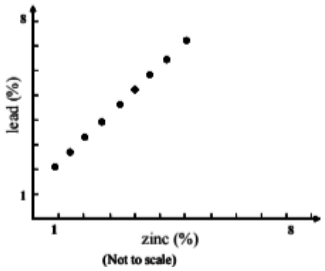
ASSIGNMENT 2: GATE 2011
MN: MINING ENGINEERING

AI25BTECH11010 - Dhanush Kumar A

1) A scatter plot prepared using a set of values of lead and zinc from a lead-zinc deposit is shown in figure below. The value of correlation coefficient is



a) 1.0 b) 0.7 c) 0.5 d) 0

2) The two vectors are orthonormal, if
   a) vector product is zero and norm of each vector is also zero
   b) vector product is one and norm of each vector is also one
   c) cross product is zero and norm of each vector is one
   d) cross product is one and norm of each vector is zero

3) The value of
$$\lim_{x\to 0} \frac{1}{x}\left(\sqrt{1+x} - \sqrt{1-x}\right) \text{ is}$$

a) 0 b) 1 c) 2 d) 3

4) The infinite series $1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \cdots$ is

a) convergent b) divergent c) oscillatory d) semi-convergent

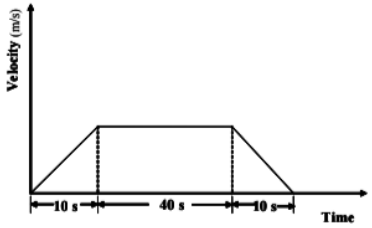
5) The largest area of a rectangular shaft for a given constant perimeter is obtained when length is

a) 2.5 times of breadth
b) 1.5 times of breadth
c) 2 times of breadth
d) equal to breadth

6) A drive shaft of an engine develops torque of 500 N·m. It rotates at a constant speed of 50 rpm. The power transmitted by the shaft in kW is

a) 1.46 b) 2.05 c) 2.62 d) 4.32

7) A mine winder cage traveling 450 m from pit bottom to pit top is following a three period duty cycle as shown in the figure below. The maximum velocity attained by the cage in m/s is



a) 7.5 b) 9.0 c) 11.0 d) 12.0

8) Stress concentration at a point on the wall of a vertical shaft results in a compressive stress of 59.66 MPa. The wall rock mass has an unconfined compressive strength of 89.49 MPa. The safety factor of the shaft wall at the point is

a) 0.67 b) 0.86 c) 1.23 d) 1.50

9) A core sample of 54 mm diameter having Young′s modulus of 68.97 GPa fails in uniaxial compression at 0.1% axial strain. The axial load at failure in kN is

a) 158.00 b) 68.97 c) 58.00 d) 15.80

10) The maximum number of coal faces in an underground bord and pillar development district is 13. The number of headings in the district is

a) 3 b) 5 c) 6 d) 7

11) The whole circle bearing of the line AB is 116°20′20″. If there exists an east declination of 20′, the true quadrantal bearing of line AB is

a) S41°59′40″E b) S43°39′40″E c) S45°59′40″W d) S47°59′40″W

12) It is proposed to connect two straights of a road by a simple circular curve. If the maximum speed of the vehicle is 60 km/h and the centrifugal ratio for the road is 1/4, the minimum radius of the curve in m is

a) 113.26 b) 98.18 c) 25.46 d) 15.50

13) A centrifugal fan rotating at 500 rpm delivers 70 m^3/s of air. If the speed is reduced to 200 rpm, the quantity of air delivered in m^3/s will be

a) 175 b) 55 c) 28 d) 11

14) According to mine regulations, the value of the fleet angle α, in degree of a drum winder installation lies in the range of

a) $1.5 < \alpha \leq 2.0$ b) $0 < \alpha \leq 1.5$ c) $2.0 < \alpha \leq 2.5$ d) $2.5 < \alpha \leq 3.0$

15) Water will not be delivered by a centrifugal pump due to

a) lack of priming
b) too low discharge head
c) wrong direction of rotation
d) partial obstruction at discharge outlet

16) Match the following

Mine car type	**Mode of unloading**
P. Granby	1. Bottom opening
Q. Gable bottom	2. Both side tilting
R. Drop bottom	3. Single side opening
S. Rocker dump	4. Both side opening

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

17) Mean air temperature of a 450 m deep downcast shaft is 29°C and that of the upcast shaft is 37°C. The height of the motive column in m is

a) 8.2 b) 9.5 c) 11.6 d) 12.8

18) The total pressure and the static pressure measured at a point in a ventilation duct are 20 mm and 10 mm of water gauge respectively. If density of air is 1.2 kg/m^3, the velocity of the air in m/s is

a) 14.08 b) 12.78 c) 8.53 d) 6.24

19) The type of fire extinguisher that must **NOT** be used in case of fire in an electric substation located in an underground metal mine is

a) multi-purpose dry chemical extinguisher
b) CO_2 snow extinguisher
c) dry chemical powder extinguisher
d) foam extinguisher

20) ISO 9000 Quality Systems **DO NOT** contain

a) legal provisions b) measurement c) document control d) standardization

21) Air samples collected from the intake and the return gates of a retreating longwall face show methane concentration values of 0.1% and 0.8% respectively. The production from the longwall face is 2000 tonne/day and the air quantity circulating the face is 15 m^3/s. The rate of methane emission in m^3 per tonne of coal produced is

a) 11.0 b) 9.5 c) 5.5 d) 4.5

22) The time study data of an equipment deployed in a mine during a calendar month is given below.
Total working hours = 400
Total maintenance hours = 100
Total hours of actual work = 240
The percentage of utilization of the equipment is

a) 85 b) 80 c) 65 d) 60

23) 100 ml of waste water is allowed to evaporate in a dish weighing 48.6232 g. The weight of the dish with dry solids is 48.6432 g. The concentration of dry solids in waste water in mg/l is

a) 200 b) 220 c) 260 d) 320

24) A longwall face cut by double back shuffle method can be only worked with

a) fixed drum shearer
b) single ended ranging drum shearer
c) double ended ranging drum shearer
d) plough

25) Proximate analysis of 50 g of a coal sample shows the following:
Moisture = 0.80 g
Ash = 7.85 g
Volatile matter = 15.90 g
The fixed carbon in percentage on a dry, ash free basis is

a) 83 b) 66 c) 55 d) 45

26) For an oil exploration drilling, chance of striking an oil reservoir is 1 out of 15. If an oil exploration company decides to explore 5 sites, the probability of striking at least one successful oil reservoir is

a) 0.292 b) 0.250 c) 0.034 d) 0.0024

27) Product of the eigen values of the matrix A is

$$A = \begin{bmatrix} 3 & 2 & 5 \\ 2 & 2 & 1 \\ 1 & 5 & 4 \end{bmatrix}$$

a) 6 b) 8 c) 10 d) 35

28) For the equation $\frac{dy}{dx} = 2x+3y$, the value of y at $x = 0.1$ in one step using Runge-Kutta fourth order method for the condition $y = 1$ when $x = 0$, is

a) 0.3608 b) 1.2508 c) 1.3608 d) 1.4625

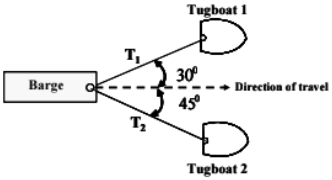
29) Value of the integral $\int_0^1 \sqrt{\frac{1+x}{1-x}}\, dx$ is

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

30) A 1 tonne mine car traveling at a constant speed o f 10 km/h collides with a stationary buffer and co mes to rest. If the buffer spring stiffness is 200 kN/m, the maximum compression in the spring in mm is

a) 49 b) 98 c) 196 d) 247

31) In an iron ore handling port, a barge is pulled by ropes using two tugboats as shown in the figure. In equilibrium, the resultant of the forces T_1 and T_2 along the axis of the barge in the direction of its travel is 5000 N. The tensions T_1 and T_2 in N respectively are

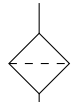
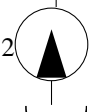
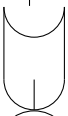
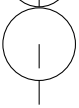


a) 9700 and 6831
b) 6831 and 9700
c) 3660 and 2588
d) 2588 and 3660

32) A flat belt conveyor is carrying coal of bulk density 1 tonne/m^3 at a rate of 400 tonne/h. The belt speed is 3 m/s. Coal is spread over the belt covering 80% of the belt width in a shape of a triangle. If the pile height is 1/4 of the belt width, the width of the belt in mm is

a) 1109 b) 909 c) 709 d) 609

33) Match the following

Hydraulic system components	Symbols
P Fixed displacement unidirectional flow pump	1 
Q Fixed displacement unidirectional flow motor	2 
R Accumulator	3 
S Filter	4 

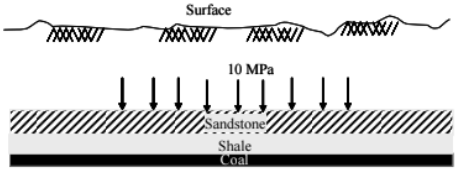
a) P-4, Q-2, R-3, S-1
b) P-2, Q-4, R-3, S-1
c) P-3, Q-2, R-1, S-4
d) P-2, Q-3, R-1, S-4

34) Match the following

Method of mining	Stope support	Ore loading
P. Shrinkage stoping	1. Insitu pillar	a. Overhead mucker
Q. Blasthole stoping	2. Broken ore	b. Pneumatic autoloader
R. Top slicing	3. Timber mat	c. Load haul dumper

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

35) A typical case of gravity loading under complete lateral restraint in flat strata is shown in the figure below. The physico-mechanical parameters of the strata are given in the table. The in situ stresses (σ_Z, σ_H) on the top of the coal seam in MPa are:



Cross-section of the strata

Strata	Thickness (m)	Specific Gravity	Young's Modulus (GPa)	Shear Modulus (GPa)
Sandstone	50	2.35	26.40	12.50
Shale	25	2.15	20.50	8.25
Coal	20	1.52	2.41	0.95

a) $(10.17, 2.54)$ b) $(10.17, 3.69)$ c) $(11.68, 3.69)$ d) $(11.68, 2.54)$