ASSIGNMENT 1: GATE 2007 MN:MINING ENGINEERING

AI25BTECH11010 - Dhanush Kumar

1) If the slope of a diagonal of a rectangle is m, the slope of the other diagonal is

   (GATE MN 2007)

   a) $\frac{1}{2m}$ b) $-\frac{1}{2m}$ c) $\frac{1}{m}$ d) $-\frac{1}{m}$

2) If the rank of a matrix A is r, the rank of the matrix A^T is

   (GATE MN 2007)

   a) r, if and only if $A^T = A$ c) p, where $p \neq r$
   b) r, for all A d) $r - 1$, where $r \geq 1$

3) Bulk modulus of rock is defined as

   (GATE MN 2007)

   a) $\frac{\text{shear stress}}{\text{volumetric strain}}$ c) $\frac{\text{hydrostatic pressure}}{\text{volumetric strain}}$
   b) $\frac{\text{hydrostatic pressure}}{\text{shear strain}}$ d) $\frac{\text{shear stress}}{\text{shear strain}}$

4) The magnitude of the resultant moment about point O in Nm of the two forces acting on the rod shown below is
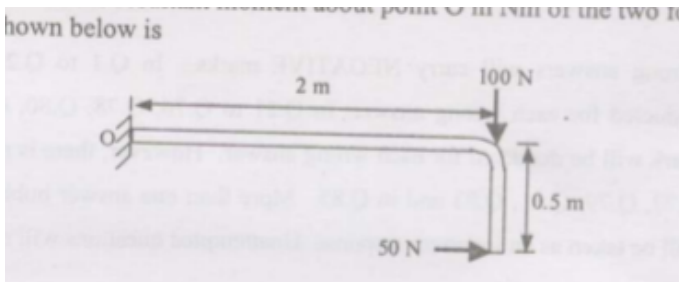
   (GATE MN 2007)

Fig. 4

   a) 25 b) 125 c) 175 d) 225

5) Radial stress on the excavation boundary of a circular tunnel is

   (GATE MN 2007)

a) always zero
b) always positive
c) always negative
d) positive in some area and negative in some area

6) The critical diameter of an explosive is defined as the diameter below which it

(GATE MN 2007)

a) develops the optimum velocity of detonation
b) does not involve in chemical reaction
c) develops the maximum velocity of detonation
d) deflagrates

7) Which one of the following supports does NOT require a power pack for its operation

(GATE MN 2007)

a) chock shield support
b) open circuit hydraulic prop
c) close circuit hydraulic prop
d) Alpine breaker line support

8) In a centrifugal flow fan the conversion of velocity pressure to static pressure is accomplished with the help of

(GATE MN 2007)

a) impeller
b) curved blades
c) hub
d) casing

9) A 3.3 kV, 3-phase AC motor having a PF of 0.85 draws current at 95 A. The motor input power in kW is

(GATE MN 2007)

a) 266.5
b) 461.5
c) 543.0
d) 799.5

10) The amount of total stone dust required in kg for a secondary/heavy type stone dust barrier in a roadway of size 4.0 m × 3.0 m is

(GATE MN 2007)

a) 1320
b) 4680
c) 5200
d) 6600

11) In the Gaussian plume model, the dispersion coefficients are function of

(GATE MN 2007)

a) distance from source and stability class
b) stack height and distance from source
c) stability class and source coordinates
d) source coordinates and distance from source

12) The rachet-and-pawl arrangement in percussive drill machine helps in

(GATE MN 2007)

a) providing required rotational speed
b) indexing at the bit rock interface

c) regulating air flow in forward and return strokes of the piston

d) engaging the bit with the rock between the blows

13) The measurement of distances from a position on the earth to artificial satellites is

(GATE MN 2007)

a) astronomical ranging

b) pseudo ranging

c) satellite ranging

d) celestial ranging

14) In opencast mining, the width which is extracted from the working bench is termed as

(GATE MN 2007)

a) cut   b) bench width   c) bank width   d) bench face

15) Zener barriers are associated with

(GATE MN 2007)

a) increased safety apparatus

b) statistically safe apparatus

c) flame proof apparatus

d) intrinsic safety

16) The most recent model of self-contained compressed-oxygen breathing apparatus is

(GATE MN 2007)

a) Proto-IV   b) BG-174   c) BG-4   d) BG-174A

17) The measures of dispersion are

(GATE MN 2007)

a) range, variance, and standard deviation

b) mean, median, and variance

c) mean, mode, and skewness

d) mean, range, and variance

18) In a single server queueing model with constant arrival rate, which one of the following probability distributions is followed by the inter–arrival times of the customers at the service facility?

(GATE MN 2007)

a) binomial   b) Poisson   c) Weibull   d) exponential

19) A company invested Rs. 4 lakh in a machine with an expected useful life of 12 years. The net income expected from the operation of the machine is Rs. 80,000 per annum. The payback period for the machine in years is

(GATE MN 2007)

a) 4   b) 5   c) 6   d) 7

20) The angular (horizontal/vertical) observation made by a transit theodolite with the face of the vertical circle on the right of the observer is called

(GATE MN 2007)

a) face right observation
b) face left observation

c) normal observation
d) reciprocal observation

21) Two sides of a triangle are represented by vectors $\mathbf{a} = \hat{i} + \hat{j} + \hat{k}$ and $\mathbf{b} = -\hat{i} - \hat{j} + \hat{k}$. The area (magnitude) of the triangle is

(GATE MN 2007)

a) $\frac{1}{\sqrt{2}}$ b) 1   c) $\sqrt{2}$ d) $2\sqrt{2}$

22) The cost of diesel is Rs. $\left(25 + \frac{x}{90}\right)$ per km to drive a dump truck at a speed of x km/hour. The maintenance cost of the truck is Rs. 10 per hour. To minimize the cost per km, the truck speed in km/hour is

(GATE MN 2007)

a) 5   b) 20   c) 25   d) 30

23) The functions $f(x)$ and $g(x)$ satisfy $f(x = 0) = 3$, $f'(x = 0) = -5$, $g(x = 0) = 2$ and $g'(x = 0) = -10$. The value of

$$\frac{d}{dx}\left(\frac{f(x)}{g(x)}\right)_{x=0}$$

is

(GATE MN 2007)

a) -35.0 b) -5.0 c) 0.5   d) 5.0

24) A wooden block of 50 kg rests on the floor (shown in figure below) for which the coefficient of static friction is 0.5. The smallest magnitude of the force P in kg that will cause impending motion of the block is
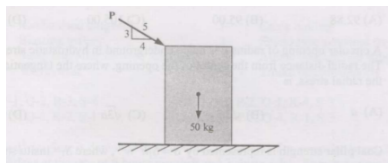
(GATE MN 2007)

Fig. 24

a) 50   b) 40   c) 30   d) 25

25) The solution of $ye^x dx + (4y + e^x)dy = 0$ for $y(0) = -1$ is

(GATE MN 2007)

a) $ye^x + 2y^2 - 1 = 0$ c) $ye^x - y^2 = 0$
b) $e^x + y^2 - 2 = 0$ d) $ye^x + y^2 - 1 = 0$

26) A point $P(10, 3)$ MPa on the Mohr's circle represents normal and shear stresses. If the centre of the Mohr's circle is $C(6, 0)$ MPa, the normal and shear stresses in MPa on the point diametrically opposite to P are

(GATE MN 2007)

a) 2, −3   b) 4, −3   c) 2, 3   d) 4, 3

27) A rock sample with a horizontal joint is subjected to 10 MPa of normal pressure as shown in the figure. The elastic modulus and Poisson's ratio of the rock are 5.0 GPa and 0 respectively. If the normal stiffness (k_n) of the joint is 50 GPa/m, normal displacement at the top of the sample (AA' line) in mm is
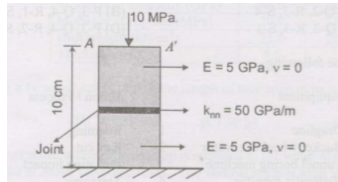
(GATE MN 2007)

Fig. 27

a) 0.2   b) 0.4   c) 0.6   d) 0.8

28) The state of stress $(\sigma_{xx}, \sigma_{yy}, \tau_{xy})$ at a point below ground is found to be $(5, 15, -3)$ MPa. The angle measured in the counter clockwise direction between the x-axis and the major principal axis in degree is

(GATE MN 2007)

a) 9.52   b) 15.48   c) 150.48   d) 164.52

29) The unconfined compressive strength of a cylindrical rock sample is 90 MPa. The angle of internal friction of the rock is $30°$. If a confining pressure of 5 MPa is applied radially to the rock sample, the confined compressive strength in MPa is

(GATE MN 2007)

a) 92.88   b) 95.00   c) 105.00   d) 110.0

30) A circular opening of radius a is made underground in hydrostatic stress condition. The radial distance from the centre of the opening, where the tangential stress is twice the radial stress, is

(GATE MN 2007)

a) a b) $\sqrt{2}a$ c) $\sqrt{3}a$ d) $2\sqrt{3}a$

31) Coal pillar strength is represented by $S = S_{in}h^{\alpha}w^{\beta}$, where S_{in} = insitu strength of the pillar, h = mining height, and w = pillar width. Two bord and pillar panels are developed in the similar geological conditions at depths D_1 and D_2 with mining heights h_1 and h_2 respectively. If the gallery width and the pillar width in both the panels remain the same, the ratio of pillar safety factors, SF_1/SF_2 is

(GATE MN 2007)

a) $\left(\frac{h_2}{h_1}\right)^{\alpha}\frac{D_1}{D_2}$ b) $\left(\frac{h_2}{h_1}\right)^{\alpha}\frac{D_2}{D_1}$ c) $\left(\frac{h_1}{h_2}\right)^{\alpha}\frac{D_2}{D_1}$ d) $\left(\frac{h_1}{h_2}\right)^{\alpha}\frac{D_1}{D_2}$

32) Match the following

Belt conveyor component	Function
P Pull cord	1. Cleaning device
Q Snub pulley	2. Discharging material side of the conveyor
R Tripper	3. Safety stopping device
S Rotary brush	4. Increasing the angle of wrap

TABLE 32

(GATE MN 2007)

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

33) Match the following

Equipment	Action/Process
P Dragline	1. Reaming
Q Bucket wheel excavator	2. Key cut
R Tunnel boring machine	3. Pulsatng impact
S Hydraulic monitor	4. Terracing

TABLE 33

(GATE MN 2007)

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

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

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

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

34) Match the following

Mining method	Face supporting system
P Mechanised longwall	1. Cable bolting
Q Blasting gallery	2. Shield type powered supports
R Steep seam mechanised longwall	3.Alpine breaker line supports
S Wangawilli	4. troika shield supports

TABLE 34

(GATE MN 2007)

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

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

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

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

35) A 15 yd^3 dragline is deployed in an overburden bench of an opencast mine. It works for 40 days at the rate of 6 hours per shift and 3 shifts a day. The cycle time, bucket fill factor, and operating efficiency of the dragline are respectively 50 s, 0.8, and 75%. The total volume of overburden in m^3 handled by the dragline is (1 yd^3 = 0.765 m^3)

(GATE MN 2007)

a) 356918   b) 634521   c) 557685   d) 991440

36) The phenomenon of fretting (necking) of pillars in room-and-pillar stoping is common in the pillars formed in

(GATE MN 2007)

a) massive rock with very high pillar height to width ratio

b) regularly jointed rock with high pillar height to width ratio

c) massive rock with low pillar height to width ratio

d) transversely jointed rock with low pillar height to width ratio

37) In an underground opening, the immediate roof strata consists of two rock layers with the following properties:

Property	Layer-1	Layer-2
Modulus of elasticity (GPa)	60.0	40.0
Modulus of rupture (MPa)	20.0	10.0
Unit weight (kN/m^3)	25.0	20.0
Thickness (m)	2.5	2.5

TABLE 37

Considering a factor of safety of 4.0, the length of safe span in m is

(GATE MN 2007)

a) 27.82   b) 34.06   c) 36.54   d) 39.34

38) In an opencast mine, a centrifugal pump is required to lift water at the rate of 60 l/s to a height of 80 m above the pump level. The vertical suction head is 4 m. The total friction head including shock and energy loss is 10 m. If the pump runs at an efficiency of 80%, the brake power of the motor in kW is

(GATE MN 2007)

a) 70.50   b) 67.50   c) 63.00   d) 57.55

39) Match the following:

Support system		Support principle
P	Shotcrete	1	reinforces rock mass by binding them together
Q	Backfill	2	acts as link between two layers of rock to transfer load between them
R	Bolt	3	imposes kinematic constraints on key pieces in a stope boundary
S	Prop	4	prevents spatially progressive disintegration of near field rock mass

TABLE 39

(GATE MN 2007)

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

40) Match the following:

Stope		Drill machine		Method of drilling	
P	Shrinkage	I	Drill jumbo	1	Fan drilling
Q	Room-and-pillar	J	Down-the-hole hammer	2	Overhand drilling
R	Sublevel	K	Hand held stopper	3	Parallel drilling
S	Sublevel caving	L	Mechanised fan drill	4	Frontal/vertical/downward benching

TABLE 40

(GATE MN 2007)

a) P-I-2, Q-K-4, R-L-3, S-J-1   c) P-K-2, Q-L-4, R-J-3, S-I-1
b) P-K-4, Q-I-3, R-J-2, S-L-1   d) P-I-3, Q-K-4, R-J-1, S-L-2

41) A coal seam of 12 m thickness is worked out by mechanized top coal caving system. The thickness of the bottom slice is 3 m, length of the solid coal face is 120 m and the average depth of cut by the shearer (web) is 70 cm. The density of coal is 1300 kg/m^3 with the percentage of extraction in the slice at 95 and in the top coal at 70. The production of coal per cycle in tonne is

(GATE MN 2007)

a) 1008   b) 999   c) 688   d) 311

42) Two reservoirs are connected by two equal length parallel pipelines with diameters d and $2d$. Assuming similar resistance coefficients, if the discharge through the smaller diameter pipeline is 0.04 m^3/s, the discharge through the other pipeline in m^3/s is

(GATE MN 2007)

a) 0.226   b) 0.426   c) 1.130   d) 1.280

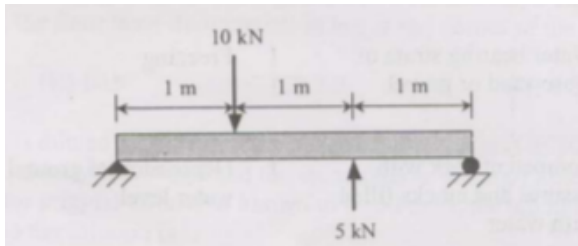43) The shear force diagram for the shaft shown below resembles which one of the following graphs?
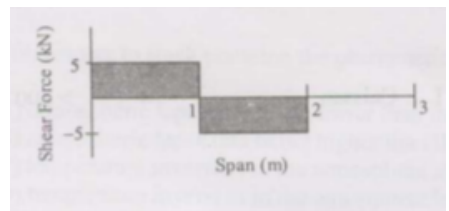

Fig. 43
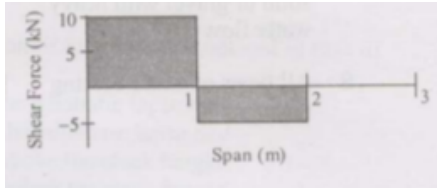
(GATE MN 2007)

Graph-I
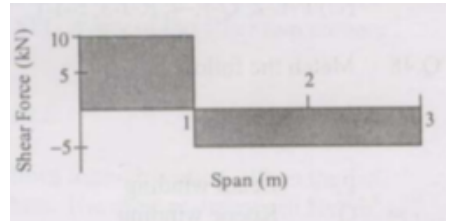

Fig. 43

Graph-II   Graph-IV

Fig. 43

Fig. 43

Graph-III
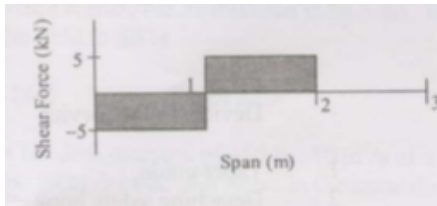
Fig. 43

a) Graph-I   b) Graph-II   c) Graph-III   d) Graph-IV

44) A 12 tonne diesel locomotive of 60 kW is plying in an underground haulage roadway. The coefficient of adhesion is 0.25 and the maximum gear efficiency is 80%. The speed in m/s at which it will haul a train at its full power is

(GATE MN 2007)

a) 2.548   b) 2.448   c) 2.038   d) 1.630

45) An air receiver of volume 0.2 m^3 has an initial temperature of 27°C and pressure 1800 kPa. After use, the air pressure falls to 1200 kPa at a temperature of 17°C. The volume of air consumed in m^3 corresponding to an air pressure of 101.3 kPa and temperature of 0°C is

(GATE MN 2007)

a) 0.693   b) 0.895   c) 1.002   d) 1.251

46) Four benches are being worked by the opencast mining system. Height, width and face angle for each bench are 15 m, 50 m and 70° respectively. The overall slope angle of the benches in degrees is

(GATE MN 2007)

a) 15.45   b) 19.25   c) 32.65   d) 36.25

47) Match the following

Rock mass condition	Shaft sinking method	Limiting depth (m)
P: Water bearing strata of loose sand or gravel	I: Freezing	1: 40
Q: Competent rock with fissures and cracks filled with water	J: Depression of ground water level	2: 150
R: Highly permeable coarse solid or gravel with heavy water flow	K: Cement grouting	3: 1000
S: All types of water bearing rocks	L: Caisson	4: >600

TABLE 47

(GATE MN 2007)

a) P-L-4, Q-K-1, R-J-2, S-I-3   c) P-L-2, Q-K-4, R-J-3, S-I-1
b) P-L-1, Q-K-4, R-J-2, S-I-3   d) P-L-4, Q-K-3, R-J-2, S-I-1

48) Match the following

System	Device / Safety device
P: Drum winding	1: Taper guide
Q: Koepe winding	2: Detaching safety hook
R: Inclined Haulage	3: Rider
S: Winding in sinking shaft	4: Back catch

TABLE 48

(GATE MN 2007)

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

49) A closed container with 10 kg of air at ambient pressure and specific heat 1020 kJ/kg°C is cooled from 35°C. If the removal of 200 kJ of heat resulted in the saturation of air, the corresponding dew point temperature in °C is:

(GATE MN 2007)

a) 33.0   b) 27.3   c) 15.4   d) 12.9

50) Identify the **INCORRECT** statement

a) Evasee is meant to minimise exit shock losses

b) Evasee efficiency is primarily a function of divergence angle and area ratio

c) Evasee produces an inevitable increase in friction losses

d) Evasee installation leads to reduction in the fan total pressure

51) A single lamp placed centrally at the roof provides 40 lux illumination vertically below, at the floor of an underground workshop. The workshop is of dimensions 20.0 m × 20.0 m with height 4.0 m. Assuming uniform spherical dispersion of luminous intensity, the floor level illumination in lux at any corner of the workshop is:

(GATE MN 2007)

a) 23.2   b) 10.9   c) 3.0   d) 0.8

52) An effluent sample is diluted with fresh water to make up a solution of 300 ml. The DO of the solution initially is 8.0 mg/l and the value falls to 3.0 mg/l after 5 days. If the 5-day BOD of the original effluent is known to be 50 mg/l, the amount of fresh water added in ml to the solution is:

(GATE MN 2007)

a) 270   b) 160   c) 54   d) 30

53) With respect to stack emission the phenomenon of fumigation is noticed in case of (GATE MN 2007)

a) atmospheric lapse rate being lower than the adiabatic lapse rate

b) atmospheric lapse rate being higher than the adiabatic lapse rate

c) temperature inversion in the atmosphere above the stack height

d) temperature inversion in the atmosphere below the stack height

54) A jackhammer operates at a corner of a square field of side 50 m. At the diagonally opposite corner, the SPL sensed is 82.3 dB. The SPL at any of the other two corners of the field in dB is

(GATE MN 2007)

a) 86.3   b) 85.3   c) 83.6   d) 81.2

55) At a fan drift pressure of 450 Pa, 50 m^3/s of air flows through a mine. When the fan stops, 10 m^3/s of air still flows in the same direction. The mine resistance in Ns^2/m^8 is

(GATE MN 2007)

a) 0.1731   b) 0.1800   c) 0.1875   d) 0.2372

56) In an experiment to determine rock thermal conductivity, a disc of rock specimen is placed between two solid brass cylinders and one-dimensional heat flow is created

as shown in the figure. The readings of the thermocouple sensors with respect to zero potential are shown in the figure. Brass thermal conductivity is 90 W/m°C, and the thermocouple constant is $40\,\mu V/°C$.
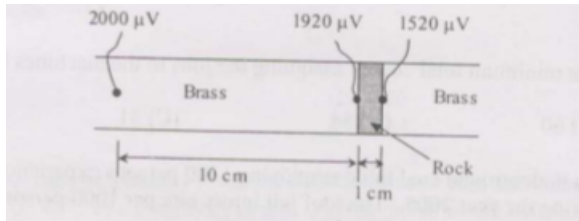
(GATE MN 2007)

Fig. 56

The rock thermal conductivity in W/m°C and the heat flux in W/m^2 respectively are

a) 1.8, 1800   b) 0.6, 1020   c) 3.2, 540   d) 2.1, 670

57) Consider the following data for the grade of iron ore from a working bench over past 5 weeks:

(GATE MN 2007)

Week	Grade (% Fe)
1	62.1
2	61.0
3	60.5
4	62.5
5	62.0

TABLE 57

The 3-week moving average forecast for the grade, in % Fe, in the 6th week is:

(GATE MN 2007)

a) 61.66   b) 61.90   c) 62.20   d) 62.50

58) The random variable X has the following probability mass function:

$$P(4) = \frac{1}{4}, \quad P(8) = \frac{1}{4}, \quad P(12) = \frac{1}{4}, \quad P(16) = \frac{1}{4}$$

The expected value of X is:

(GATE MN 2007)

a) 1   b) 3   c) 10   d) 12

59) The time between successive failures (in hours) of a side discharge loader operating in a mechanised underground coal mine are as follows:

$$62, 58, 54, 50, 52, 60, 58, 57, 50, 53$$

If the failure data follow an exponential distribution, then reliability of the equipment for a period of 50 hours is:

(GATE MN 2007)

a) 0.25   b) 0.40   c) 0.60   d) 1.00

60) Three jobs A, B, and C are to be assigned to three machines X, Y and Z. The processing costs are given below:

		Machine		
	A	19	28	31
Job	B	11	17	16
	C	12	15	13

TABLE 60

The minimum total cost of assigning the jobs to the machines is

(GATE MN 2007)

a) 60   b) 54   c) 51   d) 49

61) An underground coal mine employing 1200 persons experienced 12 roof fall injuries during the year 2005. The roof fall injury rate per 1000 persons employed during the period 2005, as per the DGMS norms, is

(GATE MN 2007)

a) 6   b) 8   c) 10   d) 12

62) Consider the following linear programming problem: Maximize $Z = 6X_1 + 4X_2$ Subject to

$$2X_1 \leq 8,$$
$$2X_2 \leq 12,$$
$$3X_1 + 2X_2 \leq 18,$$
$$X_1 \geq 0, \ X_2 \geq 0$$

The multiple optimal solutions lie on the line joining the corner points

(GATE MN 2007)

a) (0, 0), (0, 6)   b) (0, 6), (2, 6)   c) (2, 6), (4, 3)   d) (4, 3), (4, 0)

63) Match the following:

Problem	Technique
P:Queuing	1: Time series models
Q: Project scheduling and mon-itoring	2:Linear programming models
R:Transportation	3:Waiting line models
S: Forecasting of production	4: PERT and CPM

TABLE 63

(GATE MN 2007)

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

64) The net present value in Rs. of a 3-year annuity of Rs. 10,000 discounted at 10% is
(GATE MN 2007)

a) 9,091   b) 17,355   c) 24,869   d) 26,446

65) For a track gauge of 1.05 m and a speed of 10 km/hour, the super-elevation in cm from the following figure is
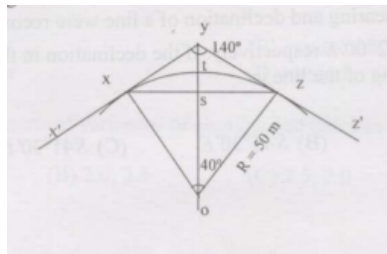

Fig. 65

(GATE MN 2007)

a) 1.65   b) 2.76   c) 5.54   d) 6.64

66) In the bubble tube of a dumpy level, the bubble moves 5 mm for a change of inclination of 40″. The sensitivity in mm and the radius of the bubble tube in m are
(1 radian = 206265″)

(GATE MN 2007)

a) 0.125, 12.89   b) 0.063, 26.78   c) 0.125, 25.78   d) 0.063, 12.89

67) The value of $A \cdot B$, if

$$A + B = \begin{pmatrix} 1 & -1 \\ 3 & 0 \end{pmatrix} \quad \text{and} \quad A - B = \begin{pmatrix} 3 & 1 \\ 1 & 4 \end{pmatrix}$$

is

(GATE MN 2007)

a) $-4\begin{pmatrix} 1 & 1 \\ 0 & 3 \end{pmatrix}$

c) $\begin{pmatrix} 1 & 3 \\ 1 & 1 \end{pmatrix}$

b) $-2\begin{pmatrix} -2 & 1 \\ 0 & 3 \end{pmatrix}$

d) $-\frac{1}{2}\begin{pmatrix} -2 & 1 \\ 0 & 3 \end{pmatrix}$

68) The values of $f(x)$ at x_0, x_1 and x_2 are 9.0, 12.0 and 15.0 respectively. Using Simpson's $\frac{1}{3}$ rule, the value of $\int f(x)\,dx$, considering an interval of 0.1 is:

(GATE MN 2007)

a) 1.2   b) 2.4   c) 1.6   d) 1.8

69) From the following page of a levelling field book, the missing values in F.S. and B.S. respectively are:

Station	B.S.	I.S.	F.S.	Rise	Fall	Remarks
1	4.550					Starting Point
2	2.125			?	0.750	Change point
3		2.225				
4	?		1.975			Change point
5		2.445	1.500			

TABLE 69

(GATE MN 2007)

a) 3.804, 0.945   b) 3.804, 3.945   c) 5.300, 0.945   d) 5.300, 3.945

70) The magnetic bearing and declination of a line were recorded in the year 1906 as $S\,43°30'E$ and $2°00'$ E respectively. If the declination in the year 2000 is $3°00'$ W, the magnetic bearing of the line is:

(GATE MN 2007)

a) $S\,48°30'E$ b) $S\,45°30'E$ c) $S\,41°30'E$ d) $S\,38°30'E$

Common Data Question

Common Data for Questions 71, 72, 73: In a straight duct of length 200 m a fan operates 50 m away from the inlet such that the mean air velocity in the duct is

8.0 m/s at a density of 1.1 kg/m^3. The friction pressure loss per m length of the duct is 3.0 Pa and the entry shock factor is 1.2. Answer the following in terms of gauge pressure values in Pa.

71) The total pressure at the outlet of the duct is

a) −35.2　　　　　b) 35.2　　　　　c) 192.2　　　　　d) 635.2

72) The total pressure at the inlet side of the fan is

a) −192.2　　　　b) −150.0　　　　c) 150.0　　　　d) 192.2

73) The total pressure generated by the fan is

a) 600.0　　　　　b) 635.2　　　　　c) 677.4　　　　　d) 682.2

Common Data for Questions 74, 75: A bauxite deposit has been intersected by 5 drill holes. The values of alumina (% by weight) and silica (% by weight) in these drill holes are as follows:

Drill hole number	Alumina (%)	Silica (%)
1	46	1
2	42	5
3	45	2
4	43	4
5	44	3

TABLE 73

74) The relationship between alumina and silica is

a) positive linear　　b) exponential　　c) negative linear　　d) random

75) The unbiased estimate of variances of alumina and silica in (%)^2 respectively are

a) 2.5, 2.5　　　　b) 2.0, 2.5　　　　c) 2.5, 2.0　　　　d) 2.0, 2.0

Linked Answer Question

Statement for Linked Answer Questions 76 & 77: Porosity of a coarse grain sandstone sample is 15%. The specific gravity of sandstone is 2.8.

76) What is the void ratio in the sandstone sample?

a) 0.150   b) 0.176   c) 0.850   d) 1.176

77) If the sandstone sample is fully saturated in water, the saturated density of the sample in kg/m^3 is

(GATE MN 2007)

a) 1590   b) 2234   c) 2438   d) 2531

Statement for Linked Answer Questions 78 & 79: A double outboard chain stranded conveyor is installed in an underground coal mine to transport coal. The mass of the chain and associated flight is 40 kg/m, the coefficients of kinematic friction are 0.33 between chain and the pan and 0.5 between conveyed coal and the pan. The motor efficiency is 80%. Coal is to be conveyed at the rate of 120 t/hour over a length of 120 m at a chain speed of 0.9 m/s. The bulk density of coal is 900 kg/m^3.

78) The power requirement of the motor of the chain conveyor in kW is

(GATE MN 2007)

a) 33.16   b) 37.53   c) 42.00   d) 45.94

79) The power requirement of the motor of the chain conveyor in kW, if it moves in the uphill direction at a gradient of 1 in 10, is

(GATE MN 2007)

a) 46.91   b) 42.00   c) 38.53   d) 30.16

Statement for Linked Answer Questions 80 & 81: The observed total time of drilling a face in an underground coal mine is 18 min. The rating of the drill crew performance, expressed in percentage, is 90. Following allowances are recommended by the mine management:
a) personal needs allowance: 5% of the basic time
b) fatigue allowance: 4% of the basic time
c) contingency delay allowance: 1% of basic time

80) The basic time required for the drilling job by the crew in min is

(GATE MN 2007)

a) 16.2   b) 17.4   c) 18.0   d) 20.0

81) The standard time required for the same drilling job by the crew in min is

(GATE MN 2007)

a) 15.50   b) 17.01   c) 17.82   d) 18.90

Statement for Linked Answer Questions 82 & 83: The results of a theodolite survey are given below:

Points	North Coordinate (m)	East Coordinate (m)
A	400.5	620.2
B	750.5	320.5

TABLE 81

82) The length of the line AB in m is

(GATE MN 2007)

a) 460.78 b) 349.70 c) 106.60 d) 50.30

83) The bearing of the line AB in degrees is

(GATE MN 2007)

a) −23.17°NE b) 23.17°NW c) 40.57°NW d) 40.57°NE

Statement for Linked Answer Questions 84 & 85: The following figure provides the grade information:
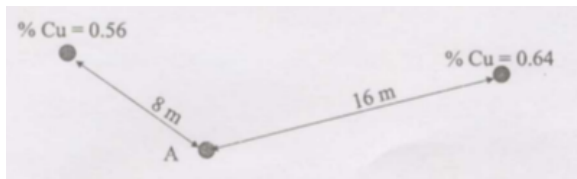

Fig. 83

84) The grade of copper (%) at point A using the inverse distance weighting method is

(GATE MN 2007)

a) 0.47 b) 0.58 c) 0.61 d) 1.20

85) Assume the grade at A to be the average grade of copper, mill recovery is 90% and the smelting & refining losses to be 1.0 kg of copper per tonne of ore. The saleable copper in kg/tonne of ore is

(GATE MN 2007)

a) 2.93 b) 3.93 c) 4.93 d) 5.93

END OF THE QUESTION PAPER