MECHANICAL ENGINEERING

PAPER-II

1. When can a piezometer be not used for pressure measurement in pipes?
   a. The pressure difference is low
   b. The velocity is high
   c. The fluid in the pipe is a gas
   d. The fluid in the pipe is highly viscous
2. Which phenomenon will occur when the value at the discharge end of a pipe connected to a reservoir is suddenly closed?
   a. Cavitation
   b. Erosion
   c. Hammering
   d. Surging
3. For linear distribution of velocity in the boundary layer on a flat plate, what is the ratio of displacement thickness (δ^*) to the boundary layer thickness (δ)?
   a. $\frac{1}{4}$
   b. $\frac{1}{3}$
   c. $\frac{1}{2}$
   d. $\frac{1}{5}$
4. Consider the following statements:
   1. For achieving dynamic in model studies on ships, Froude numbers are equated.
   2. Reynolds number should be equated for studies on an aerofoil for dynamic similarity.
   3. In model studies on a spillway, the ratio of width to height is equated for kinematics similarity.

   What of the statements given above are correct?
   a. 1,2 and 3
   b. 1 and 2
   c. 2 and 3
   d. 1 and 3
5. How is the best hydraulic channel cross-section defined?
   a. The section with minimum roughness coefficient.
   b. The section that has a max urn area of a given flow
   c. The section that has a minimum wetted perimeter
   d. The section that has maximum wetted area
6. Consider the following statements:

   In the case of convergent nozzle for compressible flow,
   1. No shock wave can occur at, any pressure ratio.
   2. No expansion wave can occur below a certain pressure ratio.
   3. Expansion wave can occur below a certain pressure ratio.
   4. Shock wave can occur above a certain pressure ratio.

   Which of the following statements given above are correct?
   a. 1 and 2
   b. 3 and 4
   c. 1 and 3
   d. 2 and 4
7. Which one of the following is the condition for stable equilibrium for a floating body?
   a. The met center coincides with the centre of gravity
   b. The met centre is below the centre of gravity
   c. The met centre is above the centre of gravity
   d. The centre of buoyancy is below the centre of gravity
8. Which of the following assumptions /conditions are true in the case of Rayleigh flow?
   1. Perfect gas.
   2. Constant area duct.

3. Steady one-dimensional real flow.
4. Heat transfer during the flow.

Select the correct answer using the code given below:

a. 1,2 and 3
b. 2,3 and 4
c. 1, 3 and 4
d. 1, 2 and 4

9. If the cross-section of a nozzle is increasing in the direction of flow in supersonic flow then in the downstream direction
   a. Both pressure and velocity will increase
   b. Both pressure and velocity will decrease
   c. Pressure will increase but velocity will decrease
   d. Pressure will decrease but velocity will increase
10. The entropy of a mixture of ideal gases is the sum of the entropies of constituents evaluated at:
   a. Temperature and pressure of the mixture
   b. Temperature of the mixture and the partial pressure of the constituents
   c. Temperature and volume of the mixture
   d. Pressure and volume of the mixture
11. A passive method to keep the house comfortably warm by solar conditioning in cold climatic condition is to paint the :
   a. Eastern wall of the house by black paint on its outer side
   b. Eastern wall of the house by back paints on its inner side
   c. Southern wall of the house by black paint on its outer side
   d. Southern wall of the house by black paint on its inner side.
12. An air-conditioned room of volume 10 m^3 has infiltration of air equivalent to 3 air changes per hour. Density of air is 1.2 kg/m^3, specific heat c_p is 1 kJ/kg K and temperature difference between room and ambient air is 20 K. What is the sensible heat load due to infiltrated air?
   a. 60 kJ/hour
   b. 12 kJ/hour
   c. 0.45 kW
   d. 0.2 kW
13. On which factor(s), does the, heat lost by the human body in the process of radiation depend?
   a. Temperature only
   b. Temperature and air motion
   c. Temperature and relative humidity
   d. Relative humidity and air motion
14. Which one of the following statements is correct?

   The optimum effective temperature for human comfort is:

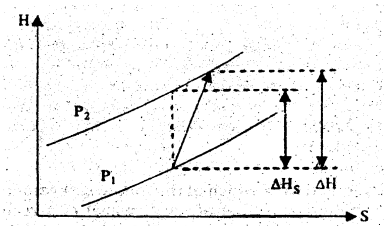
   a. Higher in winter than that in summer
   b. Lower in winter than that in summer
   c. Same m winter and summer
   d. Not dependent on season.
15. Which one of the following causes lift on an Immersed body in a fluid stream?
   a. Buoyant forces
   b. Resultant fluid force on the body
   c. Dynamic fluid force component exerted on the body parallel to the approach velocity
   d. Dynamic fluid force component exerted on the body to the approach velocity
16. If for a flow a stream function ψ exists and satisfies the Lap lace equation, then which one of the following is the correct statement?
   a. The continuity equation is satisfied and the flow is irrigational
   b. The continuity equation is satisfied and the flow is rotational
   c. The flow is irrigational but does not satisfy the continuity equation
   d. The flow is rotational
17. When a vertical cylindrical vessel containing water is rotated about Its axis, then the free surface of water becomes:
   a. A cycloid of revolution
   b. An ellipsoid of revolution
   c. A hyperboloid of revolution
   d. A parabolic of revolution
18. Which one of the following Statements is comet?

   The pressure centre is:

   a. The centroid of the pressure prism

b. A point on the line of action of the resultant force
c. At the centroid of the submerged area
d. Always above the centroid of the area

19.



Which one of the following expresses the isentropic efficiency η of the compression process in terms of enthalpy changes as indicated in the figure given above?

a. $\eta = \Delta H_s / \Delta H$
b. $\eta = \Delta H / \Delta H_s$
c. $\eta = (\Delta H - \Delta H_s) / \Delta H$
d. $\eta = (\Delta H - \Delta H_s) / \Delta H_s$

20. While flowing through the rotor blades in an axial flow air compressor, the relative velocity of air:
a. Continuously decreases
b. Continuously increases
c. First increases and then decreases
d. First decreases and then increases

21. Consider the following properties of a fluid:
1. Viscosity
2. Surface tension
3. Capillarity
4. Vapour pressure

Which of the above properties can be attributed to the flow of jet of oil in an unbroken swam?
a. 1 only
b. 2 only
c. 1 and 3
d. 2 and 4

22. Why is a minimum of Net Positive Suction Head required for a hydraulic pump?
a. To prevent cavitations
b. To increase discharge
c. To increase suction head
d. To increase efficiency

23. Which one of the following turbines exhibits a nearly constant efficiency over a 60% to 140% of design speed?
a. Pelton turbine.
b. Francis turbine
c. Deriaz turbine
d. Kaplan turbine

24. When a hydraulic turbine is operated, it is found that it has a high design efficiency and this efficiency remains constant over a wide range of regulation from the design condition. What is the type of this turbine?
a. Pelton
b. Francis
c. Kaplan
d. Propeller

25. The function of which of the following hydraulic devices is analogous to that of the flywheel of a reciprocating engine and an electric storage battery?
a. Hydraulic ram
b. Hydraulic accumulator
c. Hydraulic intensifier
d. Hydraulic jack

26. The Euler's equation of motion is a statement of:
a. Energy balance
b. Conservation of momentum for an in viscid fluid
c. Conservation of momentum for an incompressible flow
d. Conservation of momentum for a real fluid

27. Why is compounding of steam turbines done?
a. To improve efficiency
b. To reduce the speed of rotor
c. To reduce exit losses
d. To increase the. turbine output

28. Consider the following, statements:

Which of the following increase the work ratio in a simple gas turbine plant?
1. Heat exchanger
2. Inter cooling
3. Reheating

Select the correct answer using the code given below:
a. 1 and 2
b. 2 and 3

c. 1 and 3
d. 1, 2 and 3

29. For centrifugal compressors which one of the following is the relationship between pressure coefficient (ϕ_p), slip factor (ϕ_s), work input factor (ϕ_w) and isentropic efficiency (η_a)?

a. $\phi_p = \frac{\phi_s \times \phi_w}{\eta_a}$

b. $\phi_p = \frac{\phi_w}{\phi_s \times \eta_a}$

c. $\phi_p = \phi_s \times \phi_w \times \eta_a$

d. $\phi_p = \frac{\phi_s \times \eta_a}{\phi_w}$

30. Which one of the following statements is not true for a supercritical steam generator?
a. It has a very small drum compared to a conventional boiler
b. A supercritical pressure plant has higher efficiency than a sub critical pressure plant
c. The feed pressure required is very high, almost 1.2 to 1.4 times the boiler pressure
d. As it requires absolutely pure feed water, preparation of feed water is more important than in a sub critical pressure boiler

31. For a real thermodynamic cycle, which one of the following is correct?

a. $\oint ds = 0$

b. $\oint \frac{dQ}{T} < 0$

c. $\oint \frac{dQ}{T} = 0$

d. $\oint ds = 0$

32. The equation relating the following measurable properties : (i) the slope of saturation pressured temperature line, (ii) the latent heal, and (iii) the change In volume during phase transformation; is known as:
a. Maxwell relation
b. Joules equation
c. Clapeyron equation
d. None of the above.

33. Which of the following are intensive properties?
1. Kinetic Energy
2. Specific Enthalpy
3. Pressure
4. Entropy

Select the correct answer using the code. given below:
a. 1 and 3
b. 2 and 3
c. 1, 3 and 4
d. 2 and 4

34. In a Brayton cycle, what is the value of optimum pressure ratio for maximum net work done between temperatures T_1 and T_3, where T_3 is the maximum temperature and T_1 is the minimum temperature?

a. $r_p = \left(\frac{T_3}{T_1}\right)^{\frac{\gamma}{\gamma-1}}$

b. $r_p = \left(\frac{T_3}{T_1}\right)^{\frac{\gamma-1}{2\gamma}}$

c. $r_p = \left(\frac{T_3}{T_1}\right)^{\frac{\gamma}{2(\gamma-1)}}$

d. $r_p = \left(\frac{T_3}{T_1}\right)^{\frac{2(\gamma-1)}{\gamma}}$

35. A Bell-Coleman air refrigeration cycle works as a reversed :
a. Sterling cycle
b. Otto cycle
c. Diesel cycle
d. Brayton cycle

36. Which one of the following cycles has the highest thermal efficiency for given maximum and minimum cycle temperatures?
a. Brayton cycle
b. Otto cycle
c. Diesel cycle
d. Sterling cycle

37. An engine produces 10 kW break power while working with a brake thermal efficiency of 30%. If the calorific value of the fuel used is 40,000 kJ/kg, then what is the fuel consumption?

a. 1.5 kg/hour
b. 3.0 kg/hour
c. 0.3. kg/hour
d. 1.0 kg/hour

38. A 40 kW engine has a mechanical efficiency of 80%. If the frictional power is assumed to be constant with load, what is the approximate value of the mechanical efficiency at 50% of the rated load?
a. 45%
b. 55%
c. 65%
d. 75%

39. Match List I (S.I. Engine Operating Mode) with List II (Approximate A/F Ratio) and select the correct answer using the code given below the Lists:

List I

A. Cold Start
B. Idling
C. Cruising
D. Maximum Power

List II

1. 10:1
2. 16:1
3. 13:1
4. 4:1
5. 20:1

	A	B	C	D
a.	4	3	2	1
b.	2	1	5	3
c.	4	1	2	3
d.	2	3	5	1

40. The knocking tendency in compression ignition engines increases with:
a. Increase of coolant water temperature
b. Increase of temperature of inlet air
c. Decrease of compression ratio
d. Increase of compression ratio

41. Which of the following cannot be caused by a hot spark plug?
1. Pre-ignition
2. Post-ignition
3. Detonation
4. Run-on-ignition

Select the correct answer using the code given below:
a. 1 and 4
b. 2 only
c. 2 and 3
d. 3 only

42. Consider the following statements:
1. Supercharging increases the power output and increases the volumetric efficiency.
2. Supercharging is more suitable for S.I. engines than C.I. engines.
3. The limit of supercharging for an S.I. engine is set by knock while that for a C.I. engine is set by thermal loading.

Which of the statements given above are correct?
a. 2 and 3
b. 1,2 and 3
c. 1 and 3
d. 1 and 2

43. Which one of the following cannot be controlled by a three-way catalytic converter?
a. HC emission
b. CO emission
c. NO_x emission
d. SPM emission

44. The discharge of hydrocarbons from petrol automobile exhaust is minimum when the vehicle is:
a. Idling
b. Cruising
c. Accelerating
d. Decelerating

45. Weight percentage of which one of the following is determined by proximate analysis of coal?
a. Fixed carbon, volatile matter, moisture and ash
b. All solid and gaseous components
c. All solid & gaseous components except volatile matter
d. Fixed carbon and volatile matter

46. Which one of the following fuels can be obtained by fermentation of vegetable matter?
a. Benzene
b. Diesel
c. Gasoline
d. Alcohol

47. For which of the following, reasons, do the indirect injection diesel engines have higher specific output compared to direct injection diesel engines?
    1. They have lower surface to volume ratio.
    2. They run at higher speeds.
    3. They have higher air utilization factor.
    4. They have lower relative heat loss.

    Select the correct answer using the code given below:
    a. 1 and 2
    b. 2 only
    c. 2 and 3
    d. 3 and 4

48. Which one of the following statements is not correct for a regenerative steam cycle?
    a. It increases the thermodynamic efficiency
    b. It reduces boiler capacity for a given output
    c. It reduces temperature stresses in the boiler due to hotter feed
    d. The efficiency increases with increased number of feed heaters

49. Which one of the following is the correct statements?

    The degree of reaction of an impulse turbine:
    1. Is less than zero
    2. Is greater than zero
    3. Is equal to zero
    4. Increases with steam velocity at the inlet

50. Which one of the following is the correct statement?

    To get supersonic velocity of steam at nozzle exit with a large pressure drop across it, the duct must:
    a. converge from inlet to exit
    b. diverge from inlet to exit
    c. first converge to the throat and then diverge till exit
    d. remain constant in cross-section

51. Which one of the following is the correct expression for the propulsion efficiency of a jet plane (neglecting the mass of fuel)?
    a. $\eta_p = \dfrac{2}{\left(\dfrac{V_a}{V_j}\right)+1}$
    b. $\eta_p = \dfrac{2}{\left(\dfrac{V_j}{V_a}\right)+1}$
    c. $\eta_p = \dfrac{2}{\left(\dfrac{V_a}{V_j}\right)-1}$
    d. $\eta_p = \dfrac{2}{\left(\dfrac{V_j}{V_a}\right)-1}$

    (Where V_j = velocity of jet relative to plane, V_a = velocity of the plane)

52. A nuclear unit becoming critical means:
    a. It is generating power to rated capacity
    b. It is capable of generating power much more than the rated capacity
    c. There is danger of nuclear spread
    d. Chain reaction that causes automatic splitting of the fuel nuclei has been established

53. **Assertion (A):** For a mixture of solid, liquid and vapour phases of a pure substance in equilibrium the number of independent intrinsic properties needed is equal to one.

    Reason (R): The three phases can coexist only at one particular pressure.
    a. Both A and R are individually true and R is the correct explanation of A
    b. Both A and R are individually true but R is not the correct explanation of A
    c. A is true but R is false
    d. A is false but R is true

54. **Assertion (A):** Thermodynamic work is path-dependent except for an adiabatic process.

    Reason **(R):** is always possible to take a system from a given initial state to any final state by performing adiabatic work only.
    a. Both A and R are individually true and R is the correct explanation of A
    b. Both A and R are individually true but R is not the correct explanation of A
    c. A is true but R is false

d. A is false but R is true

55. **Assertion (A):** An adiabatic process is always a constant entropy process.

Reason (R): In an adiabatic process there is no heat transfer.

a. Both A and R are individually true and R is the correct explanation of A
b. Both A and R are individually true but R is not the correct explanation of A
c. A is true but R is false
d. A is false but R is true

56. **Assertion (A):** A vane type rotary compressor is a rot dynamic machine.

Reason (R): A rot dynamic machine is one in which a fluid flows freely through the rotating part of the machine.

a. Both A and R are individually true and R is the correct explanation of A
b. Both A and R are individually true but R is not the correct explanation of A
c. A is true but R is false
d. A is false but R is true

57. **Assertion (A):** The buoyant force for a floating body passes through the centroid of the displaced volume.

Reason (R): The force of buoyancy is a vertical force & equal to the weight of fluid displaced.

a. Both A and R are individually true and R is the correct explanation of A
b. Both A and R are individually true but R is not the correct explanation of A
c. A is true but R is false
d. A is false but R is true

58. **Assertion (A):** Gas and stream nozzles are shaped at inlet in such a way that the nozzle converges rapidly over the first portion of its length.

Reason: This shape is provided so that velocity at inlet to the nozzle is negligibly small in comparison with the exit velocity.

a. Both A and R are individually true and R is the correct explanation of A
b. Both A and R are individually true but R is not the correct explanation of A
c. A is true but R is false
d. A is false but R is true

59. **Assertion (A):** A correctly designed convergent divergent nozzle working at designed conditions is always choked.

Reason (R): In these conditions the mass flow through the nozzle is minimum.

a. Both A and R are individually true and R is the correct explanation of A
b. Both A and R are individually true but R is not the correct explanation of A
c. A is true but R is false
d. A is false but R is true

60. **Assertion (A):** Throttle governing is used only are small steam turbines.

Reason (R): At part loads, the efficiency of stream turbine reduces considerably with throttle governing.

a. Both A and R are individually true and R is the correct explanation of A
b. Both A and R are individually true but R is not the correct explanation of A
c. A is true but R is false
d. A is false but R is true

61. **Assertion (A):** In multi-stage compressors, the polytropic efficiency is always greater than the isentropic efficiency.

Reason (R): Higher the pressure rations, the greater is the polytropic efficiency.

a. Both A and R are individually true and R is the correct explanation of A
b. Both A and R are individually true but R is not the correct explanation of A
c. A is true but R is false
d. A is false but R is true

62. A 4-stroke diesel engine, when running at 2000 rpm has an injection duration of 1.5 ms. What is the corresponding duration of the crank angle in degrees?

a. 18°
b. 9°
c. 36°
d. 15°

63. A reversible engine operates between temperatures 900 K & T_2 (T_2 < 900 K), & another reversible engine between T_2 & 400 K(T_2 > 400K) in series. What is the value of T_2 if work outputs of both engine are equal?

a. 600K
b. 625K
c. 650K
d. 675K

64. Match List I with List II and Select the correct answer using the code given below the Lists:

List I

A. Critical point

B. Sublimation

C. Triple point

D. Melting

List II

1. All the three phases-solid, liquid and vapour co-exists in equilibrium
2. Phase change form solid to liquid
3. Properties of saturated liquid and saturated vapour are identical
4. Heating process where solid gets directly transformed to gaseous phase

	A	B	C	D
a.	2	1	4	3
b.	3	4	1	2
c.	2	4	1	3
d.	3	1	4	2

65. A plane wall is 25 cm thick with an area of 1 m^2, and has a thermal conductivity of 0.5 W/mk. If a temperature difference of 60°C is imposed across it, what is the heat flow?

a. 120W

b. 140W

c. 160W

d. 180W

66. Which of the following are boiler mountings?

1. Fusible plug
2. Blow-off cock
3. Steam trap
4. Feed check valve

Select the correct answer using the code given below:

a. 1, 2 and 3

b. 2, 3 and 4

c. 1, 3 and 4

d. 1, 2 and 4

67. Which one of the following .is the correct path of water flow through various components of boiler of a modern thermal power plant?

a. Economizer – boiler drum – water walls – boiler drum – super heater – turbine

b. Economizer – boiler drum – water wall – super heater – turbine

c. Economizer – water walls – boiler drum – super heater – turbine

d. Economizer – water walls – super heater – turbine

68. What does the reversed ideal sterling cycle consist of?

a. Two reversible isothermal processes and two reversible adiabatic processes

b. Two reversible isothermal processes and two reversible isochoric processes

c. Two reversible isobaric processes and two reversible adiabatic processes

d. Two reversible adiabatic processes and two reversible isochoric process

69. Change in internal energy in a reversible process occurring in a closed system is equal to the heat transferred if the process occurs at constant:

a. Pressure

b. Volume

c. Temperature

d. Enthalpy

70. In a poly tropic process, the term $\left(\frac{\gamma - n}{\gamma - 1}\right)\left\{\frac{p_1 v_1 - p_2 v_2}{(n-1)}\right\}$ is equal to:

a. Heat absorbed or rejected

b. Change in internal energy

c. Ratio of $\frac{T_1}{T_2}$

d. Work done during polytrophic expansion

71. A closed system undergoes a process 1-2 for which the values of $Q_{1\text{-}2}$ and $W_{1\text{-}2}$ are +20 kJ and +50 kJ, respectively. If the system is returned to state, 1, and $Q_{2\text{-}1}$ is – –10 kJ, what is the value of the work $W_{2\text{-}1}$?

a. +20kJ

b. – 40kJ

c. – 80 kJ

d. + 40kJ

72. Change in enthalpy .in a closed system is equal to the heat transferred, if the reversible process takes place at constant:

a. Temperature

b. Internal energy

c. Pressure

d. Entropy

73. A Carnot engine operates between 27°C and 327°C. If the engine produces 300 kJ of work, what is the entropy change during heat addition?
   a. 0.5 kJ/K
   b. 1.0 kJ/K
   c. 1.5 kJ/K
   d. 2.0 kJ/K

74. Which one of the following is the steady flow energy equation for a boiler?
   a. $h_1 + \frac{v_1^2}{2gJ} = h_2 + \frac{v_2^2}{2gJ}$
   b. $Q = (h_2 - h_1)$
   c. $h_1 + \frac{v_1^2}{2gJ} + Q = h_2 + \frac{v_2^2}{2gJ}$
   d. $W_s = (h_2 - h_1) + Q$

75. A gas is compressed in a cylinder by a movable piston to a volume one-half of its original volume. During the process, 300 kJ heat left the gas and the internal energy remained same. What is the work done on the gas?
   a. 100 kNm
   b. 150 kNm
   c. 200 kNm
   d. 300 kNm

76. Which of the following is/are reversible process (es)?
   1. Isentropic expansion
   2. Slow heating of water form a hot source
   3. Constant pressure heating of an ideal gas form a constant temperature source
   4. Evaporation of a liquid at constant temperature

   Select the correct answer using the code given below:
   a. 1 only
   b. 1 and 2
   c. 2 and 3
   d. 1 and 4

77. The irreversibility is defined as the difference of the maximum useful work and actual work: $I = W_{\text{max, useful}} - W_{\text{actual}}$. How can this be alternatively expressed?
   a. $I = T_0 (\Delta S_{system} + \Delta S_{surrounding})$
   b. $I = T_0 (\Delta S_{system} - \Delta S_{surrounding})$
   c. $I = T_0 \left(\sqrt{\Delta S_{system}} + \sqrt{\Delta S_{surrounding}}\right)$
   d. $I = T_0 \left(\sqrt{\Delta S_{system}} - \sqrt{\Delta S_{surrounding}}\right)$

78. Air-conditioning has to be done for a hail whose RSH = 50 kW and RLH = 50 kW. There are no other sources of heat addition or leakages. What is the value of the RSHF?
   a. 0.25
   b. 0.5
   c. 0.75
   d. 1.00

79. In order to have a low bypass factor of a cooling coil, the fin spacing and the number of tube rows should be:
   a. Wide apart and high, respectively
   b. Wide apart and low respectively
   c. Close and high respectively
   d. Close and low, respectively

80. Air at dry bulb temperature of 35°C and dew point temperature of 25°C passes through an air washer whose temperature is maintained at 20°C. What is the nature of the process involved?
   a. Cooling and humidification
   b. Sensible cooling
   c. Heating and dehumidification
   d. Cooling and dehumidification

81. When the wet bulb and dry bulb temperatures are equal, which of the following statements is/are correct?
   1. Air is fully saturated.
   2. Dew point temperature is reached.
   3. Partial pressure of vapour equals to the total pressure.
   4. Humidity ratio is 100%.
   a. 1 and 2
   b. 1 only
   c. 1,2 and 3
   d. 2 and 3

82. For an air-conditioned space, RTH = 100 kW, RSHF = 0.75, volume flow rate = 100 m^3/min, and indoor design specific humidity is 0.01 kg/kg of dry air. What is the specific humidity of the supply air?
   a. 0.010
   b. 0.0075

c. 0.005
d. 0.0025

83. Match List I with List II and select the correct answer using the code given below the Lists:

List I

A. Degree of saturation
B. Dry bulb temperature
C. Wet bulb temperature
D. Dew point temperature

List II

1. Measure of latent enthalpy of moist air
2. Measure of total enthalpy of moist air
3. Measure of the capacity of air to absorb moisture
4. Measure of sensible enthalpy of moist air

	A	B	C	D
a.	2	1	3	4
b.	3	4	2	1
c.	2	4	3	1
d.	3	1	2	4

84. Which one of the following is responsible for the operation of a thermostatic expansion value?
a. Pressure changes in evaporator
b. Temperature changes in evaporator
c. Degree of superheat in evaporator
d. Degree of sub cooling in evaporator

85. A refrigeration plant uses a condenser with heat rejection ratio of 1.2. If the capacity of the plant is 210 kJ/min, then what is the value of the COP of the refrigeration point?
a. 3
b. 5
c. 7
d. 9

86. Which is the most suitable type of air refrigeration system for supersonic planes with Mach Number 3 or above?
a. Boot-strap
b. Simple evaporative
c. Regenerative
d. Boot-strap evaporative

87. In an Electrolux refrigerator:
a. Ammonia is absorbed in water
b. Ammonia is a absorbed in hydrogen
c. Hydrogen is evaporated in ammonia
d. Ammonia evaporated in hydrogen

88. A reversed Carnot cycle working as a heat pump has a COP of 7. What is the ratio of minimum to maximum absolute temperatures?
a. 7/8
b. 1/6
c. 6/7
d. 1/7

89. A refrigerator works on reversed Carnot cycle producing a temperature of – 40°C. Work done per TR is 700 kJ per ten minutes. What is the value of its COP?
a. 3
b. 4.5
c. 5.8
d. 7.0

90. A refrigerator based on reversed Car not cycle works between two such temperatures that the ratio between the low and high temperature is 0.8. If a heat pump is operated between same temperature range, then what would be its COP?
a. 2
b. 3
c. 4
d. 5

91. The values of enthalpy at the beginning of compression, at the end of compression and at the end of condensation are 85 kJ/kg, 185 kJ/kg and 210 kJ/kg, respectively. What is the value of the COP of the vapour compression refrigeration system?
a. 0.25
b. 5.4
c. 4
d. 1.35

92. In a 0.5 TR capacity water cooler, water enters at 30°C and leaves at 15°C. What is the actual water flow rate?
a. 50 litres/hour
b. 75 litres/hour
c. 100 litres/hour
d. 125 litres/hour

93. What is the shape factor of a hemispherical body placed on a flat surface with respect to itself?
a. Zero

b. 0.25
c. 0.5
d. 1.0

94. In a vapour compression refrigeration plant, the refrigerant leaves the evaporator at 195 kJ/k and the condenser at 65 kJ/kg. For 1 kg/s of refrigerant, what is the refrigeration effect?
a. 70 KW
b. 100 KW
c. 130 KW
d. 160 KW

95. Consider the following statements:
1. In a carburetor the throttle valve is used to control the fuel supply.
2. The fuel level in the float chambers is to be about 4 to 5 mm below the orifice level of main jet.
3. An idle jet provides extra fuel during sudden acceleration.
4. An idle jet provides extra fuel during sudden acceleration richer with fuel.

Which of the statements given above are correct?
a. 2 and 4
b. 1 and 3
c. 1,2 and 3
d. 2,3 and 4

96. Which one of the following is the correct statements?

For a given centrifugal pump,
a. The discharge varies directly as the speed
b. The head varies inversely as the speed
c. The power varies as the square of the speed
d. The discharge varies as the square of the speed

97. Which of the following combustion chamber design features reduce (s) knocking in S.I. engines?
1. Spark plug located near the inlet valve.
2. T-head
3. Wedge shaped combustion chamber
4. Short flame travel distance

Select the correct answer using the code given below:
a. 1 and 3
b. 3 only
c. 3 and 4
d. 1 and 2

98. A Pelton wheel with single jet rotates at 600 rpm. The velocity of the jet from the nozzle is 100 m/s. if the ratio of the vane velocity to jet velocity is 0.44, what is the diameter of the Pelton wheel?
a. 0.7 m
b. 1.4 m
c. 2.1 m
d. 2.8 m

99. A power plant, which uses a gas turbine followed by steam turbine for power generation is called:
a. Topping cycle
b. Bottoming cycle
c. Brayton cycle
d. Combined cycle

100. In a radial blade centrifugal compressor, the velocity of blade tip is 400 m/s and slip factor is 0.9. Assuming the absolute velocity at inlet to be axial, what is the work done per kg of flow?
a. 36 kJ
b. 72 kJ
c. 144 kJ
d. 360 kJ

101. What should be the ratio of blade speed of jet speed for the maximum efficiency of a Pelton wheel?
a. $\frac{1}{4}$
b. $\frac{1}{2}$
c. $\frac{3}{4}$
d. 1

102. Which of the following types of turbine is/are suitable for tidal power plants?
1. Tubular turbine
2. Kaplan turbine
3. Bulb turbine
4. Francis turbine

Select the correct answer using the code given below:
a. 1 only
b. 1 and 3
c. 2 and 4

d. 4 only

103. If α is the blade angle at the outlet, then the maximum hydraulic efficiency of an ideal impulse turbine is:

a. $\frac{1+\cos\alpha}{2}$

b. $\frac{1-\cos\alpha}{2}$

c. $\frac{1-\sin\alpha}{2}$

d. $\frac{1+\sin\alpha}{2}$

104. Which one of the dimensionless numbers identifies the compressibility effect of a fluid?

a. Euler number
b. Froude number
c. Mach number
d. Weber number

105. A U-tube open at both ends and made of 8 mm diameter glass tube mercury up to a height of 10 cm in both the limbs. If 19 cm^3 of water is added to one of the limbs, what is the difference in mercury levels in the two limbs at equilibrium?

a. 4.5 mm
b. 1.0 mm
c. 2.8 mm
d. 3.2 mm

106. A 4-row velocity compounded steam turbine develops total 6400 kW. What is the power developed by the last row?

a. 200 kW
b. 400 kW
c. 800 kW
d. 1600 kW

107. Which one of the following is the fire-tube boiler?

a. Babcock and Wilcox boiler
b. Locomotive boiler
c. Sterling boiler
d. Benson boiler

108. Intensity of radiation at a surface in perpendicular direction is equal to:

a. Product of emissive of surface and $1/\pi$
b. Product of emissive of surface and π
c. Product of emissive power of surface and $1/\pi$
d. Product of emissive power of surface and π

109. In amass transfer process of diffusion of hot smoke in cold air in a power plant, the temperature profile and the concentration profile will become identical when:

a. Prandtl No. = 1
b. Nusselt No. 1
c. Lewis No. = 1
d. Schmilt No. = 1

110. Which one of the following numbers represents the ratio of kinematics viscosity to the thermal diffusivity?

a. Grash off number
b. Prandtl number
c. Mach number
d. Nusselt number

111. After expansion from a gas turbine, the hot exhaust gases are used to heat the compressed air from a compressor with the help of a cross flow compact heat exchanger of 0.8 effectiveness. What is the number of transfer units of the heat exchanger?

a. 2
b. 4
c. 8
d. 16

112. A thin flat plate 2m×2m is hanging freely in air. The temperature of the surroundings is 25°C. Solar radiation is falling on one side of the plate at the rate of 500 W/m^2. What should be the convective heat transfer coefficient is $W/m^2°C$, if the temperature of the plate is to remain constant at 30°C?

a. 25
b. 50
c. 100
d. 200

113. In order to achieve maximum heat dissipation, the fin should be designed in such a way that:

a. It should have maximum lateral surface at the root side of the fin
b. It should have maximum lateral surface towards the tip side of the fin
c. It should have maximum lateral surface near the centre of the fin

d. It should lave. minimum lateral surface near the centre of the fin

114. A composite hollow sphere with steady internal heating is made of 2 layers of materials of equal thickness with thermal conductivities in the ratio of 1:2 for inner to outer layers. Ratio of inside to outside diameter is 0.8. What is ratio of temperature drop across the Inner and outer layers?

a. 0.4
b. 1.6
c. 2 in 0.8
d. 2.5

115. Up to the critical radius of insulation:

a. Added insulation increases, heat loss
b. Added insulation decreases heat loss
c. Convection heat loss is less than conduction heat loss
d. Heat flux decreases.

116. Match List I (Governing Equations of Heat Transfer) with List II (Specific Cases of Heat Transfer) and select the correct answer using the code given below:

List I

A. $\frac{d^2T}{dr^2}+\frac{2dT}{r\,dr}=0$

B. $\frac{\partial^2T}{\partial x^2}=\frac{1\partial T}{\alpha\ \partial t}$

C. $\frac{d^2T}{dr^2}+\frac{1dT}{r\ dr}=0$

D. $\frac{d^2\theta}{dx^2}-m^2\theta=\theta$

List II

1. Pin fin 1-D case
2. 1-D conduction in cylinder
3. 1-D condition in sphere
4. plane slab

(Symbols have their usual meaning)

	A	B	C	D
a.	2	4	3	1
b.	3	1	2	4
c.	2	1	3	4
d.	3	4	2	1

117. 6.0 kJ of condition heat transfer has to take place in 10 minutes from one end to other end of a metallic cylinder of 10 cm^2 cross-sectional area, length 1 metre and thermal conductivity as 100 W/mK. What is the temperature difference between the two ends of the cylindrical bar?

a. 80°C
b. 100°C
c. 120°C
d. 160°C

118. Heat is conduced through a 10 cm thick wall at the rate of 30 W/m^2 when the temperature difference across the wall is 10C. What is the thermal conductivity of the wall?

a. 0.03 W/mK
b. 0.3 W/mK
c. 3.0 W/mK
d. 30.0 W/mk

119. Match List I with List II and select the correct answer using the code given below the Lists:

List I

A. Radiation heat transfer
B. Conduction heat transfer
C. Forced convection
D. Transient heat flow

List II

1. Fourier number
2. Wien displacement law
3. Fourier law
4. Stanton number

	A	B	C	D
a.	2	1	4	3
b.	4	3	2	1
c.	2	3	4	1
d.	4	1	2	3

120. Heisler charts are used to determine transient heat flow rate and temperature distribution when:

a. Solids posses infinitely large thermal conductivity
b. Internal conduction resistance is small and convective resistance is large
c. Internal conduction resistance is large and the convective resistance is small
d. Both conduction and convention resistance are almost of equal significance