

Course No : ELE-SWCE-481
Credits : 3 (2+1)

Course Title : Floods and Control Measures
Semester: VIII

Syllabus

Theory

Floods- causes of occurrence, flood classification- probable maximum flood, standard project flood, design flood, flood estimation-methods of estimation ; estimation of flood peak-rational method, empirical methods, unit hydrograph method. Statistics in hydrology, flood frequency methods-log normal, Gumbel's extreme value, Log –Pearson type-III distribution, depth-area-duration analysis. Flood forecasting. Flood routing-channel routing, Muskingum method, reservoir routing, ModifiedPul's method. Flood control-history of flood control, structural and non-structural measures of flood control, storage and detention reservoirs, levees, channel improvement. Gully erosion and its control structures-design and implementation. Ravine control measures, River training works, planning of flood control projects and their economics. Earthen embankments – functions, classification-hydraulic and rolled fill dams-homogeneous, zoned and diaphragm type, foundation requirements, grouting, seepage through dams, flow net and its properties, seepage pressure, seepage line in composite earth embankments, drainage filters, piping and its causes. Design and construction of earthen dam, stability of earthen embankments against failure by tension, overturning, sliding etc., stability of slopes- analysis of failure by different methods. Subsurface dams-site selection and constructional features. Check dams-Small earthen embankment-types and design criteria.

Practical

Determination of flood stage-discharge relationship in a watershed. Determination of flood peak-area relationships. Determination of frequency distribution functions for extreme flood values using Gumbel's method. Determination of confidence limits of the flood peak estimates for Gumbel's extreme value distribution. Determination of frequency distribution functions for extreme flood values using log-Pearson Type-III distribution. Determination of probable maximum flood, standard project flood and spillway design flood. Design of levees for flood control. Design of jetties. Study of vegetative and structural measures for gully stabilization. Design of gully/ravine control structures and cost estimation. Designing, planning and cost- benefit analysis of a flood control project. Study of different types, materials and

design considerations of earthen dams. Determination of the position of phreatic line in earth dams for various conditions, stability analysis of earthen dams against head water pressure, foundation shear, sudden draw down condition etc. Stability of slopes of earth dams by friction circle and other methods. Construction of flow net for isotropic and anisotropic media. Computation of seepage by different methods. Determination of settlement of earth dam. Input-output-storage relationships by reservoir routing. Visit to sites of earthen dam and water harvesting structures.

Teaching Schedule – Theory with weightages (%)

Lecture No	Topic	Book No	Article No.	Page No.	Weightage (%)
1	Definition & causes of floods, design flood, SPF, PMF and its importance	7 2	7.48, 7.49 7.1	445-446 245	25
2	Estimating design flood and flood flows	7 2	7.50, 7.50.1 7.2, 7.3	446-452 245-252	
3	Envelope curves	1 7	-- 7.50.2	676-678 452-453	
4	Methods of flood frequency, confidence bands	1	--	704-721	
5.	Flood frequency studies	2	7.6, 7.7	255-265	
6	Unit hydrograph method	7	7.50.4	477-478	
7.	Depth-Area-Duration analysis	1	--	734-736	
8	Flood forecasting: Need, problems, limitations	1	--	768-772	15
9	River forecasting procedure, flood forecasting methods	1 2	-- --	772-778 312-313	
10	Flood routing : channel routing, Muskingum method, crest segment routing	1 2	11.4 8.5	576-588 291-296	
11	Reservoir routing, Modified Pul's method	1 2	11.5 8.3	590-592, 601-602 281-284	
12	Flood control : history, structural and non-structural measures for flood control	2	8.10, 8.11	309-314	
13	Gully control structures : temporary check dams	3	15.8, 15.9	756-764	30
14	Permanent structures for gully control	4	26.8, 26.9	517-528	
15	Design of chute spillway, design of drop inlets	4	26.10, 26.11, 26.11	529-537	
16	Ravine reclamation	5 3	4.9 15.3-15.8	184-189 742-756	

17	Control & training of rivers, objectives, classification, methods of river training, marginal embankments	7	8.5, 8.5.1, 8.5.2, 8.5.3	500-503	30 (Lecture No.19 to 32)
18	Guide banks	7	8.5.3(2)	503-509	
19	Earthen embankments: introduction, types, methods of construction	7 5	20.1,20.2, 20.3 16.1	1045-1047 553-555	
20	Foundation design	6	128	211-212	
21	Grouting	6	129	212-218	
22	Seepage through embankments	4	27.5	545-547	
23	Flow net & its properties	5	16.6	565-567	
24	Seepage line in composite earth embankments	7	20.12.1- 20.12.3	1060-1070	
25	Drainage filters, Piping & its causes	7	20.14, 20.7.2	1090-1092 1053-1054	
26	Design of earthen dams	3	16.7	819-821	
27, 28 & 29	Stability analysis of slopes, stability of foundation against shear	7	20.8, 20.9 20.13, 20.13.3, 20.13.4 20.13.5, 20.13.6 20.13.7	1055-1057 1071-1072 1076-1077 1077-1080 1080-1082	
30	Small earthen embankments	4	27.4	542-544	
31	Subsurface dams*: site selection & constructional features	-	-	-	
32	Planning of flood control projects and their economics*	-	-	-	

*Topics may be covered from any other suitable book/source.

Practical Exercises

Exercise No.	Title
1.	Study of flood-stage-discharge and flood peak-area relationships of watershed.
2.	Determination of frequency distribution functions and confidence bands by Gumbel's method.
3.	Determination of frequency distribution functions by Log Pearson Type-III method.
4.	Determination of design flood, standard project flood and probable maximum flood.
5.	Determination of channel level by flood routing by Muskingum methods
6.	Determination of reservoir level by Modified Puls Method

7.	Determination of reservoir levels by Graphical method.
8.	Determination of reservoir inflow, outflow and storage by flood routing.
9.	Design of flood control levees and guide banks. (Ref. Book No.7, p. 501).
10.	Study of vegetative measures of gully control.
11.	Study of structural measures of gully control
12.	Design and cost estimation of permanent gully control structures.
13.	Design of earth dam and determination of phreatic (seepage) line.
14.	Analysis of stability of slopes and foundation shear safety of earth dam.
15.	Construction of flow net and computation of seepage of earth dam.
16.	Study of Designation for check dams

Suggested readings

Text Books:

1. Mutreja K. N. 1986, Applied Hydrology, Tata McGraw-Hill Publishing Co, Delhi.
2. Subramanya K., 2008, Engineering Hydrology, 3rdEdition, Tata McGraw-Hill Publishing Co, Delhi.
3. Michael, A. M. and T.P. Ojha 2003, Principles of Agricultural Engineering Volume, 4thEdition, Jain Brothers, New Delhi.
4. Murthy, V.V.N. 2002, Land and Water Management Engineering, 4thEdition, Kalyani Publishers, New Delhi.
5. Suresh R. 2014 Soil and Water Conservation Engineering, Standard Publisher Distributors, New Delhi.
6. Bureau of Reclamation, 1987, Design of Small Dams, US Department of Interior, Washington D.C.
7. Garg S.K., 2009, Irrigation Engineering and Hydraulic Structures, Khanna Publishers Pvt. Ltd, New Delhi.