MN:MINING ENGINEERING

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Q.1–Q.5 CARRY ONE MARK EACH

1) Mr. X speaks _____ Japanese _____ Chinese.

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a) neither / or b) either / nor c) neither / nor d) also / but

2) A sum of money is to be distributed among P, Q, R, and S in the proportion $5:2:4:3$, respectively. If R gets 1000 more than S, what is the share of Q ?

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a) 500 b) 1000 c) 1500 d) 2000

3) A trapezium has vertices marked as P, Q, R, and S (in that order anticlockwise). The side PQ is parallel to side SR.
Further, it is given that $PQ = 11\,\text{cm}$, $QR = 4\,\text{cm}$, $RS = 6\,\text{cm}$, $SP = 3\,\text{cm}$.
What is the shortest distance between PQ and SR (in cm)?

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a) 1.80
b) 2.40
c) 4.20
d) 5.76

4) The figure shows a grid formed by a collection of unit squares. The unshaded unit square in the grid represents a hole.

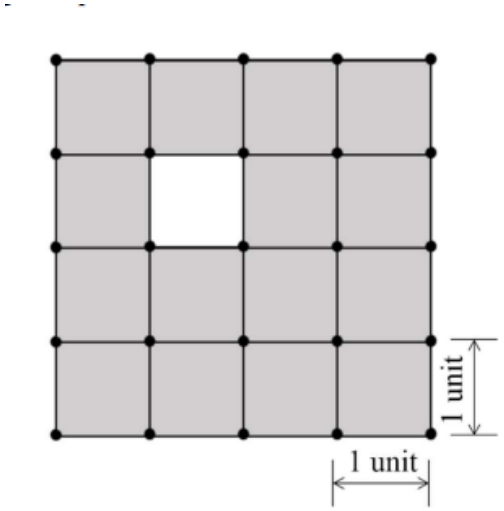

Fig. 1: Grid

What is the maximum number of squares without a hole in the interior that can be formed within the 4×4 grid using the unit squares as building blocks?

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a) 15 b) 20 c) 21 d) 26

5) An art gallery engages a security guard to ensure that the items displayed are protected. The diagram below represents the plan of the gallery where the boundary walls are opaque. The location the security guard posted is identified such that all the inner space (shaded region in the plan) of the gallery is within the line of sight of the security guard. If the security guard does not move around the posted location and has a 360° view, which one of the following correctly represents the set of ALL possible locations among the locations P, Q, R and S, where the security guard can be posted to watch over the entire inner space of the gallery.

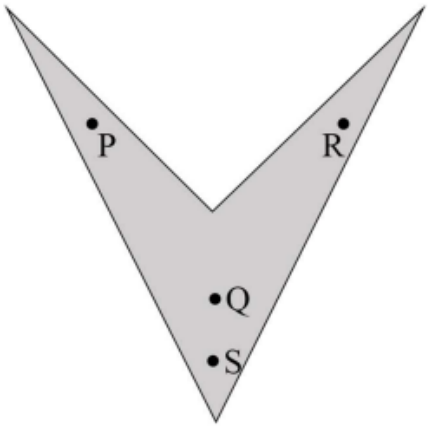

Fig. 2: diagram

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a) P and Q b) Q c) Q and S d) R and S

6) Mosquitoes pose a threat to human health. Controlling mosquitoes using chemicals may have undesired consequences. In Florida, authorities have used genetically modified mosquitoes to control the overall mosquito population. It remains to be seen if this novel approach has unforeseen consequences. Which one of the following is the correct logical inference based on the information in the above passage?

(*GATE MN* 2022)

a) Using chemicals to kill mosquitoes is better than using genetically modified mosquitoes because genetic engineering is dangerous
b) Using genetically modified mosquitoes is better than using chemicals to kill mosquitoes because they do not have any side effects
c) Both using genetically modified mosquitoes and chemicals have undesired consequences and can be dangerous
d) Using chemicals to kill mosquitoes may have undesired consequences but it is not clear if using genetically modified mosquitoes has any negative consequence

7) Consider the following inequalities:

(i) $2x - 1 \geq 7$
(ii) $2x - 9 \leq 1$

Which one of the following expressions satisfies the above two inequalities?

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a) $x \leq -4$ b) $-4 \leq x \leq 4$ c) $4 \leq x \leq 5$ d) $x \geq 5$

8) Four points P(0, 1), Q(0, −3), R(−2, −1), and S(2, −1) represent the vertices of a quadrilateral. What is the area enclosed by the quadrilateral?

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a) 4 b) $4\sqrt{2}$ c) 8 d) $8\sqrt{2}$

9) In a class of five students P, Q, R, S and T, only one student is known to have copied in the exam. The disciplinary committee has investigated the situation and recorded the statements from the students as given below. **Statement of P:** R has copied in the exam.
Statement of Q: S has copied in the exam.
Statement of R: P did not copy in the exam.
Statement of S: Only one of us is telling the truth.
Statement of T: R is telling the truth.
The investigating team had authentic information that S never lies.
Based on the information given above, the person who has copied in the exam is _____.

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a) R
b) P
c) Q
d) T

10) Consider the following square with the four corners and the center marked as P, Q, R, S and T respectively.
Let X, Y, and Z represent the following operations:

- X: rotation of the square by 180° with respect to the S-Q axis.
- Y: rotation of the square by 180° with respect to the P-R axis.
- Z: rotation of the square by 90° clockwise with respect to the axis perpendicular, going into the screen and passing through the point T.

Consider the following three distinct sequences of operation (which are applied in the left to right order):

a) $XYZZ$
b) XY
c) $ZZZZ$

Which one of the following statements is correct as per the information provided above?

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a) The sequence of operations (1) and (2) are equivalent
b) The sequence of operations (1) and (3) are equivalent
c) The sequence of operations (2) and (3) are equivalent
d) The sequence of operations (1), (2) and (3) are equivalent

11) The value of $\lim_{x\to 0} \frac{(1-x)^n - 1}{x}$ is

(*GATE MN* 2022)

a) 0 b) 1 c) $-n$ d) n

12) A velocity field in Cartesian coordinate system is expressed as

$$\mathbf{v} = x\hat{i} + y\hat{j} + p(z)\hat{k}, \quad \text{where } p(0) = 0$$

If $\nabla \cdot \mathbf{v} = 0$, $p(z)$ is

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a) 0
b) $-2z$
c) 2
d) $2z$

13) The constant term of the Fourier coefficients of the periodic function

$$f(x) = \begin{cases} -k, & -\pi < x < 0 \\ k, & 0 < x < \pi \end{cases}, \quad f(x + 2\pi) = f(x), \quad k = \text{constant}$$

is

(*GATE MN* 2022)

a) k
b) $2k$
c) 2π
d) 0

14) Two vectors x and y are shown in the figure. The projection vector of x on y is

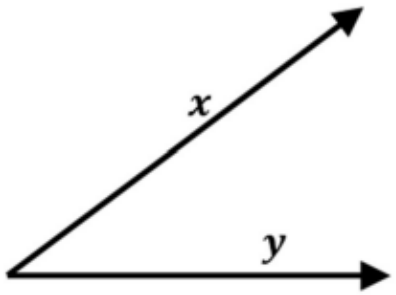

Fig. 3: Vectors

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a) $\frac{x^T y}{y^T y} y$
b) $x \times y$
c) $\frac{x \times y}{y^T y}$
d) $\frac{x^T y}{x^T x} x$

15) A deposit has the grade attribute $X \in [0, 30]$ with a density function $f(x)$. For a cut-off grade x_c, the proportion of the ore in the deposit is given by

(*GATE MN* 2022)

a) $\int_0^{30} f(x)\,dx - \int_0^{x_c} f(x)\,dx$
b) $\frac{1}{2}\int_0^{30} f(x)\,dx - \int_0^{x_c} f(x)\,dx$
c) $\frac{1}{2}\int_0^{30} f(x)\,dx + \int_0^{x_c} f(x)\,dx$
d) $\int_0^{x_c} f(x)\,dx$

16) The drilling technique applicable for mineral exploration is

(*GATE MN* 2022)

a) Percussive drilling
b) Tricone roller drilling
c) Rotary-percussive drilling
d) Diamond core drilling

17) Match the rock with its metamorphosed form

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TABLE I: Match The Following

Igneous/ Sedimentary rock	Metamorphic rock
P Granite	I Quartzite
Q Limestone	II Gneiss
R Sandstone	III Schist
S Gabbro	IV Marble

a) P-II, Q-IV, R-I, S-III
b) P-III, Q-I, R-IV, S-II
c) P-IV, Q-III, R-I, S-II
d) P-II, Q-III, R-IV, S-I

18) Identify the WRONG statement: Break-even stripping ratio

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a) takes into account the maximum pit slope that is safe
b) helps in determining the volume of the overburden
c) presents the maximum possible mine size that is economical
d) takes into account the life of the mine

19) A square pattern of blasting is shown in the figure. For the case of simultaneous blast, identify the zone of no fragmentation

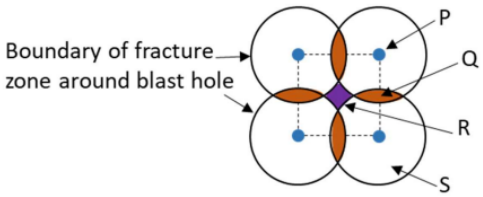

Fig. 4: Blasting

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a) P b) Q c) R d) S

20) In the truss shown in the figure, the force in the member BD, in kN is

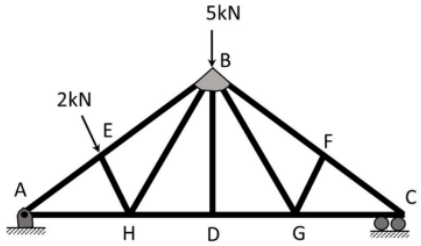

Fig. 5: Diagram

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a) 7 b) 5 c) 2 d) 0

21) The correct vertical stress profile in the case of tributary area method for pillar design is

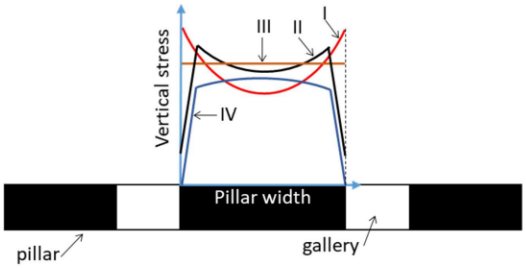

Fig. 6: Diagram

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a) *I* b) *II* c) *III* d) *IV*

22) The bottom section of a stoping block has dimensions $200m \times 40m$. If the modified RMR of rock mass is 50, the appropriate method of mining on the basis of Laubscher chart in the figure is

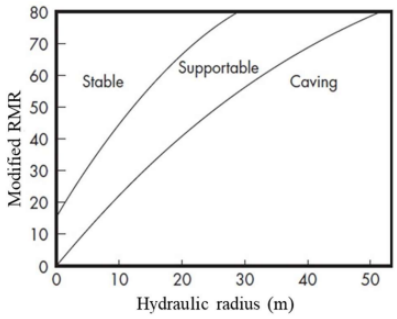

Fig. 7: Diagram

(*GATE MN* 2022)

a) Shrinkage stoping b) Cut and fill c) Block Caving d) Sublevel stoping

23) Match the machine with its component.

TABLE II: Match The Following

	Machine		**Component**
P	Continuous miner	I	Flight bar
Q	Jack hammer	II	Lemniscate link
R	AFC	III	Loading apron
S	Shield support	IV	Rifle bar

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a) P-III, Q-IV, R-I, S-II
b) P-IV, Q-III, R-I, S-II
c) P-III, Q-IV, R-II, S-I
d) P-IV, Q-III, R-II, S-I

24) Which one of the following is NOT a notifiable disease as per Indian mining legislation?

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a) Silicosis
b) Noise induced hearing loss
c) Nystagmus
d) Asbestosis

25) If the ambient lapse rate is higher than the dry adiabatic lapse rate, the atmosphere is
(*GATE MN* 2022)

a) stable b) neutral c) unstable d) strongly stable

26) Identify the WRONG statement: The application of controlled air recirculation in an underground work place can
(*GATE MN* 2022)

a) increase the air velocity at the work place
b) lead to increased concentration of contaminants in the work place
c) require the installation of an additional fan in the system
d) lead to overall ventilation cost savings

27) The correct order of pavement layers for a haul road from top to bottom is
(*GATE MN* 2022)

a) Wearing course → Base → Sub base → Sub grade
b) Wearing course → Sub base → Base → Sub grade
c) Wearing course → Sub grade → Sub base → Base
d) Wearing course → Base → Sub grade → Sub base

28) A mining company produces iron ore and sells to another company. Royalty to be paid is on the basis of
(*GATE MN* 2022)

a) quantity of ore produced
b) quantity of ore sold
c) difference between the quantities of ore produced and sold
d) net profit

29) The cost of a screw compressor with an estimated life of 15 years is $21,00,000$. If the depreciation of the compressor charged, using sum-of-the-years-digits method, at the end of 4th year is $2,00,000$, the salvage value, is.(round off to one decimal place)
(*GATE MN* 2022)

30) A safety device consists of two independent critical components x1 and x2.The failure of any one or both of these components can cause an accident.The failure probabilities of components x1 and x2 are 0.2 and 0.1, respectively.The probability of occurrence of an accident is
(*GATE MN* 2022)

31) In a levelling survey, a reading is taken as 2.25 m. However, along the line of sight there is deflection of 20 cm with respect to vertical position of the staff. The correct reading, in m is. (round off to two decimal places)
(*GATE MN* 2022)

32) Water flows through a vertical sand column of cross sectional area 4000 mm^2 and length 300 mm. For a water head of 600 mm, quantity of seepage water is 100 mm^3/min. The hydraulic conductivity of the sand column, in mm/min is (round off to three decimal places).
(*GATE MN* 2022)

33) The modified Lauffer diagram as shown in the figure relates to roof span, RMR and stand-up time. In a metal mine, roof span of a drive is $4m$. If the RMR of the rock mass changes from 40 to 60, then the stand-up time increases by a factor of. (round off to two decimal places)

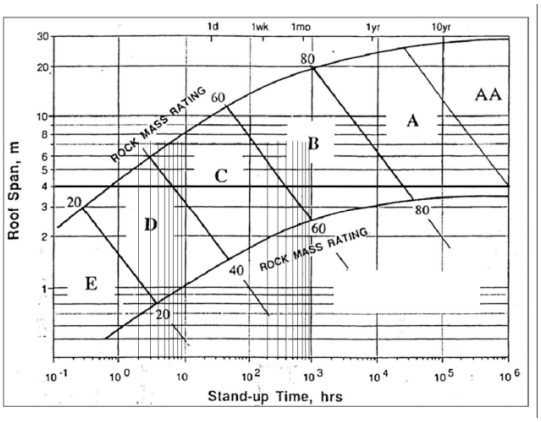


Fig. 8: Diagram

(*GATE MN* 2022)

34) In a friction winder, the skip accelerates to a steady speed over a time span of 15 s from the start. The torque vs. time diagram for the winding cycle is shown in the figure. The deceleration time in seconds is (round off to one decimal place)

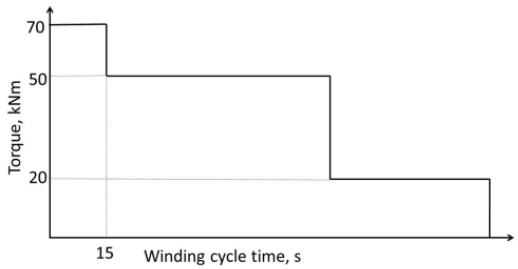


Fig. 9: Diagram

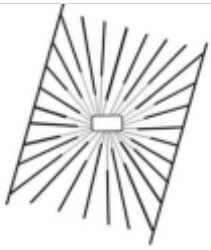
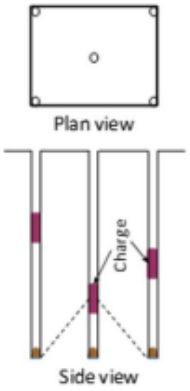
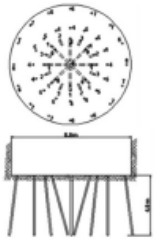
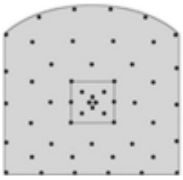
(*GATE MN* 2022)

35) At a measurement station, the air quality parameters $PM_{2.5}$, NO_2 and O_3 have the AQI sub-index values as 180, 96, and 84, respectively. The AQI for the station is _____. *(in integer)*

(*GATE MN* 2022)

36) Match The following

TABLE III: Match The Following

	Drilling Pattern	Mining Operation
P		I Drifting
Q		II Shaft Sinking
R		III Sublevel stoping
S		IV Drop Raising

(*GATE MN* 2022)

a) P → II, Q → III, R → I, S → II
b) P → III, Q → IV, R → I, S → II
c) P → II, Q → I, R → IV, S → III
d) P → III, Q → IV, R → II, S → I

37) The closest match of the scatter plot between the variables X and Y with the approximate attribute is

(*GATE MN* 2022)

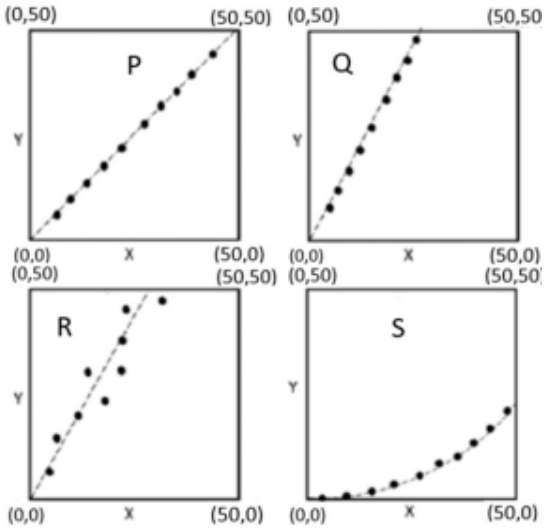


Fig. 10: GRAPH

TABLE IV: Match The Following

Attribute	
I	$\sigma_x > \sigma_y,\ 0 < \rho_{xy} < 1.0$
II	$\sigma_y > \sigma_x,\ \rho_{xy} = 1.0$
III	$\sigma_y > \sigma_x,\ 0 < \rho_{xy} < 1.0$
IV	$\sigma_x = \sigma_y,\ \rho_{xy} = 1.0$

σ_x = standard deviation of variable X
σ_y = standard deviation of variable Y
ρ_{xy} = Pearson's correlation coefficient between X and Y

a) P → II, Q → III, R → I, S → II
b) P → III, Q → IV, R → I, S → II
c) P → II, Q → I, R → IV, S → III
d) P → III, Q → IV, R → II, S → I

38) A 3-point borehole extensometer is installed to identify the location of a single discontinuity plane in a hanging wall rock by measuring deformations at three locations as shown in the figure. The absolute readings of deformations measured on two different dates are listed in the table. Based on the measured data the most likely inference is

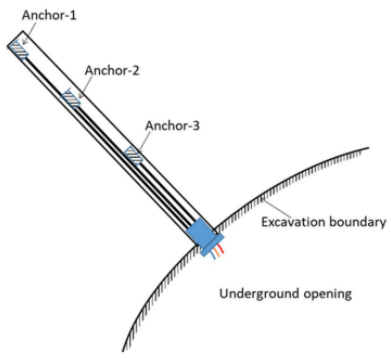


Fig. 11: Diagram

TABLE V: Match The Following

Date	Anchor -1 (mm)	Anchor -2 (mm)	Anchor -3 (mm)
May 2, 2021 (initial reading)	34.52	29.04	43.11
June 1, 2021	40.56	34.67	44.78

(*GATE MN* 2022)

a) Discontinuity between Anchor-1 and Anchor-2
b) Discontinuity between Anchor-2 and Anchor-3
c) Discontinuity between Anchor-3 and excavation boundary
d) No noticeable discontinuity

39) 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* 2022)

a) Degree IV b) Degree III c) Degree II d) Degree I

40) Match the semi-variogram shape with the model name and the property

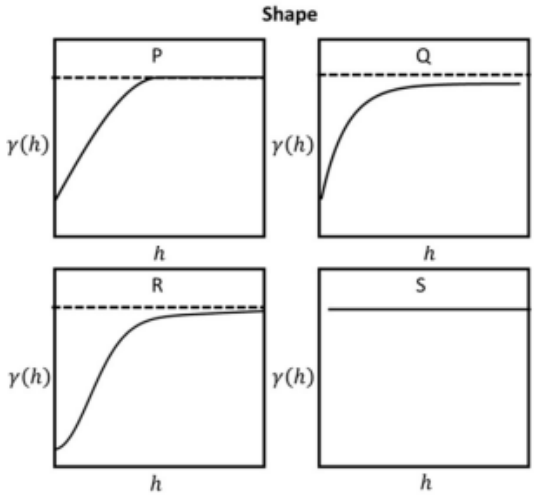


Fig. 12: Diagram

TABLE VI: Match The Following

	Semi-variogram model		Property
I	Pure nugget	E	reaches sill at finite range
II	Exponential	F	reaches sill asymptotically
III	Spherical	G	reaches sill instantaneously
IV	Gaussian		

(*GATE MN* 2022)

a) $P \rightarrow \text{III} \rightarrow E, \quad Q \rightarrow \text{II} \rightarrow F, \quad R \rightarrow \text{IV} \rightarrow E, \quad S \rightarrow \text{I} \rightarrow G$
b) $P \rightarrow \text{II} \rightarrow F, \quad Q \rightarrow \text{I} \rightarrow G, \quad R \rightarrow \text{III} \rightarrow E, \quad S \rightarrow \text{IV} \rightarrow E$
c) $P \rightarrow \text{IV} \rightarrow G, \quad Q \rightarrow \text{III} \rightarrow F, \quad R \rightarrow \text{II} \rightarrow E, \quad S \rightarrow \text{I} \rightarrow E$
d) $P \rightarrow \text{II} \rightarrow E, \quad Q \rightarrow \text{I} \rightarrow E, \quad R \rightarrow \text{III} \rightarrow F, \quad S \rightarrow \text{IV} \rightarrow G$

41) In a uniaxial compressive strength test, a rock sample of diameter 50 mm fails at an angle of 60°. If the peak load at failure is 120 kN, the normal and shear stresses on the failure plane respectively, in MPa are _____ and _____.

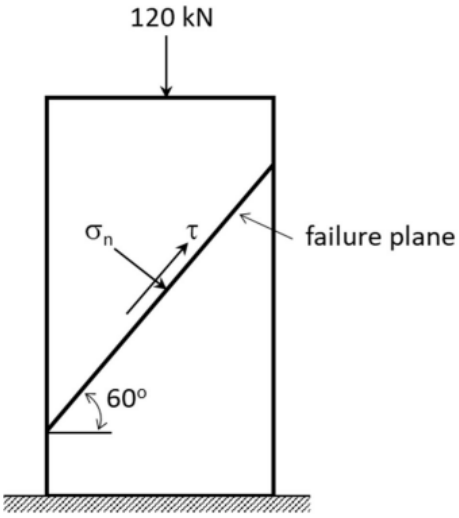


Fig. 13: Diagram

TABLE VII: Match The Following

	Semi-variogram model		**Property**
I	Pure nugget	E	reaches sill at finite range
II	Exponential	F	reaches sill asymptotically
III	Spherical	G	reaches sill instantaneously
IV	Gaussian		

(*GATE MN* 2022)

a) $20, 15$ b) $0, 30$ c) $0, 31$ d) $40, 0$

42) Let $f(x)$ be a continuous and differentiable function on $[3, 18]$. If $f(3) = -50$ and $f'(x) \leq 20$, then the largest possible value of $f(18)$ is _____. (in integer) (*GATE MN* 2022)

43) Let $\frac{dT}{dt} \propto (T_R - T)$, where T_R and T are temperatures in degree centigrade of a room and thermometer, respectively, and t denotes time in minutes. A thermometer at a reading of $2°C$ is brought in a room of temperature $40°C$. Two minutes later, the thermometer reads $15°C$. The time elapsed in minutes when the thermometer reads $39.5°C$, is _____. (*round off to two decimal places*)
(*GATE MN* 2022)

44) A project network comprises five activities as shown below. The activity durations, in days, are as indicated. Crashing of any activity costs Rs.1000 per day. If the project is crashed to the shortest possible duration, the total crashing cost in Rupees is
(*GATE MN* 2022)

45) In a health centre, the probability of full occupancy of COVID beds for a day is 0.8. Assuming Binomial probability distribution, the probability of full occupancy exactly for 5 days in a week, is___. (round off to three decimal places)
(*GATE MN* 2022)

46) Following information is given for a drilling operation to be carried out for overburden removal in a surface mine.

TABLE VIII: Match The Following

Volume of rock blasted per round, m^3	: 3,20,000
Number of blast holes	: 100
Drill hole diameter (D), mm	: 200
Length of subgrade drilling	: 8D
Stemming length	: 25D
Bench height, m	: 30
Powder factor, m^3/kg	: 3.2

The amount of explosive per unit length of charge in kg/m, is _____. (*round off to two decimal places*)

(*GATE MN* 2022)

47) The shaft-top coordinates of two vertical shafts are given below. The depth of the shaft A and B are 200*m* and 149*m*, respectively.

TABLE IX: Match The Following

Shaft	Latitude (m)	Departure (m)	Surface RL (m)
A	N670.0	W150.0	250
B	N170.0	E50.0	209

(*GATE MN* 2022)

48) The downward gradient of the line joining the bottom of the two shafts in degrees, is _____. (*round off to two decimal places*)

The oxygen-balanced equation for explosive ANFO is given below.

$$3NH_4NO_3 + CH_2 \rightarrow 7H_2O + CO_2 + 3N_2$$

For 100 litre of fuel oil having density 850 kg/m^3, the amount of ammonium nitrate to be mixed, in kg, is _____.
(*round off to two decimal places*)

(*GATE MN* 2022)

49) Two weightless cables of equal length and cross sectional area are hanging from a ceiling as shown in the figure. They are connected by a horizontal light bar of length 1.0 m and pulled by a force, F. The modulus of elasticity of Cable-1 and Cable-2 are 50 GPa and 200 GPa, respectively. If the deformation in both the cables is equal,the distance, in m is. (round off to one decimal place)

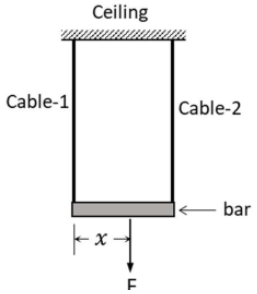


Fig. 14: diagram

50) A circular tunnel of radius 3 m is constructed in a hydrostatic stress field of 15 MPa.The modulus of elasticity and Poissons ratio of the rock are 5 GPa and 0.25, respectively. A uniform support pressure

p is applied at tunnel boundary to restrict the radial deformation at the tunnel boundary to 4 mm. The value of p in MPa is. (round off to two decimal places)

(*GATE MN* 2022)

51) The extraction ratio during development of a bord and pillar panel is 0.15 in a flat coal seam. The panel is further extracted by widening the galleries, and the extraction ratio changes to 0.25. The percentage change in pillar stress, considering tributary area method, is. (round off to two decimal places)

(*GATE MN* 2022)

52) In a small metal mine a battery powered locomotive hauls a train of mine tubs such that:
- The weight of the train of mine tubs, tonne : 3.0
- The coefficient of friction between the wheels and the rails : 0.06
- The coefficient of adhesion between the loco wheels and the rails : 0.2
- Time required from the start to reach speed of 1.8 m/s through constant acceleration, min : 3.0
- Upward gradient to be negotiated : 1 in 20

The minimum weight of the locomotive in tonnes to meet these design requirements, is _____. *(round off to one decimal place)*

(*GATE MN* 2022)

53) In a surface mine bench, overburden is removed by the shovel–dumper combination. For the dumper:
- Time required at the loading station : 3.0 min
- Time required at the unloading station : 1.0 min
- Distance between loading and unloading stations : 4.5 km
- Average speed during loaded travel : 12.0 km/hr
- Average speed during empty travel : 18.0 km/hr

Minimum number of dumpers required to avoid idle time of the shovel, is _____. *(in integer)*

(*GATE MN* 2022)

54) In a bord and pillar development panel, headings of 4.4 m $\times$ 2.5 m are advanced using solid blasting. The average pull per round of blast is 1.2 m. On an average 12 faces are blasted per day. Density of coal is 1500 kg/m^3. The mine operates in three shifts.
If the average daily employment is 330 persons, labour productivity (OMS) of the panel in tonne, is _____. *(round off to two decimal places)*

(*GATE MN* 2022)

55) In a longwall face, the full seam thickness of 3 m is cut by a shearer with a web of depth 0.7 m. The hauling speed of shearer during cutting is 12 m/min. The trough cross-section of AFC is 0.4 m^2 and the average loading coefficient is 0.7. In order to evacuate coal from the face without spillage, the speed of AFC, in m/s is _____. *(round off to one decimal place)*

(*GATE MN* 2022)

56) A city is spread over an area of 20 km $\times$ 40 km. Wind, at an average speed of 4 m/s, enters perpendicular to the 20 km long side. On a winter day the inversion layer exists over the city at a height of 100 m. PM_1 is emitted from the city at a rate of 1 kg/s.
The steady state PM_1 concentration in the city air, in μg/m^3, assuming Box model, is _____. *(round off to one decimal place)*

(*GATE MN* 2022)

57) The point A as shown in the Coward flammability diagram represents the gas composition of a sealed-off area of a coal mine. The volume of the sealed-off area is 10000 m^3. Inert gas is proposed to be injected into the sealed-off area so that the gas composition comes below the LEL (lower explosibility limit). The minimum volume of the inert gas required (at the same pressure as that of the sealed-off area), in m^3, is _____. *(round off to one decimal place)*

(*GATE MN* 2022)

58) An underground workshop has dimensions of 8 m length, 6 m width and 4 m height. Four identical

luminaires are placed at the four corners of the roof. Each luminaire is of 100 W capacity with luminous efficacy of 100 lumen/W. Light is transmitted spherically from luminaires and there are no reflections. The illumination on the horizontal plane at the centre of the floor, in lux is _____. *(round off to two decimal places)*

(*GATE MN* 2022)

59) An underground AC plant requires the delivery of 250 US gpm (15.85 US gpm = 1.0 lps) of chilled water. For this purpose, ice-pellets at 0°C temperature (latent heat of melting, 334 kJ/kg) are mixed with water at 20°C (specific heat 4.18 kJ/kg°C) on the surface. The mixture is adiabatically transported to the underground location such that the water at 7°C becomes available for the AC plant.
The requirement of ice-pellets in tonne/hr to meet the design condition, is _____. *(round off to two decimal places)*

(*GATE MN* 2022)

60) An intake shaft has resistance of 0.05 Ns^2/m^8 up to a depth of 400 m. The airflow rate is 100 m^3/s and the average density is 1.2 kg/m^3. A barometer reads 99.375 kPa when placed on surface. Considering acceleration due to gravity is 9.81 m/s^2, the reading of the barometer at the depth of 400 m, in kPa is _____. *(round off to two decimal places)*

(*GATE MN* 2022)

61) The net present values (NPV) of two mining project proposals A and B are as given.

$$NPV_A = -0.01t^2 - 0.02t + 4.44$$

$$NPV_B = -0.03t^2 - 0.01t + 6.55$$

where, t is discount rate.
The required rate of return for which both the proposals have equal possibility of acceptance and rejection, is _____. *(round off to two decimal places)*

(*GATE MN* 2022)

62) The value of $\int_0^1 x \log(1+x)\,dx$, is _____. *(round off to two decimal places)*

(*GATE MN* 2022)

63) A coal seam of uniform thickness 12 m is dipping at an angle 30° as shown in the figure. The ultimate pit is demarcated based on allowable instantaneous stripping ratio of 10 m^3/tonne and safe slope angle of 45°. The density of coal is 1.41 tonne/m^3.
The length, L in m is _____. *(round off to two decimal places)*

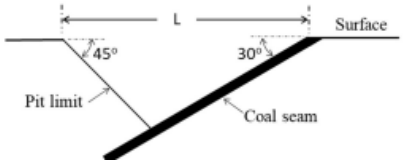


Fig. 15: diagram

(*GATE MN* 2022)

64) A mine has a reserve of 150 million tonne (Mt) and is designed for a maximum production capacity of 5 Mt per year. In the first year the production is 2 Mt and it increases by 20% each year. The reserve in Mt that remains at the end of 15 years,is. (round off to two decimal places)

(*GATE MN* 2022)

65) Information on Activity–Time duration of a project is provided below

TABLE X: Match The Following

Activity	**Predecessor event**	**Successor event**	**Estimated Time Duration (weeks)**		
			Pessimistic	Most likely	Optimistic
A	1	2	20	15	4
B	1	3	12	8	4
C	2	3	16	11	6
D	3	4	20	13	12
E	2	4	13	8	3
F	1	4	45	35	25

(*GATE MN* 2022)

END OF THE QUESTION PAPER