gate 2

AI25btech11037 - STALIN

1) If '→' denotes increasing order of intensity, then the meaning of the words [dry → arid → parched] is analogous to [diet → fast → _____]. Which one of the given options is appropriate to fill the blank? **(GATE NM 2024)**
   a) (i) starve
   b) (i) reject
   c) (i) feast
   d) (i) deny

2) If two distinct non-zero real variables x and y are such that $(x+y)$ is proportional to $(x-y)$ then the value of $\frac{x}{y}$ **(GATE NM 2024)**
   a) (i) depends on xy
   b) (i) depends only on x and not on y
   c) (i) depends only on y and not on x
   d) (i) is a constant

3) Consider the following sample of numbers:

$$9,\ 18,\ 11,\ 14,\ 15,\ 17,\ 10,\ 69,\ 11,\ 13$$

   The median of the sample is **(GATE NM 2024)**
   a) (i) 13.5
   b) (i) 14
   c) (i) 11
   d) (i) 18.7

4) The number of coins of Rs 1, Rs 5, and Rs 10 denominations that a person has are in the ratio 5 : 3 : 13. Of the total amount, the percentage of money in Rs 5 coins is **(GATE NM 2024)**
   a) (i) 21%
   b) (i) $14\frac{2}{7}\%$
   c) (i) 10%
   d) (i) 30%

5) For positive non-zero real variables p and q, if

$$\log\left(p^2+q^2\right) = \log p + \log q + 2\log 3$$

   then, the value of

$$\frac{p^4+q^4}{p^2q^2}$$

   (GATE NM 2024)

   is
   a) (i) 79
   b) (i) 81
   c) (i) 9
   d) (i) 83

6) In the given text, the blanks are numbered (i)–(iv). Select the best match for all the blanks.
   Steve was advised to keep his head _____ (i) before heading _____ (ii) to bat; for, while he had a head _____ (iii) batting, he could only do so with a cool head _____ (iv) his shoulders. **(GATE NM 2024)**
   a) (i) down (ii) down (iii) on (iv) for
   b) (i) on (ii) down (iii) for (iv) on
   c) (i) down (ii) out (iii) for (iv) on
   d) (i) on (ii) out (iii) on (iv) for

7) A rectangular paper sheet of dimensions $54\,\text{cm} \times 4\,\text{cm}$ is taken. The two longer edges of the sheet are joined together to create a cylindrical tube. A cube whose surface area is equal to the area of the sheet is also taken.

Then, the ratio of the volume of the cylindrical tube to the volume of the cube is **(GATE NM 2024) (GATE NM 2024)**

a) $\frac{1}{\pi}$
b) $\frac{2}{\pi}$
c) $\frac{3}{\pi}$
d) $\frac{4}{\pi}$

8) The pie chart presents the percentage contribution of different macronutrients to a typical 2000 kcal diet of a person. **(GATE NM 2024)**

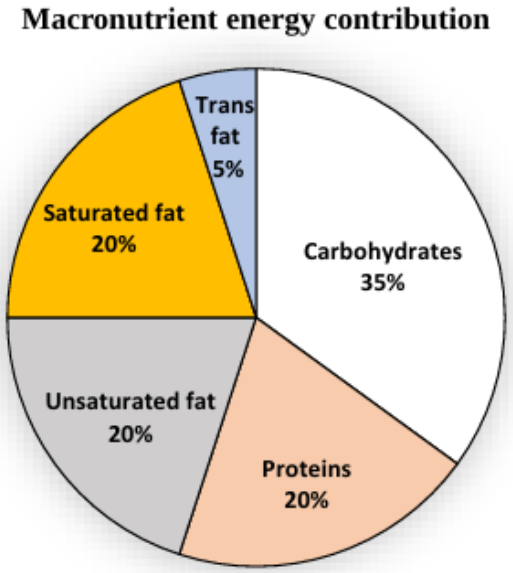


Fig. 8. Caption

9) The typical energy density (kcal/g) of these macronutrients is given in the table.
The total fat (all three types), in grams, this person consumes is: **(GATE NM 2024)**

Macronutrient	Energy density (kcal/g)
Carbohydrates	4
Proteins	4
Unsaturated fat	9
Saturated fat	9
Trans fat	9

Fig. 9. Caption

a) 44.4
b) 77.8
c) 100
d) 3,600

10) A rectangular paper of 20 cm 8 cm is folded 3 times. Each fold is made along the line of symmetry, which is perpendicular to its long edge. The perimeter of the final folded sheet (in cm) is: **(GATE NM 2024)**

a) 18
b) 24
c) 20

d) 21

11) The least number of squares to be added in the figure to make AB a line of symmetry is: **(GATE NM 2024)**

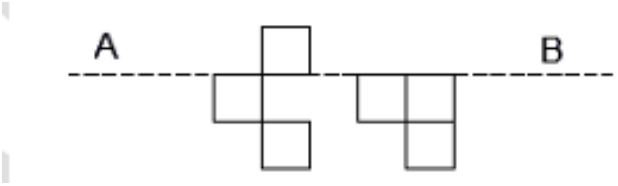


Fig. 11. Caption

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

12) The value of the contour integral $\oint \frac{dz}{2z-z^2}$ along the circle $|z| = 1$, oriented in the counterclockwise sense is: **(GATE NM 2024)**

a) πi
b) 0
c) $2\pi i$
d) $4\pi i$

13) The tangent plane to the surface $x^2 + y^2 + z = 9$ at the point $(1, 2, 4)$ is **(GATE NM 2024)**

a) $2x + 4y + z = 14$
b) $4x + 2y + z = 12$
c) $x + 4y + 2z = 17$
d) $4x + y + 2z = 14$

14) The value of the line integral $\oint x^2\,dx + 2x\,dy$ along the ellipse $4x^2 + y^2 = 4$, oriented in the counterclockwise sense is: **(GATE NM 2024)**

a) π
b) 2π
c) 4π
d) 8π

15) The system of linear equations

$$x + 2y + 3z = 4$$
$$2x - y - 2z = a^2$$
$$-x - 7y - 11z = a$$

has a solution if the values of a are:

a) -1 and 5
b) -2 and 3
c) -5 and 1
d) -3 and 4

16) A ship with a standard right-handed coordinate system has positive x, y, and z axes respectively pointing towards bow, starboard and down as shown in the figure. If the ship takes a starboard turn, then the drift angle, sway velocity and the heel angle of the ship for a steady yaw rate respectively are: **(GATE NM 2024)**

a) positive, negative and positive
b) negative, positive and positive
c) negative, positive and negative
d) positive, negative and negative

17) A ship with controls fixed, is modeled as a two degrees of freedom system. For the linear maneuvering equations of motion for coupled sway and yaw, if the derived eigenvalues are real and negative, then the ship must possess: **(GATE NM 2024)**

a) positional motion stability
b) directional stability
c) straight line stability
d) both directional and positional motion stabilities

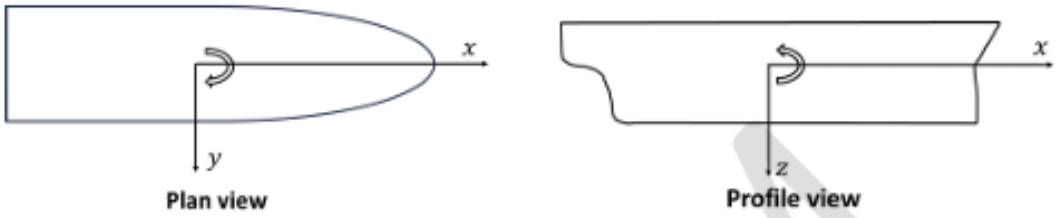


Fig. 16. Caption

18) Which one of the following cooling systems is used in large marine diesel engines? **(GATE NM 2024)**
   a) Thermosyphon
   b) Forced coolant circulation
   c) Evaporative
   d) Air circulation

19) Which one of the following reduces the ratio of vibratory response amplitude to the forcing amplitude, in large stationary engine shaft design? **(GATE NM 2024)**
   a) Reduction in axial vibrations of the rotating shaft
   b) Increase in the fundamental frequency of the rotating shaft
   c) Decrease in the rotational speed of shaft
   d) Operating the shaft at a speed exceeding the critical speed

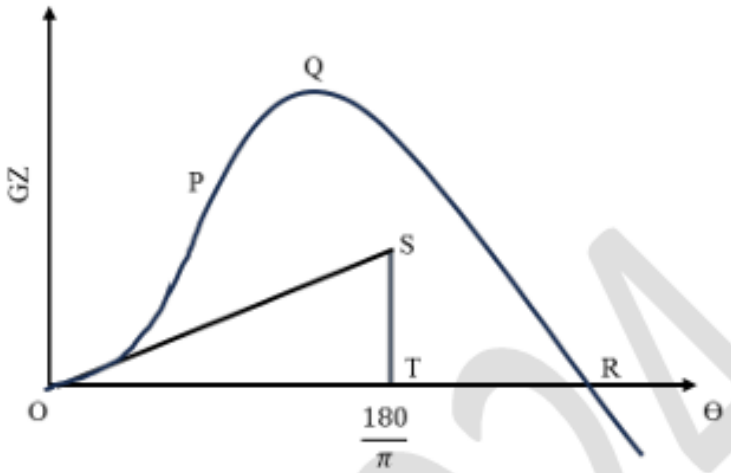
20) The GZ curve for a stable ship is shown in the figure, where P is a point of inflection on the curve. Match the labels in **Column 1** with the corresponding descriptions in **Column 2**. **(GATE NM 2024)** **(GATE NM 2024)**
   a) R - I; Q - II; ST - III; P - IV
   b) P - I; Q - II; ST - III; R - IV
   c) ST - I; Q - II; R - III; P - IV
   d) R - I; Q - II; P - III; ST - IV

21) Consider an initially perfectly straight elastic column with pinned supports at both ends. If E is the Young's modulus of the material, L is the length of the column between the supports, and . I is the least moment of inertia of the constant cross-sectional area of the column, then the Euler load is given by . **(GATE NM 2024)**
   a) $\frac{\pi^2 EI}{L^2}$
   b) $\frac{\pi^2 EI}{4L^2}$
   c) $\frac{\pi^2 EI}{\sqrt{2}L^2}$
   d) $\frac{2\pi^2 EI}{L^2}$

22) For a plane strain problem in the x-y plane, it is necessary that **(GATE NM 2024)**
   a) normal stress σ_z is zero
   b) normal strain ε_z is zero
   c) both the normal stresses σ_x and σ_y are zero
   d) shear strain γ_{xy} is equal to $\frac{\varepsilon_x - \varepsilon_y}{2}$

23) How many independent material constants in solids are required to define isotropic materials? **(GATE NM 2024)**
   a) 2
   b) 3
   c) 9
   d) 21

24) Which one of the following is the mass conservation equation? **(GATE NM 2024)**
   a) $\frac{D}{Dt}\iiint_V \rho\, \mathbf{v}\cdot\hat{n}\, dV = 0$
   b) $\frac{\partial}{\partial t}\iiint_V \rho dV = 0$
   c) $-\frac{\partial}{\partial t}\iiint_V \rho dV = \iint_S \rho \mathbf{v}\cdot\hat{n}\, ds$



Column 1	Column 2
P	I: Angle of vanishing stability
ST	II: Maximum GZ
R	III: Initial GM
Q	IV: Deck edge immersion

Fig. 20. Caption

d) $-\frac{D}{Dt}\iiint_V \rho dV = \iint_S \rho \mathbf{v} \cdot \hat{n}\, ds$

25) Identify the type of flow from the time series plots of instantaneous fluid velocity (u) at a point. **(GATE NM 2024)**

a) I - unsteady turbulent flow; II - steady turbulent flow; III - steady laminar flow; IV - unsteady laminar flow
b) I - steady turbulent flow; II - unsteady turbulent flow; III - unsteady laminar flow; IV - steady laminar flow
c) I - steady turbulent flow; II - unsteady turbulent flow; III - steady laminar flow; IV - unsteady laminar flow
d) I - steady turbulent flow; II - unsteady laminar flow; III - unsteady turbulent flow; IV - steady laminar flow

26) Which of the following hull distortion(s) is/are resisted by a ship's transverse bulkhead? **(GATE NM 2024)**

a) Racking
b) Torsion
c) Longitudinal bending
d) Horizontal bending

27) Which of the following boiler(s) is/are **NOT** used in a nuclear propulsion system for ships? **(GATE NM 2024)**

a) Water tube boiler
b) Cochran boiler
c) Double evaporation boiler
d) Boiled water reactor boiler

28) Which of the following statement(s) is/are correct about strip theory? **(GATE NM 2024)**

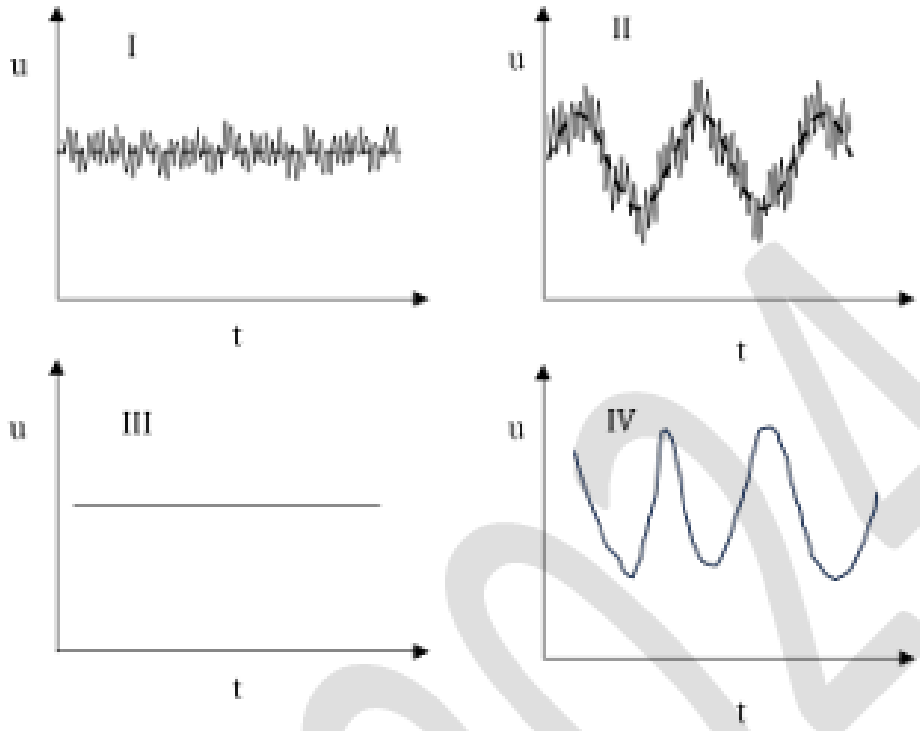


Fig. 25. Caption

a) It can be used to calculate the surge added mass
b) It is a two-dimensional theory
c) It can be used to calculate the pitch added mass
d) It can be used to calculate the coupled sway, roll and yaw added mass

29) Consider an ideal Rankine cycle as shown in the figure, where T and S represent the temperature and entropy respectively. The overall efficiency of the cycle can be improved **(GATE NM 2024)**

30) Consider an ideal Rankine cycle as shown in the figure, where T and S represent the temperature and entropy respectively. The overall efficiency of the cycle can be improved by **(GATE NM 2024)**

a) increasing the pressure at which heat is added
b) decreasing the pressure at which heat is rejected
c) employing an intercooler
d) superheating the steam

31) Which of the following statement(s) is/are correct for a thermodynamic closed system? **(GATE NM 2024)**

a) The entropy change is positive for a reversible adiabatic process
b) The entropy change is positive for a reversible cycle
c) The entropy change is positive for a reversible isothermal heat addition process
d) The entropy change is negative for a reversible isothermal heat rejection process

32) The arc length of the one arch of the cycloid given by $x = t - \sin t$ and $y = 1 - \cos t$ is _____. **(GATE NM 2024)**

33) A 10 m long pipe with inlet and outlet diameters of 40 cm and 20 cm respectively, is carrying an incompressible fluid with a flow rate of $0.04\,m^3/s$. The ratio of the velocity at the outlet to that at the inlet is _____ (rounded off to one decimal place). **(GATE NM 2024)**

34) An 80 m long barge with rectangular cross-section of 12 m beam and 4 m draft floats at even keel. The transverse metacenter (KM) above the keel is _____ m. **(GATE NM 2024)**

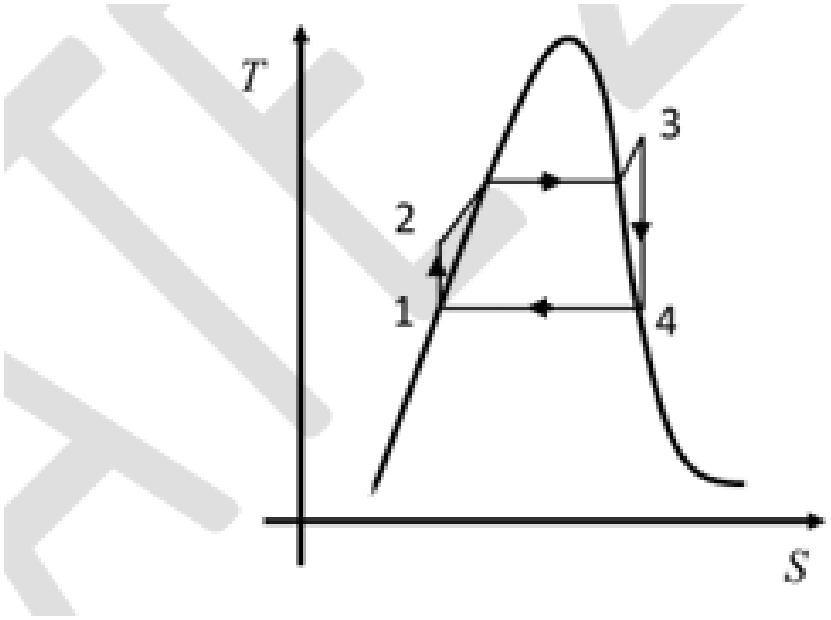


Fig. 29. Caption

35) A 100 m long ship has a cruising speed of 25 knots. A geometrically similar model of 4 m length is used for resistance prediction in a towing tank. The corresponding speed of the model is _____ knots. **(GATE NM 2024)**
36) A cube-shaped pontoon with 200 tonnes of mass placed on it, floats with a freeboard of 1 m in fresh water. When the mass is removed, the pontoon floats with a freeboard of 3 m. The length of the pontoon is _____ m (rounded off to two decimal places). **(GATE NM 2024)**
37) Consider a fluid between two horizontal parallel flat plates 5 mm apart as shown in the figure. The top plate of dimensions $0.5\,\text{m} \times 2\,\text{m}$ is towed with an applied horizontal force F of 0.01 N, while the infinitely long bottom plate is kept fixed. The horizontal velocity profile between the plates is assumed to be linear. If the dynamic viscosity (μ) of the fluid is $0.89 \times 10^{-3}\,\text{N·s/m}^2$, then the towing velocity of the top plate is _____ m/s (rounded off to three decimal places). **(GATE NM 2024)**

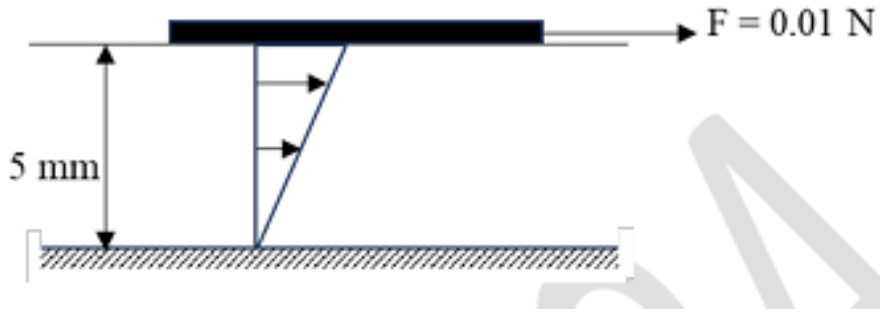


Fig. 37. Caption

38) Consider the matrices $M = \begin{pmatrix} 2 & 1 \\ 0 & 2 \end{pmatrix}$, $N = \begin{pmatrix} 1 & 0 & 0 \\ 1 & 2 & 0 \\ 1 & 1 & 0 \end{pmatrix}$. Which one of the following is true? **(GATE NM 2024)**
    a) M is not diagonalizable but N is diagonalizable
    b) Both M and N are not diagonalizable
    c) Both M and N are diagonalizable
    d) M is diagonalizable but N is not diagonalizable
39) A simply supported beam is subjected to a concentrated moment M at the mid span as shown in the figure. The magnitude of the bending moment at a distance of $L/4$ from the left support A is equal to _____. **(GATE NM 2024)**
40) A simply supported beam is subjected to a concentrated moment M at the mid span as shown in the figure. The magnitude of the bending moment at a distance of $\frac{L}{4}$ from the left support A is equal to _____. **(GATE NM 2024)**

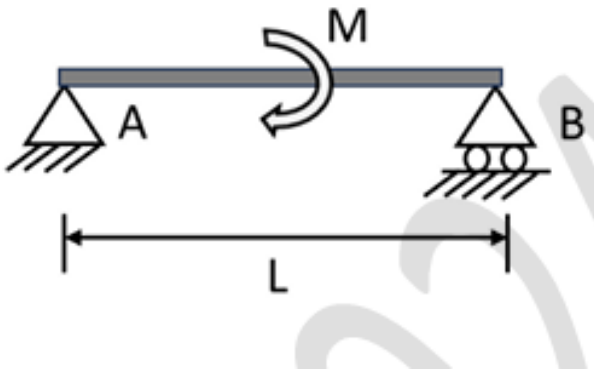


Fig. 39. Caption

41) Consider a two-dimensional ship section as shown in the figure. About the point O, let the sway added mass components be a_{22} and a_{24} and roll added moment of inertia be a_{44}. The clockwise roll angle is considered positive. The roll added mass due to roll, about P which is at a distance z_P above O is given by **(GATE NM 2024)**

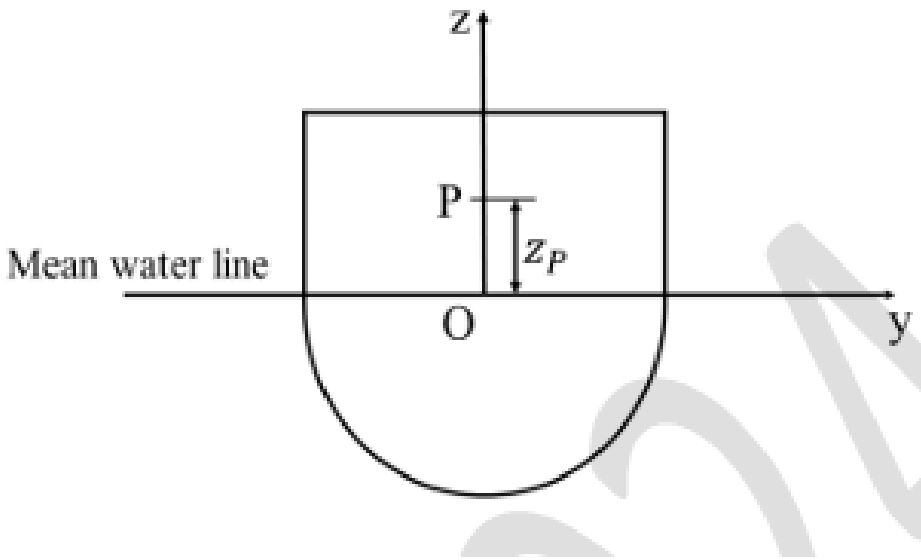


Fig. 41. Caption

a) $a_{44} - a_{24}z_P$
b) $a_{44} - a_{22}z_P - a_{24}z_P$
c) $a_{44} - a_{22}z_P + a_{24}z_P$
d) $a_{22} + a_{24} + a_{44}$

42) A ship with a displacement of 10000 tonnes has the center of gravity at 4 m above the keel and 1.5 m forward of midship. If 2000 tonnes of cargo is placed at 10 m above the keel and 1.5 m aft of midship, then the new position of the center of gravity is **(GATE NM 2024)**

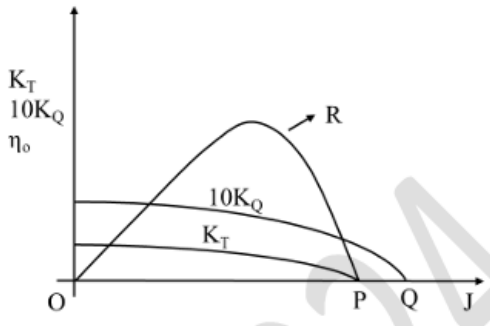
a) 5 m above the keel and 1 m aft of midship
b) 6 m above the keel and 1 m forward of midship
c) 6 m above the keel and 1 m aft of midship
d) 5 m above the keel and 1 m forward of midship

43) The waterplane area of a ship floating in sea water is 2000 m^2. The density of seawater is 1025 kg/m^3. If a mass of 246 tonnes is added to the ship, then the TPC (Tonnes Per Centimeter immersion) and increase in draft (in cm) respectively are **(GATE NM 2024)**

a) 20.50 and 12
b) 20 and 12.3

c) 20.50 and 24
d) 10.25 and 24.6

44) The open water characteristics of a propeller is shown in the figure. Match the labels in **Column 1** with the corresponding descriptions in **Column 2** **(GATE NM 2024)**



Column 1	Column 2
R	I: Bollard pull condition
Q	II: Feathering condition
P	III: Wind milling condition
O	IV: Efficiency curve

Fig. 44. Caption

a) $O-I; P-II; Q-III; R-IV$
b) $O-I; Q-II; P-III; R-IV$
c) $O-I; R-II; Q-III; P-IV$
d) $P-I; Q-II; O-III; R-IV$

45) A steel deck plate of a tanker is supported by two longitudinal stiffeners as shown in the figure. The width of the plate is a and its length is 5 times the width. Assume that the long edge is simply supported, and the short edge is free. The plate is loaded by a distributed pressure, $p = p_0 \sin\left(\frac{\pi x}{a}\right)$, where p_0 is the pressure at $y = a/2$. The flexural rigidity of the plate is D. The plate equation is given by **(GATE NM 2024)**

a) $\dfrac{\partial^4 w}{\partial y^4} = \dfrac{p_0}{D}\sin\left(\dfrac{\pi y}{a}\right)$
b) $\dfrac{\partial^2 w}{\partial x^2} = \dfrac{p_0}{D}\sin\left(\dfrac{\pi y}{a}\right)$
c) $\dfrac{\partial^2 w}{\partial y^2} = \dfrac{p_0}{D}\sin\left(\dfrac{\pi y}{a}\right)$
d) $\dfrac{\partial^4 w}{\partial x^4} = \dfrac{p_0}{D}\sin\left(\dfrac{\pi y}{a}\right)$

46) Which one of the following psychrometric processes is represented by the line 1-2 in the figure? **(GATE NM 2024)**

a) Cooling and humidification
b) Cooling and dehumidification
c) Heating and humidification
d) Heating and dehumidification

47) Consider model testing where λ is the prototype to model length scale ratio. Let ν_p and ν_m denote the corresponding fluid kinematic viscosities. If Froude and Reynolds similarities are maintained between the prototype and model, then which one of the following is correct? **(GATE NM 2024)**

a) $\nu_m = \lambda^{-3/2}\nu_p$
b) $\nu_m = \lambda^{3/2}\nu_p$
c) $\nu_m = \lambda^{2/3}\nu_p$

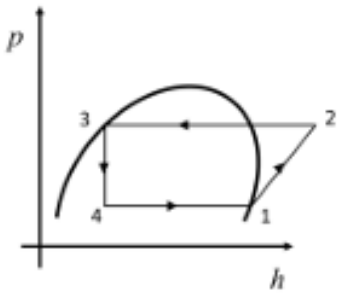
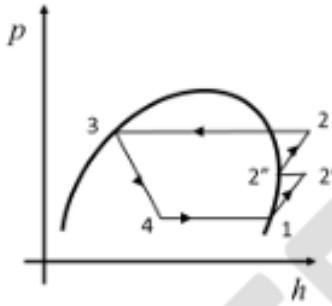
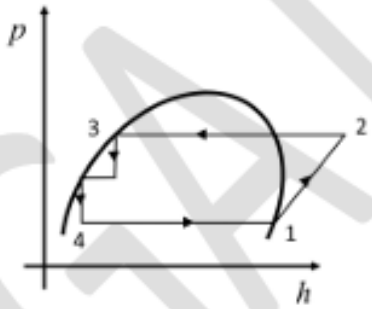
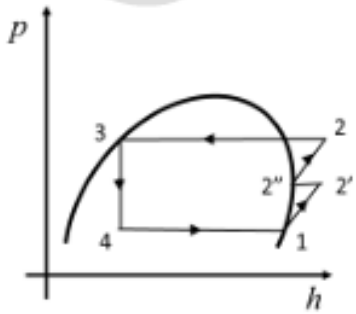
(A)	
(B)	
(C)	
(D)	

Fig. 44. Caption

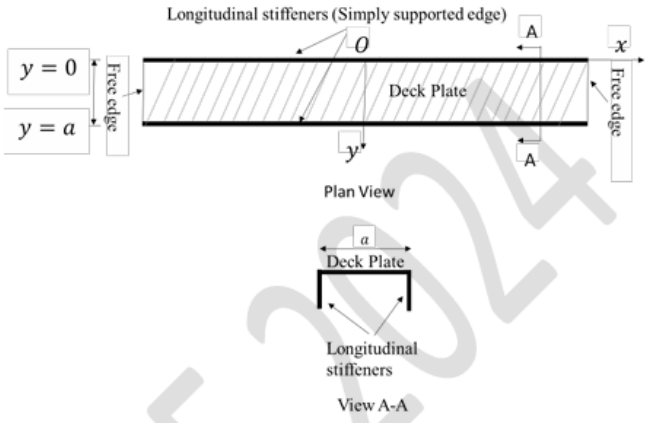


Fig. 45. Caption

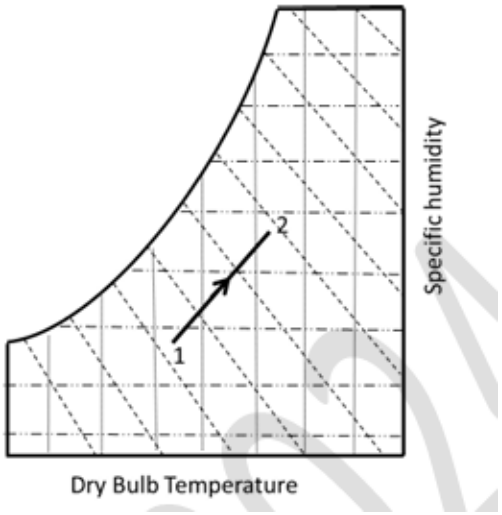


Fig. 46. Caption

d) $\nu_m = \lambda^{-2/3}\nu_p$

48) uniform flow, a point source of strength $+\sigma$ at $(a, 0)$ and a point sink of strength $-\sigma$ at $(-a, 0)$ are shown in the figure. The velocity potential ϕ resulting from the superposition of these flow fields is given by **(GATE NM 2024)**

a) $\phi = -U_\infty x + \frac{\sigma}{2\pi} \ln \sqrt{(x+a)^2 + y^2} - \frac{\sigma}{2\pi} \ln \sqrt{(x-a)^2 + y^2}$

b) $\phi = -U_\infty x + \frac{\sigma}{2\pi} \ln \sqrt{(x-a)^2 + y^2} - \frac{\sigma}{2\pi} \ln \sqrt{(x+a)^2 + y^2}$

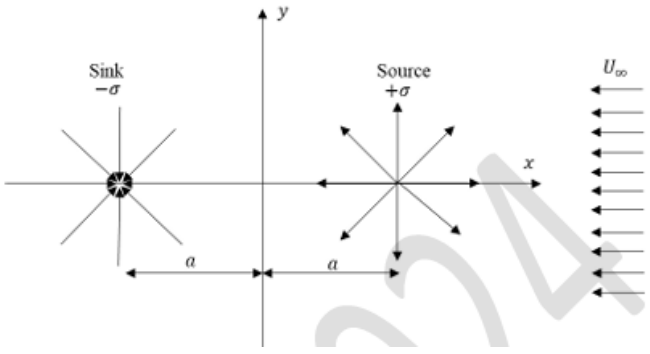


Fig. 48. Caption

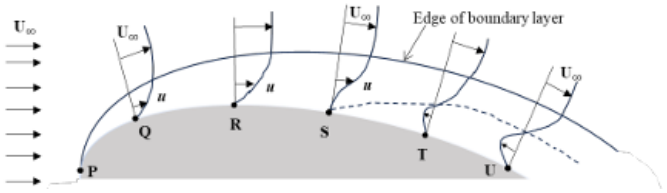


Fig. 53. Caption

c) $\phi = U_\infty x + \frac{\sigma}{2\pi}\ln\sqrt{(x-a)^2+y^2} - \frac{\sigma}{2\pi}\ln\sqrt{(x+a)^2+y^2}$

d) $\phi = U_\infty x + \frac{\sigma}{2\pi}\ln\sqrt{(x+a)^2+y^2} - \frac{\sigma}{2\pi}\ln\sqrt{(x-a)^2+y^2}$

49) In the solution of statically indeterminate problems, Castigliano's second theorem employs the **(GATE NM 2024)**

a) principle of virtual work
b) virtual displacement method
c) virtual force method
d) principle of least work

50) Consider the function $f(x,y) = x^4 + y^4 - 4xy + 1$. Which of the following is/are correct? **(GATE NM 2024)**

a) The minimum value of f occurs at $(0,0)$
b) The point $(0,0)$ is a point of inflection
c) f has three critical points
d) The minimum value of f is -1

51) Consider the 2π–periodic function defined by $f(x) = \begin{cases} -1 & \text{if } -\pi < x \le 0, \\ 1 & \text{if } 0 < x \le \pi. \end{cases}$

Which of the following is/are correct about its Fourier series expansion, $\frac{a_0}{2} + \sum_{n=1}^{\infty} a_n \cos nx + b_n \sin nx$? **(GATE NM 2024)**

a) $a_n = \frac{1}{n}\ \forall\ n = 1, 2, \ldots$
b) $a_0 = 0$
c) $b_n = \frac{4}{n\pi}$ if n is odd
d) $b_n = -\frac{4}{n\pi}$ if n is even

52) Consider the following momentum equation. Let A, B and C denote the first, second and third term on the left-hand side respectively, and D, and E denote the first and second term on the right-hand side respectively. Which of the following statement(s) is/are correct? $\rho\left[\frac{\partial \mathbf{V}}{\partial t} + \nabla\left(\frac{|\mathbf{V}|^2}{2}\right) + (\nabla \times \mathbf{V}) \times \mathbf{V}\right] = -\nabla(P + \rho g z) + \mu\nabla^2\mathbf{V}$ **(GATE NM 2024)**

a) If terms A, C and E vanish, then the flow is irrotational.
b) If term A vanishes, then the flow is steady.
c) If term D vanishes, then it leads to the Euler's equation.
d) If terms A, B, C and E vanish, then it leads to the hydrostatic equation.

53) Consider the flow past a curved wall as shown in the figure. Which of the following statement(s) is/are correct? **(GATE NM 2024)**

54) Consider the flow past a curved wall as shown in the figure. Which of the following statement(s) is/are correct? **(GATE NM 2024)**

(A) P is the separation point.
(B) Between T and U, the pressure gradient in the streamwise direction at the wall is positive.
(C) U is the stagnation point.
(D) Between T and U, the streamwise-velocity gradient in the normal direction at the wall is negative.

55) If X is a Poisson random variable with mean $\mu = 1$, then the conditional probability of the event $\{X \ge 2\}$ given that the event $\{X \ge 4\}$ has occurred, is _____ (rounded off to two decimal places). **(GATE NM 2024)**

56) The value of the triple integral $\iiint (6x^2 + y^2)\,dx\,dy\,dz$ over the region given by $-1 \le x \le 1,\ 3 \le y \le 5,\ 0 \le z \le 1$, is _____. **(GATE NM 2024)**

57) A 4-cylinder, 4-stroke diesel engine operating at 3000 rpm has a compression ratio of 21 and cut-off ratio of 2.5. The temperature inside the head at the beginning of compression is 300 K. The efficiency of an air standard diesel cycle is given

by $\eta = 1 - \frac{1}{r^{\gamma-1}} \cdot \frac{r_c^{\gamma}-1}{\gamma(r_c-1)}$. Assume the working fluid as air with a mass flow rate of 0.05 kg/s, $\gamma = 1.4$, and $C_v = 1.004$ kJ/kgK. The power output of the engine is _____ kW (rounded off to the nearest integer). **(GATE NM 2024)**

58) A ship travelling in head seas experiences a bending moment of 200 MN-m. The ship's cross-section is assumed to be a box girder of 20 m beam and 10 m depth, with a 10 mm plate thickness. The maximum bending stress is _____ MPa (rounded off to the nearest integer). **(GATE NM 2024)**

59) A single degree of freedom system has a mass, stiffness and damping of 200 kg, 20 MN/m and 8 kNs/m respectively. For a forced oscillating system, if the exciting frequency ω is equal to the undamped natural frequency, then the dynamic magnification factor is _____ (rounded off to three decimal places). **(GATE NM 2024)**

60) The wave spectrum and the ship heave Response Amplitude Operator (RAO) are shown in the figure. The variance of the heave motion is _____ (rounded off to two decimal places). **(GATE NM 2024)**

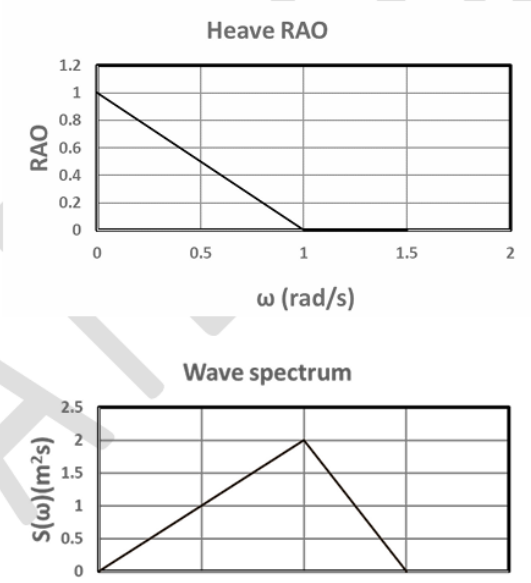


Fig. 60. Caption

61) Consider a thin-walled closed cylindrical steel vessel with an internal pressure of 2 N/mm^2. The inner diameter is 1 m, and the thickness of the wall is 10 mm. The hoop stress is _____ N/mm^2 (rounded off to one decimal place). **(GATE NM 2024)**

62) A propeller disc of diameter 2 m produces a thrust of 88 kN while advancing at a speed of 5 m/s in fresh water of density 1000 kg/m^3. Based on the axial momentum theory, the propeller efficiency is _____ % (rounded off to one decimal place). **(GATE NM 2024)**

63) Consider a rectangular plate with in-plane loads. The state of stress at an arbitrary angle θ is defined by σ_x, σ_y and τ_{xy} as shown in the figure. If the principal plane is at $\theta = 45°$, and the principal stresses are $\sigma_x = 8$ N/mm^2 and $\sigma_y = 3$ N/mm^2, then the corresponding τ_{xy} = _____ N/mm^2. **(GATE NM 2024)**

64) A ship of 5000 tonnes displacement has a rectangular tank 6 m long and 10 m wide, half-filled with oil of relative density 0.9. The virtual reduction in the transverse metacentric height of the ship due to free surface effect of the oil in the tank is _____ cm. **(GATE NM 2024)**

65) An ocean wave of period 8 s and height 2 m is propagating in the Indian Ocean from south to north. According to linear wave theory, for the wave to be considered as a deep-water wave, the minimum water depth should be _____ m (rounded off to the nearest integer). **(GATE NM 2024)**

66) Consider a gas turbine combustor with air as the working fluid. The flow enters the combustor at 360 K and leaves at 1400 K with a mass flow rate of 1 kg/s. The changes in kinetic energy and potential energy of the flow are neglected. Assuming $c_{p,a} = 1.017$ kJ/kgK and $c_{p,g} = 1.082$ kJ/kgK, the heat of combustion is _____ kW (rounded off to the nearest integer). **(GATE NM 2024)**

67) Consider a circular cylinder of diameter 0.5 m and length 2 m, rotating in clockwise direction at a speed of 10 rpm in a flow of velocity 2 m/s. Assume the density of fluid is 1250 kg/m^3 and $\pi = 3.14$. By Kutta–Joukowski theorem, the lift force on the cylinder is _____ N (rounded off to the nearest integer). **(GATE NM 2024)**

68) A new absolute temperature scale is proposed based on a Carnot engine operating between hot and cold reservoirs of temperatures $T_h = 7$ and $T_c = 3$ (arbitrary units). Let Q_h and Q_c be the respective heat transfers, with $Q_c = 9$. For consistency with the Kelvin scale, the difference between heats exchanged per cycle must satisfy $\frac{Q_h}{Q_c} = \frac{T_h}{T_c}$. On the new

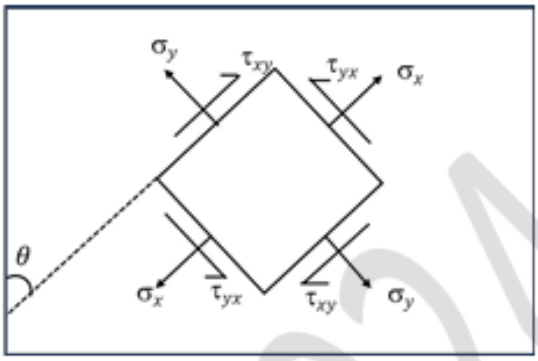


Fig. 63. Caption

scale, if the ice point of water is 32°F and the steam point of water is 212°F, then the value of ice point of water on this scale is _____ units (rounded off to the nearest integer). **(GATE NM 2024)**