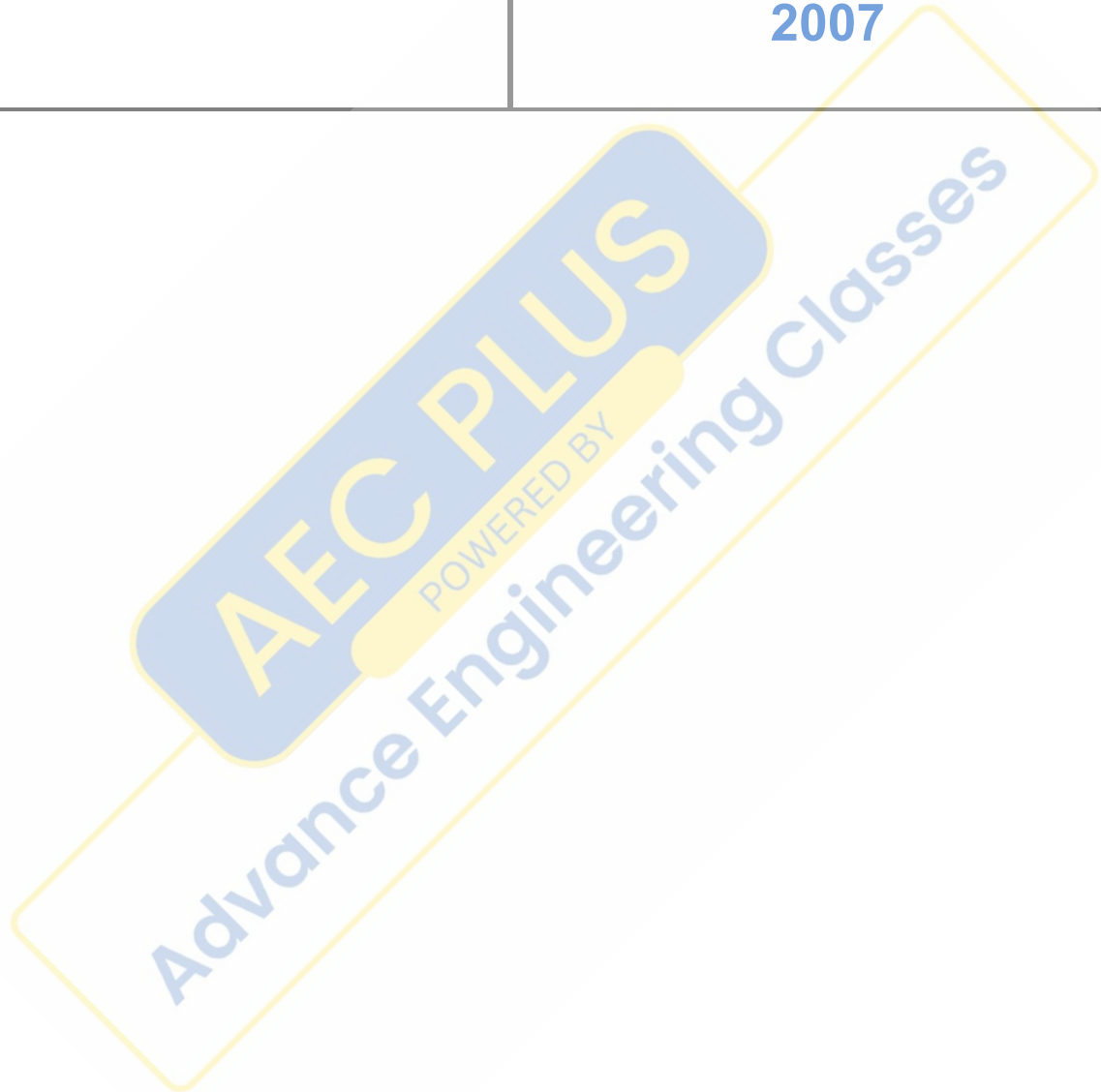


**UPPSC AE**

**Previous Year Paper  
(Mechanical) Paper-II  
2007**



# MECHANICAL ENGINEERING

## Paper-II

1. An inventor claims to have developed an engine that takes in 105 MJ at a temperature of 400 K, rejects 42 MJ at a temperature of 200 K and delivers 15 kWh of mechanical work. Is this engine feasible ?
- (a) Yes  
(b) No  
(c) The information given is not sufficient to find answer.  
(d) May be or may not be depends upon several factors.

2. In a reversible adiabatic process the ratio  $(T_1/T_2)$  is equal to

- (a)  $(P_1/P_2)^{\frac{\gamma-1}{\gamma}}$  (b)  $(V_1/V_2)^{\frac{\gamma-1}{\gamma}}$   
(c)  $(V_1 V_2)^{\frac{\gamma-1}{2\gamma}}$  (d)  $(V_2/V_1)^{\frac{\gamma-1}{\gamma}}$

Where  $\gamma$  is ratio of specific heats ?

3. A frictionless heat engine can be 100% efficient only if the exhaust temperature is

- (a) equal to its input temperature  
(b) less than its input temperature  
(c) 0 °C  
(d) 0 K

4. The thermal efficiency of a theoretical Otto cycle

- (a) increases with increase in compression ratio  
(b) increases with increase in isentropic index  $\gamma$   
(c) does not depend on the pressure ratio  
(d) follows all the above

5. Which of the following constituents of a fuel does not contribute to its calorific value on combustion ?

- (a) Carbon (b) Hydrogen  
(c) Sulphur (d) Nitrogen

6. Which of the following is an irreversible process ?

- (a) An isothermal process (b) An isentropic process  
(c) An isobaric process (d) An isenthalpic process

7. The work in a closed system undergoing an isentropic process is given by

- (a)  $\frac{\gamma}{\gamma-1} mR (T_1 - T_2)$  (b)  $\frac{\gamma-1}{\gamma} mR (T_1 - T_2)$   
(c)  $\frac{1}{\gamma-1} mR (T_1 - T_2)$  (d)  $\frac{1}{\gamma-1} m (T_1 - T_2)$

(Notations used have usual meaning)

8. The Clausius equation for a reversible cycle is

(a)  $\oint \frac{\delta Q}{T} < 0$

(b)  $\oint \frac{\delta Q}{T} = 0$

(c)  $\oint \frac{\delta Q}{T} > 0$

(d)  $\oint \frac{\delta Q}{T} \leq 0$

(Notations used have usual meaning.)

9. At the critical point, any substance

- (a) will exist in all the three phases simultaneously
- (b) will change directly from solid to vapour
- (c) will lose phase distinction between liquid and vapour
- (d) will behave as an ideal gas

10. Vander Waal's equation may be written as

(a)  $(p + \frac{a}{V})(V - b) = RT$

(b)  $(p + \frac{a}{V^2})(V - b) = RT$

(c)  $(p + \frac{a}{V^2})(V^2 - b) = RT$

(d)  $(p + \frac{a}{V^2})(V^2 - b) = RT^2$

(Notations used have usual meaning.)

11. An engine receives 15152 J/s of heat and produces 5 kW of power. The efficiency of the engine is

(a) 25%

(b) 27.5%

(c) 30%

(d) 33%

12. Air is compressed isothermally by performing work equal to 16 kJ upon it. The change in internal energy is

(a) -16 kJ

(b) Zero

(c) 16 kJ

(d) 32 kJ

13. A mixture of gases expands from 0.03 m<sup>3</sup> to 0.06 m<sup>3</sup> at constant pressure of 1MPa and absorbs 84 kJ of heat during the process. The change in internal energy of the mixture is

(a) 30 kJ

(b) 54 kJ

(c) 84 kJ

(d) 114 kJ

14. The air standard efficiency of an Otto cycle for a compression ratio of 5 and index  $\gamma = 1.4$  is

(a) 60%

(b) 50%

(c) 47.47%

(d) 40%

15. Steam coming out of the whistle of a pressure cooker is

(a) dry saturated vapour

(b) wet vapour

(c) super heated vapour

(d) ideal gas

16. The latent heat of steam with increase in pressure

(a) does not change

(b) increases

(c) decreases

(d) remains unpredictable

17. A system is taken from state A to state B along two different paths 1 and 2. The heat absorbed and work done by the system along these paths are  $Q_1$  and  $Q_2$  and  $W_1$  and  $W_2$  respectively, then
- (a)  $Q_1 = Q_2$  (b)  $W_1 + Q_1 = Q_2 + W_2$   
(c)  $W_1 = W_2$  (d)  $Q_1 - W_1 = Q_2 - W_2$
18. Steam flows through an adiabatic steady flow turbine from state 1 to state 2. with respect to a base temperature  $T_0$ , the unavailable energy is
- (a)  $T_0 (I_1 - I_2)$  (b)  $T_0 (S_1 - S_2)$   
(c)  $(I_1 - I_2) - T_0 (S_1 - S_2)$  (d)  $I_2 + T_0 (S_1 - S_2)$
19. The value of compressibility factor for a vander Waals gas is equal to
- (a) 1.0 (b) 0.375  
(c) 0.2 to 0.3 (d) 0.35
20. The slope of an isobar on the  $h - s$  coordinates is equal to the
- (a) Gibbs function  
(b) Helmholtz function  
(c) Pressure  
(d) Absolute saturation temperature at that pressure
21. A carnot heat pump absorbs heat from atmosphere at  $10^\circ\text{C}$  and supplies it to a room maintained at  $25^\circ\text{C}$ . A temperature difference of  $5^\circ\text{C}$  exists between working fluid and atmosphere on one hand, and the required room temperature on the other hand. If the heat pump consumes 1 kW power, the heat delivered to the room will be
- (a) 12.1 kW (b) 14.9 kW  
(c) 1.67 kW (d) 19.9 kW
22. For the same compression ratio and same heat rejection, the efficiency of Otto cycle is
- (a) same as that of Diesel Cycle  
(b) not comparable to that of Diesel Cycle  
(c) less than that of Diesel Cycle  
(d) more than that of Diesel Cycle
23. Choose the correct alternative :
1. First law for a closed system undergoing a cycle  $Q - W = \Delta E$
  2. Two reversible adiabatic paths can not intersect each other.
  3. If two fluids are mixed, the entropy of universe remains unchanged.
  4. Clausius statement – Heat can flow from low to high temperature body without the aid of external work.
  5. The efficiency of a reversible heat engine is independent of nature of working substance undergoing a cycle.
- (a) All statements are true.  
(b) Statements 2 and 5 are true.  
(c) Statements 1, 3, 4 and 5 are true.  
(d) Statements 1, 3 and 5 are true.

24. The unit of work is  
(a) kW (b) kWh  
(c) kW/h (d) kJ/s
25. For complete burning of 1 kg of carbon, the air required will be about  
(a) 2.67 kg (b) 11.6 kg  
(c) 12.7 kg (d) 14.5 kg
26. The efficiency of an ideal Carnot engine depends on  
(a) working substance  
(b) the temperature of the source only  
(c) the temperature of the sink only  
(d) the temperature of both source and sink.
27. Kelvin Planck's law deals with  
(a) conservation of energy (b) conservation of heat  
(c) conservation of mass (d) conversion of heat into work
28. The gas constant R is equal to the  
(a) sum of two specific heats. (b) difference of two specific heats.  
(c) product of two specific heats. (d) ratio of two specific heats.
29. The main cause of the irreversibility is  
(a) Mechanical and Fluid Friction  
(b) Unrestricted expansion  
(c) Heat transfer with a finite temperature difference  
(d) All of the above
30. Which of the following is not a property of thermodynamic system ?  
(a) Pressure (b) Energy  
(c) Heat (d) Volume
31. Parson's reaction turbine has  
(a) fixed blades only  
(b) moving blades only  
(c) identical fixed and moving blades  
(d) fixed and moving blades of different shapes.
32. The change in entropy is zero during  
(a) Hyperbolic process (b) Constant pressure process  
(c) Reversible adiabatic process (d) Polytropic process
33. Fuel injector is used in  
(a) steam engines (b) gas engines  
(c) spark ignition engines (d) compression ignition engines
34. Carnot cycle is not considered as a practical cycle because  
(a) its  $p - V$  diagram is narrow  
(b) its thermal efficiency is low  
(c) heat addition takes place at high pressure  
(d) heat rejection takes place at high temperature

35. The property of a working substance which increases or decreases as the heat is supplied or removed in a reversible manner is known as  
 (a) Enthalpy (b) Entropy  
 (c) Internal energy (d) External Energy
36. The second law of thermodynamics defines  
 (a) Heat (b) Enthalpy  
 (c) Internal Energy (d) Entropy
37. In an irreversible process there is a  
 (a) loss of heat (b) no loss of heat  
 (c) gain of heat (d) no gain of heat
38. The most practical vapour power cycle is  
 (a) Carnot (b) Joule  
 (c) Rankine (d) Binary
39. Which pair of the following alternatives is correctly matched ?  
**List – I** **List – II**  
 (a) Heat – Point function  
 (b) Energy – Path function  
 (c) Entropy – Second law of thermodynamics  
 (d) Gibbs function – Path function
40. In an Otto cycle, the heat addition and heat rejection take place at  
 (a) constant volume and at constant pressure respectively  
 (b) constant volume and at constant volume respectively  
 (c) constant pressure and at constant volume respectively  
 (d) constant pressure and at constant pressure respectively
41. Application of Bernoulli's equation requires that  
 (a) the duct is two dimensional  
 (b) the flow is laminar  
 (c) the duct is frictionless  
 (d) the fluid is inviscid and incompressible
42. A fully developed pipe flow implies that the  
 (a) flow should be laminar  
 (b) flow should be turbulent  
 (c) velocity profile should be uniform  
 (d) velocity profile should not change in the direction of flow.
43. The type of flow in which the velocity at any given time does not change with respect to space is called  
 (a) Steady flow (b) Compressible flow  
 (c) Uniform flow (d) Rotational flow
44. The concept of stream function which is based on the principle of continuity is applicable to  
 (a) irrotational flow only (b) two dimensional flow only  
 (c) three dimensional flow only (d) uniform flow only
35. कार्यकारिणी पदार्थ का वह गुण, जब ऊष्मा उत्क्रमणीय तरीके से डाली या निकाली जाती है, बढ़ता या घटाता है



45. A pitot tube is used for measuring  
 (a) velocity of flow (b) pressure of flow  
 (c) flow rate (d) total energy
46. Mach number is defined as the square root of the ratio of the  
 (a) inertia force to the pressure force  
 (b) inertia force to the surface tension force  
 (c) inertia force to the elastic force  
 (d) none of the above
47. A streamlined body is defined as a body about which  
 (a) the drag is zero (b) the flow is laminar  
 (c) the flow is along streamlines (d) the flow separation is suppressed
48. Which is the flow measuring device through which fluid does not flow ?  
 (a) Orifice plate (b) Venturimeter  
 (c) Pitot tube (d) Elbow meter
49. Rayleigh's method of dimensional analysis is used for determining the expression for a variable which depends on maximum following number of variables.  
 (a) 4 (b) 8  
 (c) 2 (d) 6
50. The velocity profile is approximated by a cubic parabola  $\frac{u}{U} = \frac{3}{2} \left(\frac{y}{\delta}\right)^2 - \frac{1}{2} \left(\frac{y}{\delta}\right)^3$ , where the displacement thickness for the profile is  
 (a)  $\frac{3}{8} \delta$  (b)  $5/8 \delta$   
 (c)  $11/8 \delta$  (d) None of the above
51. For the viscous flow the coefficient of friction is given by  
 (a)  $f = 8/Re$  (b)  $f = 16/Re$   
 (c)  $f = 32/Re$  (d)  $f = 60/Re$
52. The mathematical expression for lift force is given by  
 (a)  $F_L = C_L \cdot \rho AU$  (b)  $F_L = C_L \cdot \frac{\rho U^2}{2} \cdot A$   
 (c)  $F_L = C_L \cdot \rho U^2 \cdot A$  (d) None of the above  
 (Notations used have usual meaning.)
53. Local acceleration in fluid is due to  
 (a) unsteady nature of flow (b) non uniformity of flow  
 (c) turbulence in flow (d) irrotational nature of flow
54. An oil of kinematic viscosity 0.5 stokes flows through a pipe of 5 cm diameter. The flow is critical at a velocity of about  
 (a) 0.2 m/s (b) 2 m/s  
 (c) 2.5 m/s (d) 4 m/s

55. At a distance  $x$  from the leading edge of a plate, the thickness of laminar boundary layer varies as  
 (a)  $1/x$  (b)  $x^{4/5}$   
 (c)  $x^{1/2}$  (d)  $x^2$
56. Using Blasius Equation, the friction factor for turbulent flow through pipes varies as  
 (a)  $1/Re$  (b)  $1/Re^{0.5}$   
 (c)  $1/Re^{0.33}$  (d)  $1/Re^{0.25}$
57. For irrotational and incompressible flow, the velocity potential and stream function are given by  $\phi$  and  $\psi$  respectively. Which one of the following sets is correct ?  
 (a)  $\nabla^2 \phi = 0$  ,  $\nabla^2 \psi = 0$  (b)  $\nabla^2 \phi \neq 0$  ,  $\nabla^2 \psi = 0$   
 (c)  $\nabla^2 \phi = 0$  ,  $\nabla^2 \psi \neq 0$  (d)  $\nabla^2 \phi \neq 0$  ,  $\nabla^2 \psi \neq 0$
58. For the laminar flow through a circular pipe the ratio of maximum velocity and the average velocity is  
 (a) 1.5 (b) 2.0  
 (c) 2.5 (d) None of the above
59. The separation of boundary layer takes place in case of  
 (a) negative pressure gradient (b) positive pressure gradient  
 (c) zero pressure gradient (d) none of the above
60. Froude number is defined as the ratio of  
 (a) inertia force to viscous force (b) inertia force to gravity force  
 (c) inertia force to elastic force (d) inertia force to pressure force
61. Hammer blow in pipes occurs due to  
 (a) sudden sharp bends (b) sudden contraction  
 (c) sudden stoppage of flow (d) sudden release of fluid from pipe
62. A metal piece having density exactly equal to the density of a fluid is placed in the liquid. The metal piece will  
 (a) sink to the bottom  
 (b) float on the surface  
 (c) will be partly immersed  
 (d) will be wholly immersed
63. Which of the following head loss is significant in a pipe flow ?  
 (a) Loss of head due to gradual contraction  
 (b) Loss of head due to friction  
 (c) Loss of head due to sudden enlargement  
 (d) Loss of head due to sudden contraction
64. The resultant force on a floating body will act  
 (a) vertically upwards through centre of buoyancy  
 (b) vertically downwards through centre of buoyancy  
 (c) vertically upwards through meta centre  
 (d) vertically downwards through meta centre



65. Which of the following is a Mechanical Gauge ?  
 (a) Diaphragm gauge  
 (b) Dead weight pressure gauge  
 (c) Bourdon tube pressure gauge  
 (d) All the above
66. A box of rectangular base  $2\text{m} \times 3\text{m}$  contains gasoline (Sp. Gravity 0.7) upto a height of 5m. The force on the base and two vertical surfaces,  $2\text{m} \times 5\text{m}$  and  $3\text{m} \times 5\text{m}$  respectively.  
 (a) 206 kN, 258 kN and 172 kN (b) 21 kN, 17.5 kN and 26.3 kN  
 (c) 258 kN, 172 kN and 206 kN (d) 206 kN, 172 kN and 258 kN

67. Match the following and choose the correct alternatives :

List – I		List – II	
A.	Froude number	1.	$\rho/\rho U^2$
B.	Mach number	2.	$U/(gd)$
C.	Webber number	3.	$U/\sqrt{gd}$
D.	Euler number	4.	$\rho L U^2/\sigma$
		5.	$\frac{p}{\rho^2 U^2}$
		6.	$U/c$

(c = velocity of sound)

(Notations used have usual meaning)

Codes :

	A	B	C	D
(a)	3	6	3	5
(b)	3	6	4	1
(c)	2	4	5	2
(d)	2	6	1	5

68. The continuity equation in fluid mechanics is a mathematical statement embodying the principle of  
 (a) conservation of energy  
 (b) conservation of mass  
 (c) conservation of momentum  
 (d) none of above
69. Reynold's number is defined as the ratio of inertia force to  
 (a) gravity force (b) pressure force  
 (c) elastic force (d) viscous force
70. An ideal fluid is defined as the fluid which  
 (a) is compressible  
 (b) is incompressible  
 (c) is incompressible and inviscid  
 (d) has negligible surface tension
71. The velocity distribution in laminar flow through a circular pipe follows the  
 (a) Linear law (b) Parabolic law  
 (c) Logarithmic law (d) None of the above

72. Kinematic similarity between model and prototype means the similarity of  
 (a) forces (b) shape  
 (c) motions (d) discharge
73. The Darcy-Weisbach friction factor which is a direct measure of resistance to flow in pipes is dependent on  
 (a) Roughness height, diameter and velocity  
 (b) Relative roughness, diameter and viscosity  
 (c) Relative roughness, velocity and viscosity  
 (d) Roughness height, diameter, velocity and kinematic viscosity
74. The velocity distribution in turbulent flow is a function of the distance  $y$  measured from the boundary surface and the friction velocity  $V^*$ , and follows a  
 (a) parabolic law (b) logarithmic law  
 (c) hyperbolic law (d) linear law
75. The parameters which determine the friction factor for turbulent flow in a rough pipe are  
 (a) Froude number and relative roughness  
 (b) Froude number and Mach number  
 (c) Reynolds number and relative roughness  
 (d) Mach number and relative roughness
76. Head loss in sudden expansion is given by  
 (a)  $\frac{V_1^2 - V_2^2}{2g}$  (b)  $\frac{(V_1 - V_2)^3}{2g}$   
 (c)  $\frac{(V_1 - V_2)^2}{2g}$  (d)  $\frac{2(V_1^2 - V_2)^2}{g}$   
 (Notations used have usual meanings)
77. In order to have a continuous flow through a siphon, no portion of the pipe be higher than \_\_\_\_\_ measured above the hydraulic grade line :  
 (a) 10m (b) 10.33m  
 (c) 5.5m (d) 7.75m
78. Boundary layer on a flat plate is called laminar boundary layer if Reynold's number is less than  
 (a) 2000 (b) 4000  
 (c)  $5 \times 10^5$  (d) None of the above
79. Surface tension is a phenomenon due to  
 (a) Cohesion only  
 (b) Viscous forces only  
 (c) Adhesion between liquid and solid molecules  
 (d) Difference in magnitude between the forces due to adhesion and cohesion
80. A container carrying water is moved in a horizontal direction with an acceleration of  $2.45 \text{ m/s}^2$ . The angle of inclination of free water surface to the horizontal is  
 (a)  $14.03^\circ$  (b)  $67.8^\circ$   
 (c)  $45^\circ$  (d)  $0^\circ$

81. The rate of heat transfer through a hollow cylinder of inner and outer radii  $r_1$  and  $r_2$ , respectively, depends on
- (a) difference of radii,  $(r_2 - r_1)$                       (b) sum of radii,  $(r_2 + r_1)$
- (c) product of radii,  $(r_1 r_2)$                               (d) ratio of radii,  $\left(\frac{r_2}{r_1}\right)$
82. The rate of heat transfer from a solid surface to a fluid is obtained from
- (a) Newton's law of cooling                              (b) Fourier's law
- (c) Kirchhoff's law    (d) Stefan's law
83. If one radiation shield is placed between two infinite parallel radiating plane surfaces, then the amount of heat radiated becomes
- (a) one third    (b) one fourth
- (c) half    (d) none of the above
84. Which pair, out of the following alternatives, is not correctly matched ?
- | List – I                    | List – II                |
|-----------------------------|--------------------------|
| (a) Fourier's law           | - Conduction             |
| (b) Newton's law of cooling | - Convection             |
| (c) Stephan-Boltzman law    | - Radiation              |
| (d) Kirchoff's law          | - Radiation + Convection |
85. If  $k$  = thermal conductivity and  $h$  = heat transfer coefficient then the critical thickness of insulation for a cylinder, which will maximise the heat transfer is equal to
- (a)  $k/h$     (b)  $h/k$
- (c)  $2k/h$     (d)  $h/2k$
86. If  $\Delta T_i$  and  $\Delta T_e$  are the temperature differences at inlet and at exit of the heat exchanger, then LMTD is equal to
- (a)  $\frac{\Delta T_i - \Delta T_e}{\ln \Delta T_i / \Delta T_e}$     (b)  $\ln \left( \frac{\Delta T_i - \Delta T_e}{1 \Delta T_i / \Delta T_e} \right)$
- (c)  $\frac{\ln(\Delta T_i - \Delta T_e)}{\Delta T_i / \Delta T_e}$     (d)  $\frac{\Delta T_i - \Delta T_e}{\ln (\Delta T_i + \Delta T_e) / 2}$
87. If  $Q$  = actual rate of heat transfer and  $Q_{\max}$  = maximum possible rate of heat transfer then, heat exchanger effectiveness is equal to
- (a)  $Q_{\max} - Q$     (b)  $Q/Q_{\max}$
- (c)  $Q_{\max} / Q$     (d)  $\frac{Q_{\max} + Q}{2}$
88. If  $V$  = volume,  $A$  = surface area,  $h$  = surface film conductance,  $\rho$  = density and  $C$  = specific heat, then the time constant of a thermocouple is equal to
- (a)  $\frac{V\rho C}{Ah}$     (b)  $\frac{V\rho}{CAh}$
- (c)  $\frac{Ah}{V\rho C}$     (d)  $\frac{VC}{\rho Ah}$

89. During the process of boiling and condensation only a phase change takes place, and one fluid remains at constant temperature throughout the heat exchanger. In terms of number of transfer units (NTU), the effectiveness of such heat exchanger would be
- $\frac{NTU}{1 + NTU}$
  - $1 - \exp(-NTU)$
  - $\frac{1 - \exp(-2NTU)}{2}$
  - cannot be worked out as heat capacities are unknown
90. A cross flow type air heater has an area of  $50 \text{ cm}^2$ . The overall heat transfer coefficient is  $100 \text{ W/m}^2\text{K}$  and heat capacity of both hot and cold streams are  $1000 \text{ W/K}$ . The value of NTU is
- 1000
  - 500
  - 5
  - 0.2
91. For an opaque plane surface, the irradiation, radiosity and emissive power are 20, 12 and  $10 \text{ W/m}^2$  respectively. The emissivity of the surface is
- 0.2
  - 0.4
  - 0.8
  - 1.0
92. The Prandtl number will be the lowest for
- water
  - liquid metal
  - Aqueous solution
  - lube oil
93. Two walls of same thickness and cross sectional area have thermal conductivities in the ratio of  $1 : 2$ . If the same temperature difference is maintained across the wall faces, the ratio of heat flow  $Q_1/Q_2$  will be
- $1/2$
  - 1
  - 2
  - 4
94. The critical thickness of insulation for spheres is given by
- $k/h$
  - $k/4h$
  - $h/2k$
  - $2k/h$
95. What is the equivalent emissivity for radiant heat exchange between a small body (emissivity = 0.4) in a very large enclosure (emissivity = 0.5) ?
- 0.5
  - 0.4
  - 0.2
  - 0.1
96. In the lumped parameter model, the temperature variation with time is
- linear
  - cubic
  - exponential
  - sinusoidal
97. What is the value of shape factor for two infinite parallel surfaces separated by a distance  $x$  ?
- 0
  - $\infty$
  - 1
  - $x$

98. The Nusselt number in natural convection heat transfer is a function of fluid Prandtl number and
- (a) Stanton Number (b) Biot Number  
(c) Grashoff Number (d) Reynolds Number
99. The value of Prandtl Number of air is about
- (a) 0.1 (b) 0.4  
(c) 0.7 (d) 1.1
100. The radiant heat transfer per unit area ( $W/m^2$ ) between two plane parallel gray surfaces (emissivity = 0.9) maintained at 400 K and 300 K is
- (a) 992 (b) 893  
(c) 464 (d) 567
101. The ratio of thickness of thermal boundary layer to thickness of hydrodynamic boundary layer is equal to  $(P_r)^n$  where n is
- (a)  $-1/3$  (b)  $2/3$   
(c) 1 (d)  $-1$
102. \_\_\_\_\_ will radiate heat to a large extent.
- (a) Black polished surface (b) White rough surface  
(c) White polished surface (d) Black rough surface
103. Addition of fin to the surface increases the heat transfer if  $\sqrt{\frac{hA}{kP}}$  is
- (a) equal to 1 (b) greater than 1  
(c) less than 1 (d) greater than 1 but less than 2  
(Notations used have usual meaning)
104. Choose correct order of metals for increasing conductivity :
- (a) Cu, Al, Fe, Ag (b) Fe, Al, Cu, Ag  
(c) Al, Fe, Cu, Ag (d) Cu, Ag, Al, Fe
105. For a given heat flow and for the same thickness, the temperature drop across the material will be maximum for
- (a) Copper (b) Steel  
(c) Glass wool (d) Refractory brick
106. Reynolds analogy states that ( $St$  is the Stanton number and  $C_{fx}$  is the skin friction coefficient)
- (a)  $St = \frac{C_{fx}}{4}$  (b)  $St = \frac{C_{fx}}{2}$   
(c)  $St = \sqrt{C_{fx}}$  (d)  $St = 2 C_{fx}$
107. Two walls of thickness  $d$  and  $2d$  called A and B are made of materials such that their thermal conductivities are  $K_A = 2 K_B$ . If the difference of temperature on two sides is proportional to thickness, the ratio of heat transfer through A to that through B is
- (a) 6 (b) 4  
(c) 2 (d) 1



108. The radial heat transfer rate through hollow cylinder increases as the ratio of outer radius to inner radius :
- (a) decreases (b) increases  
(c) constant (d) none of the above
109. Metals are good thermal conductors since
- (a) they have free electrons. (b) their atoms are relatively closer.  
(c) their surfaces reflect. (d) their atoms are of larger size.
110. In forced convection, Nusselt number is a function of
- (a) Reynolds number and dynamic viscosity  
(b) dynamic viscosity and Prandtl number  
(c) Prandtl number and Reynolds number  
(d) Reynolds number and thickness of boundary layer
111. Stefan-Boltzmann law is expressed as
- (a)  $Q = \sigma AT^4$  (b)  $Q = \sigma A^2T^4$   
(c)  $Q = \sigma AT^2$  (d)  $Q = AT^4$
112. The shape factor for radiation heat transfer of a long cylinder of radius  $r_1$  enclosed by another concentric long cylinder of radius  $r_2$  is
- (a) 0.25 (b) 0.50  
(c) 0.75 (d) 1.0
113. Heat transfer rate
- (a) will be higher in turbulent flow  
(b) will be lower in turbulent flow  
(c) will depend only on the fluid  
(d) will depend only on viscosity
114. A thermal transparent body is characterised by
- (a) absorptivity = 1 (b) reflectivity = 1  
(c) absorptivity = reflectivity = 0 (d) none of the above
115. The time constant of the thermocouple is the time required by a thermocouple to reach the following value of initial temperature differences :
- (a) 63.2% (b) 65%  
(c) 68% (d) 70.2%
116. In a long cylindrical rod of radius  $R$  and for a surface heat flux of 90, the uniform internal heat generation rate is
- (a)  $290/R$  (b) 290  
(c)  $90/2 R$  (d)  $90/R^2$
117. Heat transfer in liquids and gases is essentially due to
- (a) Conduction (b) Convection  
(c) Radiation (d) Conduction and Radiation



118. The transition Reynolds number for flow over a flat plate is  $5 \times 10^5$ . What is the distance from the leading edge at which transition will occur for flow of water with uniform velocity of 1 m/s ? (For water  $\nu = 0.858 \times 10^{-6} \text{ m}^2/\text{s}$ )
- (a) 1 m (b) 0.43 m  
(c) 43 m (d) 103 m
119. In a certain heat exchanger, both the fluids have identical mass flow rate and specific heat product. The hot fluid enters at 76 °C and leaves at 47 °C and cold fluid enters at 26 °C and leaves at 55 °C. The effectiveness of the heat exchanger is
- (a) 0.16 (b) 0.58  
(c) 0.72 (d) 1.0
120. A 0.5 m thick plane wall has its two surfaces kept at 300 °C and 200 °C. Thermal conductivity of the wall varies linearly with temperature and its value at 300 °C and 200 °C are 25 W/mK and 15 W/mK respectively. Then steady heat flux through the wall is
- (a) 8 kW/m<sup>2</sup> (b) 5 kW/m<sup>2</sup>  
(c) 4 kW/m<sup>2</sup> (d) 3 kW/m<sup>2</sup>
121. For practical purposes one Ton of refrigeration means
- (a) 3.48 kW (b) 34.8 kW  
(c) 348 kW (d) None of these
122. In a refrigeration system the refrigerant gains heat at
- (a) Compressor (b) Condenser  
(c) Expansion valve (d) Evaporator
123. In summer air conditioning system fresh air is introduced into the recirculated air to
- (a) reduce load on equipment  
(b) exercise easy control over equipment  
(c) improve air quality by diluting odour and contaminants  
(d) reduce quantity of supply air
124. Temperature recorded by a thermometer which is not affected by moisture is
- (a) dry bulb temperature (b) wet bulb temperature  
(c) dew point temperature (d) adiabatic saturation temperature
125. Effects of heat pump and refrigeration respectively are obtained at
- (a) compressor and condenser (b) evaporator and condenser  
(c) condenser and evaporator (d) compressor and evaporator
126. On a psychrometric chart what does a vertical downward line represent ?
- (a) Adiabatic saturation (b) Sensible cooling  
(c) Dehumidification (d) Humidification
127. A refrigerator working on a reversed carnot cycle has a COP of 4. If it works as heat pump and consumes 1kW, the heating effect will be
- (a) 1kW (b) 4kW  
(c) 5kW (d) 6kW

128. The Bell-Coleman refrigeration cycle uses \_\_\_\_\_ as the working fluid.
- (a) Hydrogen (b) Carbon dioxide  
(c) Air (d) Any inert gas
129. The throttling operation in a refrigeration cycle is carried out in
- (a) Evaporator (b) Discharge valve  
(c) Capillary tube (d) Expansion valve
130. The chemical formula of Freon – 12 is
- (a)  $CClF_2$  (b)  $CCl_2F_3$   
(c)  $CCl_2F_2$  (d)  $CClF$
131. Dry ice is
- (a) solidified carbon dioxide  
(b) ice free from dissolved air and gases  
(c) ice free from impurities  
(d) ice made from transparent distilled water.
132. Lithium bromide in vapour absorption refrigeration system is used as
- (a) refrigerant (b) cooling substance  
(c) auxiliary refrigerant (d) absorbent
133. A simple saturated refrigeration cycle has the following state points. Enthalpy after compression = 425 kJ / kg ; enthalpy after throttling = 125 kJ/kg ; enthalpy before compression = 375 kJ / kg. The COP of refrigeration is
- (a) 5  
(b) 3.5  
(c) 6  
(d) not possible to find with this data
134. Vapour absorption system
- (a) gives noisy operation  
(b) gives quiet operation  
(c) requires little power consumption  
(d) cools below 0 °C
135. In mechanical refrigeration system, the refrigerant has the maximum temperature
- (a) before expansion valve  
(b) between compressor and condenser  
(c) between condenser and evaporator  
(d) between compressor and evaporator
136. If moist air is passed over chemicals like silica gel, the process which takes place is
- (a) humidification  
(b) dehumidification  
(c) cooling and dehumidification  
(d) heating and dehumidification

137. The curved lines on a psychrometric chart indicate
- (a) relative humidity (b) specific humidity  
(c) dry bulb temperature (d) wet bulb temperature
138. In the absorption refrigeration cycle, the compressor of vapour compression refrigeration cycle is replaced by
- (a) Liquid pump  
(b) Generator  
(c) Absorber and generator  
(d) Absorber, liquid pump and generator
139. What is the storage temperature for milk ?
- (a) 4 °C (b) 7 °C  
(c) 2 °C (d) 0.5 °C
140. The design condition of temperature for winter air conditioning is
- (a)  $25 \pm 1$  °C (b) 27 °C  
(c) 21 °C (d) none of the above
141. Which pair, out of following alternatives, is correctly matched. Normal boiling points of different refrigerants (List-I) are given in List-II.
- | List – I            | List – II    |
|---------------------|--------------|
| (a) R – 12          | - - 29.8 °C  |
| (b) NH <sub>3</sub> | - - 33.35 °C |
| (c) R 134 a         | - - 24.15 °C |
| (d) R 22            | - - 40.8 °C  |
142. Pressure drop in capillary tube (used in refrigeration systems) takes place due to
- (a) friction (b) change in momentum  
(c) both (a) & (b) above (d) none of the above
143. In a vapour absorption refrigeration system, the refrigeration temperature is – 15 °C and the generator temperature is 110 °C. If sink temperature is 55 °C, the maximum COP of the system will be
- (a) 1.00 (b) 3.69  
(c) 0.34 (d) 0.90
144. In case of ejector–compression system the power input is in the form of
- (a) electric power (b) heat  
(c) mechanical work (d) steam power
145. Due to suction vapour superheating in vapour compression cycle the COP increases in case of the following refrigerant :
- (a) R 22 (b) NH<sub>3</sub>  
(c) R – 12 (d) None of the above

- 146.** Go through the following statements and choose the correct alternative :
1. Wet compression increases COP of ammonia vapour compression system.
  2. Use of liquid-vapour heat exchanger in vapour compression system decreases COP in case of ammonia refrigerant.
  3. For good performance, a refrigerant must have high critical pressure and low critical temperature.
  4. Refrigerants that are not miscible with oils, presents many problems.
  5. In flooded evaporators, the liquid refrigerant covers the entire heat transfer surface.
- (a) Statements 1, 2 and 5 are true
  - (b) Statements 1, 2 and 3 are true
  - (c) Statements 3, 4 and 5 are true
  - (d) Statements 2, 4 and 5 are true
- 147.** The function of solenoid valve in a refrigeration system is to
- (a) control the flow of refrigerant in suction line
  - (b) control the flow of refrigerant through expansion valve
  - (c) stop the flow of refrigerant when there is no load on the evaporator
  - (d) stop the flow of refrigerant in liquid line when compressor stops
- 148.** In cooling and dehumidifying apparatus, the effect of the by pass factor is to
- (a) lower the ADP of the cooling coil
  - (b) decrease the COP of the system
  - (c) both (a) & (b) above
  - (d) increase the ADP of the cooling coil and to improve the COP of the system
- 149.** In case of air conditioning of auditoriums, the cooling load which is predominant is
- (a) lighting load
  - (b) occupancy load
  - (c) load due to fans
  - (d) load due to electronic equipments
- 150.** When air is at saturated state, which pair, out of the given alternatives is not correctly matched ?
- | List – I                 | List – II            |
|--------------------------|----------------------|
| (a) Relative humidity    | - 100%               |
| (b) DBT                  | - WBT                |
| (c) Degree of saturation | - 1                  |
| (d) Specific humidity    | - 0.01 kg w.v/kg d.a |
- 151.** The refrigerant commonly used for commercial ice plants is
- |                     |                     |
|---------------------|---------------------|
| (a) Freon - 12      | (b) NH <sub>3</sub> |
| (c) CO <sub>2</sub> | (d) Air             |
- 152.** The brine is an aqueous solution of \_\_\_\_\_ in water.
- |                       |                      |
|-----------------------|----------------------|
| (a) Calcium chloride  | (b) Sodium chloride  |
| (c) Calcium carbonate | (d) Sodium carbonate |

153. The wet bulb depression is zero when relative humidity equals  
(a) zero (b) 50%  
(c) 75% (d) 100%
154. Two reversible refrigerators are arranged in series and their COP are 4 and 5 respectively. The COP of the composite refrigeration system would be  
(a) 1.5 (b) 2  
(c) 3 (d) 4.5
155. An ideal refrigerator is operating between a condenser temperature of 37 °C and an evaporator temperature of – 3 °C. If the machine is functioning as a heat pump, its COP will be  
(a) 6 (b) 6.75  
(c) 7 (d) 7.75
156. Which refrigerant would you choose for 800 TR air conditioning plant using centrifugal compressor ?  
(a) NH<sub>3</sub> (b) CO<sub>2</sub>  
(c) CFC 11 (d) CFC 114
157. Finned evaporators are used on air conditioning application to  
(a) equalize air flow over the cooling coil surface  
(b) prevent moisture carry over  
(c) extend the effective area of the cooling surface  
(d) increase the dehumidifying capacity
158. Which one of the following is not a desirable property of a good refrigerant ?  
(a) low specific heat  
(b) high specific volume of vapour  
(c) large latent heat at evaporator pressure  
(d) high critical temperature
159. Dew point is the temperature at which the condensation begins when the air is cooled at constant  
(a) volume (b) entropy  
(c) pressure (d) enthalpy
160. In a one ton capacity water cooler, water enters at 30 °C at the rate of 200 lit/hour. Taking specific heat of water as 4.16 kJ/kg K, the outlet temperature of water will be  
(a) 3.5 °C (b) 6.3 °C  
(c) 23.7 °C (d) 15 °C
161. Performance of an air compressor at high altitudes as compared to that at sea level is  
(a) better (b) inferior  
(c) same (d) depends on type of compressor
162. A water turbine is usually designed for the given values of  
(a) N, T and Q (b) P, T and Q  
(c) P, H and Q (d) P, H and N



163. The cetane number of automotive diesel fuel used in India lies in which of the following ranges ?
- (a) 30 – 40 (b) 41 – 50  
(c) 51 – 60 (d) 61 – 70
164. In a variable speed S.I. engine, the maximum torque occurs at the maximum
- (a) speed (b) brakepower  
(c) indicated power (d) volumetric efficiency
165. The knocking tendency in C.I. engines increases with
- (a) decrease of compression ratio  
(b) increase of compression ratio  
(c) increasing the temperature of inlet air  
(d) increasing cooling water temperature
166. The ignition quality of fuels for S.I. engines is determined by
- (a) Cetane number (b) Octane number  
(c) Calorific value (d) Volatility of the fuel
167. In a 4 – cylinder petrol engine, the standard firing order is
- (a) 1 – 2 – 3 – 4 (b) 1 – 4 – 3 – 2  
(c) 1 – 3 – 2 – 4 (d) 1 – 3 – 4 – 2
168. The ratio of brake power to indicated power of an I.C. engine is called
- (a) mechanical efficiency (b) thermal efficiency  
(c) volumetric efficiency (d) relative efficiency
169. A centrifugal pump lifts water through a height  $h$  and delivers it at a velocity  $V_d$ . The loss of heat through piping is  $h_f$ . The gross lift is
- (a)  $h + h_f$  (b)  $h_f + \frac{V_d^2}{2g}$   
(c)  $h + h_f + \frac{V_d^2}{2g}$  (d)  $h + \frac{V_d^2}{2g}$
170. The process of supercharging is meant for
- (a) raising exhaust pressure  
(b) increasing density of intake air  
(c) increasing quantity of fuel going into cylinder  
(d) providing air for cooling
171. Which of the following is not a high pressure boiler ?
- (a) Lancashire boiler (b) La-mont boiler  
(c) Benson boiler (d) Loeffler boiler



172. For a reaction turbine, specific flow is given by following expression :
- (a)  $Q/D_1^2 H$  (b)  $Q/D_1 \sqrt{H}$   
(c)  $Q/D_1^2 H^{3/2}$  (d)  $Q/D_1^2 \sqrt{H}$
173. Mean diameter of runner of a pelton turbine is 200mm and least diameter of jet is 1 cm. Calculate the jet ratio and number of buckets.
- (a) 20, 25 (b) 200, 115  
(c) 20, 40 (d) 20, 45
174. Open type impeller centrifugal pump is used to handle
- (a) water  
(b) mixture of water, sand, pebbles and clay  
(c) sewage  
(d) liquids lighter than water
175. The specific speed of a turbine is expressed as
- (a)  $\frac{N \sqrt{P}}{H^{5/4}}$  (b)  $\frac{N H^{5/4}}{\sqrt{P}}$   
(c)  $\frac{N \sqrt{P}}{\rho H^{5/4}}$  (d)  $\frac{N \sqrt{P}}{(gH)^{5/4}}$
176. Iso-octane content in a fuel for S.I. Engines
- (a) retards auto-ignition (b) accelerates auto-ignition  
(c) does not affect auto ignition (d) none of the above
177. The specific fuel consumption of a diesel engine as compared to that for petrol engine is
- (a) lower (b) higher  
(c) same for same output (d) none of the above
178. In an internal combustion engine, firing order depends upon
- (a) crank shaft design (b) arrangement of cylinder  
(c) number of cylinders (d) none of the above
179. William's law gives a straight line graph between the rate of steam consumption and
- (a) pressure of steam (b) temperature of steam  
(c) volume of steam (d) indicated horse power
180. Work done by prime mover to run the compressor is minimum if the compression is
- (a) isothermal (b) adiabatic  
(c) isentropic (d) polytropic
181. In centrifugal blowers/compressors, the ratio of outlet whirl velocity to the blade velocity is known as
- (a) work factor (b) slip factor  
(c) degree of reaction (d) pressure coefficient

182. When an impeller has backward curved vanes in a centrifugal blower, then with an increase in flow rate, Euler head H
- (a) increases (b) decreases  
(c) remains constant (d) none of the above
183. Work ratio is a guide in the determination of
- (a) the size of the gas turbine  
(b) overall efficiency of the turbine  
(c) mechanical efficiency of the turbine  
(d) compressor efficiency
184. for high boiler efficiency the feed water is heated by
- (a) recuperator (b) convective heater  
(c) super heater (d) economiser
185. In parson's steam turbine, steam expands in
- (a) nozzles only (b) blades only  
(c) partly in nozzles and partly in blades (d) none of the above
186. Piston rings are generally made of following material.
- (a) cast iron (b) mild steel  
(c) aluminium (d) carbon steel
187. The degree of reaction for a turbomachinery in which heat drop in moving blades is 8 kJ/kg and in fixed blades 12 kJ/kg, would be
- (a) 66.6% (b) 150%  
(c) 40% (d) 166.6%
188. Specific speed of a turbine is defined as the speed of the turbine which
- (a) produces unit power at unit discharge  
(b) produces unit power at unit head  
(c) delivers unit discharge at unit head  
(d) delivers unit discharge at unit power
189. For a single stage impulse turbine having nozzle angle  $\alpha$ , maximum blade efficiency under ideal conditions is given by
- (a)  $\cos \alpha/2$  (b)  $\cos^2 \alpha/2$   
(c)  $\cos \alpha$  (d)  $\cos^2 \alpha$
190. Bleeding in turbine means :
- (a) leakage of steam  
(b) steam doing no useful work  
(c) removal of condensed steam  
(d) extracting steam for preheating feed water
191. Why intercooling in multistage compressors is done ?
- (a) To minimize the work of compression  
(b) To cool the air delivery  
(c) To cool the air during compression  
(d) None of these

192. Cavitation depends upon
- (a) vapour pressure which is function of temperature
  - (b) absolute pressure or barometric pressure
  - (c) suction pressure ( $H_s$ ) which is height of runner outlet above tail race level.
  - (d) all the above
193. The compression ratio for a practical diesel engine usually lies in the range.
- (a) 3 – 5
  - (b) 6 – 8
  - (c) 10 – 15
  - (d) 16 – 22
194. If maximum surface temperature of sea is  $30^\circ\text{C}$  and temperature in depth is  $4^\circ\text{C}$ , how much can be the maximum thermal efficiency of Ocean Thermal Conversion (OTEC) system ?
- (a) 8.58%
  - (b) 13.3%
  - (c) 86.7%
  - (d) none of the above
195. De-Laval turbine is
- (a) pressure compounded impulse turbine
  - (b) simple single wheel impulse turbine
  - (c) velocity compounded impulse turbine
  - (d) simple single wheel reaction turbine
196. Francis turbine is a
- (a) tangential flow reaction turbine
  - (b) axial flow reaction turbine
  - (c) radial flow reaction turbine
  - (d) mixed flow reaction turbine
197. Which of the following statements is not true for gas turbines ?
- (a) Low full load thermal efficiency
  - (b) Costly machines
  - (c) Self starting unit
  - (d) Slow in its response to acceleration
198. Which of the following statements is not correct about MHD power generation ?
- (a) Lesser thermal pollution
  - (b) No moving parts
  - (c) High operation efficiency
  - (d) No direct conversion of heat into electrical energy
199. Turbine gives best performance (i.e. work at peak efficiency) when they are operated at full or design load. The performance of many turbines deteriorate considerably at part loads. Which of the following turbines is best suited for operation at part loads. ?
- (a) Pelton Turbine
  - (b) Francis Turbine
  - (c) Propeller Turbine
  - (d) Kaplan Turbine
200. If a draft tube is used with a Francis turbine (installed above tail race level), the pressure at the runner outlet
- (a) is equal to atmospheric pressure
  - (b) is above atmospheric pressure
  - (c) is below atmosphere pressure
  - (d) depends upon turbine speed

Space For Rough Work / रफ कार्य के लिए जगह

