

|           |                             |          |   |   |   |   |        |                      |
|-----------|-----------------------------|----------|---|---|---|---|--------|----------------------|
| 25UAGT413 | FLOODS AND CONTROL MEASURES | Category | L | T | P | R | Credit | Year of Introduction |
|           |                             | PEC      | 3 | 0 | 0 | 0 | 3      | 2025                 |

**Preamble:** This course provides fundamental knowledge on the causes, estimation and management of floods with emphasis on hydrological analysis and flood control engineering. It equips students with the principles of flood frequency analysis, flood routing, design of embankments and earthen dams, and planning of flood control projects relevant to agricultural watersheds and rural infrastructure development.

**Prerequisite:** Nil

**Course Outcomes:** After the completion of the course, the student will be able to

| CO  | Course Outcomes                                                                                           | Knowledge Level  |
|-----|-----------------------------------------------------------------------------------------------------------|------------------|
| CO1 | Explain the classification and methods of flood estimation.                                               | K2<br>Understand |
| CO2 | Apply statistical and hydrological methods and hydrograph techniques for flood prediction.                | K3<br>Apply      |
| CO3 | Apply flood routing methods for flood control in watersheds.                                              | K3<br>Apply      |
| CO4 | Explain the design principles and stability analysis of earthen embankments and flood control structures. | K2<br>Understand |

#### Mapping of course outcomes with program outcomes and program specific outcomes

| CO  | PO1 | PO2 | PO3  | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 |
|-----|-----|-----|------|-----|-----|-----|-----|-----|-----|------|------|------|------|
| CO1 | 3   | 2   | 1    | 1   | -   | -   | -   | -   | -   | -    | -    | 2    | 2    |
| CO2 | 3   | 3   | 2    | 2   | -   | -   | -   | -   | -   | -    | -    | 3    | 3    |
| CO3 | 3   | 3   | 3    | 3   | -   | 3   | 2   | -   | -   | -    | -    | 3    | 3    |
| CO4 | 3   | 2   | 3    | 2   | -   | 3   | 2   | -   | -   | -    | 2    | 3    | 3    |
| Avg | 3   | 2.5 | 2.25 | 2   | -   | 3   | 2   | -   | -   | -    | 2    | 2.75 | 2.75 |

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation

#### Mapping of Course Outcomes with Knowledge and Attitude Profile (WK)

| CO  | WK1 | WK2 | WK3 | WK4 | WK5 | WK6 | WK7 | WK8 | WK9 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| CO1 | *   | *   | *   | *   | *   |     |     | *   |     |
| CO2 | *   | *   | *   | *   | *   |     |     | *   |     |
| CO3 | *   | *   | *   | *   | *   |     | *   | *   | *   |
| CO4 | *   | *   | *   | *   | *   |     | *   | *   | *   |

#### Wks Mapped with the Course

| WK1 | WK2 | WK3 | WK4 | WK5 | WK6 | WK7 | WK8 | WK9 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| *   | *   | *   | *   | *   |     | *   | *   | *   |

## Mark Distribution

| Total Marks | CIE Marks | ESE Marks | ESE Duration |
|-------------|-----------|-----------|--------------|
| 100         | 40        | 60        | 2.5 hrs      |

### Continuous Internal Evaluation Pattern:

|                                                       |            |
|-------------------------------------------------------|------------|
| Attendance                                            | : 5 marks  |
| Continuous Assessment Test                            | : 20 marks |
| Continuous Assessment Assignment / Field visit report | : 15 marks |

## SYLLABUS

### Module 1 (11 hrs)

Floods- causes of occurrence, classification- probable maximum flood, standard project flood, design flood, flood estimation methods; Estimation of flood peak- rational method, empirical methods, unit hydrograph method, Watershed-based flood mitigation

### Module 2 (10 hrs)

Statistics in hydrology, flood frequency methods, lognormal, Gumbel's extreme value, log-Pearson type-III distribution; depth-area-duration analysis, flood forecasting; Extreme rainfall analysis; Climate-resilient flood control structures

### Module 3 (11 hrs)

Flood routing- channel routing, Muskingum method, reservoir routing, modified Pul's method; Flood control- history of flood control, structural and non-structural measures, storage and detention reservoirs, levees, channel improvement; Gully erosion and its control structures, Integrated river basin management, Urban and rural flood forecasting systems, Sediment management during floods

### Module 4 (10 hrs)

Earthen embankments- functions, classification, 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 principles and construction of earthen dam, stability of earthen embankments against failure by tension, overturning, sliding; Planning of flood control projects and their economics

### Field Visits

Field visits to Irrigation dam and spillway site / River embankment construction site/ Flood-affected watershed area / Minor irrigation project / Reservoir operation control centre / Early flood warning monitoring station / Gully erosion control project site

### Text Books

1. Subramanya, K. (2013). *Engineering hydrology*. Tata McGraw Hill Education.
2. Murthy, V. V. N. (2012). *Land and water management engineering*. Kalyani Publishers.
3. Modi, P. N. (2010). *Hydrology and water resources engineering*. Standard Book House.

### Reference Books (APA Style)

1. Chow, V. T., Maidment, D. R., & Mays, L. W. (2020). *Applied hydrology*. McGraw Hill.
2. Garg, S. K. (2021). *Irrigation engineering and hydraulic structures*. Khanna Publishers.

3. Raghunath, H. M. (2022). *Hydrology: Principles, analysis, and design*. New Age International Publishers.

**END SEMESTER EXAMINATION - MODEL QUESTION PAPER**  
(STC 2025 SCHEME)

|                       |                                    |
|-----------------------|------------------------------------|
| <b>Course Code</b>    | <b>25UAGT413</b>                   |
| <b>Course Name</b>    | <b>FLOODS AND CONTROL MEASURES</b> |
| <b>Max. Marks: 60</b> | <b>Duration: 2.5 Hours</b>         |

| <b>Part A</b>                                                                         |                                                                                                      |              |           |           |
|---------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|--------------|-----------|-----------|
| <i>(Answer all questions. Each question carries 3 marks)</i>                          |                                                                                                      |              |           |           |
| <b>Qn No.</b>                                                                         | <b>Question</b>                                                                                      | <b>Marks</b> | <b>CO</b> | <b>BL</b> |
| 1.                                                                                    | Explain probable maximum flood and design flood.                                                     | 3            | CO1       | L2        |
| 2.                                                                                    | Explain the methods of flood estimation.                                                             | 3            | CO1       | L2        |
| 3.                                                                                    | Apply the rational method to explain estimation of flood peak.                                       | 3            | CO2       | L2        |
| 4.                                                                                    | Apply Gumbel's extreme value distribution in flood frequency analysis.                               | 3            | CO2       | L2        |
| 5.                                                                                    | Apply the Muskingum method to explain channel routing.                                               | 3            | CO3       | L2        |
| 6.                                                                                    | Apply the modified Pul's method to explain reservoir routing.                                        | 3            | CO3       | L2        |
| 7.                                                                                    | Explain the functions and classification of earthen embankments.                                     | 3            | CO4       | L2        |
| 8.                                                                                    | Explain the phenomenon of piping and its causes in earthen dams.                                     | 3            | CO4       | L2        |
| <b>Part B</b>                                                                         |                                                                                                      |              |           |           |
| <i>(Answer any one full question from each Module. Each question carries 9 marks)</i> |                                                                                                      |              |           |           |
| <b>Module I</b>                                                                       |                                                                                                      |              |           |           |
| <b>Qn No.</b>                                                                         | <b>Question</b>                                                                                      | <b>Marks</b> | <b>CO</b> | <b>BL</b> |
| 9                                                                                     | Explain the causes and classification of floods and the methods used for flood estimation.           | 9            | CO1       | L2        |
| <b>OR</b>                                                                             |                                                                                                      |              |           |           |
| 10                                                                                    | Explain the unit hydrograph method and empirical methods for estimating flood peak.                  | 9            | CO1       | L2        |
| <b>Module II</b>                                                                      |                                                                                                      |              |           |           |
| <b>Qn No.</b>                                                                         | <b>Question</b>                                                                                      | <b>Marks</b> | <b>CO</b> | <b>BL</b> |
| 11                                                                                    | Apply flood frequency methods such as log-Pearson type-III distribution to explain flood prediction. | 9            | CO2       | L3        |
| <b>OR</b>                                                                             |                                                                                                      |              |           |           |
| 12                                                                                    | Apply depth-area-duration analysis and extreme rainfall analysis to flood forecasting.               | 9            | CO2       | L3        |
| <b>Module III</b>                                                                     |                                                                                                      |              |           |           |
| <b>Qn No.</b>                                                                         | <b>Question</b>                                                                                      | <b>Marks</b> | <b>CO</b> | <b>BL</b> |
| 13                                                                                    | Apply the Muskingum method to explain channel flood routing for flood control in a watershed.        | 9            | CO3       | L3        |
| <b>OR</b>                                                                             |                                                                                                      |              |           |           |
| 14                                                                                    | Apply structural and non-structural flood control measures including storage reservoirs and levees.  | 9            | CO3       | L3        |

| <b>Module IV</b> |                                                                                                   |              |           |           |
|------------------|---------------------------------------------------------------------------------------------------|--------------|-----------|-----------|
| <b>Qn No.</b>    | <b>Question</b>                                                                                   | <b>Marks</b> | <b>CO</b> | <b>BL</b> |
| 15               | Explain the seepage through earthen dams using flow nets and the design of drainage filters.      | 9            | CO4       | L2        |
| <b>OR</b>        |                                                                                                   |              |           |           |
| 16               | Explain the stability analysis of earthen embankments against failure by overturning and sliding. | 9            | CO4       | L2        |

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