GATE 2014: General Instructions during Examination

1. Total duration of the GATE examination is **180** minutes.
2. The clock will be set at the server. The countdown timer at the top right corner of screen will display the remaining time available for you to complete the examination. When the timer reaches zero, the examination will end by itself. You need not terminate the examination or submit your paper.
3. Any useful data required for your paper can be viewed by clicking on the **Useful Common Data** button that appears on the screen.
4. Use the scribble pad provided to you for any rough work. Submit the scribble pad at the end of the examination.
5. You are allowed to use a non-programmable type calculator, however, sharing of calculators is not allowed.
6. The Question Palette displayed on the right side of screen will show the status of each question using one of the following symbols:

| 1 | You have not visited the question yet. |

| 3 | You have not answered the question. |

| 5 | You have answered the question. |

| 7 | You have NOT answered the question, but have marked the question for review. |

| 9 | You have answered the question, but marked it for review. |

The **Marked for Review** status for a question simply indicates that you would like to look at that question again. *If a question is answered, but marked for review, then the answer will be considered for evaluation unless the status is modified by the candidate.*

Navigating to a Question :

7. To answer a question, do the following:
    a. Click on the question number in the Question Palette to go to that question directly.
    b. Select an answer for a multiple choice type question by clicking on the bubble placed before the 4 choices, namely A, B, C and D. Use the virtual numeric keypad to enter a number as answer for a numerical type question.
    c. Click on **Save & Next** to save your answer for the current question and then go to the next question.
    d. Click on **Mark for Review & Next** to save your answer for the current question and also mark it for review, and then go to the next question.

Caution: Note that your answer for the current question will not be saved, if you navigate to another question directly by clicking on a question number without saving the answer to the previous question.

You can view all the questions by clicking on the **Question Paper** button. This feature is provided, so that if you want you can just see the entire question paper at a glance.

Answering a Question :

8. Procedure for answering a multiple choice (MCQ) type question:
   a. Choose one answer from the 4 options (A,B,C,D) given below the question, click on the bubble placed before the chosen option.
   b. To deselect your chosen answer, click on the bubble of the chosen option again or click on the **Clear Response** button.
   c. To change your chosen answer, click on the bubble of another option.
   d. To save your answer, you MUST click on the **Save & Next** button.

9. Procedure for answering a numerical answer type question:
   a. To enter a number as your answer, use the virtual numerical keypad.
   b. A fraction (e.g. -0.3 or -.3) can be entered as an answer with or without '0' before the decimal point. As many as four decimal points, e.g. 12.5435 or 0.003 or -932.6711 or 12.82 can be entered.
   c. To clear your answer, click on the **Clear Response** button.
   d. To save your answer, you MUST click on the **Save & Next** button

10. To mark a question for review, click on the **Mark for Review & Next** button. *If an answer is selected (for MCQ) or entered (for numerical answer type) for a question that is* **Marked for Review**, *that answer will be considered in the evaluation unless the status is modified by the candidate.*

11. To change your answer to a question that has already been answered, first select that question for answering and then follow the procedure for answering that type of question.

12. Note that ONLY Questions for which answers are *saved* or *marked for review after answering* will be considered for evaluation.

Choosing a Section :

13. Sections in this question paper are displayed on the top bar of the screen. Questions in a Section can be viewed by clicking on the name of that Section. The Section you are currently viewing will be highlighted.

14. A checkbox is displayed for every optional Section, if any, in the Question Paper. To select the optional Section for answering, click on the checkbox for that Section.

15. If the checkbox for an optional Section is not selected, the **Save & Next** button and the **Mark for Review & Next** button will NOT be enabled for that Section. You will

only be able to see questions in this Section, but you will not be able to answer questions in the Section.

16. After clicking the **Save & Next** button for the last question in a Section, you will automatically be taken to the first question of the next Section in sequence.

17. You can move the mouse cursor over the name of a Section to view the answering status for that Section.

Changing the Optional Section :

18. After answering the chosen optional Section, partially or completely, you can change the optional Section by selecting the checkbox for a new Section that you want to attempt. A warning message will appear along with a table showing the number of questions answered in each of the previously chosen optional Sections and a checkbox against each of these Sections. Click on a checkbox against a Section that you want to reset and then click on the **RESET** button. Note that RESETTING a Section will DELETE all the answers for questions in that Section. Hence, if you think that you may want to select this Section again later, you will have to note down your answers for questions in that Section. If you do not want to reset the Section and want to continue answering the previously chosen optional Section, then click on the **BACK** button.

19. If you deselect the checkbox for an optional Section in the top bar, the following warning message will appear: "Deselecting the checkbox will DELETE all the answers for questions in this Section. Do you want to deselect this Section?" If you want to deselect, click on the **RESET** button. If you do not want to deselect, click on the **BACK** button.

20. You can shuffle between different Sections or change the optional Sections any number of times.

GATE 2014 Examination

MN: Mining Engineering

Duration: **180 minutes**   *Maximum Marks*: **100**

Read the following instructions carefully.

1. To login, enter your Registration Number and password provided to you. Kindly go through the various symbols used in the test and understand their meaning before you start the examination.
2. Once you login and after the start of the examination, you can view all the questions in the question paper, by clicking on the **View All Questions** button in the screen.
3. This question paper consists of **2 sections**, General Aptitude (GA) for **15 marks** and the subject specific GATE paper for **85 marks**. Both these sections are compulsory.
   The GA section consists of **10** questions. Question numbers 1 to 5 are of 1-mark each, while question numbers 6 to 10 are of 2-mark each.
   The subject specific GATE paper section consists of **55** questions, out of which question numbers 1 to 25 are of 1-mark each, while question numbers 26 to 55 are of 2-mark each.
4. Depending upon the GATE paper, there may be useful common data that may be required for answering the questions. If the paper has such useful data, the same can be viewed by clicking on the **Useful Common Data** button that appears at the top, right hand side of the screen.

5. The computer allotted to you at the examination center runs specialized software that permits only one answer to be selected for multiple-choice questions using a mouse and to enter a suitable number for the numerical answer type questions using the virtual keyboard and mouse.
6. Your answers shall be updated and saved on a server periodically and also at the end of the examination. The examination will **stop automatically** at the end of **180 minutes**.
7. In each paper a candidate can answer a total of 65 questions carrying 100 marks.
8. The question paper may consist of questions of **multiple choice type** (MCQ) and **numerical answer type**.
9. Multiple choice type questions will have four choices against A, B, C, D, out of which only **ONE** is the correct answer. The candidate has to choose the correct answer by clicking on the bubble (◯) placed before the choice.
10. For numerical answer type questions, each question will have a numerical answer and there will not be any choices**. For these questions, the answer should be entered** by using the virtual keyboard that appears on the monitor and the mouse.
11. All questions that are not attempted will result in zero marks. However, wrong answers for multiple choice type questions (MCQ) will result in **NEGATIVE** marks. For all MCQ questions a wrong answer will result in deduction of $\frac{1}{3}$ marks for a 1-mark question and $\frac{2}{3}$ marks for a 2-mark question.
12. There is **NO NEGATIVE MARKING** for questions of **NUMERICAL ANSWER TYPE**.

13. Non-programmable type Calculator is allowed. Charts, graph sheets, and mathematical tables are **NOT** allowed in the Examination Hall. You must use the Scribble pad provided to you at the examination centre for all your rough work. The Scribble Pad has to be returned at the end of the examination.

Declaration by the candidate:

"I have read and understood all the above instructions. I have also read and understood clearly the instructions given on the admit card and shall follow the same. I also understand that in case I am found to violate any of these instructions, my candidature is liable to be cancelled. I also confirm that at the start of the examination all the computer hardware allotted to me are in proper working condition".

Q. 1 – Q. 5 carry one mark each.

Q.1   Choose the most appropriate word from the options given below to complete the following sentence.

A person suffering from Alzheimer's disease _____ short-term memory loss.

(A) experienced   (B) has experienced
(C) is experiencing   (D) experiences

Q.2   Choose the most appropriate word from the options given below to complete the following sentence.

_____ is the key to their happiness; they are satisfied with what they have.

(A) Contentment   (B) Ambition   (C) Perseverance   (D) Hunger

Q.3   Which of the following options is the closest in meaning to the sentence below?

"As a woman, I have no country."

(A) Women have no country.
(B) Women are not citizens of any country.
(C) Women's solidarity knows no national boundaries.
(D) Women of all countries have equal legal rights.

Q.4   In any given year, the probability of an earthquake greater than Magnitude 6 occurring in the Garhwal Himalayas is 0.04. The average time between successive occurrences of such earthquakes is ____ years.

Q.5   The population of a new city is 5 million and is growing at 20% annually. How many years would it take to double at this growth rate?

(A) 3-4 years   (B) 4-5 years   (C) 5-6 years   (D) 6-7 years

Q. 6 – Q. 10 carry two marks each.

Q.6   In a group of four children, Som is younger to Riaz. Shiv is elder to Ansu. Ansu is youngest in the group. Which of the following statements is/are required to find the eldest child in the group?
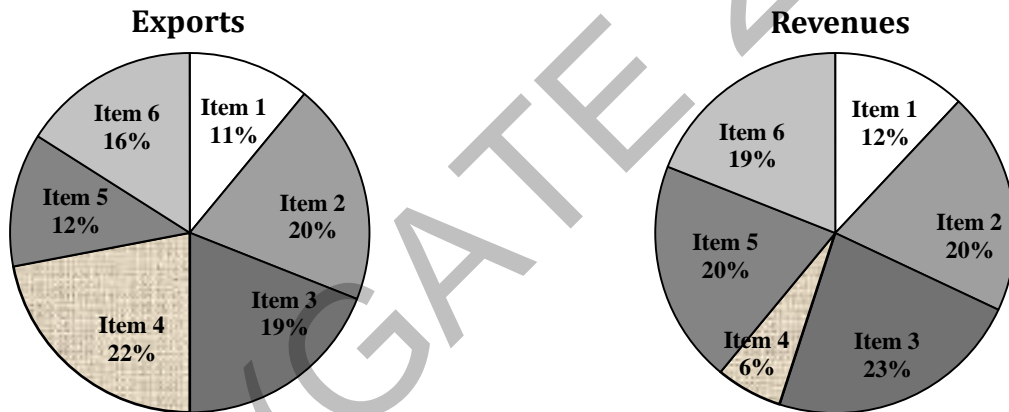**Statements**
1. Shiv is younger to Riaz.
2. Shiv is elder to Som.

(A) Statement 1by itself determines the eldest child.
(B) Statement 2 by itself determines the eldest child.
(C) Statements 1 and 2 are both required to determine the eldest child.
(D) Statements 1 and 2 are not sufficient to determine the eldest child.

Q.7   Moving into a world of big data will require us to change our thinking about the merits of exactitude. To apply the conventional mindset of measurement to the digital, connected world of the twenty-first century is to miss a crucial point. As mentioned earlier, the obsession with exactness is an artefact of the information-deprived analog era. When data was sparse, every data point was critical, and thus great care was taken to avoid letting any point bias the analysis.
From "BIG DATA" Viktor Mayer-Schonberger and Kenneth Cukier

The <u>main</u> point of the paragraph is:

(A) The twenty-first century is a digital world
(B) Big data is obsessed with exactness
(C) Exactitude is not critical in dealing with big data
(D) Sparse data leads to a bias in the analysis

Q.8   The total exports and revenues from the exports of a country are given in the two pie charts below. The pie chart for exports shows the quantity of each item as a percentage of the total quantity of exports. The pie chart for the revenues shows the percentage of the total revenue generated through export of each item. The total quantity of exports of all the items is 5 lakh tonnes and the total revenues are 250 crore rupees. What is the ratio of the revenue generated through export of Item 1 per kilogram to the revenue generated through export of Item 4 per kilogram?


Exports
Item 6 16%, Item 1 11%, Item 5 12%, Item 2 20%, Item 4 22%, Item 3 19%

Revenues
Item 6 19%, Item 1 12%, Item 5 20%, Item 2 20%, Item 4 6%, Item 3 23%

(A) 1:2   (B) 2:1   (C) 1:4   (D) 4:1

Q.9   X is 1 km northeast of Y. Y is 1 km southeast of Z. W is 1 km west of Z. P is 1 km south of W. Q is 1 km east of P. What is the distance between X and Q in km?

(A) 1   (B) $\sqrt{2}$ (C) $\sqrt{3}$ (D) 2

Q.10 10% of the population in a town is HIV$^+$. A new diagnostic kit for HIV detection is available; this kit correctly identifies HIV$^+$ individuals 95% of the time, and HIV$^-$ individuals 89% of the time. A particular patient is tested using this kit and is found to be positive. The probability that the individual is actually positive is _____

END OF THE QUESTION PAPER

Q. 1 – Q. 25 carry one mark each.

Q.1   A block of weight 100 kN rests on a floor as shown in the figure. The coefficient of static friction between the block and the floor is 0.5. A force of 45 kN is applied horizontally on the block. The static frictional force in kN is
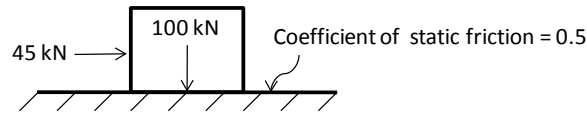
(A) 22.5   (B) 50.0   (C) 55.0   (D) 100.0

Q.2   A spring of constant stiffness k is stretched from point A to point B (displacement u in the figure) by a force F. The potential energy of the spring is expressed by
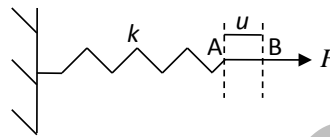
(A) $\dfrac{1}{2}ku^2 - Fu$ (B) $\dfrac{1}{2}ku^2 + Fu$

(C) $ku - F$ (D) $ku + F$

Q.3   If σ_s is the induced stress and σ_i is the insitu stress at a point below ground, the 'stress concentration' at that point is

(A) $\sqrt{\dfrac{\sigma_s}{\sigma_i}}$ (B) $\sqrt{\dfrac{\sigma_i}{\sigma_s}}$ (C) $\dfrac{\sigma_i}{\sigma_s}$ (D) $\dfrac{\sigma_s}{\sigma_i}$

Q.4   The components of state of stress at a point in $x-y$ plane are given as $\sigma_{xx} = 5\,\text{MPa}$, $\sigma_{yy} = 10\,\text{MPa}$ and $\tau_{xy} = -2\,\text{MPa}$. The sum of the principal stresses acting on the $x-y$ plane in MPa is _____

Q.5   The angle $5^0\,15^{'}\,25^{''}$ is expressed in hours, minutes, and seconds as

(A) $1^h\,20^{min}\,1.67^s$ (B) $1^h\,20^{min}\,16.00^s$ (C) $0^h\,21^{min}\,1.67^s$ (D) $0^h\,21^{min}\,16.00^s$

Q.6   A circular curve has a radius of 200 m and deflection angle of 65^0. The length of the curve in m is

(A) 221   (B) 227   (C) 235   (D) 262

Q.7   The weight strength of ANFO of specific gravity 0.8 is 912 kcal/kg. The weight strength of an emulsion explosive of specific gravity 1.2 is 850 kcal/kg. Bulk strength of the emulsion explosive relative to ANFO in percentage is _____

Q.8   In a cut-and-fill stope, the main purpose of back filling is to

(A) reduce ore dilution

(B) prevent high stress concentrations in far field domain

(C) prevent displacement due to dilation of fractured wall rock

(D) improve ore rehandling

Q.9   Bypass valve in a compressed oxygen type self-contained breathing apparatus is meant to
(A) release accumulated nitrogen in the breathing bag
(B) release excess pressure in the breathing bag
(C) supply oxygen directly to wearer in case pressure reducing valve does not function
(D) flush out the apparatus with oxygen on opening the cylinder valve

Q.10   Given S is the setting load and Y is the yield load of a hydraulic prop, the correct relationship is
(A) S < Y   (B) S > Y   (C) S = Y   (D) S = Y^2

Q.11   Solution of the differential equation $\dfrac{dy}{dx} = ky$ follows exponential decay (where k is a constant) for $x \in [0, \infty]$ if

(A) $k > 0$ (B) $k < 0$ (C) $k = 0$ (D) $k = e$

Q.12   The value of k for which the vectors $\mathbf{a} = 2\mathbf{i} - 3\mathbf{j}$ and $\mathbf{b} = k\,\mathbf{i} + 4\mathbf{j}$ are orthogonal to each other is ___

Q.13   Which one of the following is the most likely mode of slope failure for waste dump
(A) Circular   (B) Wedge
(C) Plane   (D) Toppling

Q.14   The occurrence of head in a single toss of an unbiased coin is given by a random variable X. The variance of X is _____

Q.15   The divergence of the vector $\mathbf{v} = (x + y)(-y\mathbf{i} + x\mathbf{j})$ is

(A) $y - x$ (B) $x - y$ (C) $x^2 - y^2$ (D) $y^2 - x^2$

Q.16   The $\lim\limits_{x \to 0} \dfrac{|x|}{x}$ is

(A) −1   (B) 0   (C) 1   (D) non-existent

Q.17   For Indian coal mines, the 'maximum allowable concentration' of respirable dust containing 7.5% free silica in mg/m^3 is

(A) 2.0   (B) 2.2   (C) 2.5   (D) 2.7

Q.18   Given k is the thermal conductivity, ρ is density and c is specific heat of a rock sample, the thermal diffusivity of the rock sample is

(A) $\dfrac{k\rho}{c}$ (B) $\dfrac{\rho c}{k}$ (C) $\dfrac{kc}{\rho}$ (D) $\dfrac{k}{\rho c}$

Q.19   Cyclone, bag filter and scrubber can be used for control of

(A) water pollution   (B) air pollution

(C) soil pollution   (D) noise pollution

Q.20   A mine waste dump of pH 5.2 can be neutralized by adding

(A) urea   (B) calcium carbonate

(C) sulphuric acid   (D) sodium chloride

Q.21   A flat coal seam of thickness (t) 3 m is excavated and broken roof rock has completely filled the space created due to extraction as shown in the figure. If the bulking factor of roof rock is 1.2, the caving height (H) in m is _____
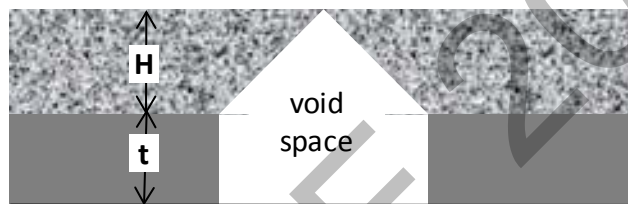
Q.22   A piece of coal sample weighs 10 kg in air and 2 kg when immersed in water. The specific gravity of the coal sample is _____

Q.23   In a borehole log of 1.2 m in length, recovery of rock cores in cm is given below

20, 8, 15, 8, 8, 4, 3, 9, 10, 1, 5, 10

The RQD in percentage is

(A) 29.2   (B) 31.8   (C) 45.8   (D) 50.0

Q.24   An underground coal mine panel produces 520 tonnes per day deploying 220, 200 and 192 persons in three shifts. As per CMR 1957, the minimum quantity of air in m^3/min to be delivered at the last ventilation connection of the panel is _____

Q.25   In a PERT network, the activities on the critical path are a, b and c. The standard deviations of the durations of these activities are 2, 2 and 1 respectively. The variance of the project duration is

(A) 3   (B) 5   (C) 9   (D) 12

Q. 26 – Q. 55 carry two marks each.

Q.26 A particle P is in equilibrium as shown in the figure. The magnitude in kN and the orientation θ in degrees of the force **F** respectively are
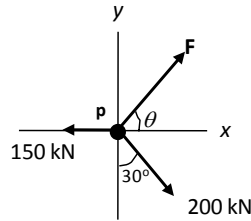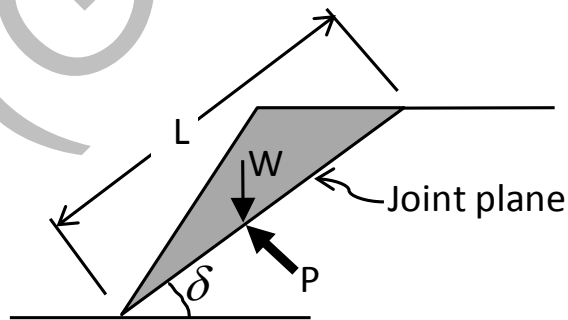

(A) 52.1, 16.1   (B) 221.2, 23.2   (C) 102.3, 53.4   (D) 180.3, 73.9

Q.27 A distributed load of 4 kN/m acts on a beam of 6 m length supported by a hinge and a roller as shown in the figure. The distance in m of the point of zero shear in the beam from the point A is __
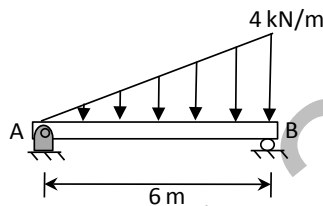
Q.28 A dry rock sample of diameter 50 mm and length 100 mm weighs 300 g. After saturating in brine solution of specific gravity 1.05, its weight increased to 330 g. The porosity of the rock sample in percentage is _____

Q.29 A joint plane of length L and dip δ intersects the toe of a slope as shown in the figure. The weight of the shaded block is W. Uniform water pressure P acts normal to the joint plane. If the cohesion and angle of internal friction of the joint surface are c and ϕ respectively, then the expression for 'safety factor' of the shaded block is

(A) $\dfrac{Lc + (W \sin \delta - LP) \tan \phi}{W \cos \delta}$

(B) $\dfrac{Lc + (W \cos \delta + LP) \tan \phi}{W \sin \delta}$

(C) $\dfrac{Lc + (W \cos \delta - LP) \tan \phi}{W \sin \delta}$

(D) $\dfrac{Lc + (W \sin \delta + LP) \tan \phi}{W \cos \delta}$

Q.30   The lengths and standard errors of three sections AB, BC, and CD of a straight line AD are given below

AB = 125.85±0.021 m; BC= 205.72±0.029 m; CD=246.21±0.025 m

The standard error in total length AD in m is

(A) ±0.0436   (B) ±0.0350   (C) ±0.0250   (D) ±0.0019

Q.31   The bearing of side AB of a regular hexagon ABCDEF is $S\,50^0 10' E$. If the station C is easterly from the station B, the whole circle bearing of the side BC is

(A) $65^0 15' 25''$ (B) $69^0 50' 25''$ (C) $69^0 15' 25''$ (D) $69^0 50' 0''$

Q.32   In a room-and-pillar stope, bench blasting is conducted using ANFO having density of 800 kg/m^3. The specific gravity of rock is 2.5, hole diameter is 100 mm and spacing to burden ratio is 1.3. The charge length of each blast hole is 80% of the hole length. For a desired powder factor of 0.48 kg/tonne, the spacing and burden of the blast pattern in m respectively are

(A) 2.0, 2.6   (B) 2.3, 1.8   (C) 5.2, 4.0   (D) 1.3, 1.0

Q.33   Match the following for ore handling operations in an underground metal mine

| Arrangement	Description
(P) Drawpoint	(I) arrangement that prevents oversized rock to pass
(Q) Ore pass	(II) a system of vertical or near vertical openings for transferring ore from a stope to a single delivery point
(R) Grizzly	(III) a place where ore can be loaded and removed
(S) Finger raise	(IV) a vertical or inclined opening used for transferring ore

(A) P-IV, Q-III, R-II, S-I   (B) P-III, Q-IV, R-I, S-II

(C) P-II, Q-IV, R-I, S-III   (D) P-III, Q-I, R-II, S-IV

Q.34   The following characteristic curves (P, Q, R, S) pertain to rotary drilling in rock.
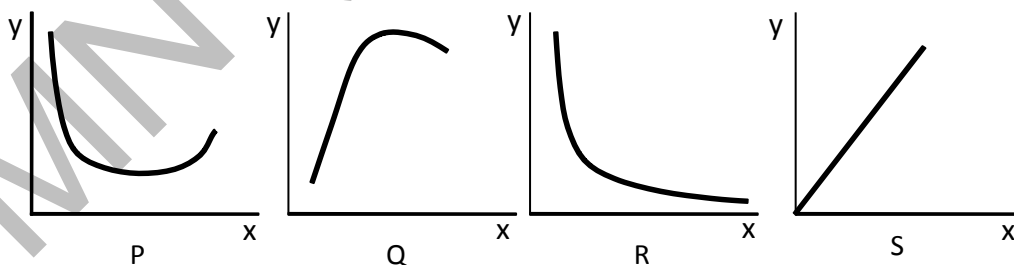
Title of the curve
I: Torque versus RPM
II: Rate of penetration versus uniaxial compressive strength of rock
III: Rate of penetration versus weight on bit
IV: Specific energy versus weight on bit
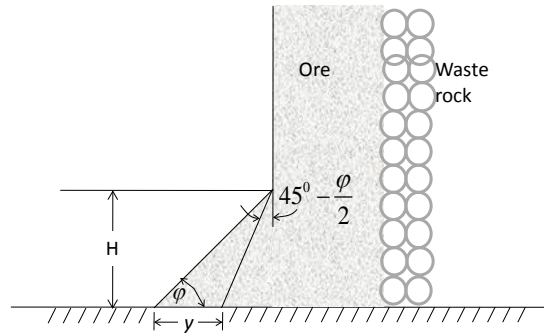
Match the curves with their titles

(A) P-III, Q-IV, R-II, S-I   (B) P-II, Q-IV, R-I, S-III

(C) P-IV, Q-III, R-II, S-I   (D) P-I, Q-III, R-II, S-IV

Q.35   The height H of a drawpoint in a sublevel caving stope is 3.0 m. If the angle of repose (φ) of broken ore is 35^0, the digging depth y of the loader as shown in the figure in m is _____

Q.36   For an explosives company, the probability of producing a defective detonator is 0.02. The probability that a lot of 50 detonators produced by the company contains at most 2 defective detonators is _____

Q.37   The area enclosed by the curves $y = x^2$ and $y = x^3$ for $x \in [0, \infty]$ is

(A) 1/12   (B) 1/6   (C) 1/2   (D) 1

Q.38   The value of a, for which the function below is continuous at $x = 1$ is

$$f(x) = \begin{cases} 2x + ax^2, & x \leq 1 \\ 4x + 3, & x > 1 \end{cases}$$

(A) -5   (B) 0   (C) 5   (D) 10

Q.39   The sum of the infinite series $a + ar + ar^2 + ar^3 + \cdots + ar^{n-1} + \cdots$ for $|r| < 1$ is

(A) $a(1 + r)$ (B) $a(1 - r)$ (C) $\dfrac{a}{1 + r}$ (D) $\dfrac{a}{1 - r}$

Q.40   A centrifugal pump has a discharge rate of 2000 L of water per min against a total head of 200 m. If the pump efficiency is 75%, the input power to the pump in kW is

(A) 87.20   (B) 49.05   (C) 13.33   (D) 7.50

Q.41   A dragline is required to remove 3,00,000 m^3 of rock per month on the bank volume basis. Consider the following data for the dragline operation.
        Effective working hours per month = 450
        Bucket fill factor = 0.8
        Cycle time = 65 s
        Swell factor of the rock = 1.25
The minimum bucket capacity of the dragline in m^3 is

(A) 7.70   (B) 9.63   (C) 12.04   (D) 18.80

Q.42   A direct rope haulage pulls 8 tubs loaded with coal through an incline of length 500 m having an inclination of 1 in 6. Consider the following additional data.

Capacity of tub = 1.0 tonne
Tare weight of tub = 500 kg
Hauling speed = 9 km per hour
Coefficient of friction between wheel and rail = 1/60
Coefficient of friction between rope and drum = 1/10
Mass of rope per meter = 1.5 kg

The minimum power required to haul the tubs in kW is

(A) 345.50   (B) 348.60   (C) 350.10   (D) 365.50

Q.43   A coal mine receives two bids for purchase of a new dragline. The first bid quotes Rs. 150 crore as a price to be paid in full on delivery. The second bid quotes Rs. 180 crore as a price payable at the end of the third year after delivery. If the discount rate is 12%, the difference in NPV between the first and second bids in crore of rupees is _____

Q.44   Match the following in the context of underground mine environment

	Instrument		Measuring parameter
P.	Haldane apparatus	I.	Humidity
Q.	Godbert-Greenwald apparatus	II.	Air velocity
R.	Hygrometer	III.	Mine air composition
S.	Anemometer	IV.	Ignition point temperature

(A) P-II, Q-I, R-III, S-IV   (B) P-III, Q-IV, R-I, S-II

(C) P-IV, Q-II, R-III, S-I   (D) P-I, Q-III, R-IV, S-II

Q.45   A mine airway having cross-section of 2.2 m × 2.2 m and length 500 m contains a bend. Given that the airway friction factor is $0.01\ Ns^2m^{-4}$, shock loss factor for the bend is 0.07 and density of air is $1.2\ kg/m^3$, the equivalent length of the airway in m is _____

Q.46   In order to estimate the NVP in a mine, measurements are made at the main fan as shown below.

Fan speed (RPM)	Fan drift pressure (Pa)	Fan quantity (m^3/s)
800	655	82.2
950	730	85.5

The NVP in Pa is _____

Q.47   The resistances of two splits A and B are $0.35\ Ns^2m^{-8}$ and $0.05\ Ns^2m^{-8}$ respectively. The combined resistance of the shafts and trunk airways is $0.4\ Ns^2m^{-8}$. A booster fan is planned to be installed in split A to increase the quantity flowing through it. Assuming that the surface fan continues to operate at a constant pressure of 1000 Pa, the critical pressure of the booster fan in Pa is _____

Q.48   A pitot tube is inserted in a ventilation duct with the nose facing the air flow. A vertical U-tube manometer filled with alcohol (specific gravity 0.8) has been used for pressure measurements such that 10.2 mm is read as the total pressure and 8.8 mm as the static pressure. Given the density of air to be 1.2 kg/m^3, the air velocity at the nose of the pitot tube in m/s is _____

Q.49
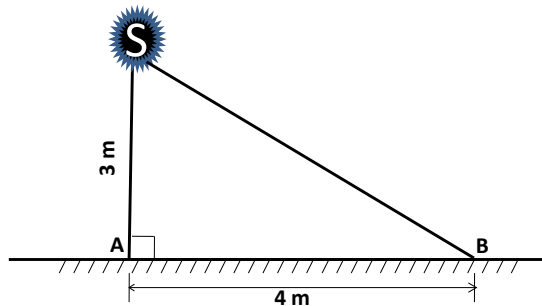
An illumination source S shown in the figure emits light equally in all directions. At a point A on the floor, the illuminance is 5.0 lux. The illuminance at point B on the floor in lux is _____

Q.50   Two machines A and B while operating simultaneously produce a sound pressure level of 85 dBA at a point. When the machine A stops, the sound pressure level at that point reduces to 80 dBA. The sound pressure level at the same point due to machine A operating alone in dBA is

(A) 70.0   (B) 75.0   (C) 80.0   (D) 83.3

Q.51   A waste water effluent has BOD$_5$ of 80 mg/L and the reaction rate constant is 0.16 per day. The ultimate BOD in mg/L is

(A) 85   (B) 100   (C) 120   (D) 145

Q.52   A series of tri-axial compression tests conducted on sandstone samples reveal the following relationship between major and minor principal stresses

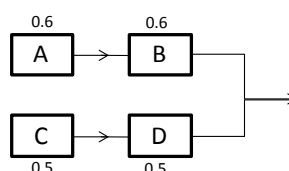$$\sigma_1 = 50 + 3\sigma_3 \quad \text{[stresses are in MPa]}$$

The cohesion in MPa and angle of internal friction in degrees of sandstone respectively are

(A) 14.43, 30.0   (B) 14.43, 60.0   (C) 0.21,73.9   (D) 0.21,16.1

Q.53   Six detonators each having resistance of 1.5 ohm are connected in parallel. A 15 V exploder is connected to the detonators by two single-core cables of resistance 3 ohm each. The current in the circuit in Ampere is _____

Q.54   The failure and the repair rates of a shovel are 0.06 hr^{-1} and 0.04 hr^{-1} respectively. The availability of the shovel in percentage is _____

Q.55   The individual reliability values of four sub-systems are given in the figure below. The reliability of the system is _____

END OF THE QUESTION PAPER