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Bengaluru

Mid Term Examinations - October 2026

Date: 05/10/2026 **Time:** 11:45 AM - 01:15 PM

Course Code: MEC3441 **Course Name:** Reliability and Maintenance in Oil and Gas Industry

Semester: Seventh Semester **Max. Marks:** 50 **Weightage:** 50%

CO - Levels	CO1	CO2	CO3
Marks	24	42	24

PART A: Answer Following Questions. 10 M

Q.N.	Questions	M	CO	BT
1	Identify two primary advantages and one key limitation of Dye Penetrant Testing (DPT).	2	CO1	BT2
2	State the fundamental working principle and primary oil and gas application of Eddy Current Testing (ECT).	2	CO1	BT2
3	Define functional failure and provide one example each for a gas compressor and a subsea pipeline.	2	CO2	BT2
4	State the natural frequency formula for torsional vibrations in a single rotor system ($f_n = \frac{1}{2\pi}\sqrt{\frac{K}{J}}$) and define each parameter.	2	CO3	BT2
5	State the gyroscopic couple equation ($C = I\omega\Omega$) and state the right-hand screw rule for determining its direction.	2	CO3	BT2

PARTB: Answer Any 1 Following Questions. 20 M

Q.N.	Questions	M	CO	BT
06.A	Construct a comprehensive in-service inspection guide for six critical plant assets (boiler tubes, pipeline welds, turbine blades, rotors/shafts, heat exchanger tubes, and storage tanks), mapping each component to its expected damage mechanism and preferred NDE method.	10	CO1	BT2
06.B	Explain the classification of equipment criticality in an offshore facility (high, medium, low) using parameters such as hydrocarbon containment, continuous production, accessibility, and environmental risk.	10	CO2	BT2
07.A	(i) Describe the three-tier acceptance level classification (Level I / Stringent, Level II / Moderate, Level III / Permissive) utilized across nuclear, pipeline, and general structural codes. (ii) Explain how acceptance criteria link Non-Destructive Examination with Fitness-for-Service (FFS) and fracture mechanics-based approaches.	10	CO1	BT2
07.B	Describe the RCM failure logic process, detailing how failure effects and failure consequences (Safety, Environmental, Economic) guide maintenance decision-making in oil and gas operations.	10	CO2	BT2

PARTC: Answer Any 1 Following Questions. 20 M

Q.N.	Questions	M	CO	BT

08.A	Describe the degradation mechanisms of external corrosion under insulation (CUI) in static piping and blade fatigue in gas turbines, detailing their underlying causes and early warning indicators.	10	CO2	BT2
08.B	Apply consequence analysis and risk matrix evaluation to develop an equipment reliability and mitigation program for an offshore platform. Address condition monitoring (vibration analysis, oil sampling, thermography), equipment redesign (dual mechanical seals), and redundancy planning for critical rotating and static equipment.	10	CO3	BT3
09.A	Explain the functional requirements and operating standards of RAM (Reliability, Availability, Maintainability) and mechanical seal reliability practices in managing rotating machinery uptime.	10	CO2	BT2
09.B	(i) Analyze torsional resonance in multi-rotor systems and evaluate how mass polar moment of inertia (J) and torsional stiffness (K) affect operational reliability.	10	CO3	BT3