

1-5 carry one mark each

- 1) Choose the appropriate word/phrase, out of the four options given below, to complete the following sentence:

Apparent lifelessness _____ dormant life.

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- | | |
|-------------|-------------|
| a) harbours | c) supports |
| b) leads to | d) affects |

- 2) Fill in the blank with the correct idiom/phrase.

That boy from the town was a _____ in the sleepy village.

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- | | |
|------------------------|------------------------|
| a) dog out of herd | c) fish out of water |
| b) sheep from the heap | d) bird from the flock |

- 3) Choose the statement where underlined word is used correctly.

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- | | |
|---|---|
| a) When the teacher eludes to different authors, he is being elusive. | c) Matters that are difficult to understand, identify or remember are <i>allusive</i> . |
| b) When the thief keeps eluding the police, he is being elusive | d) Mirages can be allusive, but a better way to express them is illusory. |

- 4) Tanya is older than Eric.

Cliff is older than Tanya.

Eric is older than Cliff.

If the first two statements are true, then the third statement is:

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- | | |
|----------|----------------------|
| a) True | c) Uncertain |
| b) False | d) Data insufficient |

- 5) Five teams have to compete in a league, with every team playing every other team exactly once, before going to the next round. How many matches will have to be held to complete the league round of matches?

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- | | |
|-------|------|
| a) 20 | c) 8 |
| b) 10 | d) 5 |

6-10 carry two marks each

- 6) Select the appropriate option in place of underlined part of the sentence.

Increased productivity necessary reflects greater efforts made by the employees.

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- | | |
|---------------------------------------|---|
| a) Increase in productivity necessary | c) Increase in productivity necessarily |
| b) Increase productivity is necessary | d) No improvement required |

- 7) Given below are two statements followed by two conclusions. Assuming these statements to be true, decide which one logically follows.

Statements:

- a) No manager is a leader.

b) All leaders are executives.

Conclusions:

a) No manager is an executive.

b) No executive is a manager.

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a) Only conclusion I follows.

c) Neither conclusion I nor II follows.

b) Only conclusion II follows.

d) Both conclusions I and II follow.

- 8) In the given figure angle Q is a right angle, $PS:QS = 3:1$, $RT:QT = 5:2$ and $PU:UR = 1:1$. If area of triangle QTS is 20 cm^2 , then the area of triangle PQR in cm^2 is _____.

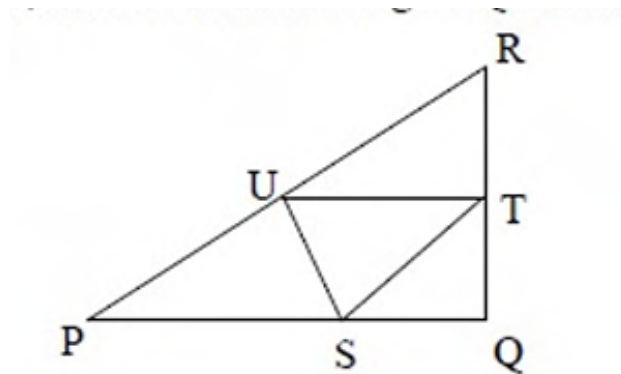


Fig. 1. fig1

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- 9) Right triangle PQR is to be constructed in the xy -plane so that the right angle is at P and line PR is parallel to the x -axis. The x and y coordinates of P, Q, and R are to be integers that satisfy the inequalities: $-4 \leq x \leq 5$ and $6 \leq y \leq 16$. How many different triangles could be constructed with these properties?

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a) 110

c) 9,900

b) 1,100

d) 10,000

- 10) A coin is tossed thrice. Let X be the event that head occurs in each of the first two tosses. Let Y be the event that a tail occurs on the third toss. Let Z be the event that two tails occur in three tosses. Based on the above information, which one of the following statements is TRUE?

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a) X and Y are not independent

c) Y and Z are independent

b) Y and Z are dependent

d) X and Z are independent

11-35 carry one mark each

- 11) In numerical integration using Simpson's rule, the approximating function in the interval is _____

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- a) constant
b) straight line
- c) cubic B-Spline
d) parabola
- 12) If a constant force \mathbf{f} applied on an object P , displaces it by a distance \mathbf{d} , inclined at an angle θ to the direction of force \mathbf{f} , then the work done by the force \mathbf{f} is GATE 2015 PI
- a) $\text{div}(\mathbf{f} \times \mathbf{d})$
b) $|\mathbf{f} \times (\text{curl} \mathbf{d})|$
- c) $|\mathbf{f} \times \mathbf{d}|$
d) $\mathbf{f} \cdot \mathbf{d}$
- 13) A product is an assembly of 5 different components. The product can be sequentially assembled in two possible ways. If the 5 components are placed in a box and these are drawn at random from the box, then the probability of getting a correct sequence is GATE 2015 PI
- a) $\frac{2}{5!}$
b) $\frac{2}{5}$
c) $\frac{2}{(5-2)!}$
d) $\frac{2}{(5-3)!}$
- 14) The function $f(x) = x^2 = x + x + x + \dots x$ times, is defined GATE 2015 PI
- a) at all real values of x
b) only at positive integer values of x
c) only at negative integer values of x
d) only at rational values of x
- 15) The room-temperature stress (σ)-strain (ϵ) curves of four materials P, Q, R, and S are shown in the figure below. The material that behaves as a rigid perfectly plastic material is
- a) P
b) Q
c) R
d) S
- GATE 2015 PI
- 16) The true stress at fracture of a tensile tested specimen, having an initial diameter of 13 mm, is 700 MPa. If the diameter of specimen at fracture is 10 mm, then the engineering stress, in MPa, at fracture is _____.
- GATE 2015 PI
- 17) If the principal stress values are 120 MPa, -50 MPa and 10 MPa in a given state of stress, then maximum shear stress in the material, in MPa, is _____.
- GATE 2015 PI
- 18) Match the items in the first column to their functions in the second column.
- | | |
|------------------|---|
| P. Sprue | 1. regulates flow of molten metal into mould cavity |
| Q. Riser | 2. feeds molten metal from pouring basin to gate |
| R. Gate | 3. acts as a reservoir for molten metal |
| S. Pouring basin | 4. supplies molten metal to compensate for liquid shrinkage |

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- a) (A) P-1, Q-2, R-3, S-4
- b) (B) P-2, Q-4, R-1, S-3
- c) (C) P-4, Q-2, R-1, S-3
- d) (D) P-2, Q-4, R-3, S-1

19) In rolling of a flat strip, the relative velocity of strip with respect to the roller is

- a) positive at entry plane, negative at exit plane
- b) negative at entry plane, positive at exit plane
- c) positive throughout from entry to exit plane
- d) negative throughout from entry to exit plane

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20) The maximum reduction per pass during wire drawing of an aluminum alloy ignoring friction and redundant work is 77%. The strain hardening exponent of the material is _____.

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21) Built-up edge formation decreases under the conditions listed below **EXCEPT**

- a) at low cutting speeds
- b) using large positive rake angle
- c) with sharper tool
- d) using cutting fluid

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22) During turning of mild steel work material, the maximum temperature is observed at

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- a) primary deformation zone
- b) tool and chip interface
- c) tool-flank and work interface
- d) machined sub-surface

23) Which one of the following statements related to grinding process is **INCORRECT**?

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- a) Grinding wheels made of finer abrasive grains produce better surface finish.
- b) Abrasive grains tend to fracture frequently during the grinding process.
- c) Specific energy in grinding is higher than that in turning.
- d) Cutting speed in grinding process is much lower than that in face milling.

24) For an assembly made of n components, the dimensions on each component i follow a normal distribution and have tolerance T_i . Overall dimension of the assembly is L_a with tolerance T_a . The relationship between T_a and T_i is

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- a) $T_a = L_a \sqrt{\sum_{i=1}^n \frac{T_i^2}{L_a^2}}$
- b) $T_a = \sqrt{\sum_{i=1}^n T_i^2}$
- c) $T_a = L_a + \sqrt{\sum_{i=1}^n T_i^2}$
- d) $T_a = L_a + \sum_{i=1}^n T_i^2$

25) Which of the following **DO NOT** influence the material removal rate in Electrical Discharge Machining process?

- a) Hardness of work piece material
- b) Melting temperature of work piece material

- c) Hardness of tool material
 - d) Discharge current and frequency
 - a) (i) and (ii)
 - b) (i) and (iii)
 - c) (iii) and (iv)
 - d) (i), (ii) and (iii)
- 26) In Computer Aided Process Planning, determination of process sequence for manufacture of any part design without predefined standard plans is known as
- a) variant type process planning
 - b) retrieval type process planning
 - c) generative type process planning
 - d) group technology based process planning
- 27) The angle of a twist drill that determines its rake angle is
- a) lip relief angle
 - b) chisel edge angle
 - c) helix angle
 - d) point angle
- 28) A line balancing problem is solved in the context of GATE 2015 PI
- a) process layout
 - b) fixed position layout
 - c) product layout
 - d) production schedule
- 29) Solution to the balanced assignment problem is binary due to GATE 2015 PI
- a) linear formulation
 - b) non-empty feasible region
 - c) approximation algorithms
 - d) uni-modularity property
- 30) Material Requirements Planning **DOES NOT** include GATE 2015 PI
- a) material price
 - b) bill of material
 - c) inventory level
 - d) production schedule
- 31) Ishikawa diagram represents
- a) different types of quality defects
 - b) quantitative relation between the extent of defect and a process parameter
 - c) relation between defects and their causes
 - d) prioritized quality defects
- 32) As per the principles of motion economy, which one of the following is **NOT** a pivot for a classified movement of human body? GATE 2015 PI
- a) Knee
 - b) Elbow
 - c) Torso
 - d) Wrist
- 33) For air travel over a distance of 500 km, the ticket price is Rs. 4000. The comfort of the

air travel can be monetized at Rs. 3000, and the monetary value of time saved because of air travel is Rs. 3000. The value of air travel is _____.

- 34) Which one of the following is NOT in the scope of Enterprise Resource Planning (ERP) system?

GATE 2015 PI

- a) General ledger entries
- b) Materials management system
- c) Order management system
- d) Employee promotion policy

- 35) If standard production is 20 units, a worker's actual output is 18 units, piece rate is Rs. 500 per unit, and over-achievement rate is Rs. 750 per unit, then the wage paid to the worker, in Rs., as per Taylor's differential price rate wage incentive plan, is _____. GATE 2015 PI

- 36) The solution to $6yy' - 25x = 0$ represents a GATE 2015 PI

- a) family of circles
- b) family of ellipses
- c) family of parabolas
- d) family of hyperbolas

- 37) The solution to $x^2y'' + xy' - y = 0$ is GATE 2015 PI

- a) $y = c_1x^2 + c_2x^{-3}$
- b) $y = c_1 + c_2x^{-2}$
- c) $y = c_1x + \frac{c_2}{x}$
- d) $y = c_1x + c_2x^4$

- 38) Match the linear transformation matrices listed in the first column to their interpretations in the second column. GATE 2015 PI

| Matrix | Interpretation |
|---|------------------------------------|
| P. $\begin{bmatrix} 1 & 0 \\ 0 & 0 \end{bmatrix}$ | 1. Stretch in the y-axis |
| Q. $\begin{bmatrix} 0 & 0 \\ 0 & 1 \end{bmatrix}$ | 2. Uniform stretch in x and y-axes |
| R. $\begin{bmatrix} 1 & 0 \\ 0 & 3 \end{bmatrix}$ | 3. Projection in x-axis |
| S. $\begin{bmatrix} 4 & 0 \\ 0 & 4 \end{bmatrix}$ | 4. Projection in y-axis |

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

- 39) The value of $\lim_{(x,y) \rightarrow (0,0)} \frac{x^2 - xy}{\sqrt{x} - \sqrt{y}}$ is GATE 2015 PI

- a) 0
- b) $\frac{1}{2}$
- c) 1
- d) ∞

- 40) The curve $y = x^4$ is GATE 2015 PI

- a) concave up for all values of x
 - b) concave down for all values of x
 - c) concave up only for positive values of x
 - d) concave up only for negative values of x
- 41) A metallic bar of uniform cross-section with specific weight of 100 kN/m^3 is hung vertically down. The length and Young's modulus of the bar are 100 m and 200 GPa, respectively. The elongation of the bar, in mm, due to its own weight is _____. GATE 2015 PI
- 42) The bending moment, in Nm, at point R is _____. GATE 2015 PI
- 43) In an off-set slider crank mechanism, shown in figure, the crank is rotated at a constant speed of 150 rpm. The value of the angle θ shown in the figure is 20° . What is the ratio of forward to return stroke time? Can this mechanism be used in an application involving quick return? GATE 2015 PI
- a) 3.33, No
 - b) 0.73, Yes
 - c) 1.25, Yes
 - d) 0.73, No
- 44) In a 1 m thick wall, the temperature distribution at a given instant is $T(x) = c_0 + c_1x + c_2x^2$ where T is in $^\circ\text{C}$ and x is in m. The constants are: $c_0 = 800^\circ\text{C}$, $c_1 = -250^\circ\text{C/m}$ and $c_2 = -40^\circ\text{C/m}^2$. The thermal conductivity of the wall is 50 W/mK and wall area is 5 m^2 . If there is a heat source generating uniform volumetric heating at the rate of 500 W/m^3 inside the wall, then the rate of change of energy storage in the wall, in kW, is _____. GATE 2015 PI
- 45) In a vertical piston-cylinder arrangement the force applied to the piston pushes water through a nozzle. The water flows out from the nozzle and reaches the top of its trajectory. The kinetic and pressure energies at points (1), (2) and (3), respectively, are GATE 2015 PI
- a) (small and large), (large and zero) and (zero and zero)
 - b) (small and zero), (large and large) and (small and zero)
 - c) (large and zero), (zero and large) and (large and zero)
 - d) (large and small), (small and zero) and (small and large)
- 46) Consider a glass-fiber reinforced polymer material. The stress-strain curves of the fiber, matrix and composite are plotted. Which one of the following statements is **TRUE**? GATE 2015 PI
- a) Curve P represents the composite, Curve Q the matrix and Curve R the fiber.
 - b) Curve Q represents the composite, Curve R the matrix and Curve P the fiber.
 - c) Curve R represents the composite, Curve P the matrix and Curve Q the fiber.
 - d) Curve P represents the composite, Curve R the matrix and Curve Q the fiber.
- 47) A mould for injection moulding is designed for polymer P having shrinkage of 0.010 mm/mm . A critical dimension needed in the moulded part is 35 mm . If the same mould is now used to make a similar part but made of a different polymer Q with shrinkage of 0.025 mm/mm , then the critical dimension in the moulded part made of polymer Q, in mm, is _____. GATE 2015 PI
- 48) Open die forging of a cylinder made of a rigid perfectly plastic material with yield strength of 200 MPa having a height of 25 mm and diameter of 25 mm is being carried out. The cylinder is subjected to a true compressive strain of 3.6 during the process. Assuming frictionless and homogeneous deformation, the energy expended, in kJ, is _____. GATE 2015 PI

the time required for pick-up and drop is 30 s each, neglecting idle times, then the number of AGVs required to meet the demand of 50 deliveries per hour is _____. GATE 2015 PI

- 57) A machine is bought for Rs. 25,00,000. The organization follows a declining balance method of depreciation with a depreciation charge of 25%. If the machine is sold at Rs. 17,50,000 at the end of second year, then the profit on the book, in Rs., is _____. GATE 2015 PI
- 58) A manufacturing line requires 7.2 minutes to make a product. The line has six workstations arranged as per the required sequence of operations. Total production required is 300 products in 7.5 hours. At steady state, the line efficiency, in %, is _____. GATE 2015 PI
- 59) A single facility is to be located to meet the demand at coordinates (1, 2), (2, 3), (3, 5) and (4, 1). The demand at these points is 700, 100, 300 and 500 respectively. Using the rectilinear distance measure and weighted distance minimization criterion, the facility should be located
- a) anywhere on the line joining points (2, 2) and (3, 2) c) anywhere on the line joining (2, 3) and (3, 3)
b) at the point (2, 3) d) at the point (3, 3)
- 60) The value of (X_1, X_2) for an optimal solution for

$$\text{Minimize } Z = 6X_1 - 8X_2$$

subject to:

$$5X_1 + 10X_2 \leq 30$$

$$4X_1 + 4X_2 \leq 20$$

$$X_1 \geq 0, X_2 \geq 0$$

is

- a) (0, 0) c) (0, 3)
b) (1, 6) d) (3, 7)
- 61) Arrival of machines for repair in a maintenance shop follows a Poisson distribution at a rate of one per 18 hours. The time to repair follows an exponential distribution with Mean Time To Repair (MTTR) of 14 hours. If the productivity loss is Rs. 22,500 per hour, then the total expected loss of productivity due to machine breakdowns, in Rs., is _____ GATE 2015 PI
- a) 78,750 c) 11,81,250
b) 1,01,250 d) 14,17,500
- 62) In a manufacturing process, 24 samples each of size 50 items were inspected and a total of 52 defective items were observed. The lower and upper control limits set for the p-chart should, respectively, be _____ GATE 2015 PI

- a) $(0.043, 0.12)$ c) $(-0.043, 0.10)$
b) $(-0.043, 0.086)$ d) $(0, 0.13)$

63) Data on five products to be processed on a single machine is given below:

| Product | Release time | Processing time | Due date |
|---------|--------------|-----------------|----------|
| P | 0 | 3 | 10 |
| Q | 2 | 4 | 9 |
| R | 0 | 2 | 15 |
| S | 1 | 5 | 11 |
| T | 1 | 1 | 13 |

For the processing sequence $R - P - S - T - Q$, total tardiness is _____.

GATE 2015 PI

- 64) In a time study experiment, observed time is 15 minutes, operator rating is 90, personal need allowance is 4%, fatigue allowance is 3%, contingency allowance for work is 3% and contingency allowance for delay is 2%. The total work content, in minutes, is _____.

GATE 2015 PI

- 65) There are three alternatives to meet the demand of a product.

Alternative I: Manufacture using a process P

Alternative II: Manufacture using a process Q

Alternative III: Buy the product from a vendor

The costs associated with each alternative is given below:

| Cost | Alternative I | Alternative II | Alternative III |
|---------------------------|---------------|----------------|-----------------|
| Fixed cost | Rs. 100,000 | Rs. 190,000 | |
| Variable cost (per unit) | Rs. 75 | Rs. 60 | |
| Purchase price (per unit) | | | Rs. 87.50 |

Alternative I is cheaper compared to Alternative II when the demand is

- a) 8500 c) 6500
b) above 8000 d) below 6000