Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME - SEMESTER– III • EXAMINATION – SUMMER 2015

Subject Code: 734302 **Date: 02/05/2015**

Subject Name: Rock Opening & Tunnels

Time: 2:30 pm to 5:00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary**
3. **Figures to the right indicate full marks**

Q.1	**(a)**	State various index properties of rock. Explain their importance and application. Also summarize the tests carried out to determine each property.	**07**
	(b)	Enlist classification of tunnel as per purpose with neat sketch. Explain in detail purpose of geological exploration for tunnel construction	**07**
Q.2	**(a)**	Write a detail note on strain rosettes supported by equations.	**07**
	(b)	State various methods to determine absolute stress in rock. Explain Borehole deformation method with deformation rosette.	**07**
Q.3	**(a)**	Explain fundamental difference between Coulomb-Navier and Mohrôs theory of failure. How Griffithôs theory of brittle fracture is found to be more better in predicting failure , state the criteriaôs given by him.	**07**
	(b)	What is allowable bearing pressure on footings on rock? For sand stone give Raphael and Goodman bearing capacity analysis. What guidelines are observed while placing footing on rock with open joints and on layered rock?	**07**
		OR	
Q.3	**(a)**	Explain in detail with neat sketch óBrazilian tensile testô for rock. State their advantages.	**07**
	(b)	Explain the importance of ófrictionô on rock surfaces. Give various configurations used for measuring friction in triaxial testing machine. State óByerleeôsô law.	**07**
Q.4	**(a)**	Elaborate design of single opening under various stress fields. Explain stress concentration for circular opening with their conclusions.	**07**
	(b)	In a two layer roof, layer has a thickness of 6cm and 12cm respectively for upper and lower layer. The observed E values are 1.1 x 10^4 kg/cm^2 and 1.44 x 10^4 kg/cm^2 respectively. If unit weight of upper layer is 15% higher than lower layer of rock, calculate percentage variation in maximum tensile, shear stress and deflection with respect to gravity loaded roof.	**07**
		OR	
Q.4	**(a)**	Define multiple opening. State criteria for single and multiple opening. Give and explain various boundary conditions for stress distribution in case of row of elliptical openings.	**07**
Q.4	**(b)**	A roof layer is subjected to a uniformly distribution gas pressure. The thickness of the roof is 35cm and modulus of elasticity is 1.2 x 10^4 kg/cm^2, poisons ratio is 0.33. If maximum deflection is 2.13cm and unit weight as 27.5 kN/m^3. Calculate modulus of rupture of rock assuming span 5m, take factor of safety as 4.	**07**

Q.5 **(a)** Define rib pillars. Show the empirical equation to calculate extraction ratio and maximum compressive strength of pillars. What is the importance of extraction ratio in design for 2D and 3D case? **07**

(b) The compressive strength of rib pillars having over burden of rock equal 250m height is 1345 kg/cm^2. Estimate room width in 2D and 3D array of pillars. Consider height of pillar as 4.5m thick bedded rock having width to height ratio as 3. Take unit weight as 28.5 kN/m^3, FOS =4 and length of pillar as 2 times width of pillar. **07**

OR

Q.5 **(a)** What are the advantages of rock bolting? Explain rock reinforcement of laminated rock by suspension effect with necessary equations. **07**

(b) The ratio of room width in 3D and 2D array of pillar is 1:3. The extraction ratio obtained is 0.8 in 3D array of pillars for 4m thick pillar bedded of rock having effective width to height ratio of 2.5. Estimate room width for both array of pillars and extraction ratio of 2D opening. Assume length of pillar as 1.5 times width of pillar. **07**