ISRO
ICRB 2023
MECHANICAL
ENGINEERING
(SET E)

Exam Held on
7th January
2024

QUESTIONS & ANSWER KEYS

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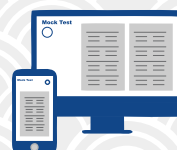## TARGET GATE COURSE

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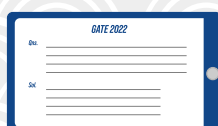## Distance Learning Program

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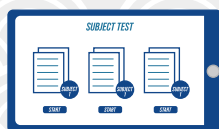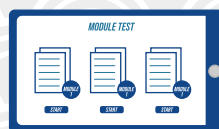
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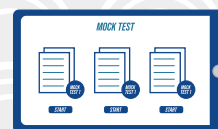
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PART-A
Area/Discipline Specific

1. A beam is subjected to the uniform load W_c per unit length and M_A, V_A & V_B are the reactions as shown in the figure. The expression for shear force $V(x)$ and Bending moment $M(x)$ is given by.
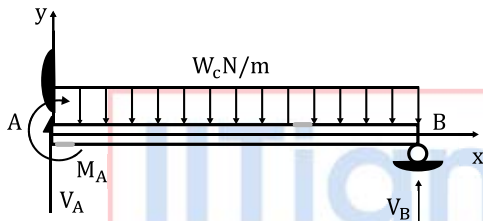
(A) $V(x) = V_A + W_c x, M(x) = M_A + V_A x - \dfrac{W_c x^2}{2}$

(B) $V(x) = V_A - W_c x, M(x) = M_A - V_A x - \dfrac{W_c x^2}{2}$

(C) $V(x) = V_A + W_c x, M(x) = M_A - V_A x - \dfrac{W_c x^2}{2}$

(D) $V(x) = V_A - W_c x, M(x) = M_A + V_A x - \dfrac{W_c x^2}{2}$

2. A weld with a triangular cross section as shown below is to be produced on a steel work piece by shielded metal arc welding operation using steel electrode. If a 24 V power supply is used and the welding speed is 12 mm/s, what is the current needed? Assume the efficiency as 80% and the specific energy to melt steel as 8 J/mm^3.
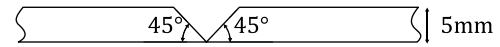
(A) 50A   (B) 75A

(C) 125A   (D) 175A

3. A slider moving outward on a rod OR with a velocity of 3 m/s and acceleration of 9 m/s^2. The rod has an angular velocity of 7 rad/s counter clockwise about 0 and an angular acceleration of 12 rad/s^2 clockwise. The magnitude of absolute acceleration of the slider at location A in m/s^2 is.
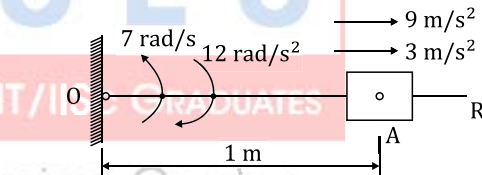
(A) 20   (B) 50

(C) 67   (D) 79

4. The specific stiffness of a material is defined as the ratio of

(A) Mass to Young's modulus

(B) Density to Young's modulus

(C) Young's modulus to Density

(D) Young's modulus to Mass

5. The type of gear used to transmit rotary motion between non-parallel and non-intersecting shaft is.

   (A) Spur gear   (B) Helical gear

   (C) Bevel gear   (D) Worm gear

6. Which of the bearings given below is not suitable for axial thrust load?

   (A) Deep groove ball bearing

   (B) Angular contact ball bearing

   (C) Single row tapered bearing

   (D) Straight Cylindrical roller bearing

7. The configuration of a planar four bar mechanism with frictionless joints is shown in the figure below. The length of the links are $L_1 = 40$ mm, $L_2 = 15$ mm, $L_3 = 35$ mm, and $L_4 = 30$ mm. The suffixes 1, 2, 3 and 4 represents the fixed, input, coupler and output link respectively. If T_i and T_0 are the torque to the input and output link, what is the mechanical advantage (T_0/T_i) of the mechanism?

   (A) 2   (B) 0.5

   (C) ∞   (D) 0

8. A solid bar 50 mm in diameter and 2000 mm long consists of a steel and aluminum part joined together. When axial force P is applied to the system, a strain gauge attached to the aluminum indicates an axial strain of 800 pm/m. What is the corresponding axial strain on the Steel? Assume $E_{st} = 200$ GPa and $E_{Al} = 70$ Gpa.

   (A) 28 µm/m   (B) 140 µm/m

   (C) 280 µm/m   (D) 14 µm/m

9. Two flanges are connected by a single bolt of nominal diameter 10 mm and is preloaded to a torque of 30 Nm. An external tensile load of 10,000 N is applied to the joint. The torque coefficient is 0.15 and joint stiffness constant is 0.2. The maximum tension in the bolt is.

   (A) 10,000 N   (B) 20,000 N

   (C) 22,000 N   (D) 30,000 N

10. A mass m is attached to two identical springs having stiffness k as shown in figure below. The natural frequency of the vibrating system is.
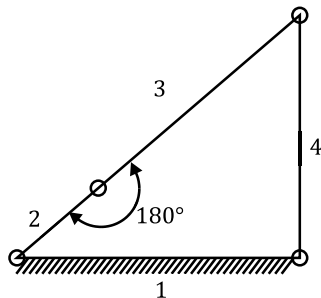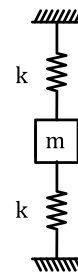
(A) $\dfrac{1}{2\pi}\sqrt{\dfrac{k}{m}}$ (B) $\dfrac{1}{2\pi}\sqrt{\dfrac{2k}{m}}$

(C) $\dfrac{1}{2\pi}\sqrt{\dfrac{k}{2m}}$ (D) $\dfrac{1}{2\pi}\sqrt{\dfrac{4k}{m}}$

11. A damped spring-mass system is forced to oscillate at t = 0 by the application of an impulse force. Which of the following are true?

(A) If the damping ratio is between 0 and 1, the system will show no oscillations.

(B) If the damping ratio is between 0 and 1, the system will eventual come to rest.

(C) If the damping ratio < 0, the system will eventually come to rest.

(D) The system will always oscillate.

12. In an accident site, tyre marks shows that a car was travelling along straight level street skidded for a total distance of 23 m, after the brakes applied. The coefficient of friction between the tyre and road estimated to be 0.5, what was the probable speed of car when break applied.

(A) 54 kmph   (B) 60.7 kmph

(C) 45.3 kmph   (D) 97 kmph

13. If a solid cylinder, thin hollow cylinder and a sphere, all with same material and are having same outside diameter are allowed to roll down in same inclination without sliding. All surfaces are having same coefficient of friction. What is the order of the bodies reaching bottom?

(A) All reach together

(B) Solid cylinder, sphere, thin hollow cylinder

(C) Sphere, solid cylinder, thin hollow cylinder

(D) Thin hollow cylinder, solid cylinder, sphere

14. A 0.2 mm thick strip is bent and laid over a frictionless pulley of 25 mm diameter. If E = 100 GPa, the maximum stress in the strip is

(A) 100 MPa   (B) 200 MPa

(C) 400 MPa   (D) 800 MPa

15. The velocity field of a certain two-dimensional flow is given by $V(x, y) = k\,(x_i - y_i)$ where k = 2/s and x and y are in meters. If the fluid density is 100 kg/m^3 and pressure at origin is 10 kPa, what is the pressure at point (3,3)?

(A) 3.2 kPa   (B) 6.4 kPa

(C) 1.6 kPa   (D) None

16. A spherical water drop of diameter 2 mm splits in to 8 small drops of equal size in air at temperature of 25°C. The surface

tension coefficient of water in air is 0.073 N/m and dynamic viscosity is 0.01 poise. The approximate work done in splitting up the drop is.

(A) 0.29×10^{-6}J   (B) 0.92×10^{-6}J

(C) 0.86×10^{-6}J   (D) 0.78×10^{-6}J

17. Which is identified as the coefficient of momentum transport?

(A) Density

(B) Kinematic viscosity

(C) Dynamic viscosity

(D) Reynolds number

18. Which is the most economical depth of flow in an open rectangular channel?

(A) Depth of flow equals to the width of channel.

(B) Depth of flow is double the width of channel.

(C) Depth of flow is half of the width of channel.

(D) Depth of flow is 1/3rd the width of channel.

19. A 50 mm diameter solid shaft is welded to a flat plate all around by fillet weld of 4mm leg size as shown in Fig. If the allowable shear strength of the weld material is 100 MPa, the maximum approximate torque in Nm that the welded joint can sustain under pure torsion is.
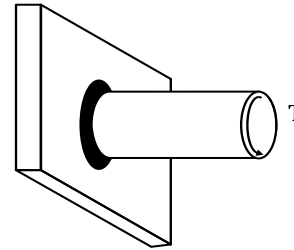
(A) $500\pi/\sqrt{2}$ (B) $1000\pi/\sqrt{2}$

(C) $500\pi\sqrt{2}$ (D) $1000\pi\sqrt{2}$

20. What is the revolving joint of the robot called?

(A) V-Joint   (B) L-Joint

(C) O-Joint   (D) T-Joint

21. The diagram below is showing the various criteria of fatigue failure. Which option is the correct representation of these criteria? (Subscripts e, y and u represent endurance, yield and ultimate respectively.)
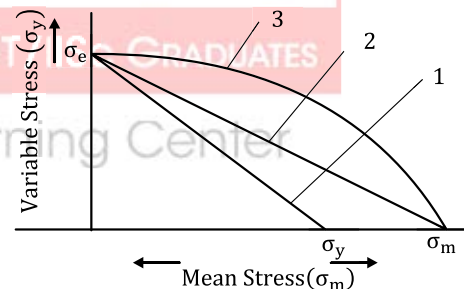
(A) 1-Soderberg line, 2-Goodman line, 3-Gerber line

(B) 1-Goodman line, 2-Soderberg line, 3-Gerber line

(C) 1-Soderberg line, 2-Gerber line, 3-Goodman line

(D) 1-Gerber line, 2-Soderberg line, 3-Goodman line

22. A 20 mm diameter Aluminium rod is turned to 19 mm diameter in a single pass. If the axial speed of the tool is 200 mm/min and the spindle rotate at 600 rpm, the material removal rate is nearly.

    (A) 6100 mm^3/min

    (B) 12250 mm^3/min

    (C) 3050 mm^3/min

    (D) 9150 mm^3/min

23. A planar four bar mechanism with all revolute joints has link lengths AB = 30 mm, BC = 120 mm, CD = 100 mm and AD = 80 mm. The link to be fixed to obtain a double crank mechanism is.

    (A) AB   (B) BC

    (C) CD   (D) AD

24. A small ring Z carries vertical load A of mass 27.3 kg by two strings ZX and ZY. String ZY carries a load B at its free end through a frictionless pulley. Find the value of B (rounded to nearest integer), if the string is stable at the configuration shown in fig.

(A) 14 kg   (B) 20 kg

(C) 10 kg   (D) 5 kg

25. A flat belt run over a pulley and transmitting the power of 2.5 KW. The linear velocity of the belt is 2.5 m/s. The angle of lap is 165° and the coefficient of friction between the belt and pulley is 0.3. If the initial tension of the belt is increased by 10%, what is the effect on power transmission? (neglecting the slip and centrifugal effect of the belt)

    (A) The power transmission is increased by 10 %

    (B) The power transmission is reduced by 10 %

    (C) The power transmission is doubled.

    (D) The power transmission is reduced to half.

26. An aluminium ring of mean diameter of 5m at ambient temperature is clipped into a liquid nitrogen bath. What will be the mean diameter of ring in the LN$_2$ bath. The coefficient of linear expansion of aluminium alloy in the temperature range may be taken as 20×10^{-6}/K. (Ambient temperature may be taken as 24°C. Boiling temperature of liquid nitrogen: 77 K).

    (A) 4.978 m   (B) 4.958 m

    (C) 5.138 m   (D) 4.865 m
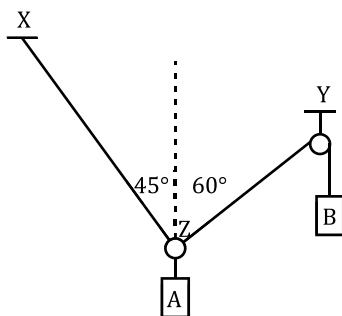
27. A travelling crane as shown is used to carry a load of two tonnes at point D. A counter mass CW is to be added as shown to avoid toppling of the crane. Find the limiting value of counter mass and distance, X from F, such that it will not topple the crane even in the absence of load at D. The mass of the crane may be taken as 2 tonnes and is acting 2 meters away from E towards D.
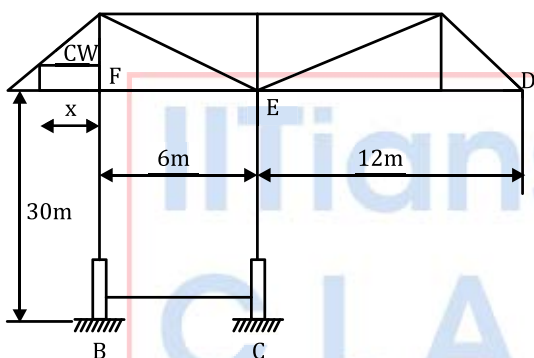

(A) CW = 2 t at X = 8 m

(B) CW = 16 t at X = 10 m

(C) CW= 1.5 t at X = 6 m

(D) CW = 16.67 t at X= 12 m

28. A journal bearing of radius 'r_1' and radial clearance 'c_1' has a sommerfeld number 's_1.' Another journal bearing of radius and radial clearance 'c_2' has a Sommerfeld number 's_2' All the other parameters remain the same for both bearings. If $r_2 = 2r_1$ and $c_2 = c_1/2$, then s_2/s_1

(A) 4   (B) 8

(C) 16   (D) 32

29. Match the following:

Column-I	Column-II
Theories of failure	Shape of region of safety
(A) Rankine Theory	(i) Hexagon
(B) Tresca Theory	(ii) Ellipse
(C) St. Venants Theory	(iii) Square
(D) Von mises Theory	(iv) Rhombus

(A) (A)-(ii), (B)-(iv), (C)-(i), (D)-(iii)

(B) (A)-(iii), (B)-(iv), (C)-(ii), (D)-(i)

(C) (A)-(iii), (B)-(i), (C)-(iv), (D)-(ii)

(D) (A)-(iv), (B)-(i), (C)-(iii), (D)-(ii)

30. The moment of resultant of concurrent forces with respect to a center in their plane is equal to the algebraic sum of the moments of components with respect to same center. This theorem is known as

(A) Theorem of Varignon

(B) Method of moments

(C) Theorem of equilibrium of active forces

(D) Theorem of three forces

31. Stress strain curve of three types of material is given in the figure below. Please identify the correct combination
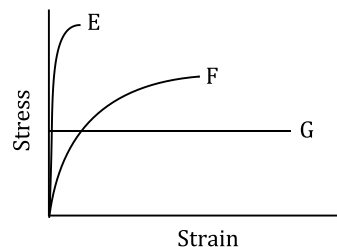
(A) E - brittle, F - ductile, G-plastic

(B) E - plastic, F - brittle, G-ductile

(C) E - brittle, F - plastic, G-ductile

(D) E - ductile, F - plastic, G- brittle

32. A machine member is subjected to fluctuating stress, $\sigma = \sigma_0 \cos(5\pi t)$. The endurance limit of the material is 350 MPa and the yield strength is 500 MPa. If the factor of safety used in the design is 3.5, then the maximum allowable stress σ_0 in MPa according to Soderberg fatigue criteria is.

(A) 10

(B) 200

(C) 100

(D) 50

33. A plane stress element in a structural member under loading has $\sigma_x = 4P, \sigma_y = 2P$ and $\tau_{xy} = \sqrt{3}P$, and $\tau_{xy} = \sqrt{3}P$, where $P > 0$. The yield strength of the material is 300 MPa. If the member is designed using the maximum shear stress theory, then the value of P at which yielding starts is.

(A) 60 MPa

(B) 75 MPa

(C) 100 MPa

(D) 120 MPa

34. Radius of the Mohr circle of stress numerically equal to

(A) Maximum normal stress

(B) Maximum shear stress

(C) Average normal stress

(D) Average shear stress

35. In a casting process, a horizontal channel through which molten metal flows from pouring basin to reach mold cavity is called.

(A) Runner

(B) Thinner

(C) Corridor

(D) Raiser

36. 3D Printing Techniques are.

(A) Selective laser sintering

(B) Selective laser melting

(C) Electron beam melting

(D) All the Above

37. A round wire helical spring is loaded by the axial force. The maximum shear stress in the wire cross section will be at

(A) Outer fibre

(B) Inner fibre

(C) Center of the cross section

(D) Both outer and inner fibres

38. The power is transmitted through a spur gear with 20° pressure angle mounted at the mid span of shaft supported on bearings at the ends. The nature of stress induced in the shaft is.

(A) Normal stress due to bending only.

(B) Normal stress due to bending and shear stress due to torsion.

(C) Normal stress due to bending, axial loading and shear stress due to torsion.

(D) Normal stress due to axial loading and shear stress due to torsion

39. As shown in the figure, the plane, having a mass of 8000 kg, is hoisted back until θ =60° and then the pull-back cable AC is released when the plane is at rest. Determine the speed of the plane just before it crashes into the ground at θ = 30°. (Neglect the size of the plane and effect of lift caused by the wings during the motion, assume g = 10 m/s^2)
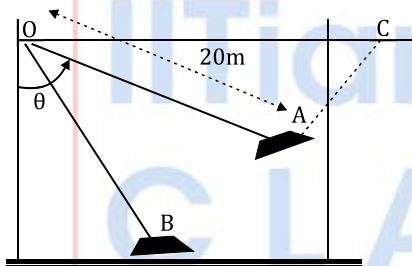
(A) 23.98 m/s   (B) 12.1 m/s
(C) 9.56 m/s   (D) 6.76 m/s

40. A manufacturer has the following data regarding a product.

Fixed cost per month = Rs. 80,000

Variable cost per unit = Rs. 350

Selling price per unit = Rs. 500

Production capacity = 1600 units per month

If the production is carried out at 75% of the rated capacity, then monthly profit is (in Rs.)

(A) 1 Lakh   (B) 1.2 Lakhs
(C) 1.4 Lakhs   (D) 0.8 Lakhs

41. For a PERT activity, the optimistic time is 6 minutes, the most likely time is 9 minutes and pessimistic time is 16 minutes. The expected time of the activity (in seconds) is.

(A) 600   (B) 540
(C) 620   (D) 580

42. A cantilever beam of cross section A, moment of inertia I and length L is having natural frequency ω_1. If the beam is accidentally broken into two halves, the natural frequency of the remaining cantilever beam a)2 will be such that it.

(A) Increases ($\omega_2 > \omega_1$)

(B) Decreases ($\omega_2 < \omega_1$)

(C) Remains same $\omega_2 = \omega_1$

(D) Cannot be obtained from the given data.

43. Vapor pressure in mm of mercury of solid and liquid ammonia is given by $\ln P = 23.1 - (3749/T)$ and $\ln P = 19.6 - (3049/T)$, find out the triple point.

(A) 700 K   (B) 231 K
(C) 200 K   (D) 180 K

44. If the load acting on the ball bearing is increased 2 times its life will

(A) Reduce by 2 times.

(B) Reduce by 4 times.

(C) Reduce by 8 times.

(D) Not change.

45. An old clutch is to transmit a torque of 100 N-m. The inner and outer diameter of the clutch plate is 100 mm and 200 mm respectively. The force required for engagement is (assume μ = 1/3 with uniform wear theory)

    (A) 4 kN
    (B) 10 kN
    (C) 25 kN
    (D) 50 kN

46. What is the change in entropy when water is vaporized at 100°C. Latent heat of vaporization of water may be taken as 2238 kJ/kg.

    (A) 22.38 kJ/kg K
    (B) 2.238 kJ/kg K
    (C) 6 kJ/kg K
    (D) 100 kJ/kg K

47. Examine the following statements:

    (i)   Work is high grade energy.

    (ii) It is possible for a heat engine to produce work in a cycle by exchanging heat with bodies at same temperature.

    (iii) It is impossible to construct a device which operating in a cycle will produce no other effect other than transfer of heat from a cooler to a hotter body.

    (A) All statements are wrong.
    (B) All statements are correct.
    (C) Statements (i) and (iii) are correct.
    (D) Statements (ii) and (iii) are correct.

48. The elastic strain energy stored in a rectangular cantilever beam due to a bending moment M applied at the end is given by (σ_{max} is Maximum Bending Stress, V is Volume and E is Young's Modulus)
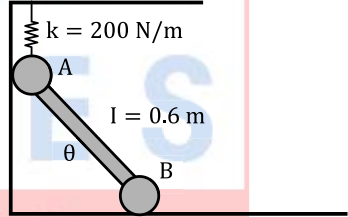

    (A) $\sigma_{max}^2(V/3E)$
    (B) $\sigma_{max}^2(V/2E)$
    (C) $\sigma_{max}^2(V/6E)$
    (D) $\sigma_{max}^2(V/4E)$
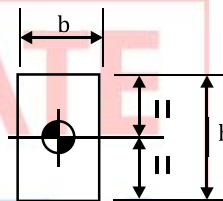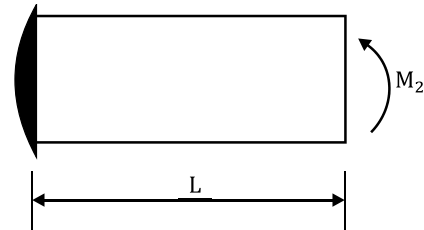
49. Molliar diagram is also called as

    (A) Temperature - entropy chart
    (B) Pressure - volume chart
    (C) Pressure - enthalpy chart
    (D) Enthalpy - entropy chart

50. Real gas behavior approaches ideal gas equation when.

    (A) Pressure and temperature are very high.
    (B) Pressure is very high and temperature is very low.

(C) Pressure and temperature are very low.

(D) Pressure is very low and temperature is very high.

51. A stainless-steel rod of diameter 12 mm and length 2.5 m is kept on frictionless surface and heated from 300 K to 400 K. What is the thermal stress on the rod? (coefficient of linear expansion of the steel may be taken as 10^{-5}/K; yield strength of steel as 200 MPa and Young's modulus as 210 GPa)

(A) 52.5 MPa   (B) 0.525 MPa

(C) 1 MPa   (D) 0 MPa

52. What is the kind of deformation that occurs in shape memory alloys?

(A) Thermo Plastic

(B) Plastic

(C) Thermo Elastic

(D) None

53. The equation of motion of a spring-mass-damper system is given by $\ddot{x} = 4x]\dot{} + 16x = 12 \sin 5t$ What is the damping factor of the system?

(A) 1   (B) 0.5

(C) 0.25   (D) 0.75

54. A gear train comprises of 4 spur gears the driven gear G_1? two idlers G_2, G_3 and the driving gear G_4. The radii of G_1, G_2, G_3 and G_4 are r, r/2, r/3 and 2r, respectively. What is the ratio of angular velocities of G_1 to G_4 and their direction of rotation?

(A) Ratio = 1, opposite direction

(B) Ratio = 1/6, same direction

(C) Ratio = 2, Opposite direction

(D) Ratio = 1/2, same direction

55. The uniform link shown in the following figure has a mass of 12 kg. If the spring is un-stretched at $\theta = 0°$, determine the angle 6 for stable equilibrium. Neglect the surface friction and assume g = 10 m/s^2)

(A) 0°   (B) 60°

(C) 90°   (D) 30°

56. A face milling operation is carried out with a 100 mm diameter milling cutter having 4 teeth and spindle speed 0f 300 rpm. If the feed per tooth is 0.125 mm, what is the table feed in mm/min?

(A) 90 mm/min   (B) 120 mm/min

(C) 150 mm/min   (D) 180 mm/min

57. Which is the correct sequence of machining operations to be performed to finish a through hole of large diameter?

    (A) Drilling, reaming, boring

    (B) Drilling, boring, reaming

    (C) Boring, drilling, reaming

    (D) Boring, reaming, drilling

58. In abrasive jet machining process, the main mechanism of material removal takes place due to.

    (A) Electrochemical action

    (B) Ionic dissolution

    (C) Mechanical impact

    (D) Melting and evaporation

59. For water, the latent heat of freezing is 334 kJ/kg and the specific heat capacity averages 4.19 kJ/kgK. The quantity of heat to be removed from 1 kg of water at 30°C in order to turn it into ice at 0°C is:

    (A) 567 kJ   (B) 319 kJ

    (C) 483 kJ   (D) 459 kJ

60. A point load applied at shear center of beam induces.

    (A) Zero shear force

    (B) Zero bending

    (C) Pure twisting

    (D) Pure bending

61. A cam and oscillating follower mechanism is shown in the figure below. The Mobility of the mechanism is.
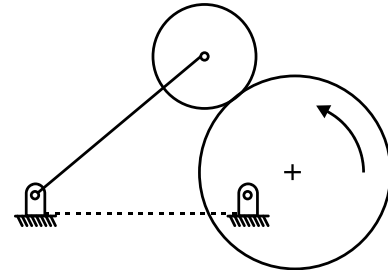
    (A) −1   (B) 0
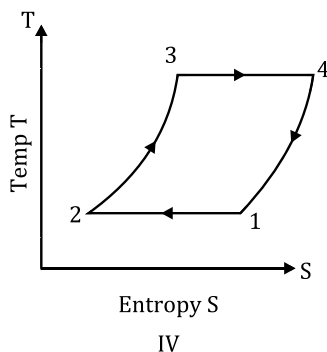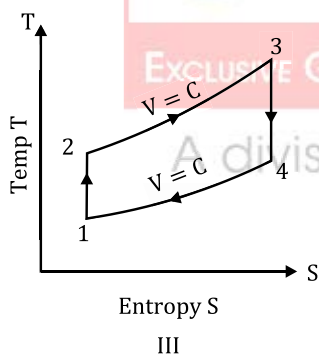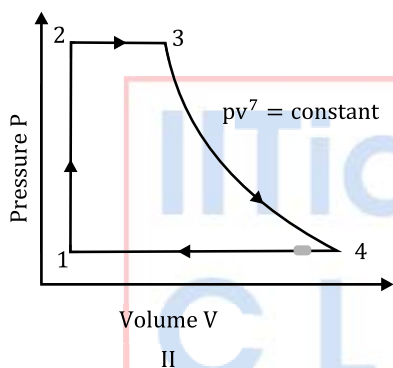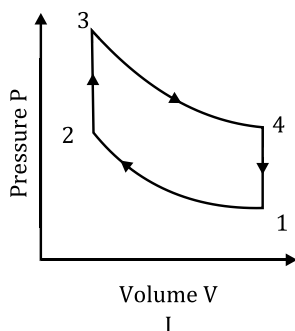   (C) 1   (D) 2

62. A body is subjected to a bi-axial state of stress as shown in figure below: The magnitude of normal and shear stresses acting on the 45-degree plane in MPa.
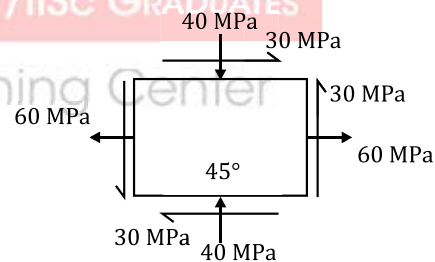
    (A) 50, 50 MPa   (B) 60, 40 MPa
    (C) 40, 50 MPa   (D) 50, 30 MPa

63. Which of the following represent sterling cycle?

Volume V
I

$pv^7 = constant$

Volume V
II

Entropy S
III

Entropy S
IV

(A) II   (B) I and III

(C) I and IV   (D) All of the above

64. Rapid and sharp changes in fluid properties in a very small region of gas flow is known as

(A) Cavitation

(B) Shock wave

(C) Sublimation

(D) Chocking

65. The wall of a chemical plant is modified with two additional layers having half the thermal conductivity of original wall material. The inner layer is of half the thickness and outer layer of same thickness as original wall. What will be the heat flow across the modified wall?

(A) Same as original

(B) Twice of original

(C) 50% of original

(D) 25% of original

66. Three metal balls are suspended by three wires (a, b & c) of equal length arranged in sequence as shown in figure. The masses of the balls, starting at the top are 2 kg, 4kg and 3 kg. The wire diameters in the same order are 2 mm, 1.2 mm & 1 mm respectively. What is the correct order of increasing stresses in the wires?
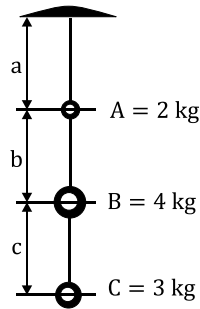
(A)   a, c, b   (B)   b, c, a

(C)   a, b, x   (D)   All are having
                              same stress

Young's modulus as E and Moment of inertia as I)
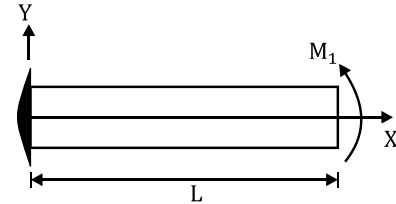
(A) $y = M_1 x^2/3EI$ (B) $y = M_1 x^2/EI$

(C) $y = M_1 x^2/2EI$ (D) $y = M_1 x^2/4EI$

67. What is the power of 2 tonne refrigeration system? Latent heat of ice may be taken as 336 kJ/kg and specific heat capacity of water as 4 kJ/kgK.

(A)   7.7 kW   (B)   70 kW

(C)   12.5 kW   (D)   0.7 kW.

68. An air standard Otto cycle operates with a compression ratio of 9 and the ambient temperature is 300 K. If the adiabatic index of the medium is 1.5, what is the efficiency?

(A)   75 %

(B)   66.67 %

(C)   50 %

(D)   33 %

69. Determine the equation of the elastic curve for the cantilever beam of uniform cross section as shown in the figure due to the applied bending moment M_1 (Consider

70. The preferred choice of the steel material for Cryogenic application is.

(A)   Ferrite

(B)   Austenitic

(C)   Martensite

(D)   All are having same stress.

71. A satellite of mass 100 kg is attached centrally to the rocket stage of mass 900 kg using a separation system. In space the satellite is to be separated and ejected using 10 numbers of identical spring thrusters having same stroke of 30 mm. Assume springs are fully transferring the energy and angular body rate of the bodies are negligible after separation. What is the stiffness of the spring required to get the satellite axial relative velocity of 1 m/s.?

(A)   0.01 N/mm   (B)   10 N/mm

(C)   20 N/mm   (D)   100 N/mm

72. Which of the following is not a casting defect?

(A) Spatter (B) Blow holes

(C) Cold shut (D) Hot tear

73. Which of the following improve weld ability of steel?

(A) Low carbon content and poor affinity to oxygen

(B) High carbon content and poor affinity to oxygen

(C) Low carbon content and good affinity to oxygen

(D) High carbon content and good affinity to oxygen

74. What is true in respect of the self-locking screw jack with square thread?

(I) The friction angle is more than the helix angle of the thread.

(II) The efficiency of the screw jack should not be more than 50%

(A) Only I

(B) Only II

(C) Both I and II

(D) None of the above

75. The commonly used flux for brazing is:

(A) Borax (B) Epoxy

(C) NH_4CI (D) Inert gas

76. For a particular project, six activities are to be carried out. The precedence relation and duration of activities are as per the following table. The minimum project completion time (in days) is.

Activity	Immediate Predecessor	Duration (days)
A	-	6
B	A	5
C	A	8
D	B	11
E	C	6
F	D, E	7

(A) 32 (B) 27

(C) 29 (D) 30

77. The property of the material that represents maximum amount of strain energy that it can absorb before it fractures under load is called:

(A) Modulus of Resilience

(B) Modulus of Toughness

(C) Modulus of Elasticity

(D) None of the above

78. A Carnot refrigerator works in temperature range of 300 K to 270 K with different refrigerants CFC, R -32 and ammonia. Which of the refrigerant give better COP?

(A) CFC

(B) R- 32

(C) Ammonia

(D) All gives same COP.

79. A cylindrical body of diameter 2 m and height 1.5 m having a mass of 2 tonnes and floats in sea water with its axis vertical. A lighting equipment is placed on the body such that the water level is at least 0.5 m below the top surface. What is the maximum mass of the electrical equipment that can be placed on the body? (The specific gravity of sea water may be taken as 1.02 and n = 3.14)

(A) 252 kg   (B) 750 kg

(C) 1202 kg   (D) 275 kg

80. Examine the following statements:

(i) Euler's equation is applicable to inviscid liquid.

(ii) Bernoulli's equation applicable to steady state

(iii) Viscous forces are not considered in Navier Stokes equation.

(iv) Surface tension and compressibility forces are considered in Navier Stokes equation.

(A) Statements (i) and (ii) are not correct.

(B) Statements (iii) and (iv) are correct.

(C) Statements (i), (ii) and (iii) are correct.

(D) All the statements are correct.

PART-B

Aptitude/Ability Test

81. You are a retail clerk who typically works Monday through Friday. You arrive at work and notice the new schedule is posted, and your manager has given you a Saturday shift. It happens to be your son's birthday on Saturday, and you have a party planned. What is the most appropriate response? **(1 Mark)**

(A) Speak with your manager and explain you have a birthday party planned for your son on Saturday and ask if they can find someone else or if you can find someone to cover your shift.

(B) Ask your coworkers if they can cover your shift because you have a birthday party for your son planned.

(C) Pretend like you did not see the schedule since you always work Monday through Friday and do not show up on Saturday.

(D) Do not say anything to anyone, and plan on calling in sick on Saturday.

82. **Fact 1 :** Pictures can tell a story.

Fact 2 : All storybooks have pictures.

Fact 3 : Some storybooks have words.

If the first three statements are facts which of the following statements must also be a fact?

I: Pictures can tell a story better than words can.

II: The stories in storybooks are very simple.

III: Some storybooks have both words and pictures. **(1 Mark)**

(A) I only

(B) II only

(C) III only

(D) None of the statements is a known fact.

83. **Statement:** Exporters in the capital are alleging that commercial banks are violating a Reserve Bank of India directive to operate a post-shipment export credit denominated in foreign currency at international rates from January this year.

Courses of Action:

I. The officers concerned in the commercial banks are to be suspended.

II. The RBI should be asked to stop giving such directives to commercial banks. **(1 Mark)**

(A) Only I follow.

(B) Only II follows.

(C) Either I or II follows

(D) Neither I nor II follows

84. Eight friends P, Q, R, S, T, V, W and Y are sitting around a square table.

1. Out of eight, four persons are sitting at the corners of the table and the other four are sitting at the mid - points of each side of the table.

2. Persons at the corners are facing the centre while the persons at the mid - points of side are facing outside.

3. S is third to the right of P. P is facing the centre.

4. Y is not sitting beside P or S.

5. T is third to the right of R.

6. R is not sitting at the mid - point of any side of the table.

7. R is also not beside Y.

8. There is only one person between P and V.

9. Q is not sitting beside V.

How many people are there between T and Q? **(2 Marks)**

(A) 1   (B) 2

(C) 3   (D) None

85. Which option replaces the question mark? **(1 Mark)**
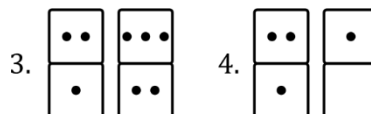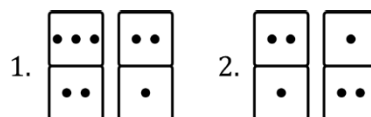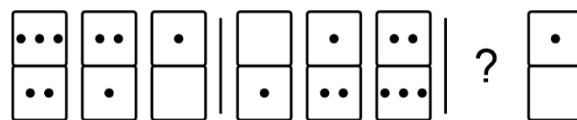
(A) 1   (B) 2

(C) 3   (D) 4

86.   Study the following table carefully and answer the questions given below it:

Year	TOYS				
	A	B	C	D	E
1982	200	150	78	90	65
1983	150	180	100	105	70
1984	180	175	92	110	85
1985	195	160	120	125	75
1986	220	185	130	135	80

What was the percentage (approximate) increase in production of D type of toys from 1983 to 1985?   **(1 Mark)**

(A) 10   (B) 20

(C) 19   (D) 76

87.   What is the maximum area of the rectangle with perimeter 620 mm? **(2 Marks)**

(A) 24,025 mm^2 (B) 22,725 mm^2

(C) 24,000 mm^2 (D) 24,075 mm^2

88.   Find out the wrong number in the series 7, 8, 18, 57, 228, 1165, 6996 (2 Marks)

(A) 7   (B) 8

(C) 6996   (D) 228

89.   **Directions :** The graph given below represents the variations in earnings in rupees over a week. Study the graph and answer questions given below **(1 Mark)**

Earnings Per Day
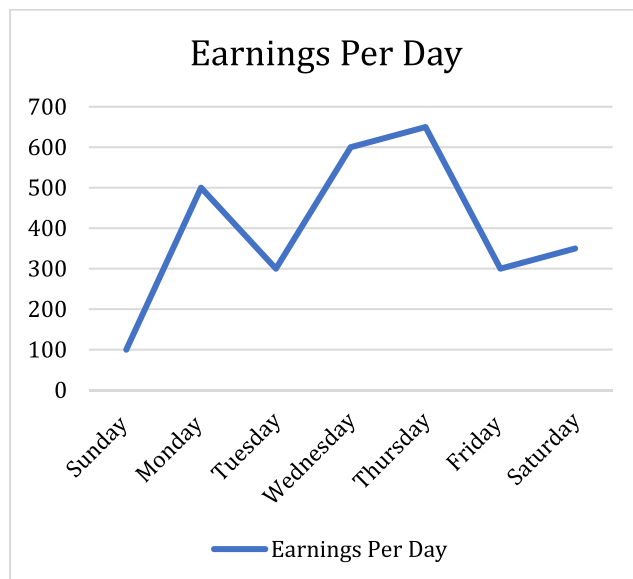
The difference in earnings was large between

(A) Sunday-Monday

(B) Tuesday-Wednesday

(C) Thursday-Friday

(D) None of these

90.   Which of the following best completes the passage below?

In a survey of job applicants, two-fifths admitted to being at least a little dishonest. However, the survey may underestimate the proportion of job applicants who are dishonest, because _____.
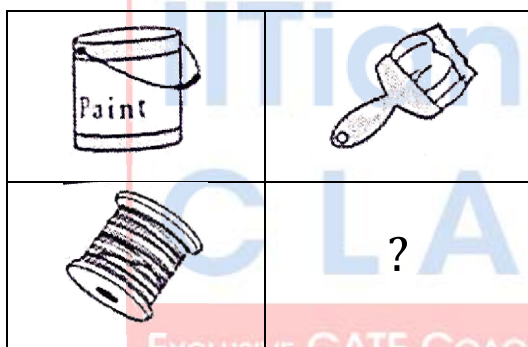
(1 Mark)

(A) some dishonest people taking the survey might have claimed on the survey to be honest.

(B) some generally honest people taking the survey might have claimed on the survey to be dishonest.

(C) some people who claimed on the survey to be at least a little dishonest may be very dishonest.

(D) some people who claimed on the survey to be dishonest may have been answering honestly.
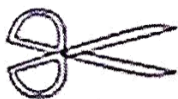
91. Which option replaces the question mark?
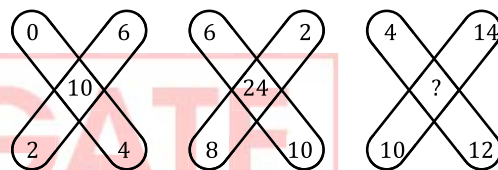
(1 Mark)

1.

2.

3.

4.

(A) 1   (B) 2

(C) 3   (D) 4

92. Which one will replace the question mark?

(1 Mark)

0	6	6	2	4	14
10		24		?	
2	4	8	10	10	12

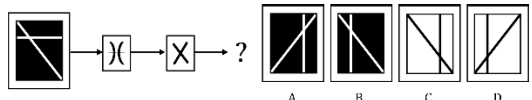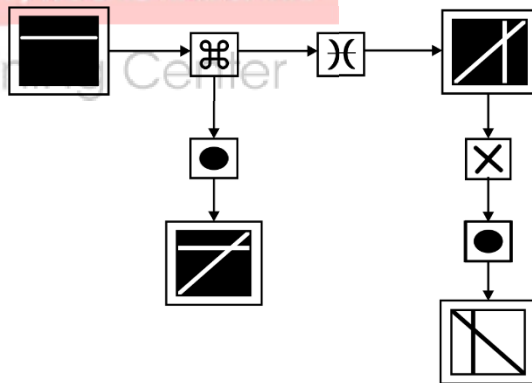(A) 45   (B) 8

(C) 38   (D) 48

93. Which option replaces the question mark?

(2 Marks)

(A) A   (B) B

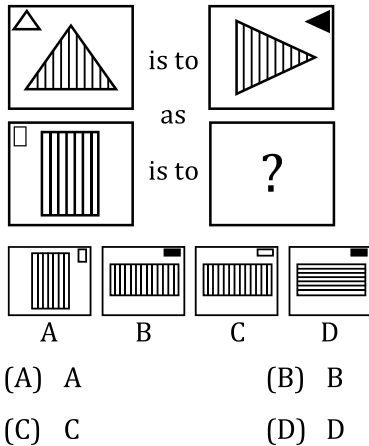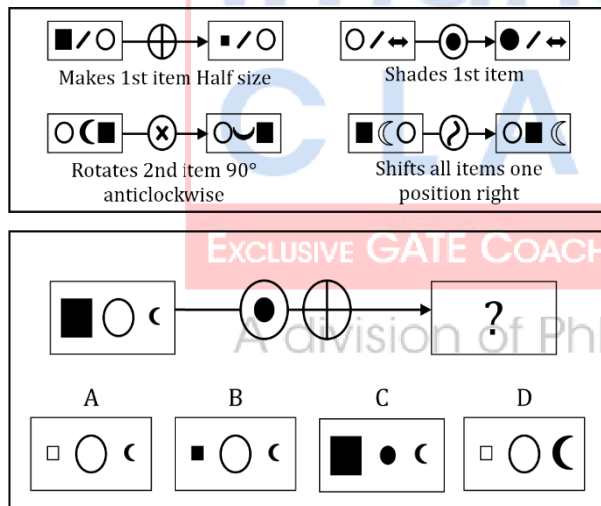(C) C   (D) D

94. Which option replaces the questions mark? **(1 Mark)**

(A) A   (B) B

(C) C   (D) D

95. Which option replaces the questions mark? **(2 Marks)**

(A) A   (B) B

(C) C   (D) D

Explanations **ISRO ICRB 2023 – Mechanical Engineering**

1	D	21	A	41	A	61	C	81	A
2	C	22	A	42	A	62	C	82	C
3	B	23	A	43	C	63	C	83	D
4	C	24	B	44	C	64	B	84	B
5	D	25	A	45	A	65	D	85	A
6	D	26	A	46	C	66	A	86	C
7	C	27	A	47	C	67	A	87	A
8	C	28	C	48	C	68	B	88	D
9	C	29	C	49	D	69	C	89	A
10	B	30	A	50	D	70	B	90	B
11	B	31	A	51	D	71	B	91	D
12	A	32	C	52	C	72	A	92	C
13	C	33	A	53	B	73	A	93	B
14	D	34	B	54	C	74	C	94	B
15	B	35	A	55	B	75	A	95	B
16	B	36	D	56	C	76	C		
17	C	37	B	57	B	77	B		
18	C	38	B	58	C	78	D		
19	A	39	B	59	D	79	C		
20	D	40	A	60	D	80	None		