GOVERNMENT OF INDIA : : DEPARTMENT OF SPACE

INDIAN SPACE RESEARCH ORGANISATION

ISRO Centralised Recruitment Board

Recruitment for Scientist/Engineer 'SC'

Test Booklet		REFRIGERATION AND AIR CONDITIONING	E
Date	:	January 12, 2020 (Sunday)	
Time	:	0900 hrs to 1030 hrs	
Test Duration (Minutes)	:	90	
No. of Questions	:	80	
No. of Pages (Other than cover sheet)	:	20	

Instructions to the candidates

1. The question paper is in the form of test booklet. All candidates will be assessed on identical questions.
2. A separate **OMR** answer sheet is provided to all candidates for answering.
3. Each objective question is provided with a text and/or figures wherever applicable with **multiple answer choices (a), (b), (c) and (d)**. Choose the most appropriate answer.
4. Read the instructions on the **OMR** sheet carefully. Use only **Black or Blue Ball Point Pen** for writing on OMR sheet and marking/bubbling your answers.
5. All objective type questions carry equal marks of **THREE** for a correct answer, **ZERO** for no answer and minus **ONE** for a wrong answer.
6. **Multiple answers** for a question will be regarded as a wrong answer.
7. Although the test stresses on accuracy more than speed, it is important to use time as effectively as possible.
8. Do not spend time on questions, which are difficult for you. Go on to other questions and come back to the difficult ones later
9. Question booklets have been marked with **A** or **B** or **C** or **D** or **E** on the right hand top corner, which is mandatory to be written on the OMR sheet in the box and bubbled appropriately, failing which, the answer sheet will not be evaluated.
10. Space available in the booklet could be used for rough work, if required. No separate sheet will be provided.
11. Attempt of any malpractice in the exam hall shall entail disqualification of candidature, debar from future exams and legal action against the candidate.

***

SEAL

1. A furnace wall made of steel plate 10 mm thick and thermal conductivity 15 kcal/m-hr-°C is lined inside with silica brick of 150 mm thick of thermal conductivity 1.75 kcal/m-hr-°C and on outside with magnesia bricks of 200 mm thick with thermal conductivity of 4.5 kcal/m-hr-°C. The total resistance of the composite wall will be

(a) 0.13 °C-hr/kcal (b) 0.23 °C-hr/kcal

(c) 0.03 °C-hr/kcal (d) 0.33 °C-hr/kcal

2. A water turbine delivering 10 MW power is to be tested with the help of a geometrically similar 1:10 model which runs at the same speed and efficiency. The power developed by the model will be

(a) 10 W (b) 100 W

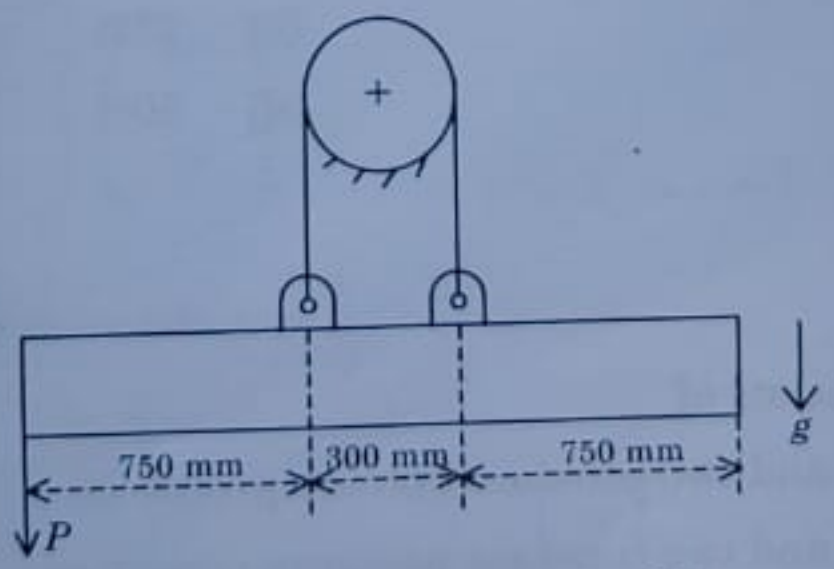
(c) 1000 W (d) 10000 W

3. A hot fluid is flowing through a long pipe of 4 cm outer diameter and covered with 2 cm thick insulation. It is proposed to reduce the conduction heat loss to the surroundings to one third of the present rate by increasing the same insulation thickness. The additional thickness of insulation required will be

(a) 2 cm (b) 6 cm

(c) 9 cm (d) 12 cm

4. A uniform beam of mass density 74 kg/m and length 1.8 m is suspended symmetrically as shown in Fig. Calculate the maximum force P that can be supported without tipping the beam. Take the coefficient of static friction between the cord and the cylinder to be 7/22



(a) 100.7 N (b) 200.9 N

(c) 150.8 N (d) 50.2 N

5. For which of the following situations, zeroth law of thermodynamics will not be applicable?

(a) 50 cc of water at 25°C is mixed with 150 cc of water at 25°C

(b) 500 cc of milk at 15°C is mixed with 100 cc of water at 15°C

(c) 5 kg of wet steam at 100°C is mixed with 50 kg of dry and saturated steam at 100°C

(d) 10 cc of water at 20°C is mixed with 10 cc of sulphuric acid at 20°C

6. A system undergoes a change of state during which 100 kJ of heat is transferred to it and it does 50 kJ of work. The system is brought back to its original state through a process during which 120 kJ of heat is transferred to it. The work done by the system in kJ is

(a) 50 (b) 70

(c) 170 (d) 200

$100 = U_2 - U_1 + 50$

$50 = U_2 - U_1$

$-120 = -50 + -70$

7. 90 kilograms of ice at 0°C is completely melted. Find the entropy change in kJ/K, if final temperature is 0°C

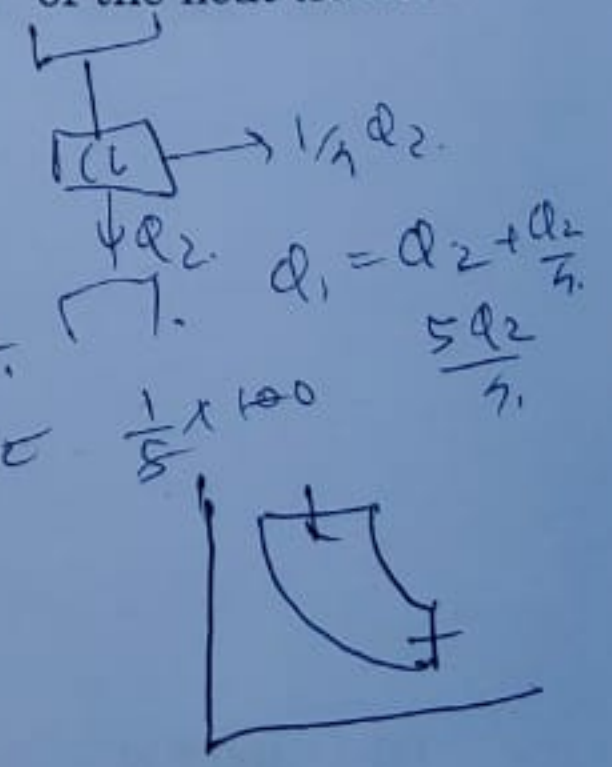
(a) 0 (b) 85

(c) 45 (d) 105

8. For a heat engine operating on Carnot cycle, the work output is 1/4th of the heat transferred to the cold system. The efficiency of the Engine is

(a) 20% (b) 25%

(c) 75% (d) 50%



9. Ideal Diesel cycle consists of

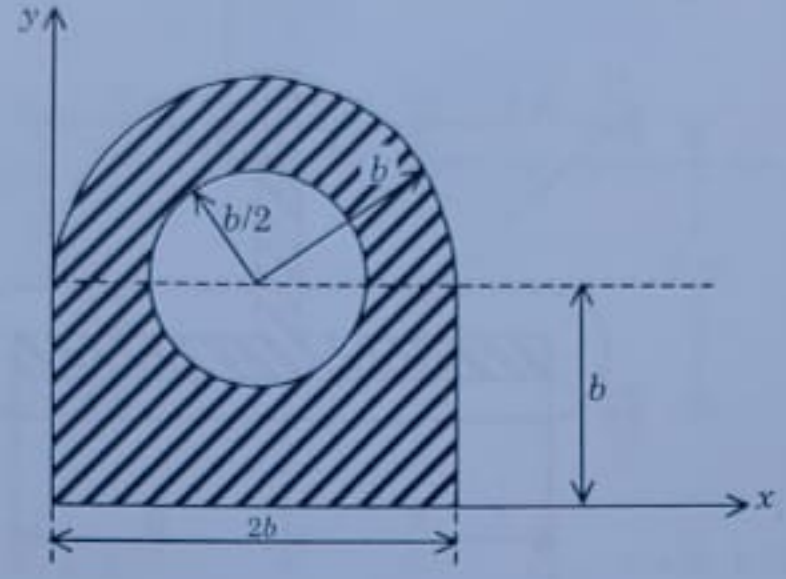
(a) Two adiabatic and two constant volume processes

(b) Two adiabatic and two constant pressure processes

(c) Two adiabatic, one constant pressure and one constant volume processes

(d) Two isothermal, one constant pressure and one constant volume processes

10. Determine the centroid (x_c, y_c) of the shaded area as shown in Figure with respect to given coordinate axes



(a) $\left(b, \frac{28+3\pi}{3(8+\pi)}b\right)$

(b) $\left(\frac{b}{2}, \frac{12+2\pi}{4(2+\pi)}b\right)$

(c) $\left(b, \frac{5}{(8+\pi)}b\right)$

(d) $\left(b, \frac{1+2\pi}{2(8+\pi)}b\right)$

11. The operating temperatures of a single stage Vapour Absorption Refrigeration System (VARS) are : Generator 90 °C, condenser and absorber 40°C, evaporator 0°C. If the pump work is negligible, find the ideal COP of this VARS

(a) 0.94

(b) 1.4

(c) 0.84

(d) 2.4

12. One of the Eigen vectors of the matrix $\begin{bmatrix} -5 & 2 \\ -9 & 6 \end{bmatrix}$ is

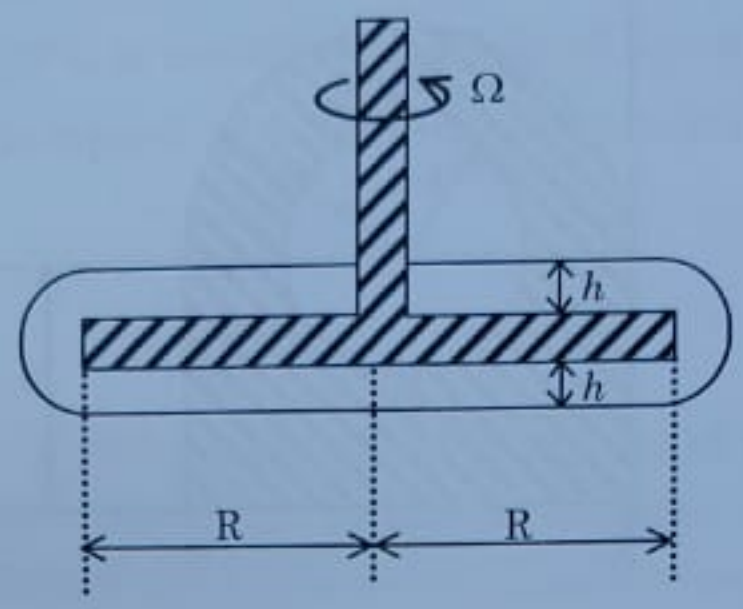
(a) $\begin{bmatrix} -1 \\ 1 \end{bmatrix}$

(b) $\begin{bmatrix} -2 \\ 9 \end{bmatrix}$

(c) $\begin{bmatrix} 2 \\ -1 \end{bmatrix}$

(d) $\begin{bmatrix} 1 \\ 1 \end{bmatrix}$

13. A disc of radius R rotates at an angular velocity Ω inside a disc shaped container filled with oil of viscosity μ, as shown in figure. Assuming a linear velocity profile and neglecting shear stress on the outer disc edges, the formula for viscous torque on the disc is



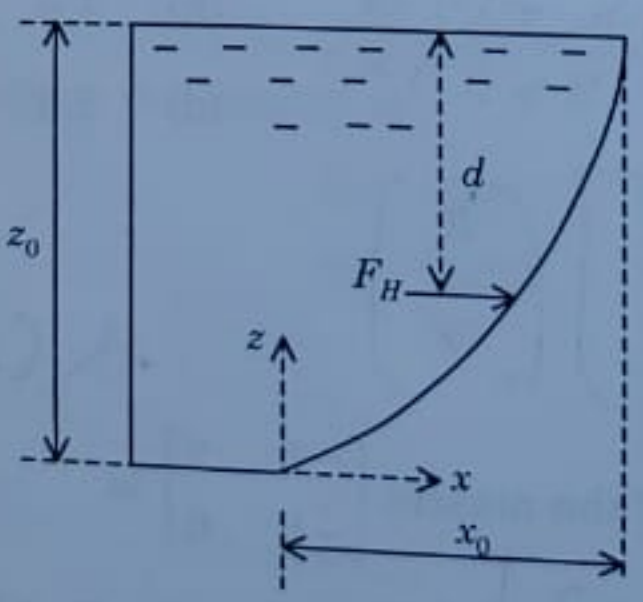
(a) $\dfrac{\pi \mu \Omega R^2}{h}$

(b) $\pi \mu \Omega h R^3$

(c) $\dfrac{\pi \mu \Omega R^5}{h^2}$

(d) $\dfrac{\pi \mu \Omega R^4}{h}$

14. A dam has a parabolic shape $\dfrac{z}{z_0} = \left(\dfrac{x}{x_0}\right)^2$ as in shown in figure. with $x_0 = 3$ m and $z_0 = 7$ m. The fluid is water (specific weight = 9810 N/m^3) and atmospheric pressure may be omitted. Compute the horizontal force F_H and its line of action from surface of water 'd'. Assume width of dam is 15 m.



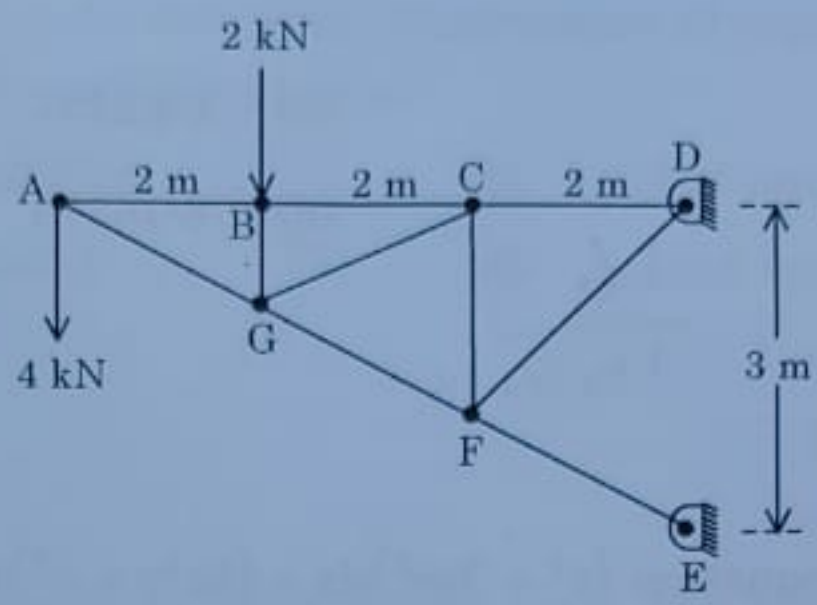
(a) $F_H = 3605$ kN, d = 1.16 m

(b) $F_H = 3605$ kN, d = 4.66 m

(c) $F_H = 4300$ kN, d = 4.66 m

(d) $F_H = 4300$ kN, d = 1.16 m

15. Calculate the forces in the members CG and CF for the truss shown.



(a) $F_{CG} = \sqrt{5}$ kN , $F_{CF} = 1$ kN

(b) $F_{CG} = \sqrt{3}$ kN , $F_{CF} = 2$ kN

(c) $F_{CG} = 2$ kN , $F_{CF} = \sqrt{3}$ kN

(d) $F_{CG} = \sqrt{5}$ kN , $F_{CF} = 2$ kN

16. Which of the following statement regarding centrifugal compressor is true?

(a) Conversion of dynamic pressure into static pressure takes place in the volute casing due to its convergent shape

(b) In multi stage centrifugal compressor, the width of the blades reduces progressively in the direction of flow

(c) In multi stage centrifugal compressor, the width of the blades increases progressively in the direction of flow

(d) Multi staging in centrifugal compressors is commonly used for high refrigerant capacity applications

17. Which one of the following statements is true?

(a) Compared to reciprocating compressor, the performance of centrifugal compressor is less sensitive to speed

(b) Surging in centrifugal compressor takes place as evaporator pressure increases and condenser pressure decreases

(c) Surging in centrifugal compressor takes place as evaporator pressure decreases and condenser pressure increases

(d) For a given flow rate, frictional losses decrease as the number of blades increases

18. Three cards were drawn from a pack of 52 cards. The probability that they are a king, a queen and a jack is

(a) 16/5525 (b) 64/2197

(c) 3/13 (d) 8/16575

19. General solution to the equation $(x^3 + 3xy^2)dx + (3x^2y + y^3)dy = 0$ is (c is a constant)

(a) $\frac{1}{4}(x^4 + 6x^2y^2 + y^4) = c$ (b) $\frac{1}{5}(8x^4 + 6x^3y + y^3) = c$

(c) $\frac{1}{12}(x^3 + 6xy^2 + y^4) = c$ (d) $(x^2 + y^2) = c$

20. Let $f(t) = \sin^2 t$, find the Laplace transform of $f(t)$

(a) $\frac{2}{s^2 + 4}$ (b) $\frac{2}{s(s^2 + 4)}$

(c) $\frac{2s}{s^2 + 4}$ (d) $\frac{2}{s(s^2 - 4)}$

21. Find the particular solution for the initial value problem

$2\sin(y^2)dx + xy\cos(y^2)dy = 0$, if $y(2) = \sqrt{(\pi/2)}$

(a) $x^4 \sin(y^3) = 28$ (b) $x^3 \sin(y^2) = 8$

(c) $x^4 = 16$ (d) $x^4 \sin(y^2) = 16$

22. When the air is passed through an insulated chamber having sprays of water maintained at a temperature higher than the dew point temperature of entering air but lower than the dry bulb temperature, then the air is said to be

(a) cooled and dehumidified
(b) cooled and humidified
(c) heated and humidified
(d) heated and dehumidified

23. In an ideal vapour compression refrigeration cycle, the specific enthalpy of refrigerant in kJ/kg at the following states is given as

Inlet of condenser : 283
Exit of condenser : 116
Exit of evaporator : 232

The COP of the cycle is

(a) 2.27
(b) 2.75
(c) 3.27
(d) 3.75

24. A 10 kg solid at 100°C with a specific heat of 0.8 kJ/kg°C is immersed in 40 kg of 20°C liquid with a specific heat of 4.0 kJ/kg°C. The temperature of the solid after a long time if the container is insulated will be

(a) 30.8 °C
(b) 27.8 °C
(c) 26.3 °C
(d) 23.8 °C

25. In a counter flow heat exchanger, cold fluid enters at 30 °C and leaves at 50 °C, whereas the hot fluid enters at 150 °C and leaves at 130 °C. The mean temperature difference for this case is

(a) 20 °C
(b) 80 °C
(c) 100 °C
(d) 120 °C

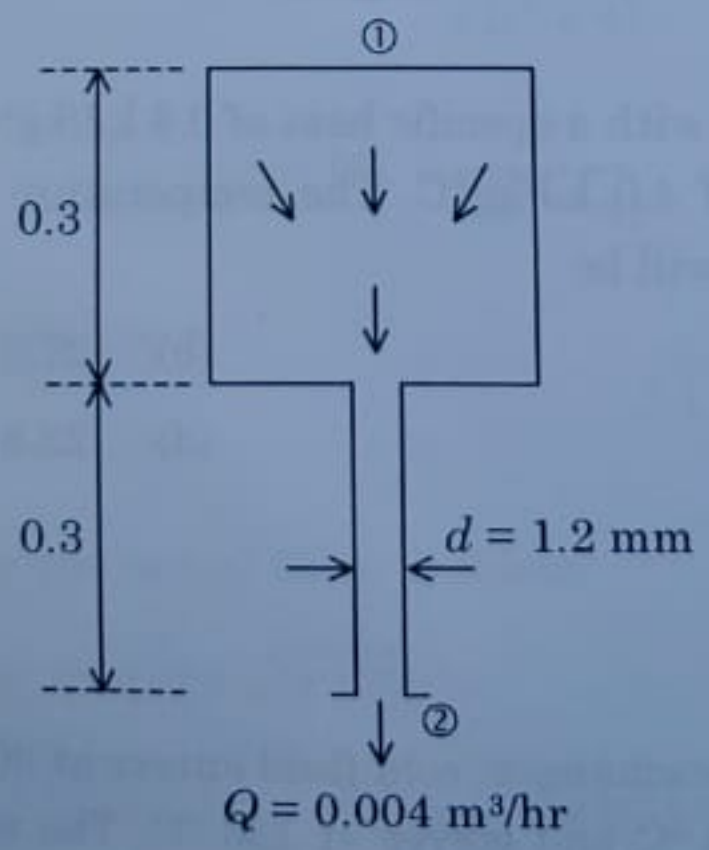
26. Find the change in height (h) in a circular tube (of radius R = 1 mm) filled with liquid (water) with surface tension $T = 0.073$ N/m. Contact angle of water-air-glass interface is 0°

(a) 1.5 cm
(b) 2.5 cm
(c) 0.5 cm
(d) 0.15 cm

27. Oil at 20°C (density = 870 kg/m³ and viscosity = 0.104 kg/m-s) flows (laminar flow) at 1.1 m³/hr through a horizontal pipe with diameter $d = 2$ cm and length $L = 12$ m. Find the power required to cause the flow

(a) 29.7 W
(b) 35.8 W
(c) 15.7 W
(d) 49.8 W

28. A liquid of specific weight (ρg) = 9000 N/m³ flows by gravity from a tank of 0.3 m height through a 1.2 mm diameter capillary tube at a rate of 0.004 m³/hr. as shown in figure. Sections 1 and 2 are at atmospheric pressure. Neglecting entrance effects and friction in the large tank, compute the viscosity of the liquid. Assume kinetic energy correction factor $\alpha = 2.0$.



(a) 8.9×10^{-4} kg/m-s
(b) 10×10^{-4} kg/m-s
(c) 6.9×10^{-4} kg/m-s
(d) 3×10^{-3} kg/m-s

29. An electric cable of Aluminum conductor of thermal conductivity 240 W/mK is to be insulated with rubber of thermal conductivity 0.15 W/mK. The cable is to be located in air of heat transfer coefficient of 6 W/m^{2}K. The critical thickness of insulation will be

(a) 25 mm
(b) 40 mm
(c) 150 mm
(d) 160 mm

30. The power per tonne of refrigeration (in kW) is

(a) 3.5/COP
(b) COP/3.5
(c) 3.5 × COP
(d) None of these

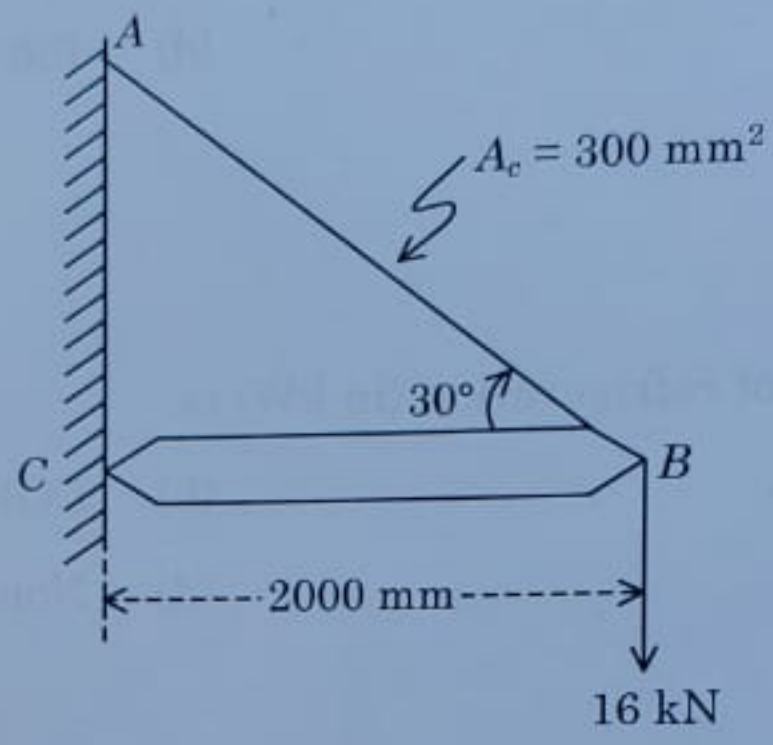
31. A bag house is to be designed to handle 1000 m^3/min of air. The filtration takes place at constant pressure so that the air velocity through each bag decreases during the time between cleaning according to the relation $u = \frac{1}{0.267 + 0.08t}$ where, u is in m/min of cloth and t is the time in min. The bags are shaken in sequence row by row on a 30 min cycle. Each bag is 20 cm in diameter and 3 m height. The bag house is to be square in cross-section with 30 cm spacing between bags and 30 cm clearance from the walls. Calculate the minimum number of bags required

(a) 663
(b) 753
(c) 553
(d) 883

32. The thermostatic expansion valve operates based on

(a) temperature of the evaporator
(b) pressure in the evaporator
(c) degree of superheat at exit of evaporator
(d) degree of super heat at exit of the compressor

33. A jib crane consists of a rigid beam BC supported by an elastic rod AB and hinged at C. Determine the deflection of the point B when a load of 16 kN is applied. Take $E = 200$ GPa. Area of cross section (A_c) of elastic rod AB is 300 mm^2



(a) 1.23 mm (b) 4.56 mm

(c) 2.46 mm (d) 5.23 mm

34. The heat rejection factor in vapour compression refrigeration system will be

(a) equal to 1

(b) more than 1

(c) less than one

(d) depends on cooling medium of the condenser

35. The power consumption of Vapour Compression Refrigeration System (VCRS) with air cooled condenser compared to VCRS with water cooled system will be higher due to

(a) High discharge temperature

(b) High condensing temperature

(c) Low suction temperature

(d) High refrigeration load

36. During turning a metallic rod at a given condition, the tool life was found to increase from 25 min to 50 min, when Cutting velocity V_c alone was reduced from 141.4 m/min to 100 m/min. How much will be the life of that tool if machined at 353.5 m/min?

(a) 20 min
(b) 15 min
(c) 10 min
(d) 4 min

37. Reciprocating motion of the cutting tool in shaping machines is accomplished by

(a) rack pinion mechanism
(b) crank and connecting rod mechanism
(c) cam and cam follower mechanism
(d) oscillating lever mechanism

38. The job reciprocates in which type of machine

(a) shaping machine
(b) planning machine
(c) slotting machine
(d) drilling machine

39. Estimate the machining time that will be required to finish a vertical flat surface of length 100 mm and depth 20 mm by an 8 teeth HSS (High speed steel) end mill cutter of 32 mm diameter and 60 mm length in a milling machine. Assume cutting velocity (V_c) = 30 m/min and feed (s_0) = 0.12 mm/tooth. Take approach and run over both 2 mm

(a) 0.4 minutes
(b) 0.6 minutes
(c) 0.8 minutes
(d) 1.0 minute

40. Which of the following is not generally machined by Ultra Sonic Machining (USM)?

(a) Copper
(b) Glass
(c) Silicon
(d) Germanium

41. The blade height of axial compressor decreases in axial direction to maintain

(a) Maximum mass flow rate
(b) Lower mass flow rate
(c) Constant speed
(d) Constant mass flow rate

42. The T joint of steel plates which is subjected to 350 kN load is developed using intermitted 4 double fillet welds of length each of 40 mm at an interval of 100 mm. Allowable shear strength of the weld metal is 100 MPa. Determine the leg length of the weld

(a) 12.45 mm
(b) 15.45 mm
(c) 17.25 mm
(d) 20.25 mm

43. Shaping grey cast iron will produce

(a) Continuous chip with Built Up Edge (BUE)
(b) Continuous chip without Built Up Edge (BUE)
(c) Discontinuous chip of irregular size and shape
(d) Discontinuous chip of regular size and shape

44. For same tool-work materials and speed, feed and depth of cut, the average cutting temperature will decrease

(a) with the increase in principal cutting edge angle (ϕ)
(b) with the decrease in principal cutting edge angle (ϕ)
(c) with the increase in auxiliary cutting edge angle (ϕ_1)
(d) with the decrease in auxiliary cutting edge angle (ϕ_1)

45. Extreme Pressure Additive (EPA) is mixed with cutting fluid for improving its power of

(a) cooling
(b) lubrication
(c) cleaning of cutting zone
(d) protection of machined surface

46. Equation of the line normal to function $f(x) = (x-8)^{2/3} + 1$ at $P(0,5)$ is

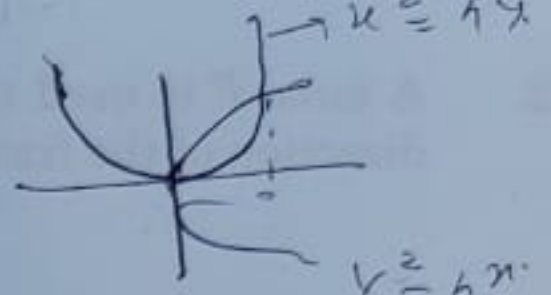
(a) $y = 3x - 5$ (b) $y = 3x + 5$

(c) $3y = x + 15$ (d) $3y = x - 15$

47. The area enclosed between the curves $y^2 = 4x$ and $x^2 = 4y$ is

(a) 16/3 (b) 8

(c) 32/3 (d) 16



48. The Laplace transform of e^{i5t} where $i = \sqrt{-1}$, is

(a) $\dfrac{s-5i}{s^2-25}$ (b) $\dfrac{s+5i}{s^2+25}$

(c) $\dfrac{s+5i}{s^2-25}$ (d) $\dfrac{s-5i}{s^2+25}$

49. If $y = f(x)$ is the solution of $\dfrac{d^2y}{dx^2} = 0$, with the boundary conditions $y = 5$ at $x = 0$ and $\dfrac{dy}{dx} = 2$ at $x = 10, f(15) =$

(a) 15 (b) 25

(c) 35 (d) 5

50. Given two complex numbers $z_1 = 5 + (5\sqrt{3})i$ and $z_2 = \dfrac{2}{\sqrt{3}} + (2)i$, the argument of z_1 / z_2 in degree is

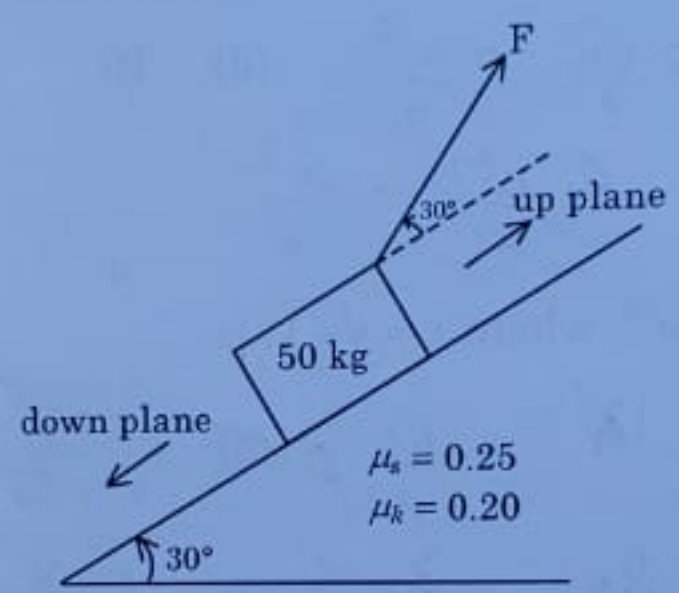
(a) 0 (b) 30

(c) 60 (d) 90

51. Two cantilever beams, '*A*' carrying pointed load of '*W*' at free end and the other '*B*' carrying uniformly distributed load totaling to '*W*'. The ratio of maximum deflection of beam *A* to that of beam *B* is

(a) 3/8
(b) 8/3
(c) 6/15
(d) 15/6

52. A force *F* is used to pull a 50 kg block, as shown in Figure. Determine the magnitude and direction of the friction force when $F = 400$ N



(a) 45 N up the plane
(b) 80 N up the plane
(c) 45 N down the plane
(d) 80 N down the plane

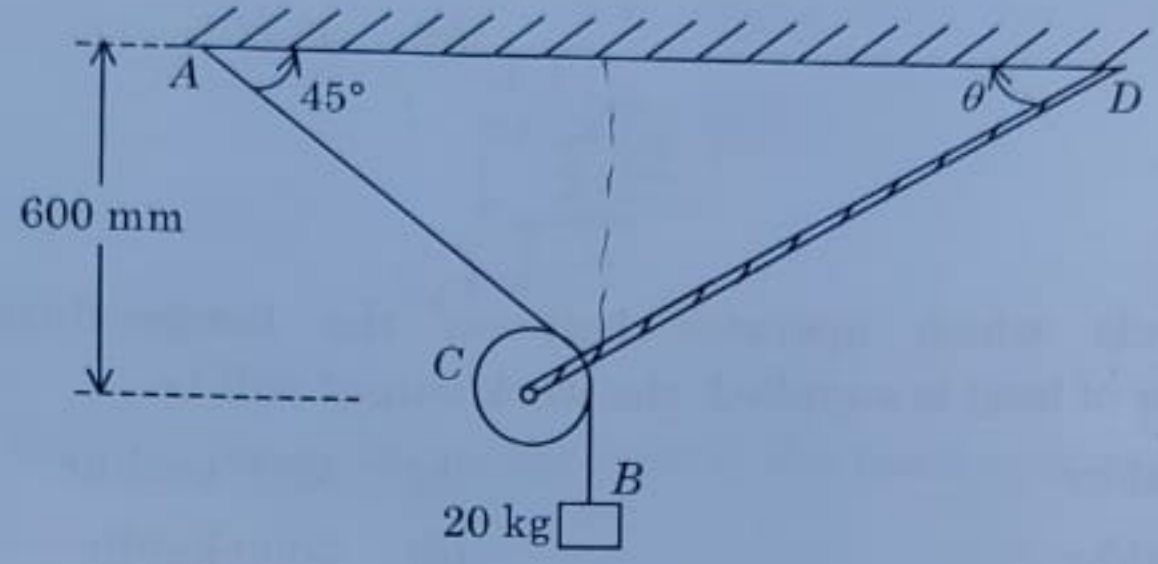
53. When a beam is subjected to bending moment alone, the bending stress at any point from the neutral axis

(a) equal
(b) varies directly proportional with respect to distance from neutral axis
(c) varies inversely proportional with respect to distance from neutral axis
(d) stress is independent of the distance

54. A fabric filter is to be constructed using bags that are 0.1 m in diameter and 5.0 m long. The bag house is to receive 5 m^3/s of air. Filtering velocity is 2.0 m/min. Determine the minimum number of bags required for a continuous removal of particulate matter.

(a) 96
(b) 106
(c) 78
(d) 88

55. A load of 20 kg is supported as shown in fig. Assuming the pulley to be ideal and the equilibrium configuration as shown in Figure, determine the tension in cable *CD*



(a) 250 N

(b) 200.4 N

(c) 150.2 N

(d) 100 N

56. Liquid sub cooler in Vapour Compression Refrigeration System will

(a) Prevent the entry of liquid into compressor

(b) Increases Net Refrigeration Effect

(c) Reduce work of compression

(d) Increase work of compression



57. A pump having an efficiency of 68% delivers 3 L/s of water against a head of 22 m. Compute the power requirement of the pump in *W*

(a) 952

(b) 850

(c) 1050

(d) 752

58. A heat engine is supplied heat at the rate of 1700 kJ/min and gives an output of 9 kW. The thermal efficiency will be around

(a) 31.76%
(b) 35.76%
(c) 42.85%
(d) 45.85%

59. A Carnot cycle which operates between the temperatures of 400K and 300K. If 20000 kcal/hr of heat is supplied, the work output will be

(a) 3000 kcal/hr
(b) 4000 kcal/hr
(c) 5000 kcal/hr
(d) 6000 kal/hr

60. A solid shaft of diameter 'D' carries a twisting moment that develops maximum shear stress τ. If this shaft is replaced by a hollow one of outside diameter D and inside diameter $D/2$, then the maximum shear stress will be

(a) 1.067 τ
(b) 1.145 τ
(c) 1.335 τ
(d) 2 τ

61. A square beam and a circular beam of same material have the same length, same allowable stress and the same bending moment. The ratio of weights of the square beam to that of circular beam is

(a) 1/2
(b) 1
(c) 1/1.12
(d) 1/3

62. A circular shaft subjected to torsion undergoes a twist of 1° in a length of 120 cm. If the maximum shear stress induced is limited to 1000 kg/cm^2 and if the modulus of rigidity, $G = 0.8 \times 10^6$ kg/cm^2, then the radius of shaft in cm should be

(a) $\frac{\pi}{18}$
(b) $\frac{\pi}{27}$
(c) $\frac{18}{\pi}$
(d) $\frac{27}{\pi}$

63. Air flows isentropically through a duct. At a section, the area is 0.05 m^2, velocity $v = 180$m/s and temperature $T = 470$ K. Compute the stagnation temperature T_0

(a) 486 K
(b) 286 K
(c) 556 K
(d) 508 K

64. Which of the following element in the refrigerant is the main contributing factor for ozone depletion of the stratosphere?

(a) Carbon
(b) Chlorine
(c) Fluorine
(d) Hydrogen

65. A fan running at 720 rpm develops static pressure of 12 mm. If the speed of the fan is doubled the static pressure developed will be

(a) 24 mm
(b) 12 mm
(c) 48 mm
(d) 96 mm

66. The Apparatus Dew Point (ADP) for the cooling coil of an air conditioning system with high latent load compared to a system with high sensible load will be

(a) More
(b) Less
(c) Remains same
(d) Depends on air flow through the coil

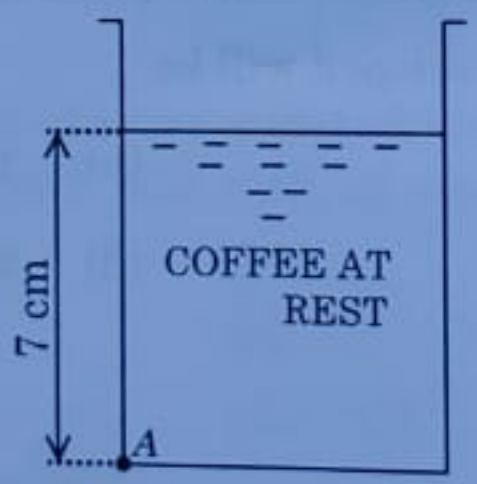
67. Gasoline at 20°C (density = 680 kg/m³) is pumped through a smooth 12 cm diameter pipe, 10 km long, at a flow rate of 75 m³/hr. The inlet is fed by a pump at an absolute pressure of 24 atm. The exit is at standard atmospheric pressure and is 150 m higher. Estimate frictional head loss h_f.

(a) 199 m
(b) 299 m
(c) 99 m
(d) 399 m

68. Oil at 20°C (density = 870 kg/m³ and viscosity = 0.104 kg/m-s) flows at 1.1 m³/hr through a horizontal pipe with diameter d = 2 cm and length L = 12 m. Find the Reynolds number for the flow.

(a) 104
(b) 163
(c) 208
(d) 78

69. A person rests her coffee mug on a horizontal tray while she accelerates at $\frac{10}{\sqrt{3}}$ m/s². The mug is 10 cm deep and 6 cm in diameter and contains coffee 7 cm deep at rest. Assuming rigid body acceleration, calculate gauge pressure in the bottom corner point A as shown in figure if density of coffee is 1010 kg/m³. Assume acceleration due to gravity g = 10 m/s².



(a) 965 Pa
(b) 1005 Pa
(c) 865 Pa
(d) 765 Pa

70. A process in which the working substance neither receives nor gives out heat to its surroundings during its expansion or contraction is called

(a) Isothermal process
(b) Isentropic process
(c) Polytrophic process
(d) Adiabatic process

71. A two stage centrifugal compressor operating at 3000 rpm is to compress refrigerant R134a from an evaporator temperature of 0°C (h_i = 398.6 kJ/kg) to a condensing temperature of 32°C (h_e = 419.8 kJ/kg). If the impeller diameter of both the stages have to be same, what is the diameter of the impeller?

Assume suction condition to be dry saturated, compression process isentropic, impeller blades radial and refrigerant enters impeller radially

(a) 0.65 m (b) 0.8 m

(c) 1.0 m (d) 1.5 m

72. Water with specific heat (c_p = 4 kJ/kgK) is fed to a boiler at 30°C, the enthalpy of vaporization at atmospheric pressure in the boiler is 2400 kJ/kg, the steam coming from the boiler is 0.9 dry. The net heat supplied (in kJ/kg) in the boiler is

(a) 2160 (b) 2400

(c) 2440 (d) 2280

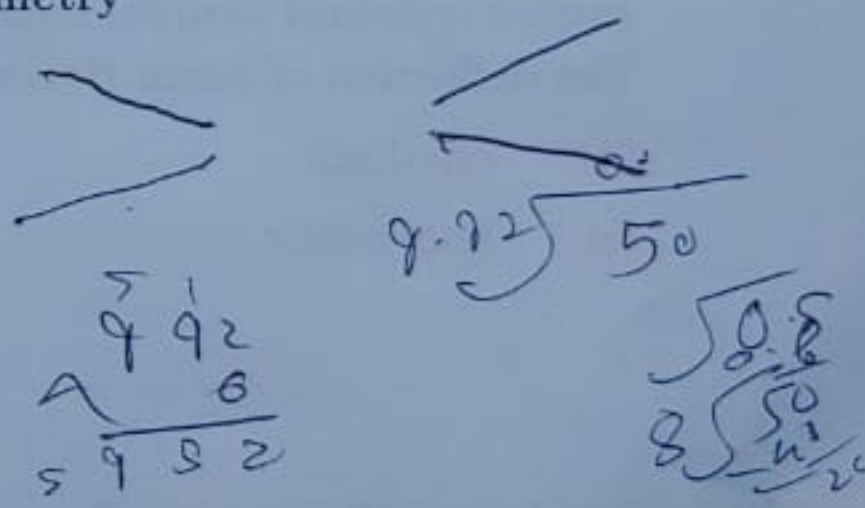
73. Subsonic and supersonic diffusers have the following geometry

(a) Divergent and convergent respectively

(b) Both divergent

(c) Both convergent

(d) Convergent and divergent respectively



74. The isentropic heat drop in the nozzle of an impulse steam turbine with nozzle efficiency 0.9, blade velocity ratio 0.5 and mean blade velocity 150 m/s in kJ/kg is

(a) 50 (b) 40

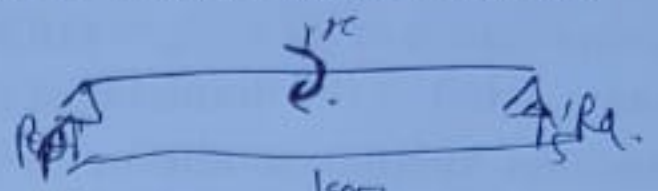
(c) 60 (d) 70

75. Consider a simple gas turbine (Brayton cycle) and a gas turbine with perfect regeneration. In both the cycles, the pressure ratio is 8 and the ratio of specific heats of working medium is 1.5. The ratio of minimum to maximum temperature is 0.2 (with temperature in K) in the regenerative cycle. The ratio of the thermal efficiency of the simple cycle to that of regenerative cycle is

(a) 0.63 (b) 0.73

(c) 0.83 (d) 0.93

76. A simply supported beam PQ is loaded by a moment of 1 kN-m at the mid span of the beam of length 1 m. The reaction forces R_p and R_q at supports P and Q respectively are



(a) 1 kN downward, 1 kN upward
(b) 0.5 kN upward, 0.5 kN downward
(c) 0.5 kN downward, 1 kN upward
(d) 0.5 kN upward, 0.5 kN upward

77. Two solid shafts 'A' and 'B' are made of the same material. The shaft 'A' is 50 mm diameter and shaft 'B' is 100 mm diameter. The ratio of strength of shaft 'B' compared to shaft 'A' is

(a) 1/2
(b) 2
(c) 4
(d) 8

78. Two simply supported beams 'A' and 'B' of same breadth and depth and same material carries constant central load W at the centre. The span of beam B is double that of beam A. The deflection of beam B compared to beam A will be

(a) one-half
(b) one-eighth
(c) four times
(d) eight times

79. In a beam where shear force changes its sign, the bending moment will be

(a) minimum
(b) zero
(c) maximum
(d) same as shear force

80. The rectangular beam 'A' has length l, width b and depth d. Another beam 'B' of same material has the same length and width but depth is double that of 'A'. The elastic strength of beam B compared to that of A will be

(a) same
(b) double
(c) four times
(d) six times