CSWCRTI Publication, Dehradun.
11. USDA. 1964. Engineering Hand Book on Drop Spillways (Section-11). USDA, Soil Conservation Service.
12. Soil Conservation Service, (1984). Engineering Field Manual. 4th Ed., USDA, Washington, D.C.
13. Bancy, Mati. (2012). Soil and Water Conservation Structures for Smallholder Agriculture: Training Manual 5, Nile Basin Initiative.

Digital Learning Resources:

<http://www.westbengalforest.gov.in/upload/development/cm25.pdf>

<http://www.mfe.govt.nz/publications/land/soil-conservation-handbook-jun01/soil-conserv-handbook-jun01.pdf>