Full Marks:70   **Time: 3hours**

Answer six questions taking three from each half.
Question No.1 and 6 are compulsory
Figures on the right-hand side margin indicate full marks

Ist Half

1. a. Describe the basic principle of trigonometric leveling.

   b. Define: Law of accidental error, Weight of an observation, Conditioned quantity.

   c. Describe the principle of operation of GNSS.

   d. Describe the method of ranging an underground curve by chord and offset method.

   (3+3+3+6)

2. a. Name the different methods of correlation survey.

   b. Describe any one method of correlation survey using two shafts.

   c. What are the general precautions to be taken while undertaking a correlation survey?

   (3+5+2)

3. a. Determine the distance and elevation of the staff station by tacheometric method when the line of collimation is inclined to the horizontal and the staff is held vertically.

   b. Describe the method of determination of tachometric constants of an instrument

   (7+3)

4. a, Define the followings :

   1. Point of intersection

   2. Angle of intersection

   3. Reverse curve

   4. Deflection angle

   b. Find the most probable values of the angles a, b and c from the following observations:

   $a = 54° 12' 40.7"$ Weight 2

   $b = 46° 31' 15.4"$ Weight 2

$$a + b = 100° \ 43' \ 53.8"$$ Weight 1

$$c = 69° \ 22' \ 31.2"$$ Weight 1

$$b + c = 115° \ 53' \ 49.0"$$ Weight 1

(4+6)

5. Write short notes on:

a. Methods of stope surveying

b. Grade pegs and grade lines

c. ETS

(4+3+3)

Second Half

6. Write short notes on: UTM, WGS 84, Ventilation plan, ECEFXYZ   (4+3+4+4)

7. You are given lease of a large virgin area of land for detailed exploration and mining. Enumerate and detail the steps you will adopt for surveying and preparation of plan of the entire leasehold area in national grid coordinates.

8. An underground bord and pillar mine has two districts working, one development and the other depillaring, working with a single seam opened by two shafts. Draw underground plan following the guidelines provided in coal mines regulations of the mine stating your assumptions therein. Show position of the workings, shafts, boreholes, surface contours, main and trunk roadways, position of goaf etc.   (10)

9. A 6 m thick seam is developed by bord and pillar method to a thickness of 3 m from the floor with 50 m pillars, center to center, and 4 m gallery. Calculate the percentage of extraction during development. The seam is proposed to be depillared full thickness with complete sand stowing by splitting the pillars with a level gallery of same width as the main gallery. Find out the volumetric ratio between the coal taken during depillaring and the sand required to pack the entire goaf.

(10)

10. a) Calculate the weight of coal in a heap which occupies an area measuring 30 m by 20 m and 6 m high. The coal has an angle of repose of 40 degree and weigh 1.25 ton/cu.m.

b) Calculate the area of the ground defined by the following offset points from a chain line at an interval of 30 m starting from zero chainage: 15.6m, 21.3m, 14.8m, 18.1m, 17.2m, 14.7m, 15.3m, 17.1m, 19.8m, 20.8m, 21.4m, 19.3m.   (4+6)