Roll No. | | | | | | | | | | |

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. /B. Tech / B. Arch (Full Time) - END SEMESTER EXAMINATIONS, December 2024

Mining Engineering

Fifth semester

MI 5503 Rock Mechanics and Ground Control

(Regulation 2019)

Time: 3 hrs **Max. Marks: 100**

CO1	To study about application of Rock Mechanics in mining and allied engineering
CO2	To study about Physico-Mechanical properties of rocks
CO3	To study about non-destructive testing methods
CO4	To study about time dependent properties of rock
CO5	To study different types of underground supports

BL – Bloom's Taxonomy Levels

(L1-Remembering, L2-Understanding, L3-Applying, L4-Analysing, L5-Evaluating, L6-Creating)

PART- A (10 x 2 = 20 Marks)

Q.No.	Questions	Marks	CO	BL
1	A steel rod of 20mm diameter has a maximum allowable stress of 140 Mpa. Can it safely support a subjected load of 20 kN?	2	1	3
2	For the given data estimate the inclinations of the principal planes: σ_x = +60 Mpa σ_y = -20 Mpa τ_{xy} = +70 Mpa.	2	1	3
3	What is a hydrostatic state of stress?	2	2	2
4	Can sonic velocity within a rock be a good index ?	2	2	2
5	Explain the term "internal friction".	2	3	2
6	What is Poisson's ratio?	2	3	2
7	What is an immediate roof?	2	4	2
8	Explain the relevance of creep in a rock mass.	2	4	2
9	What is a chock shield support?	2	5	2
10	What is a split set stabilizer?	2	5	2

PART- B (5 x 13 = 65 Marks)

Q.No.	Questions	Marks	CO	BL
11 (a)	For a plane stress system with the following values: σ_x = -50 Mpa σ_y = 35 Mpa and τ_{xy} = +20 Mpa, determine principal planes, principal stresses, maximum shearing stress, its direction and the corresponding normal stress using Mohr's circle. (use a graph sheet). If the system is rotated in the clockwise direction by 40^0, then estimate the above mentioned parameters. Verify the graphical results by manual calculation.	13	1	3
	OR			
11 (b)	For the following system of stresses, Tensile stresses of 100 Mpa and 60 Mpa in the x and y directions and shear stress of 40 Mpa clockwise direction, estimate: Principal planes and principal stresses. The stress components exerted on the element by rotating the given element counter clockwise through 30^0.(use a graph sheet and verify by manual calculations.)	13	1	3

12 (a)	Explain the principles of hydraulic permeability and conductivity, and how can sonic velocity used as an index to the degree of fissuring	13	2	3
	OR			
12 (b)	Explain the principles of RQD index and Rock structure rating method.	13	2	2
13 (a)	Explain the laboratory procedure for finding the triaxial and compressive strength of a rock sample (with diagrams).	13	3	2
	OR			
13 (b)	With neat graphical interpretation explain the Mohr-Coulomb failure criterion for rocks. Compare it with the other theories of rock failure.	13	3	2
14 (a)	What are linear visco elastic models? How are visco elastic constants determined from laboratory tests?	13	4	2
	OR			
14 (b)	Explain the mechanisms used to explain creep in a rock mass, and how are in situ horizontal and vertical stresses in rocks estimated?	13	4	2
15 (a)	With neat diagrams, explain the usage of timber as a mine support. (Answer with reference to setting a prop, underset prop, yielding steel prop with timber core, setting it along a roof, setting along an inclined roadway) Explain the setting of these supports for various gallery heights.	13	5	2
	OR			
15 (b)	What are self-advancing/walking supports? Explain their construction and working. (4 leg 6 leg canopy supports (chock and chock shield supports)) How are they installed along a Longwall face? (Answer should include supports available till date for the 8m/9m high Longwall faces)	13	5	2

PART- C (1 x 15 = 15 Marks)

Q.No.	Questions	Marks	CO	BL
16.	Explain the basis for rock mass classification systems. Summarize on the various classification systems with their uniqueness and applicability. (Terzaghi's, RQD, RSR, RMR and Q system)	15	2	4