

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -2 EXAMINATION- 2026

B.Tech-VIII Semester

COURSE CODE (CREDITS): 21B1WCE831 (3)

MAX. MARKS: 25

COURSE NAME: DISASTER RISK ANALYSIS AND MANAGEMENT

COURSE INSTRUCTORS: DR. SAURAV

MAX. TIME: 1 Hour 30 Min

Note: (a) All questions are compulsory.

(b) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems

(c) Use of Non programmable calculator is allowed.

Q.No	Question	CO	Marks																		
Q1	Data covering a period of 90 years for a natural hazard flood given a standard deviation of 2465 units and mean of the data is 6524 units. Applying Gumbell's methods determine the flood data you will adopt for a project as a disaster management student that has a return period of 450 years. If confidence for the estimate of the above flood data is 80% then calculate limits of flood data based on the confidence percentage. Given $S_n = 1.2020$ and $Y_n = 0.5589$. For 80% confidence $f(c) = 1.282$	3	5																		
Q2	<p>A concrete dam located in a mountainous seismic region may fail due to earthquake shaking and landslide activity. The top event (T) is Dam Failure.</p> <p>The system behavior is described below:</p> <ol style="list-style-type: none"> Dam failure occurs if structural instability (A) or landslide impact on the dam (H) occurs. Structural instability (A) occurs when both: <ul style="list-style-type: none"> Strong earthquake shaking (B) and Foundation weakness (C) occur simultaneously. Foundation weakness (C) occurs if either: <ul style="list-style-type: none"> Poor construction quality (D), or Excessive seepage pressure (E) occurs. Excessive seepage pressure (E) occurs when both: <ul style="list-style-type: none"> High reservoir water level (F) and Drainage system blockage (G) occur simultaneously. <p>The probabilities of the basic events are given below:</p> <table border="1"> <thead> <tr> <th>Event</th> <th>Description</th> <th>Probability</th> </tr> </thead> <tbody> <tr> <td>B</td> <td>Strong earthquake shaking</td> <td>0.025</td> </tr> <tr> <td>D</td> <td>Poor construction quality</td> <td>0.018</td> </tr> <tr> <td>F</td> <td>High reservoir water level</td> <td>0.030</td> </tr> <tr> <td>G</td> <td>Drainage system blockage</td> <td>0.015</td> </tr> <tr> <td>H</td> <td>Landslide impact on dam</td> <td>0.012</td> </tr> </tbody> </table> <p>Assume all basic events are independent.</p>	Event	Description	Probability	B	Strong earthquake shaking	0.025	D	Poor construction quality	0.018	F	High reservoir water level	0.030	G	Drainage system blockage	0.015	H	Landslide impact on dam	0.012	3	6
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	<p>a) Develop the Boolean expression for the top event in terms of basic events.</p> <p>b) Determine the minimal cut sets.</p> <p>c) Calculate the probability of each minimal cut set.</p> <p>d) Estimate the top event probability using the minimal cut set approximation method.</p> <p>e) Identify the most critical failure path.</p>		
Q3.	<p>A river bridge is exposed to structural and environmental risks. The top event (T) is defined as "Bridge Collapse".</p> <p>The system behavior is described below:</p> <ol style="list-style-type: none"> 1. Bridge collapse occurs if foundation failure (A) OR superstructure failure (B) occurs. 2. Superstructure failure (B) occurs when both: <ul style="list-style-type: none"> • Girder failure (C) and • Bearing failure (D) occur simultaneously. 3. Bearing failure (D) occurs if: <ul style="list-style-type: none"> • Corrosion (E) OR • Overloading (F) occurs. <p>a) Develop the Boolean expression for the top event in terms of basic events.</p> <p>b) Determine the minimal cut sets of the system.</p> <p>c) Explain why the identified cut sets are minimal.</p> <p>d) Identify the most critical failure path and justify your answer.</p>	3	6
Q4.	<p>Discuss the concept and process of Disaster Risk Assessment (DRA) in detail.</p> <p>In your answer, explain:</p> <ol style="list-style-type: none"> i. The paradigm shift from traditional disaster response to modern disaster prevention approaches ii. The step-by-step process of DRA, including: Hazard assessment, Exposure assessment, Vulnerability assessment and Risk estimation iii. The concepts of acceptable risk and residual risk, and their significance in infrastructure design and disaster management <p>Support your answer with suitable examples and diagrams wherever necessary.</p>	2	6
Q5.	<p>At a multi-hazard site, design is controlled by either a major flood or a strong earthquake. The annual probability that a major flood exceeds the design capacity is $p_f=0.004$ The annual probability that a strong earthquake exceeds the design capacity is $p_e=0.0015$</p> <p>Assume independence between years and between hazards.</p> <p>(a) Determine the annual probability that at least one of these hazards exceeds the design capacity in a given year.</p> <p>(b) Compute the probability that no exceedance of any type occurs in 50 years.</p>	2	2