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Total Number of Pages: 02 **B.Tech**
PCMN4308

6th Semester Regular / Back Examination 2016-17
ROCK MECHANICS AND GROUND CONTROL
BRANCH: MINING
Time: 3 Hours
Max Marks: 70
Q.CODE: Z253

Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.

Q1 **Answer the following questions:** **(2 x 10)**

a) Define the following stress states: triaxial stress and hydrostatic stress
b) An immediate roof of Rock Mass Rating (RMR) 50 is to be supported by roof bolts. If the width of the gallery is 4.5 m, determine the minimum length of the roof bolt.
c) In a bi-axial stress field, the vertical stress is 10 MPa and the Poisson's ratio of the rock mass is 0.2. Determine the horizontal stress.
d) Define modulus of elasticity and Poison's ratio of rocks.
e) During Brazilian test of a cylindrical rock core of 50 mm diameter and 25 mm thickness, failure occurred at diametrical loading of 10.5 kN. Determine the tensile strength of the rock.
f) State the applications of numerical modelling technique in mining.
g) Define angle of draw and Inflection point in mine subsidence.
h) State the applications of stress meter and extensometer in monitoring of underground excavation stability.
i) List out the general modes of slope failures in surface mines.
j) Define the terms 'rock burst' and 'coal bump'.

Q2 **a)** Discuss briefly the factors influencing the stress-strain behaviour of rocks? **(5)**

b) A cylindrical specimen of brittle rock of 50 mm diameter and 125 mm length, tested in uniaxial compression gave the following results: **(5)**
Load at failure = 250 kN
Longitudinal deformation up to failure = 2.5 mm
Assuming load-deformation curve to be a straight line up to failure, determine the uniaxial compressive strength and the modulus of elasticity of the rock specimen.

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Q3 **a)** List out the various theories of rock and rockmass failure. Explain the Mohr-Coulomb's theory of rock failure. **(5)**

b) Enumerate the list of numerical modelling methods of stress and deformation analysis in rock engineering. Explain briefly the general procedure for the solution of a problem by Finite Element Method. **(5)**

Q4 **a)** List out the methods of stability analysis for mine slopes. Describe briefly through neat sketch the circular mode of slope failure. **(5)**

b) What are the ISRM suggested methods for determination of rock stresses? Explain the principle of hydro-fracturing method of rock stress determination. **(5)**

Q5 **a)** Describe briefly through neat sketches the subcritical, critical and supercritical widths of extraction in mine subsidence. **(5)**

b) What is rheology? Describe the strain-time curve which typically represents the standard creep behaviour of an isotropic rock material under constant temperature and stress. **(5)**

Q6 **a)** What are the various factors affecting mine subsidence? Explain briefly any one method of reducing subsidence influence in mines. **(5)**

b) Explain the phenomena of rock burst. What are the various causes of rock burst? **(5)**

Q7 A point 'P' is at a radial distance of 3 m from the center of a circular tunnel of 3 m diameter and at an angle of 30^{o} from the horizontal. The unit weight and Poisson's ratio of the surrounding rock strata are 25 kN/m^3 and 0.27 respectively, and the depth of excavation from the ground surface is 350 m. Assuming that the rock mass is elastic, homogeneous and isotropic, calculate the radial and tangential stresses acting upon point 'P'. **(10)**

Q8 **Write short notes on any TWO:** **(5 x 2)**

a) Point load strength index of rocks
b) Instrumentation for monitoring underground excavation stability
c) Design of supports in mine openings
d) Mechanics of surface subsidence