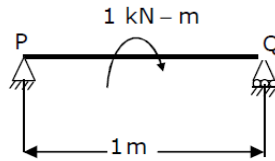


M.E.Mechanical Engg. (Manufacturing Technology)

1. In a petrol engine, the tendency for detonation increases with
A) retarded spark timing (b) running the engine at high speed
C) supercharging (d) increasing the cooling rate
2. A pump handling a liquid raises its pressure from 1 bar to 30 bar. If the density of the liquid is 990 kg/m^3 , the isentropic specific work done by the pump in kJ/kg is
(a) 0.10 (b) 0.30 (c) 2.50 (d) 2.93
3. Maximum power from a Pelton turbine is obtained when the bucket speed is
(a) equal to the jet speed (b) equal to half the jet speed
(c) equal to twice the jet speed (d) independent of the jet speed
4. Pressure loss for laminar flow through pipeline is dependent
(a) inversely on flow of velocity (b) directly on square of pipe radius
(c) directly on length of pipe (d) inversely on viscosity of flowing medium.
5. A reversible engine has ideal thermal efficiency of 30%. When it is used as a refrigerating machine with all conditions unchanged, the COP will be
(a) 3.33 (b) 3.00 (c) 2.33 (d) 1.33
6. As the temperature increases, the thermal conductivity of a gas
(a) increases (b) decreases
(c) remains constant (d) increases up to a certain temperature and then decreases
7. Which of the following materials has maximum thermal conductivity?
(a) Copper (b) Iron (c) Zinc (d) Brass
8. Gray surface is defined as:
(a) surface whose colour is gray
(b) surface that absorbs all the radiations falling on that
(c) surface that reflect all the radiations falling on it
(d) surface whose monochromatic emissivity is independent of wave length.
9. The shear strength of a sheet metal is 300 MPa. The blanking force required to produce a blank of 100 mm diameter from a 1.5 mm thick sheet is close to
(a) 45 kN (b) 70 kN (c) 141 kN (d) 3500 kN
10. A simply supported beam PQ is loaded by a moment of 1kN-m at the mid-span of the beam as shown blow. The reaction forces at supports P and Q respectively are:

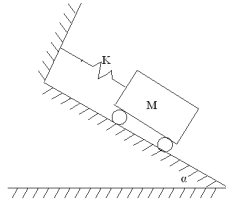


- (a) 1kN downward, 1kN upward
 (b) 0.5kN upward, 0.5kN downward
 (c) 0.5kN downward, 0.5kN upward
 (d) 1kN upward, 1kN upward
11. A rectangular cross-section column, 10 mm x 20 mm is 1m long. The slenderness ratio of the column is close to
 (a) 200 (b) 346 (c) 477 (d) 1000
12. Creep of belt can be controlled by
 (a) decreasing belt length (b) reducing stress in belt
 (c) increasing centre distance (d) reducing belt velocity
13. In a centrifugal governor, the controlling force is observed to be 14 N when the radius of rotation is 2 cm and 38 N when the radius of rotation is 6 cm, the governor:
 (a) is a stable governor
 (b) is an unstable governor
 (c) is an isochronous governor
 (d) cannot be said of what type with the given data
14. In a vibrating system the spring has stiffness 32 N/m and the mass 2kg and the system has a damper with coefficient of viscous damping 8 N-s/m. The system is:
 (a) over damped system (b) under damped system
 (c) critical damped system (d) un-damped system
15. If the load on a ball bearing is reduced to one third, its life would increase by
 (a) 3 times (b) 9 times (c) 27 times (d) 81 times
16. A simply supported beam $50h$ long a rectangular cross-section of depth, h , and width, $2h$ carries a vertical point load, P at its mid-point. The ratio of the maximum shear stress to the maximum bending stress in the beam is
 (a) 0.02 (b) 0.10 (c) 0.05 (d) 0.01
17. Which of the following phase of steel is not present in Iron-Carbon phase diagram?
 (a) Ferrite (b) Cementite (c) Austenite (d) Martensite

18. A carbide tool ($n = 0.25$) used with mild steel work-piece was found to give life of 1 hour 21 minutes at cutting speed of 60 m/min. The value of C in Taylor's tool life equation $VT^n = C$ would be equal to:
 (a) 200 (b) 180 (c) 150 (d) 100
19. The maximum possible draft in cold rolling of sheet increases with the
 (a) Increase in coefficient of friction
 (b) Decrease in coefficient of friction
 (c) Decrease in roll radius
 (d) Increase in roll velocity
20. The hot tearing in a metal casting is due to
 (a) high fluidity
 (b) high melt temperature
 (c) wide range of solidification temperature
 (d) low coefficient of thermal expansion
21. Customers arrive at a ticket counter at a rate of 50 per hour and tickets are issued in the order of their arrival with average time for issuing a ticket being 1 minute. Assuming that customer arrivals follow Poisson distribution and service times are exponentially distributed, the average waiting time in queue in minutes is:
 (a) 3 (b) 4 (c) 5 (d) 6
22. Large size of inventory is a sign of:
 (a) Better planning (b) Inefficiency
 (a) Reliable control of vendors (d) Better scheduling
23. For function $f(x) = 2x^3 - 15x^2 + 36x + 10$, maxima will occur at
 (a) $x = 3$ (b) $x = 1$ (c) $x = 2$ (d) $x = 4$
24. Taylor series expansion of the function, $F(x) = \frac{x}{x+1}$ around $x = 0$ is
 (a) $x + x^2 + x^3 + x^4 + \dots$ (b) $1 + x + x^2 + x^3 + x^4 + \dots$
 (c) $x - x^2 + x^3 - x^4 + \dots$ (d) $2x + 4x^2 + 8x^3 + 16x^4 + \dots$
25. Match the following
- | | |
|-------------------|---|
| A. Newton-Raphson | 1. Integration |
| B. Runge-Kutta | 2. Root finding |
| C. Gauss-Seidel | 3. Ordinary differential equations |
| D. Simpsons' rule | 4. Solution of system of linear equations |

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

26. A ball weighing 0.01 kg hits a hard surface vertically with a speed of 5 m/s and rebounds with the same speed. The ball remains in contact with the surface for 0.01 second. The average force exerted by the surface on the ball is
- (a) 0.1 N (b) 1.0 N (c) 5.0 N (d) 10 N
27. Angular speed of a second hand of a clock is
- (a) π rad/sec (b) $\pi/6$ rad/sec (c) $\pi/15$ rad/sec (d) $\pi/30$ rad/sec
28. The outside diameter of a hollow shaft is twice its inside diameter. The ratio of its torque carrying capacity to that of a solid shaft of the same material having its diameter same as outside diameter is
- (a) 5/16 (b) 9/16 (c) 15/16 (d) 1/16
29. The shape of the bending moment diagram for a uniform cantilever beam carrying a uniformly distributed load over its entire length is
- (a) straight line (b) hyperbola (c) ellipse (d) parabola
30. A fixed gear having 100 teeth meshes with another gear having 25 teeth. The center line of both the gears is joined by an arm so as to form an epicyclic gear train. The number of rotations made by the smaller gear for one rotation of the arm is :
- (a) 3 (b) 4 (c) 5 (d) 6
31. The equation $m \frac{d^2x}{dt^2} + C \frac{dx}{dt} + Kx = 0$ represents
- (a) free vibration
(b) forced vibration
(c) periodically forced vibration
(d) free vibration with viscous damping
32. A simple spring–mass (k-m) model has a natural frequency of ω_n . If the stiffness of the spring is halved and the mass is doubled, then the new natural frequency will become
- (a) $\omega_n/2$ (b) ω_n (c) $2\omega_n$ (d) $4\omega_n$
33. For a single degree of freedom system as shown below, the mass M rolls along an inclined plane at an angle α . The natural frequency of the system will



- (a) increase as α increases
 (b) decrease as α increase
 (c) increase initially as α increases and then decrease with further increase in α
 (d) be independent of α
34. Total number of grades of tolerances as per BIS is :
- (a) 16 (b) 18 (c) 20 (d) 22
35. To resist breaking of the plate in front of the rivet, minimum distance from the centre of the rivet to the edge of the plate at least is, (where d is rivet diameter),
- (a) $1.5d$ (b) $2.0d$ (c) $2.5d$ (d) $3.0d$
36. When the thickness of the insulation on a pipe exceeds the critical value:
- (a) heat transfer rate decreases
 (b) heat transfer rate increases
 (c) heat transfer rate remains constant
 (d) none of the these
37. For the same compression ratio, the efficiency of diesel cycle compared to Otto cycle is
- (a) more (b) equal (c) less (d) none of the these
38. A Francis turbine under a head of 25 m produces 2000 kW at 250 rpm. The power produced under a head of 1 meter will be
- (a) 2 kW (b) 10 kW (c) 16 kW (d) 25 kW
39. Two castings with same surface are , one in sphere shape and other cube are of the same metal What is the ratio of the solidification time for the sphere to that of the cube?
- (a) $3/4$ (b) $6/\pi$ (c) $\pi/6$ (d) $4/3$
40. A shaft (diameter $20^{+0.05/-0.15}$ mm) and a hole (diameter $20^{+0.20/+0.10}$ mm) when assembled will give
- (a) transition fit (b) clearance fit
 (c) interference fit (d) none of the above

41. Given $f(t) = L^{-1} \left[\frac{3s+1}{s^3 + 4s^2 + (K-3)s} \right]$. If $\lim_{t \rightarrow \infty} f(t) = 1$, then the value of K is
 (a) 1 (b) 2 (c) 3 (d) 4
42. How many solutions are feasible for the system of linear equations $x + 2y + z = 0$, $3x + 2y - z = 0$ and $4x + y - 3z = 0$?
 (a) 1 (b) 3 (c) 0 (d) ∞
43. A coin is tossed independently four times. The probability of the event “the number of time heads shows up is more than the number of times tails shows up” is
 (a) $\frac{1}{16}$ (b) $\frac{1}{8}$ (c) $\frac{5}{16}$ (d) $\frac{1}{4}$
44. For cutting of brass with single-point cutting tool on a lathe, tool should have
 (a) Negative rake angle (b) Positive rake angle
 (c) Zero rake angle (d) Zero side relief angle
45. In a machining operation if chip thickness ratio is 0.3 and the rake angle of the tool is 10° , the value of shear strain will be :
 (a) 0.31 (b) 0.13 (c) 3.00 (d) 3.34
46. In the forging operation, fullering is done to
 (a) Draw out the material
 (b) Bend the material
 (c) Upset the material
 (d) Extruding the material
47. A shaft has a dimension $\phi 35^{+0.009}_{-0.025}$. The respective values of fundamental deviation and tolerance are
 (a) -0.025, ± 0.008 (b) -0.025, ± 0.016
 (c) -0.009, ± 0.008 (d) -0.009, ± 0.016
48. Four samples P, Q, R and S with natural frequencies 64, 96, 128 and 256 Hz respectively are mounted on vibration test setups for experiments. If a loud pure note of frequency 144 Hz is produced by some instrument, which of the samples will show the most perceptible induced vibration?
 (a) P (b) Q (c) R (d) S
49. A simple pendulum of length 5 m, with a bob of mass 1 kg, is in simple harmonic motion. At its mean position, the bob has a speed of 5 m/s. The net force on the bob at the mean position is (a) 2.5 N (b) 5 N (c) 25 N (d) Zero
50. A rod of length ‘ l ’ tapers uniformly from diameter ‘ D ’ to ‘ d ’. The Young’s modulus of the material is E . The extension caused by an axial load ‘ P ’ is

$$(a) \frac{4Pl}{\pi(D^2 - d^2)E}$$

$$(b) \frac{4Pl}{\pi(D^2 + d^2)E}$$

$$(c) \frac{4Pl}{\pi D d E}$$

$$(d) \frac{2Pl}{\pi D d E}$$

51. A cube of side 'b' is constrained in all directions and is heated uniformly so that the temperature is raised to $T^\circ C$. If α is the thermal coefficient of expansion of the cube material and 'E' the modulus of elasticity, the stress developed in the cube is

$$(a) \frac{\alpha T E}{\gamma}$$

$$(b) \frac{\alpha T E}{(1 - 2\gamma)}$$

$$(c) \frac{\alpha T E}{2\gamma}$$

$$(d) \frac{\alpha T E}{(1 + 2\gamma)}$$

52. A body of mass 'm' and radius of gyration 'k' is subjected to two masses m_1 and m_2 located at distances h_1 and h_2 from the CG of the original body. An equivalent dynamic system will result, if

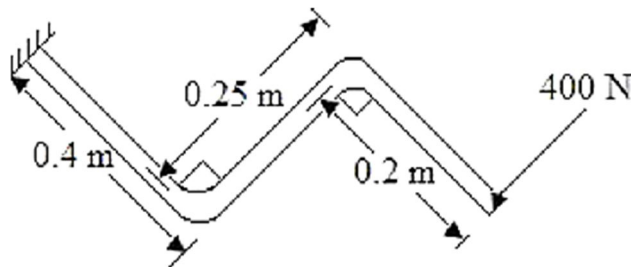
$$(a) h_1 + h_2 = k$$

$$(b) h_1^2 + h_2^2 = k^2$$

$$(c) h_1 h_2 = k^2$$

$$(d) \sqrt{h_1 h_2} = k^2$$

53. A load of 400 N is applied perpendicular to the plane of the handle at the free end as shown in given figure. The values of Shear forces and Bending moment at the fixed end of the handle is



- (a) 400 N and 240 N-m
(c) 100 N and 240 N-m

- (b) 240 N and 400 N-m
(d) 100 N and 400 N-m

54. The work done in stretching a spring of stiffness 10 N/mm, of length 0.6 m to 1 m is

$$(a) 800 \text{ J}$$

$$(b) 1600 \text{ J}$$

$$(c) 3200 \text{ J}$$

$$(d) 6400 \text{ J}$$

55. One kg of ice at $0^\circ C$ is completely melted into water at $0^\circ C$ at 1 bar pressure. The latent heat of fusion of water is 333 kJ/kg and the densities of water and ice at $0^\circ C$ are 999.0 kg/m³ and 916.0 kg/m³ respectively. The approximate values of the work done and energy transferred as heat for the process, respectively are

$$(a) -9.4 \text{ J and } 333.0 \text{ kJ}$$

$$(b) 9.4 \text{ J and } 333.0 \text{ kJ}$$

$$(c) -333.0 \text{ kJ and } -9.4 \text{ J}$$

$$(d) \text{None of the above}$$

56. Match the following

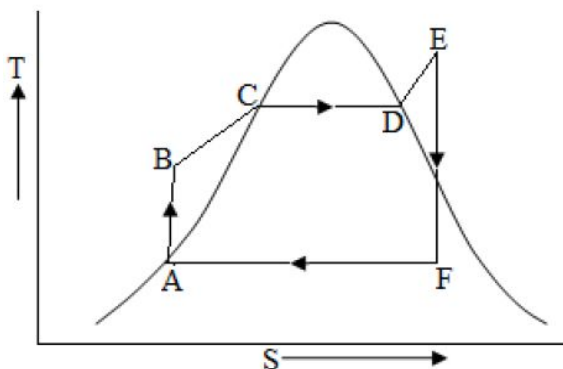
- | | | |
|----|------------------|-------------------------------|
| A. | Reversible cycle | 1. Measurement of temperature |
| B. | Mechanical work | 2. Clausius Theorem |
| C. | Zeroth Law | 3. Inexact differential |
| D. | Heat | 4. High grade energy |

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

57. In thermal power plants, the deaerator is used mainly to

- | | |
|-------------------------------|---|
| (a) Remove air from condenser | (b) increase feed water temperature |
| (c) Reduce steam pressure | (d) remove dissolved gases from fed water |

58. A superheated Rankine Cycle is shown in the given T-S diagram. Starting from the feed pump, the fluid flow upto the boiler exit is represented by state-line



- | | |
|------------|-----------|
| (a) ABCD | (b) BCDE |
| (c) ABDEFA | (d) ABCDE |

59. Which one of the following fuels is used to determine the water equivalent of a bomb calorimeter?

- | | | | |
|------------------|------------|----------|------------|
| (a) Benzoic acid | (b) Octane | (c) Coke | (d) Cetane |
|------------------|------------|----------|------------|

60. A company has an annual demand of 1000 units, ordering cost of Rs. 100/order and carrying cost of Rs. 100/unit/year. If the stock-out costs are estimated to be nearly Rs. 400 each time the company runs out-of-stock, the safety stock justified by the carrying cost will be

- | | | | |
|-------|--------|--------|---------|
| (a) 4 | (b) 20 | (c) 40 | (d) 100 |
|-------|--------|--------|---------|

61. Match the following

	NC Code	Definition
A.	M05	1. Absolute coordinate system
B.	G01	2. Dwell
C.	G04	3. Spindle stop
D.	G90	4. Linear interpolation

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

62. A robot arm PQ with end coordinates P (0, 0) and Q (2, 5) rotates counter clockwise about P in the XY plane by 90° . The new coordinate pair of the end point Q is
 (a) (-2, 5) (b) (-5, 2) (c) (-5, -2) (d) (2, -5)
63. In a DC arc welding operation, the voltage-Arc length characteristic was obtained as $V_{arc} = 20 + 5L$ where the arc length 'L' was varied between 5 mm and 7 mm. Here V_{arc} denotes the arc voltage in volts. The arc current was varied from 400 A to 500 A. Assuming linear power source characteristic, the open circuit voltage and short circuit current for the welding operation are
 (a) 45 V, 450 A (b) 75 V, 750 A
 (c) 95 V, 950 A (d) 150 V, 1500 A
64. In a sand casting operation, the total liquid head is maintained constant such that it is equal to the mould height. The time taken to fill the mould with a top gate is t_A . If the same mould is filled with a bottom gate, then the time taken is t_B . Ignoring the time required to fill the runner and frictional effects and assuming atmospheric pressure at the top molten metal surfaces, the relation between t_A and t_B is:
 (a) $t_B = \sqrt{2} t_A$ (b) $t_B = 2 t_A$
 (c) $t_B = \frac{t_A}{\sqrt{2}}$ (d) $t_B = 2\sqrt{2} t_A$
65. Tap, dies and drills contain carbon of the order of
 (a) Below 0.5% (b) Below 1%
 (c) Above 1% (d) Above 2%
66. Two parallel glass plates, each of width 'W' and negligible thickness are dipped vertically into a body of liquid (surface tension = σ , density = ρ). If the distance between the plates is 't' and the contact angle is ' θ ' then the capillary rise of the liquid between the plates is given by:
 (a) $\frac{2\sigma \cos \theta}{W\rho g}$ (b) $\frac{2\sigma \cos \theta}{t\rho g}$ (c) $\frac{4\sigma \cos \theta}{t\rho g}$ (d) $\frac{\sigma \cos \theta}{t\rho g}$

67. For a completely submerged body with centre of gravity 'G' and centre of buoyancy 'B', the condition of stability will be
 (a) G is located below B (b) G is located above B
 (c) G and B are coincident (d) independent of the locations of G and B
68. A steady 3-dimensional velocity field is given by: $\vec{V} = ax^3\hat{i} + (10b - 3cy^4)\hat{j} + x^2y^2\hat{k}$. The condition under the flow field will be incompressible is
 (a) $a = 4c$ (b) $a = 0$
 (c) $a = 12c$ (d) $b = c$
69. A rectangular water tank filled to the brim, has its length, breadth and height in the ratio of 2: 1: 2. The ratio of hydrostatic forces at the bottom to that at any larger vertical surface is:
 (a) $\frac{1}{2}$ (b) 1 (c) 2 (d) 4
70. Which non-dimensional number relates the thermal boundary layer and hydrodynamic layer?
 (a) Rayleigh number (b) Peclet number
 (c) Grashof number (d) Prandtl number
71. Match the following
- | | List - I | | List - II | |
|----|---------------------|--|-----------|------------------------|
| A. | Schmidt number | | 1. | $\frac{k}{\rho C_p D}$ |
| B. | Thermal diffusivity | | 2. | $\frac{h_m L}{D}$ |
| C. | Lewis number | | 3. | $\frac{\mu}{\rho D}$ |
| D. | Sherwood number | | 4. | $\frac{k}{\rho C_p}$ |
- | | A | B | C | D |
|-----|---|---|---|---|
| (a) | 4 | 3 | 2 | 1 |
| (b) | 4 | 3 | 1 | 2 |
| (c) | 3 | 4 | 2 | 1 |
| (d) | 3 | 4 | 1 | 2 |
72. In a counter flow heat exchanger, the product of specific heat and mass flow rate is same for hot and cold fluids. If NTU is equal to 0.5, then the effectiveness of the heat exchanger is
 (a) 1.0 (b) 0.5 (c) 0.33 (d) 0.2
73. Six sigma signifies
 (a) 65 % compliance (b) 99.73 % compliance
 (c) 90 % compliance (d) None of above

74. In orthogonal cutting, the depth of cut is halved and the feed rate is double. If the chip thickness ratio is unaffected with the changed cutting conditions, the actual chip thickness will be
- | | |
|-------------|----------------|
| (a) Doubled | (b) Quadrupled |
| (c) Halved | (d) Unchanged |
75. Additive manufacturing is also called
- | | |
|---------------------------|-------------|
| (a) Turning | (b) Milling |
| (c) layered manufacturing | (d) Welding |