	INDIAN SPACE RESEARCH ORGANISATION	SET A
इसरो isro	REFRIGERATION AND AIR-CONDITIONING	

1. Carnot Cycle consists of

   (a) Two constant pressure and two isentropic processes

   (b) One constant isenthalpic, one constant volume and two constant pressure processes

   (c) Two isothermal and two isentropic processes

   (d) One constant pressure, one constant volume and two isothermal processes

2. One reversible heat engine operates between 1600°K and T_2°K and another reversible heat engine operates between T_2°K and 400°K. If both the engines have the same heat input and output, then temperature T_2 is equal to

   (a) 800 K (b) 1600 K

   (c) 1200 K (d) 6400 K

3. Isentropic flow is

   (a) Reversible adiabatic flow

   (b) Irreversible adiabatic flow

   (c) Frictionless fluid flow

   (d) Reversible isothermal flow

4. Reversed Joule cycle is known as

   (a) Rankine cycle (b) Carnot cycle

   (c) Bell-Coleman cycle (d) Otto cycle

5. The thermal efficiency of Gas turbine plant is

   (a) $r^{\gamma-1}$ (b) $1-r^{\gamma-1}$

   (c) $1-(1/r)^{\gamma/(\gamma-1)}$ (d) $1-(1/r)^{(\gamma-1)/\gamma}$

   Where r is pressure ratio and γ is relation between specific heats.

6. A 100 W electric bulb was switched on in a 2.5 m × 3m × 3 m size thermally insulated room having temperature of 20°C. The room temperature at the end of 24 hrs. will be

(a) 100°C (b) 470°C

(c) 370°C (d) 600°C

Consider density and specific heat of air as 1.2 kg/m^3 and 0.718 kW/°C/kg

7. A solar energy based heat engine which receives 80 kJ of heat at 100°C and rejects 70 kJ of heat to the ambient at 30°C is to be designed. The thermal efficiency of heat engine is

(a) 70% (b) 18.8%

(c) 12.5% (d) cannot be calculated

8. A mixure of gases expand from 0.03 m^3 to 0.06 m^3 at constant pressure of 1 MPA and absorb 84 kJ of heat during the process. The change in internal energy of the mixture is

(a) 54 kJ (b) 30 kJ

(c) 84 kJ (d) 110 kJ

9. If the concentrated load applied at the free end of a cantilever beam is doubled along with its length and moment of inertia also, then the deflection at free end will increase by

(a) 2 times (b) 4 times

(c) 8 times (d) 12 times

10. In the case of a beam simply supported at both ends, if the same load instead of being concentrated at centre is distributed uniformly throughout the length, then deflection at centre will get reduced by

(a) 1/2 times (b) 1/4 times

(c) 5/8 times (d) 3/8 times

11. If the Bending moment is increased three times, then to keep the stress in the beam same, sectional modulus shall be

(a) decreased 3 times (b) increased 3 times

(c) unchanged (d) increased 6 times

12. A beam with rectangular section of 120 mm × 40 mm is placed horizontally by mistake, (with width as 120 mm and depth as 40 mm) whereas it was designed to be placed vertically. (with width as 40 mm and depth as 120 mm). The ratio of section modulus will be

(a) 1/3 (b) 1/2

(c) 1/6 (d) 1/8

13. If a shaft is required to transmit twice the power at twice the speed for which it is designed, its diameter must

(a) increase two times (b) reduce two times

(c) remain same (d) increase three times

14. The strength of a hollow shaft in comparison to solid shaft, both having outer diameter D and inner diameter of hollow shaft as D/2 is

(a) Half (b) $7/8^{th}$

(c) 15/16 times (d) Remain same

15. Steel bar of 40 mm × 40 mm square section is subjected to an axial compressive load of 200 kN. If the length of the bar is 2 m and E (Youngs modulus) = 200 GPa. The elongation of bar will be

(a) 5.4 mm (b) 1.25 mm

(c) 2.7 mm (d) 3.4 mm

16. The shear force diagram for a simply supported beam carrying uniformly distributed load of w per unit length, consists of

(a) One right angled triangle

(b) One equilateral triangle

(c) Two right angled triangle

(d) Two rectangles

17. The power transmitted by a shaft 60 mm diameter at 180 RPM, if the permissible stress is 85 N/mm^2

(a) 68 kW (b) 650 KW

(c) 1200 kW (d) 7 KW

18. A material has a young's modulus of 1.25×10^5 N/mm^2 and a poisson's ratio of 0.25. The bulk modulus of the material will be

(a) 83×10^5 N/mm^2 (b) 0.83×10^5 N/mm^2

(c) 8.3×10^3 N/mm^2 (d) 8.3×10^5 N/mm^2

19. Neutral solution is one which has pH value

(a) Greater than 7 (b) Equal to 7

(c) Less than 7 (d) None of the above

20. Forced feed lubrication system means that oil is delivered to the engine by

(a) Gravity

(b) Pressure created by oil pump

(c) Splashing of the crank shaft

(d) None of the above

21. The purpose of thermostat in an engine cooling system is to

(a) Indicate coolant temperature

(b) Prevent coolant from boiling

(c) Allow the engine to warm up quickly

(d) Pressurize coolant for effective cooling

22. In a boiler, feed water supplied per hour is 205 kg while coal fired per hour is 23 kg. The net enthalpy rise per kg of water is 145 kj. If the calorific value of coal is 2050 kj/kg, then boiler efficiency will be

(a) 56% (b) 75%

(c) 48% (d) 63%

23. A throttle governed steam engine develops 15 kW with 280 kg power of steam and 35 kW with 520 kg per hour of steam. The steam consumption in kg per hour when developing 20 kW of power will be nearly

(a) 340 kg/hr (b) 150 kg/hr

(c) cannot be calculated (d) 280 kg/hr

24. A fluid which obeys Newton's law of viscosity is termed as

(a) Real fluid (b) Newtonian fluid

(c) Non-Newtonian fluid (d) Ideal fluid

25. A water tank contains 1.3 m deep water. The pressure exerted by water per metre length of tank is

(a) 8.29 kN (b) 18.29 kN

(c) 28.9 kN (d) 0.28 kN

26. The gauge pressure at the surface of a liquid of density 900 kg/m^3 is 0.4 bar. If the atmospheric pressure is 1×10^5 pa, the absolute pressure at a depth of 50 M is

(a) 5.81 bar (b) 15.8 bar

(c) 25.8 bar (d) 0.5 bar

27. In Hydro-Electric plants, power transmitted through pipe is maximum when the head lost due to friction is

(a) One fourth of the total supply head

(b) One half of the total supply head

(c) One third of the total supply head

(d) Two third of the total supply head

28. Reynolds number is ratio of Inertial forces to

(a) Elastic force (b) Surface tension

(c) Critical velocity (d) Viscous force

29. A pelton wheel develops 1750 kW under a head of 100 mts while running at 200 rpm and discharging 2500 litres of water per sec. The unit power of wheel will be

(a) 3.75 kW (b) 0.75 kW

(c) 1.75 kW (d) 0.25 kW

30. Power required to drive a centrifugal pump is

(a) Directly proportional to speed of its impeller

(b) Directly proportional to square of the speed of its impeller

(c) Directly proportional to cube of the speed of its impeller

(d) Inversely proportional to cube of the speed of its impeller

31. The specific speed of a centrifugal pump delivering 810 Litres of water per sec. against head of 16 mts. at 725 RPM is

(a) 81 RPM (b) 810 RPM

(c) 40 RPM (d) 16 RPM

32. A centrifugal pump delivers 1000 lts per minute at 2000 RPM against total head of 50 mts. and requires 32 BHP for its operation. If speed is reduced to 1000 RPM, the discharge and head developed will be

(a) 500 lts/min and 25 Mtr

(b) 500 lts/min and 12.5 Mtr

(c) 250 lts/min and 12.5 mtr

(d) 250 lts/min and 25 mtr

33. A flow is said to be supersonic, if the

(a) If the velocity of flow is very high

(b) Mach number is between 1 and 6

(c) Mach number is more than 6

(d) If the discharge is difficult to measure

34. Fouling factor is used in heat exchangers due to

(a) Factor in case of Newtonian fluids

(b) Safety factor in design

(c) Due to fluid leakage

(d) When liquid exchanges heat with vapour

35. In a Counter flow heat exchanger design, fluid rates and specific heats were chosen in such a manner that heat capacities of both the fluids are same. A hot fluid enters at 100°C and leaves at 60°C. The cold fluid enters heat exchanger at 40 °C. The mean temperature difference between the two fluids is

(a) 40°C (b) 60°C

(c) 20°C (d) 36.6°C

36. The unit of overall coefficient of heat transfer is:

(a) $W/m^2°K$. (b) W/m^2

(c) W/m°K. (d) W/m

37. The heat transfer by conduction through a thick cylinder of inner radius r_1, outer radius r_2, Higher temperature T_1, lower temperature T_2, length of cylinder l and thermal conductivity k is given by:

(a) $\dfrac{2\pi lk(T_1 - T_2)}{2.3 \log\left(\dfrac{r_2}{r_1}\right)}$

(b) $\dfrac{2.3 \log\left(\dfrac{r_2}{r_1}\right)}{2\pi lk(T_1 - T_2)}$

(c) $\dfrac{2\pi(T_1 - T_2)}{2.3\, lk \log\left(\dfrac{r_2}{r_1}\right)}$

(d) $\dfrac{2\pi lk}{2.3(T_1 - T_2)\log\left(\dfrac{r_2}{r_1}\right)}$

38. According to Stefan-Boltzmann law, the total radiation from black body per second per unit area is directly proportional to the

(a) Absolute temperature

(b) Fourth power of absolute temperature

(c) Cube of the absolute temperature

(d) Square of the absolute temperature

39. In a condenser of a power plant, the steam condenses at temperature of 60°C. The cooling water enters at 30°C and leaves at 45°C. The logarithmic mean temperature difference will be around

(a) 20°C

(b) 80°C

(c) 200°C

(d) 5°C

40. In shell and tube heat exchanger, baffles are mainly used for

(a) Increase the mixing of fluid

(b) Direct the flow in desired direction

(c) Reduce fouling of the tube surface

(d) Increase the heat transfer area

41. For a glass plate, transitivity and reflectivity are specified as 0.86 and 0.08 respectively, the absorptivity of the glass plate is

(a) 0.86

(b) 0.06

(c) 0.08

(d) 1.00

42. A composite slab has two layers of different materials with thermal conductivities k_1 and k_2. If each layer has same thickness, then the equivalent thermal conductivity will be:

(a) $k_1 k_2$ (b) $k_1 + k_2$

(c) $\frac{2k_1 k_2}{(k_1 + k_2)}$ (d) $\frac{(k_1 + k_2)}{k_1 k_2}$

43. The ratio of heat flow Q_1/Q_2 from two walls of same thickness having their thermal conductivities as $K_1 = 2K_2$ will be:

(a) 1 (b) 1/2

(c) 3/4 (d) 2

44. In case of saddle key, power is transmitted by means of

(a) Friction force

(b) Shear resistance of key

(c) Torsional resistance of key

(d) Tensile force

45. The angle of twist for a transmission shaft is inversely proportional to

(a) Shaft diameter

(b) (shaft diameter)^2

(c) (shaft diameter)^3

(d) (shaft diameter)^4

46. Two mating spur gears have 40 and 120 teeth respectively. The pinion transmits at 1200 rpm and transmits a torque of 20 N-m. The torque transmitted by gear is:

(a) 60 N-m (b) 6.6 N-m

(c) 40 N-m (d) 66 N-m

47. The expected life of a ball bearing subjected to a load of 9800 N and operating at 1000 RPM is 3000 hrs. What is the expected life of the same bearing for similar load of 4900 N and speed of 2000 RPM

(a) 12000 hrs.
(b) Remain same
(c) 6000 hrs.
(d) 1500 hrs.

48. Neutral axis of a beam is;

(a) Layer subjected to tensile stress
(b) Layer subjected to compressive stress
(c) Layer subjected to torsion stress
(d) Layer subjected to zero stress

49. A Gas engine has a swept volume of 300 cm^3 and its volumetric efficiency is 0.88 and mechanical efficiency is 0.90. The volume of mixture taken in per stroke is

(a) 248 cm^3
(b) 252 cm^3
(c) 264 cm^3
(d) 286 cm^3

50. The ratio of the brake power to indicated power is called

(a) Overall efficiency
(b) Thermal efficiency
(c) Mechanical efficiency
(d) Volumetric efficiency

51. A heat engine is supplied with 250 kJ/s of heat at a constant fixed temperature of 227°C. The heat is rejected at 27°C. If the cycle is reversible, the amount of heat rejected is :

(a) 150 kJ/s
(b) 200 kJ/s
(c) 273 kJ/s
(d) 185 kJ/s

52. A heat Engine gives an output of 3 kW when the input is 10000 joules/sec. The thermal efficiency of the engine is

(a) 30% (b) 20%

(c) 40% (d) 76.7%

53. A base load power station of capacity 35 MW has annual output of 150×10^6 kWh. The plant capacity factor of the power plant is

(a) 68% (b) 35%

(c) 49% (d) 25%

54. Diesel engine having brake thermal efficiency of 30% and the calorific value of fuel used is 10000 kcal/kg, the brake specific fuel consumption will be

(a) 0.21 kg/HP.hr

(b) 0.29 kg/HP.hr

(c) 0.39 kg/HP.hr

(d) 0.49 kg/HP.hr

55. The control rods in the control system of nuclear reactors are used to

(a) Control fuel consumption

(b) Absorb excess neutrons

(c) Control temperature

(d) None of the above

56. Efficiency of Carnot engine is 80%. If the cycle direction is reversed, what will be the value of COP of reversed Carnot cycle

(a) 0.25 (b) 0.5

(c) 1.25 (d) 1.5

57. If the evaporator temperature of a refrigeration plant is lowered, keeping condensing temperature constant, the horse power requirement of compressor will

(a) Remain same

(b) Increase

(c) Decrease

(d) More or less depending on capacity

58. For Ammonia refrigeration system, the pipe for carrying refrigerant shall be made of following material:

(a) brass (b) copper

(c) steel or wrought iron (d) aluminium

59. In psychrometric chart, relative humidity lines are:

(a) curved (b) horizontal

(c) straight inclined from left to right (d) vertical

60. The operating temperature of a cold storage is –9°C and load for the refrigeration plant is 20 kW for ambient temperature of 24°C. The actual COP of the plant used is one fourth that of ideal plant working between the same temperatures. The power required to drive the plant is:

(a) 2.5 kW (b) 5 kW

(c) 10 kW (d) 3 kW

61. The formation of frost on cooling coils in a refrigerator

(a) Increases heat transfer

(b) Improves COP of the system

(c) Reduces power consumption

(d) Increases power consumption

62. The effect of Sub cooling in a refrigeration cycle will result in

(a) More COP

(b) Less COP

(c) No change in COP

(d) More power consumption

63. In order to cool and dehumidify a stream of moist air, it must be passed over the coil at a temperature

(a) Which lies between dry bulb and wet bulb temperature of incoming stream

(b) Which lies between wet bulb and dew point temperature of incoming stream

(c) Which is equal to wet bulb temperature of air

(d) Which is lower than dew point temperature of air

64. In a chemical dehumidification process, the dry bulb temperature of air

(a) Decreases

(b) Remains constant

(c) Increases

(d) Depends on wet bulb temperature

65. The atmospheric air at dry bulb temperature of 15°C enters a heating coil maintained at 40°C. The air leaves the heating coil at 25°C. The by-pass factor of the heating coil is

(a) 0.376 (b) 0.6

(c) 0.4 (d) 0.5

66. A grinding wheel of 150 mm diameter is rotating at 3000 rpm. The grinding speed is :

(a) 15 π m/s (b) 7.5 π m/s

(c) 45 π m/s (d) 450 π m/s

67. The angle made by the face of the tool and the plane parallel to the base of cutting tool is called

(a) Rake angle
(b) Cutting angle
(c) Lip angle
(d) Clearance angle

68. When the metal is removed by erosion caused by rapidly recurring spark discharges between the tool and work, the process is known as

(a) Electro chemical machining
(b) Ultra-sonic machining
(c) Electro-discharge machining
(d) Electro-static machining

69. In order to double the period of a simple pendulum, the length of the string should be :

(a) Halved
(b) Doubled
(c) Tripled
(d) Quadrupled

70. In a multiple V-belt drive system, when a single belt is damaged, it is preferable to change the complete set in order to

(a) reduce vibration
(b) reduce slip
(c) ensure proper alignment
(d) ensure uniform loading

71. Mohan is five times older than his son. After 4 years the sum of their ages will be 44 years. Find the present age of Mohan?

(a) 42 years
(b) 30 years
(c) 25 years
(d) 40 years

72. For a sphere of radius 10 cm, the numerical value of surface area is what percent of numerical value of its volume?

(a) 40 (b) 25

(c) 12.5 (d) 30

73. A man bought a house and a cart. If he sells the house at 10% loss and cart at 20% gain, he will not lose anything. But, if he sells the house at 5% loss and cart at 5% gain he would lose Rs.100. The amount paid by him for the house and cart will be?

(a) Rs.2000 and Rs.4000

(b) Rs. 400 and Rs. 200

(c) Rs. 200 and Rs.400

(d) Rs. 4000 and Rs. 2000

74. Average marks of 15 students in a class is 145, maximum marks being 150. If two lowest scores are removed, the average increases by 5. Also two lowest scores are consecutive multiples of 9. What is the lowest score in the class?

(a) 126 (b) 108

(c) 117 (d) None of the above

75. In a mixture of wheat and barley, wheat is 60% of 400 kg of mixture. Further, some quantity of barley is added and percentage of wheat becomes $53\frac{1}{3}\%$. How many kg of barley is added?

(a) 25 (b) 50

(c) 80 (d) 40

76. I see an object 3 kms to east and 4 kms to north. It appears to be moving at 1 km per minute in south west direction. At what speed (km per minute) is it getting closer to me?

(a) $\frac{1}{5\sqrt{2}}$ (b) $\frac{1}{5}$

(c) $\frac{7}{5\sqrt{2}}$ (d) $\frac{7}{5}$

77. Eigen values of a 4×4 matrix [A] are given as 2, –3, 13 and 7. Then, what is the value of |det[A]|?

(a) 25 (b) 19

(c) –546 (d) 546

78. The mean value of a function $f(x)$ from point 'a' to point 'b' is given by

(a) $\dfrac{f(a)+f(b)}{2}$

(b) $\dfrac{f(a)+2f\left(\dfrac{a+b}{2}\right)+f(b)}{4}$

(c) $\int_a^b f(x)\,dx$

(d) $\dfrac{\int_a^b f(x)\,dx}{(b-a)}$

79. The area of a circle of radius 'a' can be found by following integral

(a) $\int_a^b (a^2+x^2)\,dx$ (b) $\int_0^{2\pi} \sqrt{(a^2-x^2)}\,dx$

(c) $4\times\int_0^a \sqrt{(a^2-x^2)}\,dx$ (d) $\int_0^a \sqrt{(a^2-x^2)}\,dx$

80. In a box there are 5 red balls, 3 blue balls and 2 green balls. If a ball is selected at random what is the probability that it is blue or green?

(a) 2/5 (b) 1/3

(c) 9/10 (d) 1/2

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