

176/2015

Maximum : 100 marks

Time : 1 hour and 15 minutes

1. Resultant of two forces is equal to either of them. The angle between the forces is :

- (A) 120° (B) 60°
(C) 90° (D) 0°

2. The maximum efficiency of a square threaded screw jack is :

- (A) $(1 + \sin \phi)/(1 - \sin \phi)$ (B) $(1 - \sin \phi)/(1 + \sin \phi)$
(C) $(1 - \tan \phi)/(1 + \tan \phi)$ (D) $(1 - \sin \phi)/(1 + \cos \phi)$

Where ϕ is the angle of friction?

3. An operating characteristic curve is a plot between :

- (A) Consumers risk and producers risk
(B) Probability of acceptance and probability of rejection
(C) Percentage of defective and probability of acceptance
(D) Average outgoing quality and probability of acceptance

4. Which of the following is not a part of steam engine?

- (A) Cross head (B) Camshaft
(C) Crank (D) Eccentric

5. Consider the following statements :

- (a) The translator effect of a couple on a body is zero
(b) A couple can be balanced by a couple of opposite sense
(c) The moment of a couple about any point is the same

Which of these statements are correct?

- (A) (b) and (c) (B) (c) only
(C) (a) and (b) (D) (a), (b) and (c)

6. Cam followers are generally classified according to :

1. The nature of its motion
2. The nature of its surface in contact with cam
3. The speed of cam

Which of the above statements are correct?

- (A) 1, 2 and 3 (B) 1 and 2
(C) 2 and 3 (D) 1 and 3

7. A second order system would be critically damped when damping ratio is :
- (A) Less than 1 (B) Equals 1
(C) Greater than 1 (D) Tends to infinity
8. The order of values of thermal efficiency of Otto, Diesel and Dual cycle when they have equal compression ratio and heat rejection is :
- (A) $\eta_{otto} > \eta_{diesel} > \eta_{dual}$ (B) $\eta_{diesel} > \eta_{dual} > \eta_{otto}$
(C) $\eta_{dual} > \eta_{diesel} > \eta_{otto}$ (D) $\eta_{otto} > \eta_{dual} > \eta_{diesel}$
9. A particle starts from rest and moving with a constant acceleration covers a distance x_1 in the third second and x_2 in the fifth second. The ratio x_1/x_2 is :
- (A) 3/5 (B) 5/9
(C) 9/25 (D) 25/81
10. A system of masses rotating in different parallel planes is in dynamic balance if the resultant :
- (A) Force is equal to zero
(B) Couple is equal to zero
(C) Force and resultant couple both are equal to zero
(D) Force is numerically equal to resultant couple but neither of them need necessarily be zero
11. High vacuum pressure is usually expressed in :
- (A) cm of water (B) pascal
(C) torr (D) micron
12. Knocking tendency in a SI engine reduces with increasing :
- (A) Compression ratio (B) Wall temperature
(C) Supercharging (D) Engine speed
13. A body slides down a smooth inclined plane and takes 4 seconds to reach the bottom. If it starts from rest at the top the time taken to cover $1/4^{\text{th}}$ of distance from top is :
- (A) 2 sec. (B) 1.2 sec.
(C) 1.6 sec. (D) 1 sec.
14. Which of the following iron has maximum tensile strength :
- (A) Pig iron (B) White cast iron
(C) Grey cast iron (D) Nodular cast iron

15. The head over a 90 degree V notch increases from 0.15 m to 0.3 m. The ratio of new discharge to original discharge is :
- (A) 5.657 (B) 4
(C) 2 (D) 1.414
16. The purpose of differential speed on trains is served by :
- (A) Taper on rails (B) Taper on wheel face
(C) Track contour (D) Track curvature
17. A projectile has a range R in the gravitational field of earth. Under identical conditions of velocity and acceleration its range on moon will be :
- (A) 6 R (B) R/6
(C) 36 R (D) R/36
18. The coordination number of FCC crystal structure is :
- (A) 4 (B) 8
(C) 12 (D) 16
19. Auto-collimator is used to check :
- (A) Roughness (B) Flatness
(C) Angle (D) Automobile balances
20. The work input to an air compressor will be least if the exponent "n" in the compression process $pv^n = \text{constant}$ equals :
- (A) 1 (B) 1.2
(C) 1.4 (D) Infinity
21. Two particles with masses in the ratio 1 : 4 are moving with equal kinetic energies. The ratio of their linear momentum will be in the ratio :
- (A) 1 : 8 (B) 1 : 2
(C) 1 : 4 (D) 1 : 1
22. Monal metal is an alloy of :
- (A) Nickel and copper (B) Copper and Chromium
(C) Nickel and Chromium (D) Copper, Nickel and Chromium
23. Which one of the following is an extensive property of a thermodynamic system?
- (A) Volume (B) Pressure
(C) Temperature (D) Density

24. Volumetric efficiency of a reciprocating compressor increases with :
1. Increase in clearance ratio
 2. Decrease in delivery pressure
 3. Multistaging
- Which of the statements given above are correct?
- (A) 1 and 2 (B) 2 and 3
(C) 3 only (D) 1, 2 and 3
25. For perfectly elastic bodies, the value of coefficient of restitution is :
- (A) 1 (B) 0.5 to 1
(C) 0 to 0.5 (D) Zero
26. A screw thread is defined by its :
- (A) Root diameter (B) Core diameter
(C) Pitch diameter (D) Crest diameter
27. The gas with highest value of adiabatic index is :
- (A) Helium (B) Nitrogen
(C) Oxygen (D) Methane
28. The use of regenerator in a gas turbine cycle increases :
- (A) Efficiency but has no effect on output (B) Output but has no effect on efficiency
(C) Both efficiency and output (D) Efficiency but decreases output
29. The moment of inertia of a uniform rod of mass m and length l about an axis through its centre and perpendicular to the length of rod is :
- (A) $ml^2/6$ (B) $ml^2/8$
(C) $ml^2/12$ (D) $ml^2/3$
30. A key connecting a flange coupling to a shaft is likely to fail in :
- (A) Shear (B) Tension
(C) Torsion (D) Bending
31. If the thermal efficiency of a carnot engine is 40%, then coefficient of performance of a refrigerator working within the same temperature limits is :
- (A) 0.5 (B) 1.0
(C) 1.5 (D) 4.5
32. Propulsion efficiency of a jet engine is given by :
- (A) $2V_a/(V_j - V_a)$ (B) $(V_j + V_a)/2V_a$
(C) $2V_a/(V_j + V_a)$ (D) $(V_j - V_a)/2V_a$
- Where V_j and V_a are jet velocity and flight velocity relative to aircraft?

33. Toughness of a material signifies :
- (A) Strength (B) Softness
(C) Brittleness (D) Fatigue resistance
34. Which category of the following chains is not used for power transmission?
- (A) Roller chains (B) Bush chains
(C) Tractive chains (D) Inverted tooth chain
35. An engine operates between temperature limits of 900 K and T_2 and another engine operates between T_2 and 400 K. If both the engines are equally efficient T_2 will be :
- (A) 600 K (B) 625 K
(C) 650 K (D) 700 K
36. Consider the following nuclear fuels :
1. Pu - 239
 2. U - 235
 3. U - 233
 4. Th - 232
- Which is the correct sequence of above nuclear fuels in order to increase in half life?
- (A) 1 - 2 - 3 - 4 (B) 1 - 3 - 2 - 4
(C) 2 - 4 - 3 - 1 (D) 4 - 1 - 2 - 3
37. The impact strength is expressed in :
- (A) N (B) N/m
(C) Nm (D) N/m^2
38. The gear size is generally specified by :
- (A) Pitch circle diameter (B) Working depth
(C) Module (D) Tooth thickness
39. During Joule-Thomson expansion the property which remains constant is :
- (A) Temperature (B) Pressure
(C) Enthalpy (D) Volume
40. Falling drops of water is spherical due to :
- (A) Adhesion (B) Cohesion
(C) Surface tension (D) Absorption

41. Modulus of resilience of a material is :
- (A) A measure of its elasticity
 - (B) An index of its compressibility
 - (C) A shock resisting property
 - (D) Property to store energy without undergoing permanent deformation
42. Two closed coil helical springs made from the same diameter wire are wound on 2.5 cm diameter core and the other on 1.25 cm diameter core. If each spring has the same number of coils then the ratio of their spring constants will be :
- (A) 1/16
 - (B) 1/8
 - (C) 1/4
 - (D) 1/2
43. Which of the following gaseous fuels does not have different higher and lower calorific values?
- (A) Methane
 - (B) Ethane
 - (C) Carbon monoxide
 - (D) Hydrogen
44. A rectangular water tank has its length, breadth and height ratio 2 : 1 : 2. The ratio of the hydrostatic force at bottom to any larger vertical surface is :
- (A) 1/2
 - (B) 1
 - (C) 2
 - (D) 4
45. A thin cylindrical pressure vessel has been subjected to internal pressure. The ratio of longitudinal to hoop stress is :
- (A) 0.25
 - (B) 0.5
 - (C) 1
 - (D) 2
46. In deep drawing of sheets, the limiting draw ratio depends on :
- (A) Percentage of elongation of sheet metal
 - (B) Yield strength of sheet metal
 - (C) Type of press used
 - (D) Thickness of sheet
47. In which one of the following materials, the heat energy propagation due to conduction heat transfer will be minimum :
- (A) Lead
 - (B) Copper
 - (C) Water
 - (D) Air
48. A metallic body weighs 80 N in air and 60 N in water. The relative density of the body is :
- (A) 8
 - (B) 6
 - (C) 4
 - (D) 3

49. The rate of change of bending moment is equal to _____ at the section.
 (A) shear force (B) deflection
 (C) loading (D) slope
50. According to Chvorin's equation the solidification time of a casting is proportional to :
 (A) V^2 (B) V
 (C) $1/V$ (D) $1/V^2$
 Where V is the volume of casting
51. A composite wall of a furnace has two layers of equal thickness having thermal conductivities in the ratio 3 : 2. What is the ratio of temperature drop across two layers?
 (A) 3 : 2 (B) 2 : 3
 (C) 1 : 2 (D) 2 : 1
52. A block of ice floats on the surface of water contained in a vessel. How the water level will change when the snow melts?
 (A) Rises (B) Falls
 (C) Remains same (D) Can't predict
53. A uniformly distributed load w in KN/m is acting over the entire length of a 3 m long cantilever beam. If the shear force at the mid-point of cantilever is 6 kN the value of w is :
 (A) 3 (B) 4
 (C) 5 (D) 6
54. The brazing process is carried out in the temperature range (degree Celsius) :
 (A) 60 – 150 (B) 180 – 250
 (C) 350 – 500 (D) 600 – 750
55. The unit of thermal diffusivity is :
 (A) $m^2/hr \text{ } ^\circ C$ (B) $kcal/m^2 \text{ hr}$
 (C) $m/hr \text{ } ^\circ C$ (D) m^2/hr
56. For a steady incompressible flow, the u component of velocity is Ae^x . The corresponding v component of velocity is
 (A) Ae^y (B) Ae^{xy}
 (C) $-Ae^{xy}$ (D) None
57. The diameter of a shaft is increased from 30 mm to 60 mm, all the other conditions remain unchanged. How many times its torque carrying capacity increases?
 (A) 2 (B) 8
 (C) 16 (D) 32

58. In machining aluminum parts the chips produced will be in the form of :
- (A) fragments (B) snarls
(C) helix (D) closed spiral
59. The emissive power is multiplied by _____ to get the intensity of normal radiation for a unit surface.
- (A) $1/\sqrt{\pi}$ (B) $1/\pi$
(C) $1/2\pi$ (D) $\sqrt{\pi}$
60. The value of momentum correction factor for a laminar flow through a circular pipe is approximately :
- (A) $3/4$ (B) 0.87
(C) 1.02 (D) 1.33
61. If a closed coil helical spring absorb 30 N mm of energy while extending by 5 mm, its stiffness is :
- (A) 1 N/mm (B) 2 N/mm
(C) 3 N/mm (D) 4 N/mm.
62. In Taylors tool life equation $VT^n = \text{Constant}$, what is the value of n for ceramic tools?
- (A) 0.15 to 0.25 (B) 0.4 to 0.55
(C) 0.6 to 0.75 (D) 0.8 to 0.9
63. Which dimensionless number has a significance role in forced convection?
- (A) Peclet Number (B) Weber Number
(C) Mach Number (D) Reynolds Number
64. The pressure drop in a pipe flow is directly proportional to the mean velocity. It suggests that :
- (A) The flow is laminar (B) Flow is turbulent
(C) Pipe is smooth (D) Pipe is rough
65. Which among the following constitutes a higher pair?
- (A) a ball and socket joint (B) toothed gearing
(C) universal joint (D) none
66. Which of the following types of layouts is used for the manufacture of huge aircrafts?
- (A) Product layout (B) Process layout
(C) Combination layout (D) Fixed position layout