GATE-2023-NM

ai25btech11008- Chiruvella Harshith Sharan

Q.1 – Q.10

1) "You are delaying the completion of the task. Send _ _ _ _ _ contributions at the earliest." (GATE NM 2023)

   A. you are   B. your   C. you're   D. yore

2) References : _ _ _ _ _ : : Guidelines : Implement (By word meaning) (GATE NM 2023)

   A. Sight   B. Site   C. Cite   D. Plagiarise

3) In the given figure, PQRS is a parallelogram with $PS = 7$ cm, $PT = 4$ cm and $PV = 5$ cm. What is the length of RS in cm? (The diagram is representative.) (GATE NM 2023)
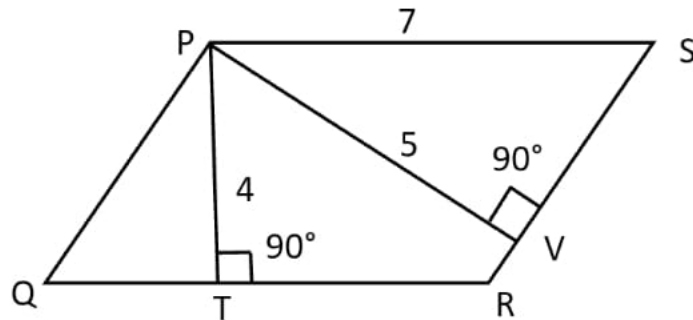

Fig. 1.

   A. 20/7   B. 28/5   C. 9/2   D. 35/4

4) In 2022, June Huh was awarded the Fields medal, which is the highest prize in Mathematics. When he was younger, he was also a poet. He did not win any medals in the International Mathematics Olympiads. He dropped out of college.
Based only on the above information, which one of the following statements can be logically inferred with certainty? (GATE NM 2023)
   A. Every Fields medalist has won a medal in an International Mathematics Olympiad.
   B. Everyone who has dropped out of college has won the Fields medal.
   C. All Fields medalists are part-time poets.
   D. Some Fields medalists have dropped out of college.

5) A line of symmetry is defined as a line that divides a figure into two parts in a way such that each part is a mirror image of the other part about that line.

The given figure consists of 16 unit squares arranged as shown. In addition to the three black squares, what is the minimum number of squares that must be coloured black, such that both *PQ* and *MN* form lines of symmetry? (The figure is representative)(GATE NM 2023)
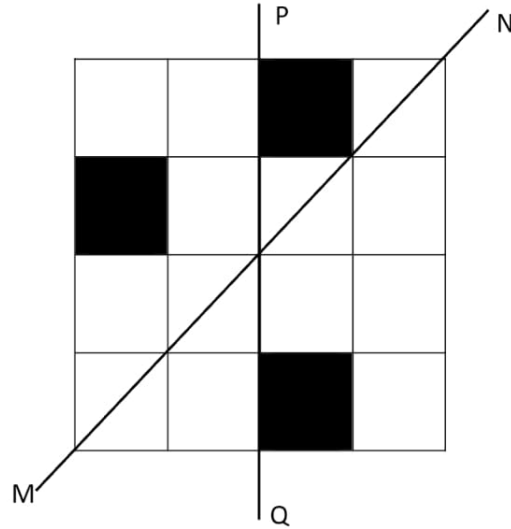

Fig. 2.

   A. 3   B. 4   C. 5   D. 6

6) Human beings are one among many creatures that inhabit an imagined world. In this imagined world, some creatures are cruel. If in this imagined world, it is given that the statement "Some human beings are not cruel creatures" is FALSE, then which of the following set of statements can be logically inferred with certainty?
(i) All human beings are cruel creatures. (ii) Some human beings are cruel creatures. (iii) Some creatures that are cruel are human beings. (iv) No human beings are cruel creatures. (GATE NM 2023)

   A. only (i)   B. only (iii) and (iv)   C. only (i) and (ii)   D. (i), (ii) and (iii)

7) To construct a wall, sand and cement are mixed in the ratio of 3:1. The cost of sand and that of cement are in the ratio of 1:2. If the total cost of sand and cement to construct the wall is 1000 rupees, then what is the cost (in rupees) of cement used? (GATE NM 2023)

   A. 400   B. 600   C. 800   D. 200

8) The World Bank has declared that it does not plan to offer new financing to Sri Lanka, which is battling its worst economic crisis in decades, until the country has an adequate macroeconomic policy framework in place.
In a statement, the World Bank said Sri Lanka needed to adopt structural reforms that focus on economic stabilisation and tackle the root causes of its crisis. The latter has starved it of foreign exchange and led to shortages of food, fuel, and medicines. The bank is repurposing resources under existing loans to help alleviate shortages of essential items such as medicine, cooking gas, fertiliser, meals for children, and cash for vulnerable households.

Based only on the above passage, which one of the following statements can be inferred with certainty? (GATE NM 2023)

A. According to the World Bank, the root cause of Sri Lanka's economic crisis is that it does not have enough foreign exchange.
B. The World Bank has stated that it will advise the Sri Lankan government about how to tackle the root causes of its economic crisis.
C. According to the World Bank, Sri Lanka does not yet have an adequate macroeconomic policy framework.
D. The World Bank has stated that it will provide Sri Lanka with additional funds for essentials such as food, fuel, and medicines.

9) The coefficient of x^4 in the polynomial $(x-1)^3(x-2)^3$ is equal to _ _ _ _ _.(GATE NM 2023)

   A. 33   B. −3   C. 30   D. 21

10) Which one of the following shapes can be used to tile (completely cover by repeating) a flat plane, extending to infinity in all directions, without leaving any empty spaces in between them? The copies of the shape used to tile are identical and are not allowed to overlap. (GATE NM 2023)

   A. Circle   B. Regular octagon   C. Regular pentagon D. Rhombus

Q.11 – Q.35

11) The velocity profile in a laminar boundary layer is $u/U = y/\delta$ where u is the velocity at a distance y from the wall, U is the free stream velocity, and δ is the boundary layer thickness. The ratio of displacement thickness (δ^*) to momentum thickness (θ) is _ _ _ _ _. (GATE NM 2023)

   A. 2.0   B. 1.5   C. 1.33   D. 1.25

12) A circular cylinder of radius R is floating in water with its axis vertical. The depth of immersion of the cylinder is $R/2$. The density ratio of cylinder to water is _ _ _ _ _. (GATE NM 2023)

   A. 0.25   B. 0.5   C. 0.75   D. 1.0

13) The profile of a camber line is defined by $y(x) = 2x - x^2$ where x and y are non-dimensional coordinates. The slope $\frac{dy}{dx}$ at $x = 0.5$ is _ _ _ _ _. (GATE NM 2023)

   A. 0   B. 1   C. 2   D. 3

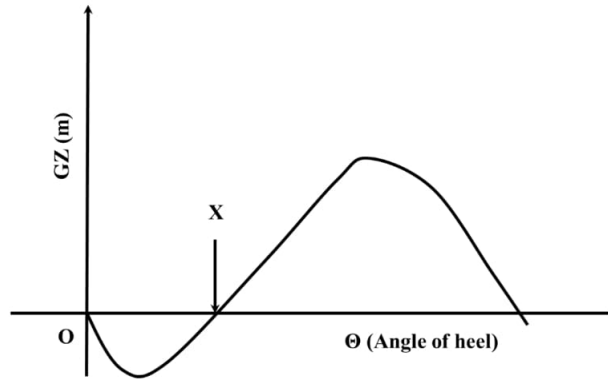14) A floating body will be in stable equilibrium when (GATE NM 2023)

Fig. 3.

A. metacentric height is zero
B. metacentric height is positive
C. metacentric height is negative
D. metacentre coincides with centre of buoyancy

15) The principal dimensions of a ship are: length = 100 m, breadth = 15 m, depth = 10 m, and draft = 5 m. The block coefficient is _ _ _ _ _.   (GATE NM 2023)

A. 0.50   B. 0.67   C. 0.75   D. 1.00

16) In turbulent flow through a smooth circular pipe, the friction factor f varies with Reynolds number Re approximately as _ _ _ _ _.   (GATE NM 2023)
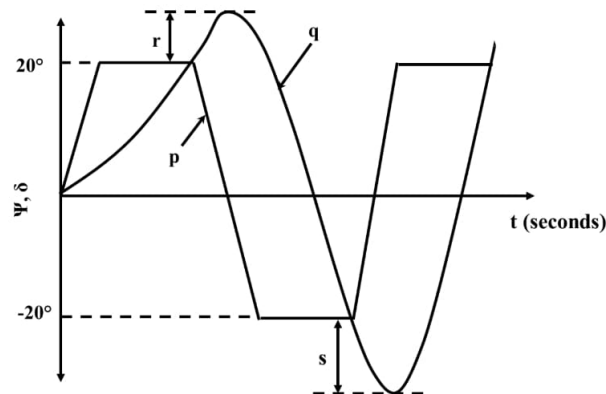

Fig. 4.

A. $f \sim 1/Re$ B. $f \sim 1/Re^{0.25}$ C. $f \sim 1/Re^{0.33}$ D. $f \sim 1/\sqrt{Re}$

17) For a hydrofoil of chord length c, moving with speed V in water of density ρ, the lift per unit span is given by   (GATE NM 2023)

A. $\rho V^2 c$ B. $\frac{1}{2}\rho V^2 c$ C. $\frac{1}{2}\rho V^2 c C_L$ D. $\rho V^2 c C_D$

18) A wave of length 200 m is propagating in deep water. The approximate wave celerity is _ _ _ _ _.   (GATE NM 2023)

     A. 10 m/s   B. 15 m/s   C. 20 m/s   D. 25 m/s

19) A marine propeller operates at an advance coefficient $J = 0.8$, thrust coefficient $K_T = 0.1$, and torque coefficient $K_Q = 0.02$. The propeller efficiency is _ _ _ _ _. (GATE NM 2023)

     A. 0.5   B. 0.6   C. 0.7   D. 0.8

20) The natural period of rolling of a ship depends primarily on   (GATE NM 2023)

     A. breadth of ship   B. length of ship   C. draft of ship   D. speed of ship

21) A slender body moving slowly in water experiences resistance mainly due to (GATE NM 2023)

     A. form drag   B. wave making drag   C. skin friction drag   D. induced drag

22) The Froude number is defined as the ratio of   (GATE NM 2023)
     A. inertia force to viscous force
     B. inertia force to gravitational force
     C. inertia force to elastic force
     D. inertia force to elastic force

23) A rectangular barge is 60 m long and 20 m wide. Its displacement is 12,000 tonnes. The draft of the barge is _ _ _ _ _.   (GATE NM 2023)
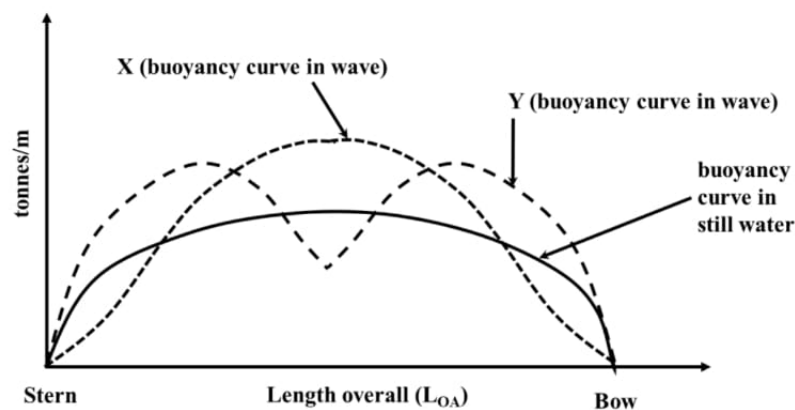

Fig. 5.

     A. 5 m   B. 6 m   C. 8 m   D. 10 m

24) The restoring moment of a ship at small angles of heel is proportional to(GATE NM 2023)
     A. displacement only
     B. metacentric height only

C. product of displacement and metacentric height
D. square of displacement

25) The metacentric height of a ship decreases when (GATE NM 2023)
   A. centre of buoyancy rises
   B. metacentre rises
   C. centre of gravity rises
   D. centre of gravity lowers

26) For a marine diesel engine, the mean effective pressure is 1 MPa and displacement volume per cylinder is 1 m^3. The indicated power per cylinder at 100 rpm is _____. (GATE NM 2023)

   A. 1 MW   B. 1.5 MW   C. 2 MW   D. 3 MW

27) The efficiency of a diesel cycle increases if (GATE NM 2023)
   A. compression ratio increases
   B. cut-off ratio increases
   C. heat addition decreases
   D. mean effective pressure decreases

28) The stoichiometric air-fuel ratio for diesel engines is approximately (GATE NM 2023)

   A. 5:1   B. 10:1   C. 15:1   D. 20:1

29) The stress-strain curve of mild steel under uniaxial tension shows a distinct (GATE NM 2023)

   A. elastic limit   C. ultimate stress point
   B. yield point   D. fracture point

30) A thin cylindrical shell of diameter D and thickness t subjected to internal pressure p has hoop stress (GATE NM 2023)

   A. $\frac{pD}{2t}$ B. $\frac{pD}{4t}$ C. $\frac{pD}{t}$ D. $\frac{pD}{8t}$

31) The slenderness ratio of a column is defined as (GATE NM 2023)

   A. $\frac{L}{k}$ B. $\frac{k}{L}$ C. $\frac{A}{I}$ D. $\frac{I}{A}$

32) The critical speed of a shaft is the speed at which (GATE NM 2023)

   A. the shaft bends indefinitely   C. torque is maximum
   B. resonance occurs   D. power transmitted is maximum

33) The S-N curve is used in the context of (GATE NM 2023)

   A. creep   B. fatigue   C. fracture   D. impact

34) The efficiency of a riveted joint is defined as the ratio of (GATE NM 2023)
   A. strength of rivet to strength of plate
   B. strength of joint to strength of solid plate

C. strength of plate to strength of rivet

D. strength of rivet to strength of joint

35) The principal planes are the planes on which (GATE NM 2023)

A. shear stress is maximum   C. normal stress is zero

B. shear stress is zero   D. normal stress is maximum

Q.36 – Q.65

36) The centroid of a right-angled triangle of base b and height h, measured from the right angle, is located at (GATE NM 2023)

A. $(b/3, h/3)$ B. $(2b/3, 2h/3)$ C. $(b/2, h/2)$ D. $(b/4, h/4)$

37) A simply supported beam of length L carries a uniformly distributed load w per unit length. The maximum bending moment is (GATE NM 2023)

A. $wL/4$ B. $wL^2/8$ C. $wL^2/12$ D. $wL^2/16$

38) A cantilever beam of length L carries a concentrated load P at the free end. The deflection at the free end is $\frac{PL^3}{3EI}$. If the beam length is doubled, keeping P, E, and I same, the deflection will increase by a factor of (GATE NM 2023)
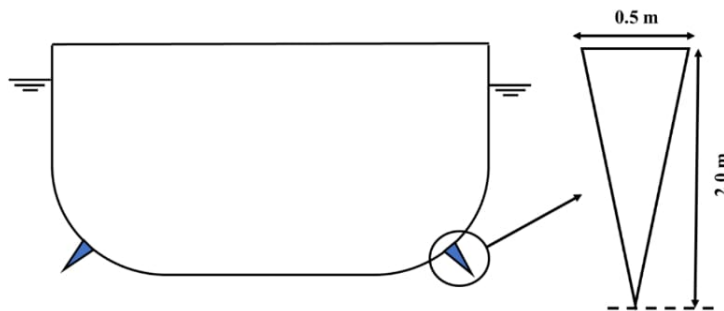

Fig. 6.

A. 2   B. 4   C. 6   D. 8

39) The shear force at the free end of a cantilever beam carrying a point load at the free end is (GATE NM 2023)

A. zero   C. maximum at fixed end

B. equal to the load   D. equal to bending moment

40) A circular shaft subjected to torsion experiences maximum shear stress at (GATE NM 2023)

A. centre   B. surface   C. middle radius   D. along axis

41) Euler's buckling load for a column with both ends hinged is $P_{cr} = \frac{\pi^2 EI}{L^2}$. If one end is fixed and the other free, the buckling load is (GATE NM 2023)

A. $\frac{\pi^2 EI}{L^2}$ B. $\frac{\pi^2 EI}{4L^2}$ C. $\frac{\pi^2 EI}{2L^2}$ D. $\frac{\pi^2 EI}{L^2/4}$

42) For an incompressible fluid, the continuity equation is   (GATE NM 2023)

A. $\nabla \cdot \mathbf{V} = 0$ B. $\nabla \times \mathbf{V} = 0$ C. $\nabla \cdot \mathbf{V} = \rho$ D. $\nabla \times \mathbf{V} = \rho$

43) Bernoulli's equation represents conservation of   (GATE NM 2023)

A. mass   B. energy   C. momentum   D. vorticity

44) Kelvin's circulation theorem applies to   (GATE NM 2023)

A. viscous flows   C. inviscid barotropic flows
B. irrotational flows   D. compressible flows

45) The Prandtl number is defined as the ratio of   (GATE NM 2023)
   A. momentum diffusivity to thermal diffusivity
   B. thermal diffusivity to momentum diffusivity
   C. viscosity to conductivity
   D. Reynolds number to Nusselt number

46) The Mach number is defined as the ratio of   (GATE NM 2023)
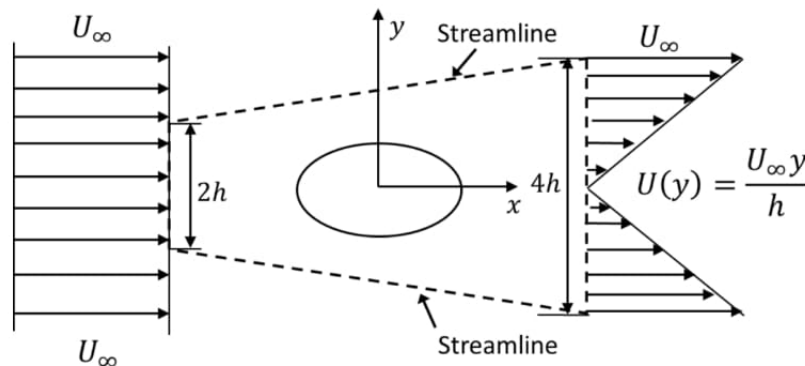

Fig. 7.

A. flow velocity to local speed of sound   C. inertia to compressibility
B. pressure to density   D. velocity head to pressure head

47) The lift coefficient C_L for a thin airfoil at small angle of attack α (in radians) is approximately
   (GATE NM 2023)

A. $2\pi\alpha$ B. $\pi\alpha$ C. $4\pi\alpha$ D. α

48) For a propeller, the thrust T is given by $T = \rho n^2 D^4 K_T$, where n is revolutions per second
   and D is diameter. The unit of K_T is   (GATE NM 2023)

A. dimensionless B. length C. time D. force

49) The efficiency of a propeller is maximum when the slip ratio is   (GATE NM 2023)

   A. zero B. small positive C. large positive D. negative

50) A ship of length L moving with speed V in deep water will have wave-making resistance that primarily depends on   (GATE NM 2023)

   A. Froude number B. Reynolds number C. Mach number D. Weber number

51) In a four-stroke diesel engine, one power stroke occurs in   (GATE NM 2023)

   A. 180° crank rotation   C. 540° crank rotation
   B. 360° crank rotation   D. 720° crank rotation

52) The brake power of an IC engine is measured using   (GATE NM 2023)

   A. calorimeter B. manometer C. dynamometer D. orifice meter

53) For an ideal Otto cycle, the efficiency depends only on   (GATE NM 2023)

   A. compression ratio B. expansion ratio C. cut-off ratio D. clearance volume

54) The brake thermal efficiency of an IC engine is the ratio of   (GATE NM 2023)

   A. brake power to heat supplied   C. indicated power to brake power
   B. brake power to indicated power   D. indicated power to heat supplied

55) The volumetric efficiency of a compressor is defined as the ratio of   (GATE NM 2023)

   A. swept volume to clearance volume   C. actual intake to theoretical intake
   B. actual intake to swept volume   D. theoretical intake to swept volume

56) The thermal efficiency of a Rankine cycle increases with   (GATE NM 2023)

   A. increasing condenser pressure   C. superheating of steam
   B. decreasing boiler pressure   D. decreasing turbine inlet temperature

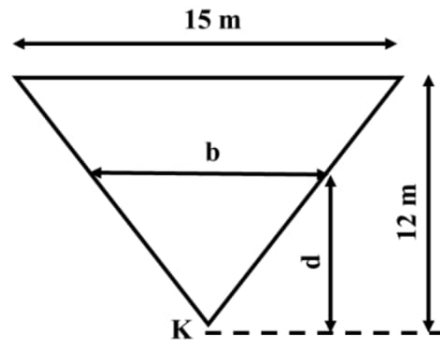57) The coefficient of performance (COP) of a refrigerator is defined as   (GATE NM 2023)

Fig. 8.

A. heat absorbed in condenser / work input
B. heat absorbed in evaporator / work input
C. work input / heat absorbed in condenser
D. work input / heat absorbed in evaporator

58) In welding, lack of fusion is a type of   (GATE NM 2023)

A. surface defect   C. volumetric defect
B. subsurface defect   D. dimensional defect

59) In casting, risers are used to   (GATE NM 2023)
A. provide molten metal to compensate shrinkage
B. improve surface finish
C. control solidification rate
D. improve machinability

60) In gas welding, the commonly used fuel gas is   (GATE NM 2023)

A. methane   B. propane   C. acetylene   D. butane

61) In orthogonal cutting, the shear angle is the angle between   (GATE NM 2023)

A. shear plane and cutting velocity   C. cutting edge and work surface
B. shear plane and rake face   D. rake angle and clearance angle

62) Tool life is generally represented by the Taylor's equation $VT^n = C$, where n is typically
in the range of   (GATE NM 2023)

A. 0.01–0.05   B. 0.1–0.2   C. 0.2–0.6   D. 0.7–1.0

63) Gantt charts are used for   (GATE NM 2023)

A. inventory control   B. project scheduling   C. quality control   D. material handling

64) The Economic Order Quantity (EOQ) is the order quantity that   (GATE NM 2023)

A. minimizes total cost   C. minimizes holding cost

B. maximizes profit   D. minimizes ordering cost

65) PERT is a project management technique primarily concerned with   (GATE NM 2023)
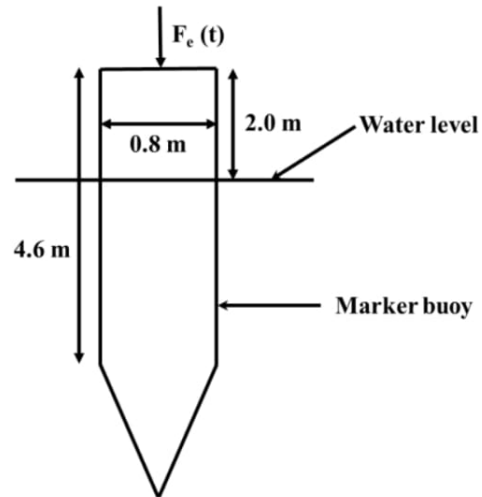

Fig. 9.

A. time   B. cost   C. resources   D. quality

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