Seat No./Enrollment No.: _____

GUJARAT TECHNOLOGICAL UNIVERSITY
BACHELOR OF ENGINEERING – SEMESTER 4 – EXAMINATION – SUMMER 2026

Subject Code: BE04022011 **Date: 21/05/2026**

Subject Name: Rock Mechanics

Time: 10:30 AM TO 01:00 PM **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

Q.1	**(a)**	What is the difference between "rock" and "rock mass" in an engineering context?	**03**
	(b)	Analyze the specific contributions of Rock Mechanics to the design and stability of underground mining structures.	**04**
	(c)	Formulate the differential equation of static equilibrium for a rock element and discuss its practical utility in mining stress analysis.	**07**
Q.2	**(a)**	Explain the engineering significance of the Slake Durability Index for assessing rock weatherability.	**03**
	(b)	Describe the construction of a Mohr's failure envelope and how it helps in identifying the shear strength parameters of a rock.	**04**
	(c)	Outline the standardized ISRM experimental procedure for evaluating the Uniaxial Compressive Strength (UCS) and the Young's Modulus of a rock specimen.	**07**
		OR	
Q.2	**(c)**	Evaluate various rheological models used to simulate the time-dependent deformation and creep behavior of rocks.	**07**
Q.3	**(a)**	Compare the characteristics of virgin (in-situ) stresses with those of secondary (induced) stresses.	**03**
	(b)	Illustrate the Pressure Arch Theory with a labeled diagram and explain how it influences the selection of support locations.	**04**
	(c)	Provide a comprehensive technical report on the Hydrofracturing technique for measuring in-situ stresses, detailing both its operational merits and constraints.	**07**
		OR	
Q.3	**(a)**	Explain the difference between Elasticity and Plasticity in the context of rock deformation.	**03**
	(b)	What is Shotcreting, and how does it provide immediate support to a newly excavated rock face?	**04**
	(c)	Explain the Terzaghi's rock load classification and its limitations compared to modern numerical models like FEM and BEM.	**07**
Q.4	**(a)**	Demonstrate the method of calculating Rock Quality Designation (RQD) and its role in preliminary site investigation.	**03**
	(b)	Discuss the application of the Geological Strength Index (GSI) in estimating the strength parameters of jointed rock masses.	**04**

	(c)	Detail the six fundamental parameters of the Rock Mass Rating (RMR) system and explain how they are integrated to determine the final stand-up time.	**07**

OR

Q.4	**(a)**	Describe the purpose of Convergence measurement instruments like extensometers.	**03**
	(b)	What engineering parameters are derived from the Brazilian test, and how do they influence the design of underground supports?"	**04**
	(c)	Examine the Barton's Q-system of rock classification, focusing on the six parameters and the relevance of the Excavation Support Ratio (ESR).	**07**
Q.5	**(a)**	Summarize the essential functional requirements that a primary support system must satisfy in an underground excavation.	**03**
	(b)	Characterize the reinforcement mechanism provided by cable bolting in heavy strata or large-span openings.	**04**
	(c)	Critically analyze the mechanics of rock mass reinforcement through rock bolting, focusing on the interaction between internal forces and rock displacement.	**07**

OR

Q.5	**(a)**	How does the 'Degree of Saturation' affect the unit weight of a rock mass?	**03**
	(b)	How structural discontinuities and pore water influence the overall strength and stability of a rock mass?	**04**
	(c)	"Analyze the fundamental mechanical differences and operational overlaps between the Coulomb, and Mohr theories when predicting the structural breakdown of rock under diverse stress states."	**07**

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