SECTION A
(ANSWER ALL QUESTIONS)

1. Write short notes or explain the followings:
    a) Shape effect in Uniaxial Compressive Strength testing.
    b) Procedures for designing an underground excavation in competent, elastic rock.
    c) Q-system of rock mass classification.
    d) Different stabilization strategies and differences between them.   (5*4=20)

SECTION B
(ANSWER 2, 3, 4 and EITHER 5 OR 6)

2. a) Why in UCS testing, load is applied by constant strain-rate but not in constant stress-rate?
    b) How the interaction matrix of rock mechanics fundamental and rock engineering system can be formed? Give examples.   (4+6)

3. a) What are the differences of Point Load and Brazilian test?
    b) Explain the effects of excavation in a rock.   (4+6)

4. a) How the stress-strain graph can be correlated to in-situ stress condition near excavation?
    b) What are the different components of Subsidence?   (5+5)

5. a) Define: Rock burst and Coal Bump. What are the differences between them?
    b) Draw a subsidence profile for horizontal seam and critical width of excavation. Also show on this graph, different curves for different components of subsidence. What is the value of each component at point of inflection?
         (5+5)

OR

6. a) Discuss the three aspects of excavations.
    b) Discuss ground response characteristics for selection of supports.   (6+4)

SECTION C
(ANSWER 7 and 8 OR 7 and 9)

7. a) Determine and plot the subsidence for a **full-width of excavation** based on the following information: Width of excavation=150m, depth=500m, seam thickness=1.5m, subsidence factor=0.40, the excavation is horizontal with critical width of excavation.

S/S_{max}	0	0.05	0.1	0.2	0.4	0.6	0.8	1.0
	Distances from the panel centre in terms of depth							
w/h	0.90	0.59	0.47	0.34	0.24	0.18	0.12	0

Also calculate and plot the strain profile as per the data given: K for compression=1.7 and K for tension=0.8.

E/E_{max}	0	0.2	0.6	1.0	0.8	0	0.2	0.6	1.0	0.6	0
	Distances from the panel centre in terms of depth										
w/h	0.90	0.61	0.45	0.32	0.28	0.21	0.18	0.11	0.05	0.03	0

Clearly show the calculation for each point for subsidence and strain. Assume any further condition(s) if required. (8+12)

8. a) Discuss the factors responsible for rock bursts.
   b) Write the assumptions needed for designing a circular opening in massive rock.
   c) Assuming your conditions, show how in-situ stress direction may change depending on the properties of a single discontinuity.
   (8+8+4)

OR

9. a) Discuss the various factors of Mine Subsidence.
   b) Discuss the problems associated with hydraulic fracturing.
   c) The stresses in a granitic rock mass have been measured by the hydraulic fracturing technique. Two tests were conducted in a vertical borehole, the results were as follows:

Depth, m	Breakdown pressure, MPa	Shut-in pressure, MPa
400	10.0	6.0
800	25.0	10

If tensile strength of the rock is 10 MPa, estimate and list the values of Principal stresses. Assuming other data as needed, are these data consistent? Justify your reasons for the statement. (8+6+6)

Roll No: ---------------------------

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

UPES
THE NATION BUILDERS UNIVERSITY

End Semester Examination, December, 2017

Program Name: B.Tech. in Mining Engineering   **Semester –** **V**

Course Name : Rock Mechanics   **Max. Marks : 100**
Course Code : GSEG 324   **Duration : 3 Hrs**
No. of page/s: 2

SECTION A
(ANSWER ALL QUESTIONS)

1. Write short notes or explain briefly the followings:
  a) Mohr's circle of stress.
  b) Different components of subsidence.
  c) Hoek-Brown failure criteria.
  d) Importance of stress-strain behavior in rock engineering.   (5*4=20)

SECTION B
(ANSWER 2, 3, 4 and EITHER 5 OR 6)

2. a) What are the problems associated in UCS testing?
  b) Explain ANY FOUR different loading conditions for UCS testing.   (6+4)

3. a) Discuss the hydraulic fracturing method in brief.
  b) Compare RMR and Q-system of rock mass classification.   (5+5)

4. a) Explain the mechanism for rock breakage in blasting.
  b) Discuss the principle of Superposition method for subsidence.   (6+4)

5. a) What are Breakdown pressure and Shut-in pressure?
  b) Briefly explain the properties of the discontinuities.   (2+8)

<div align="center">OR</div>

6. a) Explain different methods to estimate JRC and JCS for discontinuities.
  b) Explain the parameters on which permeability of rock depends.   (6+4)

SECTION C
(ANSWER 7 and 8 OR 7 and 9)

7. a) Discuss the general effects of an excavation.
   b) What is RQD?
   c) Given: $\sigma_x = 20$ MPa, $\sigma_y = 10$ MPa, $\tau_{xy} = 10$ MPa, $\tau_{yx} = 10$ MPa, $\theta = 20°$ in clockwise. Calculate the values of stresses after rotation. Also, calculate the principal stresses and principal stress directions. (8+2+10)

8. a) Show the steps for designing an underground excavation in competent rock.
   b) Briefly discuss the Triaxial Compression test.
   c) What are the ground response curves for excavation made by different method? (7+8+5)

OR

9. a) What is subsidence? Discuss the factors on which subsidence depends.
   b) Discuss the factors on which rockburst will depend.
   c) What is the importance of ground response curve for selection of support? (7+8+5)