Mechanical Engineering

1. A lot has 10% defective items. Ten items are chosen randomly from this lot. The probability that exactly 2 of the chosen items are defective is
   a) 0.0036
   b) 0.197
   c) 0.2234
   d) 0.3874

2. The time variation of the position of a particle in rectilinear motion is given by $x = 2t^3 + t^2 + 2t$. If v is the velocity and a the acceleration of the particle in consistent units, the motion started with
   a) v=0, a=0
   b) v=0, a=2
   c) v=2, a=0
   d) v=2, a=2

3. A simple pendulum of length 5m, with a bob of mass 1 kg, is in simple harmonic motion as it passes through its mean position, the bob has a speed of 5 m/s. The net force on the bob at the mean position is
   a) Zero
   b) 2.5 N
   c) 5 N
   d) 25 N

4. Water at $42^\circ C$ is sprayed into a stream of air at atmospheric pressure, dry bulb temperature of $40^\circ C$ and a wet bulb temperature of $20^\circ C$. The air leaving the spray humidifier is not saturated. Which of the following statement is true?
   c) Air gets cooled and humidified
   b) Air gets heated and humidified
   c) Air gets heated and dehumidified
   d) Air gets cooled and dehumidified

5. When the temperature of a solid material increases,
   a) strength of the metal decreases but ductility increases
   b) both strength and ductility of the metal decreases
   c) both strength and ductility of the metal increases
   d) strength of the metal increases but ductility decreases

6. The strength of a brazed joint
   a) decreases with increase in gap between the two joining surfaces
   b) increases with increase in gap between the two joining surfaces
   c) decreases up to certain gap between the two joining surfaces beyond which it increases
   d) increases up to certain gap between the two joining surfaces beyond which it decreases

7. With a 1 unit change in b , what is the change in x in the solution of the system of equations x + y=2 , 1.01x + 0.99y = b?

   a) zero
   b) 2 units

   c) 50 units
   d) 100 units

8. Two books of mass 1 kg each are kept on a table, one over the other. The coefficient of friction on every pair of contacting surfaces is 0.3 the lower book is pulled with a horizontal force F. The minimum value of F for which slip occurs between the two books is

    a)   Zero   b) 1.06 N

    c)   5.74 N   d) 8.83 N

9. The linear velocity (V) of a rotating body is given by

    (a) $V = w / r$ (b)   none of these answers

    (c) $V = 1 / wr$ (d) $V = w . r$

10. A reversible thermodynamic cycle containing only three processes and producing work is to be constructed. The constraints are

    (i)   There must be one isothermal process,

    (ii)   There must be one isentropic process

    (iii)   The maximum and minimum cycle pressures and the clearance volume are fixed, and

    (iv)   Polytropic processes are not allowed. Then the number of possible cycles are

    a) 1   b) 2

    c) 3   d) 4

11. A component can be produced by any of the four processes I,II,III and IV. Process I has fixed cost of Rs 20 and variable cost of Rs 3 per piece. Process II has a fixed cost of Rs 50 and variable cost of Re 1 per piece. Process III has a fixed cost of Rs 40 and variable cost of Rs 2 per piece. Process IV has affixed cost of Rs 10 and variable cost of Rs 4 per piece. If the company wishes to produce 100 pieces of the components, from economic point of view it should choose

    a) Process I   b) Process II

    c) Process III   d) Process IV

12. Let x denote a real number. Find out the INCORRECT statement.

    (a) S={x:x>3} represents the set of all real numbers greater than 3

    (b) S={x:x^2<0} represents the empty set

    (c) S={x:x∈ A and x ∈B} represents the union of set A and set B

    (d) S={x:a<x<b} represents the set of all real numbers between a and b, where a and b are real numbers.

13. For a circular shaft of diameter d subjected to torque T, the maximum value of shear stress is

    a) $\dfrac{64T}{\Pi d^3}$ b) $\dfrac{32T}{\Pi d^3}$

    c) $\dfrac{16T}{\Pi d^3}$ c) $\dfrac{8T}{\Pi d^3}$

14. **The number of inversions for a slider crank mechanism is**

    a)   6   b) 5

    c)   4   d) 3

15. **For a Newtonian fluid**

    a)   Shear stress is proportional to shear strain

    b)   Rate of shear stress is proportional to shear strain

    c)   Shear stress is proportional to rate of shear strain

    d)   Rate of shear stress is proportional to rate of shear strain

16. **Dew point temperature is the temperature at which condensation begins when air is cooled at constant**

    a)   Volume   b) entropy

    c)   Pressure   d) enthalpy

17. **An expandable pattern is used in**

    a)   Slush casting   b) squeeze casting

    c)   Centrifugal casting   d) investment casting

18. **The main purpose of spheroidising treatment is to improve**

    a)   Hardenability of low carbon steels

    b)   Machinability of low carbon steels

    c)   Hardenability of high carbon steels

    d)   Machinability of high carbon steels

19. **A ring gauge is used to measure**

    a)   Outside diameter but not roundness

    b)   Roundness but not outside diameter

    c)   Both outside diameter and roundness

    d)   Only external threads

20. **The number of customers arriving at a railway reservation counter is Poisson distributed with an arrival rate of eight customers per hour. The reservation clerk at this counter takes six minute per customer on an average with an exponentially distributed service time. The average number of customers in the queue will be**

    a)   3   b)   3.2

    c)   4   d)   4.2

21. **Twenty degree full depth involute profiled 19 tooth pinion and 37 tooth gear are in mesh. If the module is 5mm, the centre distance between the gear pair will be**

    a)   140 mm   b)   150 mm

    c)   280 mm   d)   300 mm

22. A steel bar of 40mm X 40mm square cross-section is subjected to an axial compressive load of 200 kN. If the length of the bar is 2m and E=200 GPa, the elongation of the bar will be

    a) 1.25 mm   b)   2.70 mm

    c) 4.05 mm   d)   5.40 mm

23. A 60 mm long and 6 mm thick fillet weld carries a steady load of 15 kN along the weld. The shear strength of the weld material is equal to 200 MPa. The factor of safety is

    a) 2.4   b)   3.4

    c) 4.8   e)   6.8

24. A 4 mm thick sheet is rolled with 300 mm diameter rolls to reduce thickness without any change in its width. The friction coefficient at the work roll interface is 0.1. The minimum possible thickness of the sheet that can be produced in a single pass is

    a) 1.0 mm   b)   1.5 mm

    c) 2.5 mm   d)   3.7 mm

25. Formation of shock wave front in case of convergent -divergent nozzle takes place.

    (a)   at throat   (b)   in convergent portion

    (c)   in divergent portion   (d)   none of the above.

26. Consider steady laminar incompressible axi-symmetric fully developed viscous flow through a straight circular pipe of constant cross-sectional area at a Reynold number of 5. The ratio of inertia force to viscous force on a fluid particle is

    a) 5   b)   1/5

    c) 0   d) α

27. A ball bearing operating at a load F has 8000 hours of life. The life of bearing in hours when load is doubled to 2F is

    c) 8000   b)   6000

    c) 4000   d)   1000

28. During inelastic collision of two particles, which one of the following is conserved?

    a) Total linear momentum only

    b) Total kinetic energy only

c) Both linear momentum and kinetic energy

d) Neither linear momentum nor kinetic energy

29. A steel rod of length L and diameter D, fixed at both ends is uniformly heated to a temp rise of ΔT. The Young's Modulus is E and the coefficient of linear expansion is α. The thermal stress in the rod is

a) 0   b) $\alpha \Delta T$

c) $E \alpha \Delta T$ d) $E \alpha \Delta TL$

30. If a particular Fe-C alloy contains less than 0.83% carbon, it is called

a) High speed steel   b)   hypoeutectoid steel

c) Hypereutectoid steel   d)   Cast Iron

31. Which one of the following is a solid state joining process?

a) Gas tungsten arc welding   b)   resistance spot welding

c) Friction welding   d)   submerged arc welding

32. The gravitational acceleration at a place is 6 times the value of gravitational acceleration at earth, the weight of the body at that place will be

(a)   one-sixth of the weight at earth
(b)   same as at earth
(c)   6 times the weight at earth
(d)   none of the above

33.   The pressure rise (p_i) due to water hammer depends on

(a)   the diameter of pipe only
(b)   the length of pipe only
(c)   time required to close the valve only
(d)   all of the above

34.   Over-control by the governor causes

(a)   hunting   (b)   speed drop

(c)   carburetion   (d)   none of the above

35. Atmospheric pressure head in terms of water column is
(a)   7.5 m   (b)   8.5 m

(c)   9.81 m   (d)   10.30 m

36. The petrol generally used in petrol engines has the octane number of the order of

(a)   100-120   (b) 40-50   (c)   60-70   (d)   80-90

37. In a four-stroke cycle petrol engine, the thing which starts at 40° alter bottom dead centre and ends at 30° before top dead centre is known as

(a)   expansion   (b)   compression

(c)   exhaust valve   (d)   inlet valve.

38. In a helical spring if the pitch angle is more than 10° and spring is subjected to an axial compressive load, the stresses induced in the wire would be

(a)   compressive   (b)   bending

(c)   shear   (d)   (b) and (c) only.

39. For a four cylinder in-line internal combustion engine, the most popular firing order is

(a)   1-4-3-2   (b) 1-3-4-2   (c)   1-2-3-4   (d) 1-2-4-3.

40. One atmospheric pressure is equal to

(a)   1.033 kgf/cm2   (b)   1 kgf/m2

(c)   14.7 kgf/cm2   (d)   1.033 kgf/m2.