

MN:MINING ENGINEERING

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Q.1–Q.25 CARRY ONE MARK EACH

- 1) “From where are they bringing their books? _____ bringing _____ books from _____,”
The words that best fill the blanks in the above sentence are
(A) Their, they’re, there
(B) They’re, their, there
(C) There, their, they’re
(D) They’re, there, there
- 2) “A _____ investigation can sometimes yield new facts, but typically organized ones are more successful.”
The word that best fills the blank in the above sentence is (GATE MN 2018)
a) meandering b) timely c) consistent d) systematic
- 3) The area of a square is d . What is the area of the circle which has the diagonal of the square as its diameter?
(GATE MN 2018)
a) πd b) πd^2 c) $\frac{1}{4}\pi d^2$ d) $\frac{1}{2}\pi d$
- 4) What would be the smallest natural number which when divided either by 20 or by 42 or by 76 leaves a remainder of 7 in each case?
(GATE MN 2018)
a) 3047 b) 6047 c) 7987 d) 63487
- 5) What is the missing number in the following sequence? 2, 12, 60, 240, 720, 1440, _____, 0
(GATE MN 2018)
a) 2880 b) 1440 c) 720 d) 0

Q6-Q10 CARRIES TWO MARKS

- 6) In appreciation of the social improvements completed in a town, a wealthy philanthropist decided to gift Rs 750 to each male senior citizen in the town and Rs 1000 to each female senior citizen. Altogether, there were 300 senior citizens eligible for this gift. However, only $\frac{8}{9}$ of the eligible men and $\frac{2}{3}$ of the eligible women claimed the gift. How much money (in Rupees) did the philanthropist give away in total?
(GATE MN 2018)
a) 1,50,000 b) 2,00,000 c) 1,75,000 d) 1,51,000
- 7) If $pqr \neq 0$ and $p^{-x} = \frac{1}{q}$, $q^{-y} = \frac{1}{r}$, $r^{-z} = \frac{1}{p}$, what is the value of the product xyz ?
(GATE MN 2018)

- a) -1 b) $\frac{1}{pqr}$ c) 1 d) pqr

8) In a party, 60% of the invited guests are male and 40% are female. If 80% of the invited guests attended the party and if all the invited female guests attended, what would be the ratio of males to females among the attendees in the party?

(GATE MN 2018)

- a) 2 : 3 b) 1 : 1 c) 3 : 2 d) 2 : 1

9) In the figure below, $\angle DEC + \angle BFC$ is equal to

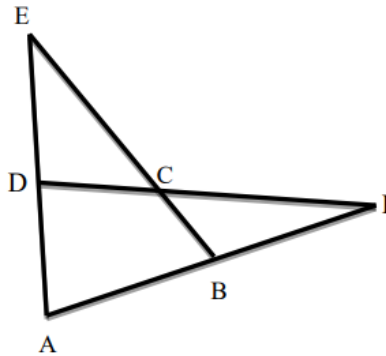


Fig. 1: Triangle

(GATE MN 2018)

- a) $\angle BCD - \angle BAD$ c) $\angle BAD + \angle BCD$
b) $\angle BAD + \angle BCF$ d) $\angle CBA + \angle ADC$

10) A six sided unbiased die with four green faces and two red faces is rolled seven times. Which of the following combinations is the most likely outcome of the experiment?

(GATE MN 2018)

- a) Three green faces and four red faces. c) Five green faces and two red faces.
b) Four green faces and three red faces. d) Six green faces and one red face.

Q1 TO Q25 CARRY ONE MARK EAC

1)

If $X = \begin{bmatrix} \cos \theta & \sin \theta \\ -\sin \theta & \cos \theta \end{bmatrix}$, then XX^T is

(GATE MN 2018)

- a) $\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$
b) $\begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix}$
c) $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$
d) $\begin{bmatrix} 0 & -1 \\ -1 & 0 \end{bmatrix}$

- a) over-winding of the cage
- b) deceleration of the cage

- c) acceleration of the cage
- d) over-speeding of the cage

9) The equipment NOT related to extraction of coal from longwall face operation is

(GATE MN 2018)

- a) AFC
- b) road header
- c) powered support
- d) DERD shearer

10) The correct figure depicting the extraction of contiguous seams in bord and pillar working is indicated by

(GATE MN 2018)



Fig. 3: Option A

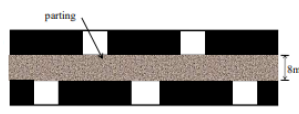


Fig. 4: Option B



Fig. 5: Option C

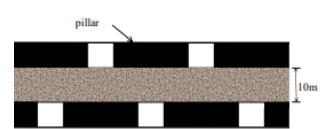


Fig. 6: Option D

- a)
- b)
- c)
- d)

11) The significance of potentially explosive mixture in Coward flammability diagram is

(GATE MN 2018)

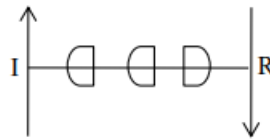


Fig. 7: Option A

- a)

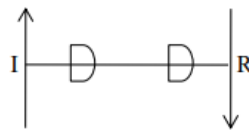


Fig. 8: Option B

- b)



Fig. 9: Option C

- c)

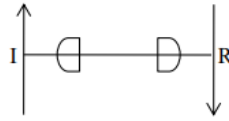


Fig. 10: Option D

d)

- 12) From a coal seam of a mine 1000 tonnes of coal is produced per day. The seam has inflammable gas emission rate of 14000 m^3 per day. Percentage of inflammable gas in general body of air is 0.14. The gassiness of the seam is

(GATE MN 2018)

a) Degree IV

b) Degree III

c) Degree II

d) Degree I

- 13) The temperature profiles and the plume patterns that are most likely to result are given in the figures. The dotted line represents 'adiabatic lapse rate' and the bold line represents 'environmental lapse rate'. The WRONG combination is

(GATE MN 2018)

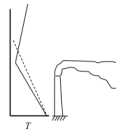


Fig. 11: Option A

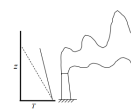


Fig. 13: Option C

a)

c)

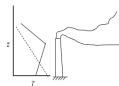


Fig. 12: Option B

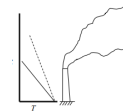


Fig. 14: Option D

b)

d)

- 14) The inventory pattern shown does NOT represent the following.

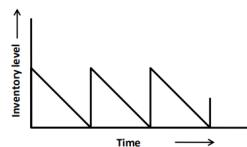


Fig. 15: Graph

(GATE MN 2018)

a) Inventory is replenished instantaneously

c) Shortage is not permitted

b) Demand decreases with time

d) Demand is uniform

- 15) The figure depicts a transportation problem along with the solution. The correct statement is

(GATE MN 2018)

| | | | | | |
|----|--|----|--|----|----|
| | | D1 | | D2 | |
| | | 5 | | 20 | |
| S1 | | 10 | | 5 | 15 |
| | | 15 | | 5 | |
| S2 | | 0 | | 15 | 15 |
| | | 10 | | 20 | |

Fig. 16: transportation problem

- a) unbalanced problem, optimal solution c) balanced problem, optimal solution
b) unbalanced problem, sub-optimal solution d) balanced problem, sub-optimal solution

16) The degree of the differential equation $\frac{d^2x}{dt^2} + 2x^3 = 0$ is

(GATE MN 2018)

17) The slope of the line connecting the points (20, 6), (40, 8),

(GATE MN 2018)

18) Two contours of RL 60 m and 70 m are separated by 34 m measured along dip of the seam. The dip of the seam in degree is

(GATE MN 2018)

19) The RL of the initial station is 200 m. If $\sum BS = 1.54$ m and $\sum FS = 0.45$ m, then the RL of the last station in m is

20) For the conveyor belt drive shown, the tension on the tight side (T_1) is double that of the slack side. The coefficient of friction between belt and drum is 0.21. The minimum angle of lap (in degree) to avoid slippage of the belt is

(GATE MN 2018)

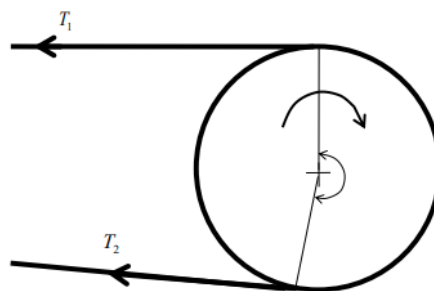


Fig. 17: Schematic diagram of a pulley system

21) In a bord and pillar development district, 6 headings driven along the strike direction are surrounded by panel barriers on the dip and rise sides. The maximum possible number of faces for the panel is

(GATE MN 2018)

22) A roadway in a mine, a single light source as shown, emits light uniformly in all directions. The floor level illumination at station A is 20 lux. The floor level illumination at a point B in lux is

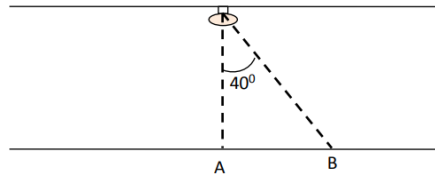


Fig. 18: Light Source

(GATE MN 2018)

23) A system of two identical components connected in series has reliability of 0.25. The reliability of each component is

(GATE MN 2018)

24) The operational status of an HEMM in a shift is shown in the diagram. The availability of the machine in % is

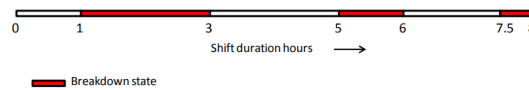


Fig. 19: HEMM

(GATE MN 2018)

25) If c is a constant, the solution of the differential equation $4y \frac{dy}{dx} + 9x = 0$ is

(GATE MN 2018)

a) $\frac{x^2}{81} + \frac{y^2}{16} = c$

b) $\frac{x^2}{16} + \frac{y^2}{81} = c$

c) $\frac{x^2}{9} + \frac{y^2}{4} = c$

d) $\frac{x^2}{4} + \frac{y^2}{9} = c$

26) Match the following blasting elements with the corresponding initiators

TABLE I: Match The Following

| Blasting Elements | Initiators |
|-------------------------------|----------------------|
| P Electric detonator | 1 Match stick |
| Q Safety fuse | 2 Booster |
| R Detonating fuse | 3 Exploder |
| S Non cap-sensitive explosive | 4 Ordinary detonator |

(GATE MN 2018)

a) P-2, Q-3, R-4, S-1 b) P-3, Q-1, R-4, S-2 c) P-3, Q-1, R-2, S-4 d) P-1, Q-4, R-2, S-3

27) The following plot is developed for a rock type after a series of triaxial tests. The uniaxial compressive strength and tensile strength of the rock type, respectively, in MPa, are

(GATE MN 2018)

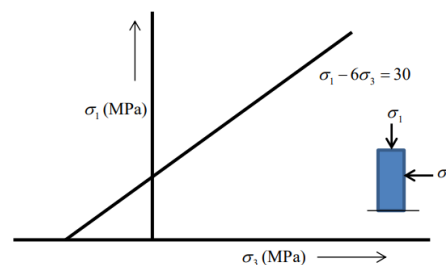


Fig. 20: graph

a) 30, 5

b) 30, 6

c) 24, 6

d) 24, 5

28) Match the following in the context of environmental management.

TABLE II: Match The Following

| Technique | Purpose |
|-----------------|-------------------------|
| P Mulching | 1 Dust control |
| Q Aeration | 2 Noise control |
| R Wet-scrubbing | 3 Soil conservation |
| S Silencer | 4 Waste water treatment |

(GATE MN 2018)

a) P-1, Q-4, R-3, S-2 b) P-3, Q-1, R-4, S-2 c) P-4, Q-3, R-1, S-2 d) P-3, Q-4, R-1, S-2

29) A panel in coal mine produces 400 tonne per day. The number of persons employed in each of the three shifts is 110, 130 and 120. As per CMR, the minimum quantity of air that needs to be circulated at the last ventilation connection of the panel in m^3/min is

(GATE MN 2018)

a) 780

b) 900

c) 1000

d) 2400

30) A right conical iron ore stack on level ground of height 10 m has 60% Fe. The height of the conical stack is extended up to 20 m using iron ore of 50% Fe. The angle of repose of iron ore is 38° . The mean grade of the final stack in

(GATE MN 2018)

31) The feasible region of a linear programming problem is shown in the figure. The maximum value of the objective function $Z = 4X + 3Y$ is

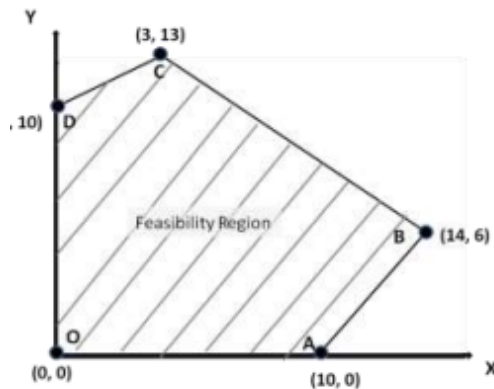


Fig. 21: LP

(GATE MN 2018)

32) Cash flow of a project of duration 4 years is shown. The uniform income 'R', in Rs. crores, at the end of 2nd, 3rd and 4th years for an internal rate of return of 10% is

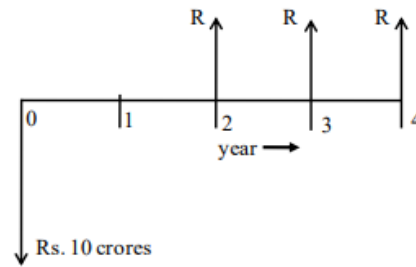


Fig. 22: Graph

(GATE MN 2018)

- 33) The grade values of alumina at three sample locations (A, B and C) in a bauxite deposit are as shown. Using the 'inverse distance' method, the computed grade in % alumina at location Z is

(GATE MN 2018)

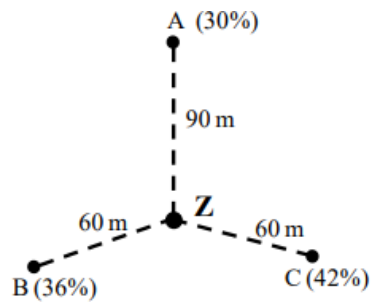


Fig. 23: Diagram

- 34) Economic feasibility of two methods is examined for meeting a targeted mine production. On a yearly basis, the following cost parameters (Rs in crores) are applicable for these methods.

TABLE III: Match The Following

| | Method 1 | Method 2 |
|---------------|----------|----------|
| Fixed cost | 20 | 5 |
| Variable cost | $2X$ | X^2 |

The annual rate of production, X in million tonnes for which both the methods will yield the same operating cost is

(GATE MN 2018)

- 35) A person standing 50 m away from an HEMM experiences 90 dB sound pressure level. If the person moves to a new location that is 70 m away from the HEMM, the sound pressure level experienced by the person, in dB, becomes

(GATE MN 2018)

- 36) A portion of a ventilation system has two splits as shown. Split A has a resistance of $0.2 \text{ } Ns^2/m^8$ and a regulator of size $2.0 \text{ } m^2$. The resistance of split B in Ns^2/m^8 is

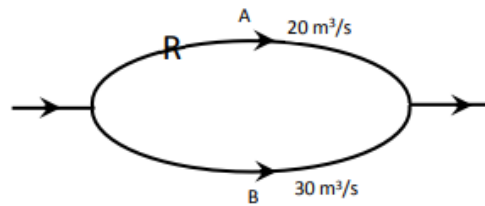


Fig. 24: Diagram

(GATE MN 2018)

- 37) Air enters a bord and pillar panel at 10 ppm CO and 20.78% O_2 . The air at the panel return has 80 ppm CO and 20.52% O_2 . The Grahams ratio for the status of fire in the panel in % is :

(GATE MN 2018)

- 38) In a sublevel stope, 20 m high excavation is made with ring drilling in a 6 m wide orebody. In an effective shift time of 6 hrs, three rings are blasted resulting in 9 m extraction length. LHDs of 5.0 m^3 bucket capacity and cycle time of 5 minutes are used for ore transportation. The number of LHDs required for this operation is

(GATE MN 2018)

- 39) A coal seam lying at a depth of 200 m is developed by bord and pillar method. Pillars are 30 m centre to centre with a gallery width of 4 m. Unit weight of the overlying strata is 28 kN/m^3 . If the pillar strength is 9.32 MPa, the factor of safety of pillar is

(GATE MN 2018)

- 40) Following information about a longwall retreating panel is given.

Panel length = 1800 m

Face length = 150 m

Depth of web = 0.6 m

Shearer travels at a speed of 1.5 m/min along the face. Each cutting cycle requires a non-operational time of 2 h 20 min. The panel is fully extractable. The number of working days required to extract the panel is

(GATE MN 2018)

- 41) In a direct rope haulage operating along a 1500 m long incline, 180 tonne of coal is hauled in 7 hours. The average rope speed is 7.5 km/h. The set changing time for the tubs is 2 minutes each at the top and bottom of the incline. If the tub capacity is 1.0 tonne, the number of tubs in the set is

(GATE MN 2018).

- 42) An SDL of 1.0 tonne capacity operates with a cycle time of 6 minutes. The dimension of the face is 4 m x 3 m. Five blasts are conducted per shift with an average pull of 1.2 m. If the density of blasted coal is 0.8 $tonne/m^3$, the time required by the SDL in the shift to lift all the prepared coal in hours is

(GATE MN 2018)

- 43) A force diagram is shown below. Considering clockwise moments to be positive, the resultant moment about A in Nm is

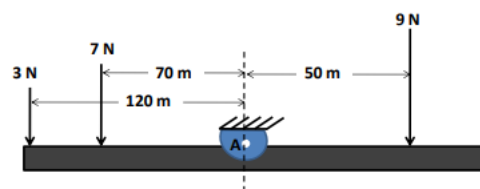


Fig. 25: Diagram

(GATE MN 2018)

- 44) The experiment to determine permeability of a soil sample is illustrated below. The crosssectional area of the sample is 20.0 cm^2 . The permeability of the soil sample in cm/s is

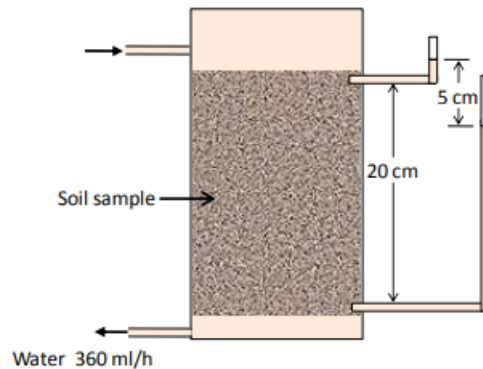


Fig. 26: Diagram

(GATE MN 2018)

- 45) In underground face blasting, the pull is found to be 10% less than the drillhole length. The headings of 3.6 m width are supported by prop density of $1.44/\text{m}^2$. The hole length is 1.5 m, and 6 rounds of blasting are done in the panel per shift. The number of props to be erected in a shift is

(GATE MN 2018)

- 46) The immediate roof of a mine is supported by bolts of length 1.5 m, arranged in $1.2 \text{ m} \times 1.2 \text{ m}$ grid pattern. If the unit weight of roof rock is $2.25 \text{ tonne}/\text{m}^3$ and load carrying capacity of each bolt is 7.5 tonne, the factor of safety of the support system is

(GATE MN 2018)

- 47) In a level terrain, a vertical orebody of 20 m uniform width is worked by surface mining method. The density of the ore is $2.5 \text{ tonne}/\text{m}^3$. The ultimate pit has a depth of 60 m, width of 20 m at pit bottom, and a pit slope of 45° . The overall stripping ratio for this condition in m^3/tonne is

(GATE MN 2018)

- 48) A 20 m long steel tape used for survey is found to be short by 10 cm. If the area measured with the steel tape is 5000 m^2 , the actual area in m^2 is

(GATE MN 2018)

- 49) The following figure shows the designed blast pattern of a bench. The explosive column is charged at $18 \text{ kg}/\text{m}$. If the unit weight of the blasted material is $2.5 \text{ tonne}/\text{m}^3$, the powder factor for the blast in tonne/kg is

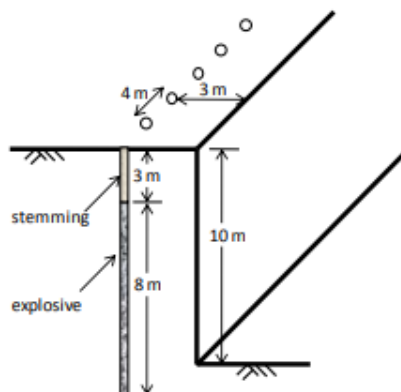


Fig. 27: Diagram

(GATE MN 2018)

- 50) Two points on the equator have longitudes $55^\circ E$ and $25^\circ W$. Considering radius of earth as 6400 km, the distance between the two points in km is

(GATE MN 2018)

- 51) Sum of the series 5, 10, 15, ..., 500 is

(GATE MN 2018)

- 52) The sample standard deviation for the following set of observations is 40, 45, 50 and 55

(GATE MN 2018)

- 53) For the given function $f(x, y) = (3 + x)(4 + y)$, the value of $\frac{\partial f}{\partial x} + \frac{\partial f}{\partial y}$ at $x = 2$ and $y = 1$ is _____.

(GATE MN 2018)

- 54) A positive integer m in base 10, when represented in base 2 has the representation p , and in base 3 has the representation q . We get $p - q = 990$, where the subtraction is done in base 10. Which of the following is necessarily true :

(GATE MN 2018)

- 55) Given $y = x^2 + x + 6$, the value of $\frac{d}{dx}(\ln y)$ at $x = 2$ is _____.

(GATE MN 2018)

END OF THE QUESTION PAPER