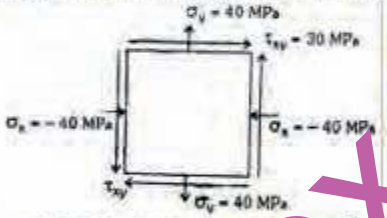
MECHANICAL ENGINEERING

1. If the cross-section of a member is subjected to a uniform shear stress of intensity 'q', then the strain energy stored per unit volume is equal to (C = modulus of rigidity)
   a. $2q^2/C$
   b. $2C/q^2$
   c. $q^2/2C$
   d. $C/2q^2$

2. For a linearly elastic, isotropic and homogeneous material, the number of elastic constants required to relate stress and strain is
   a. two ρ
   b. three
   c. four
   d. six

3. The state of stress at a point in a loaded member is shown in the figure. The magnitude of maximum shear stress is



   a. 10 MPa [1MPa = 1 kg/cm^2]
   b. 30 MPa
   c. 50 MPa
   d. 100 MPa

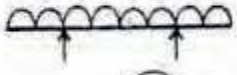
4. A rod of length 'l' and cross-sectional area 'A' rotates about an axis passing through one end of the rod. The extension produced in the rod due to centrifugal force is (w is the weight of the rod per unit length and ω is the angular velocity of rotation of the rod
   a. $\omega wl^2 / gE$
   b. $\omega^2 wl^2 / 3gE$
   c. $\omega^2 wl^2 / gE$
   d. $3gE / \omega^2 wl^2$

5. The unit of elastic modulus is the same as those of
   a. stress, shear modulus and pressure
   b. strain, shear modulus and force
   c. shear modulus, stress and force
   d. stress, strain and pressure

6. In the case of an engineering material under unidirectional stress in the x-direction, the Poisson's ratio is equal to (symbols have the usual meaning)
   a. $\varepsilon_y / \varepsilon_x$
   b. ε_y / σ_x
   c. $\varepsilon_y / E\sigma_x$
   d. σ_x / ε_x

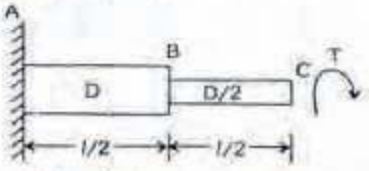
7. Young's modulus of elasticity and Poisson's ratio of a material are 1.25×10^5 MPa and 0.34 respectively. The modulus of rigidity of the material is
   a. 0.025×10^5 MPa
   b. 0.664×10^5 MPa
   c. 0.8375×10^5 MPa
   d. 0.9469×10^5 MPa

8. A beam carries a uniformly distributed load and is supported with two equal overhangs as shown in figure A. Which one of the following correctly shows the bending moment diagram for the beam?



   a. 
   b. 
   c. 
   d. 

9. A circular shaft fixed at A has diameter D for half of its length and diameter D/2 over the other half. What is the rotation of C relative to B if the rotation of B relative to A is 0.1 radian?

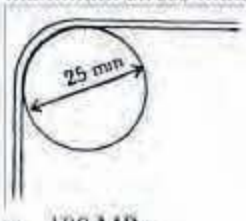


   a. 0.4 radian

b. 0.8 radian
c. 1.6 radian
d. 3.2 radian

10. If two shafts of the same length, one of which is hollow, transmit equal torques and have equal maximum stress, then they should have equal
a. polar moment of inertia
b. polar modulus of section
c. diameter
d. angle of twist

11. A 0.2 mm thick tape goes over a frictionless pulley of 25 mm diameter. If E of the material is 100 GPa, then the maximum stress induced in the tape is



a. 100 MPa
b. 200 MPa
c. 400 MPa
d. 800 MPa

12. The ratio of circumferential stress to longitudinal stress in a thin cylinde subjected to internal hydrostatic pressure i
a. ½
b. 1
c. 2
d. 4

13. The ends of the leaves of semi-elliptical leaf spring are made triangular in plan in order to
a. obtain variable I in each leaf
b. permit each leaf to act as a overhanging beam
c. have variable bending moment in each leaf
d. make MR constant throughout the length of the leaf

14. Consider the following characteristics
1. The cutting edge is normal to the cutting velocity
2. The cutting forces occur in two directions only
3. The cutting edge is wider than the depth of Cut

The characteristics applicable to orthogonal cutting would include
a. 1 and 2
b. 1 and 3
c. 2 and 3
d. 1, 2 and 3

15. The time (in minutes) for drilling a hole is given by

$$t = \frac{Depth\ of\ the\ hole + h}{Feed \times RPM}$$

Where 'h' is the
a. length of the drill
b. drill diameter
c. flute length of the drill
d. cone height of the drill

16. Major operations in the manufacture of steel balls used for Ball Bearings are given below
1. Oil lapping
2. Cold heading
3. Annealing
4. Hardening
5. Rough grinding

The correct sequence of these operations is
a. 3, 2, 4, 1, 5
b. 3, 2, 1, 4, 5
c. 2, 3, 4, 5, 1
d. 2, 3, 5, 4, 1

17. Stroke of a shaping machine is 250 mm. It makes 30 double strokes per minute. Overall average speed of operation is
a. 3.75 m/min
b. 5.0 m/min
c. 7.5 m/min
d. 15.0 m/min

18. Which of the following methods can be used for manufacturing 2 meter long seamless metallic tubes?
1. Drawing
2. Extrusion
3. Rolling

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

19. A standard dividing head is equipped with the following index plates
1. Plate with 15, 16, 17, 18, 19, 20 holes circles
2. Plate with 21, 23, 27, 29, 31, 33 holes circles
3. Plate with 37, 39, 41, 43, 47, 49 holes circles

For obtaining 24 divisions on a work piece by simple indexing

a. hole plate 2 alone can be used
b. hole plates 1 and 2canbe used
c. hole plates 1 and 3 can be used
d. any of the three hole plates can be used

20. Chills are used in casting moulds to
a. achieve directional solidification
b. reduce possibility of blow holes
c. reduce the freezing time
d. increase the smoothness of cast surface

21. In a blanking operation to produce steel washer, the maximum punch load used is 2 × 10^5N. The plate thickness is 4mm and percentage penetration is 25. The work done during this shearing operation is
a. 200 J
b. 400 J
c. 600 J
d. 800 J

22. Consider the following factors
1. Clearance between the punch and the die is too small.
2. The finish at the corners of the punch is poor.
3. The finish at the corners of the die is poor.
4. The punch and die alignment is not proper.
5. The factors responsible for the vertical lines parallel to the axis noticed on the outside of a drawn cylindrical cup would include
a. 2, 3 and 4
b. 1 and 2
c. 2 and 4
d. 1, 3 and 4

23. In gas welding of mild steel using an oxy-acetylene flame, the total amount of acetylene consumed was 10 liter. The oxygen consumption from the cylinder is
a. litre
b. litre
c. litre
d. 20 litre

24. A multispindle automat performs four operations with times 50, 60, 65 and 75 seconds at each of its work centers. The cycle time (time required to manufacture one work piece) in seconds will be
a. 50 + 60 + 65 + 75
b. (50 + 60 + 65 + 75)/4
c. 75/4
d. 75

25. To reduce the consumption of synthetic resins, the ingredient added is
a. accelerator
b. elastomer
c. modifier
d. filler

26. Work study involves
a. only method study
b. only work measurement
c. method study and work measurement
d. only motion study

27. Consider the following advantages
1. Lower in-process inventory
2. Higher flexibility in scheduling in case of machine breakdown
3. Lower cost in material handling equipment
4. When compared to process layout, the advantages of product layout would include
a. and 2
b. 1 and 2
c. and 3
d. 2 and 3

28. The following activities are to be performed in a particular sequence for routing a product
1. Analysis of the product and breaking it down into components requirement
2. Determination of the lot size
3. Determination of operations and processing time
4. Taking make or buy decisions
The correct sequence of these activities is
a. 1, 2, 3, 4
b. 3, 1, 2, 4
c. 3, 1, 4, 2
d. 1, 4, 3, 2

29. Consider the following situations
1. Loads are uniform
2. Materials move relatively continuously
3. Movement rate is variable
4. Routes do not vary
For material transportation, conveyors are used when the prevailing conditions include
a. 1, 3 and 4
b. 1, 2 and 4
c. 1, 2 and 3
d. 2, 3 and 4

30. A systematic job improvement sequence will consist of
1. Motion Study

2. Time Study
3. Job Enrichment
4. Job Enlargement

An optimal sequence would consist of

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

31. Money required for the purchase of stores, payment of wages etc is known as

a. Block Capital
b. Reserved Capital
c. Authorized Capital
d. Working Capital

32. Fixed investments for manufacturing a product in a particular year is Rs. 80,000/-. The estimated sales for this period is Rs. 2,00,000/-. The variable cost per unit for this product is Rs.41 If each unit is sold at Rs. 20/- then the break even point would be

a. 4,000
b. 5,000
c. 10,000
d. 20,000

33. If orders are placed once a month to meet an annual demand of 6,000 units, then the average inventory would be

a. 200
b. 250
c. 300
d. 500

34. The reading of the pressure gauge fitted on a vessel is 25 bar. The atmospheric pressure is 1.03 bar and the value of g is 9.81 m/s^2. The absolute pressure in the vessel is

a. 23.97 bar
b. 25.0 bar
c. 26.03 bar
d. 3.84 bar

35. A mixture of gases expands form 0.03 m^3 to 0.06 m^3 at a constant pressure of 1 MPa and absorbs 84 kJ of heat during the process. The change in internal evergy of the mixture is

a. 30 kJ
b. 54 kJ
c. 84 kJ
d. 114 kJ

36. Match List I with List II and select the correct answer using the codes given below the lists

List I

A. Mechanical work
B. $\oint \frac{dQ}{T} \leq 0$
C. Zeroth Law
D. H-TS

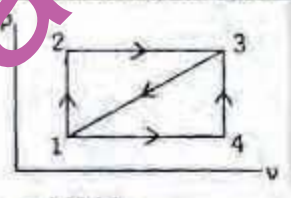
List II

1. Clausius-Clapeyron equation
2. Gibb's equation
3. High grade energy
4. Concept of temperature

Codes:

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

37. Given that along the path 1-2-3, a system absorbs 140 kJ as heat and does 60 kJ work while along the path 1-4-3 it does 20 kJ work (see figure given). The heat absorbed during the cycle 1-4-3 is



a. - 140 kJ
b. - 80 kJ
c. - 40 kJ
d. + 60 kJ

38. In a cyclic heat engine operating between a source temperature of 600°C and a sink temperature of 20°C, the least rate of heat rejection per kW net output of the engine is

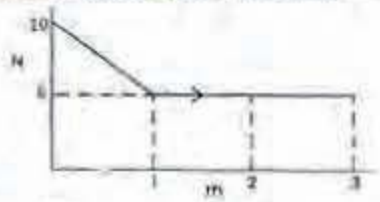
a. 0.460 kW
b. 0.505 kW
c. 0.588 kW
d. 0.650 kW

39. In a steam condenser, the partial pressure of steam and air are 0.06 bar and 0.007 bar respectively. The condenser pressure is

a. 0.067 bar
b. 0.06 bar
c. 0.053 bar
d. 0.007 bar

40. The given figure shows the variation of force in an elementary system which undergoes a process during which the plunger position changes form 0 to 3m. If the internal energy of the system at the end

of the process is 2.5 J higher, then the heat absorbed during the process is



a. 15 J
b. 20 J
c. 25 J
d. 30 J

41. The fundamental unit of enthalpy is
a. $M L T^{-2}$
b. $M L^2 T^{-2}$
c. $M L^2 T^{-2}$
d. $M L^3 T^{-2}$

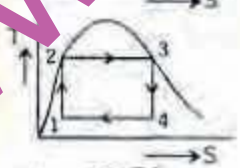
42. Increase in entropy of a system represents
a. increase in availability of energy
b. increase in temperature
c. decrease in pressure
d. degradation of energy

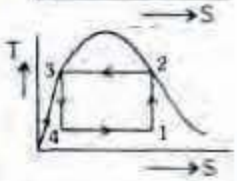
43. A Carnot engine receiving heat at 400 K has an efficiency of 25%. The C.O.P. of a Carnot refrigerator working between the same temperature limits is
a. 1
b. 2
c. 3
d. 4

44. The correct representation of a simple Rankine cycle on a T-S diagram is

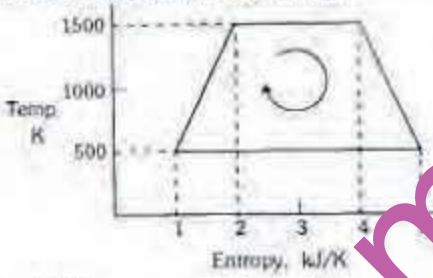
a.


b.


c.


d.


45. The efficiency of a reversible cyclic process undergone by a substance as shown in the given diagram is



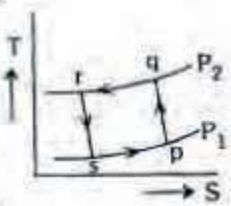
a. 0.40
b. 0.55
c. 0.66
d. 0.80

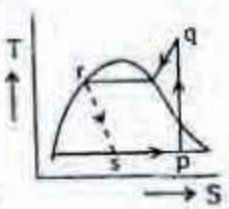
46. Otto cycle efficiency is higher than Diesel cycle efficiency for the same compression ratio and heat input because, in Otto cycle
a. combustion is at constant volume
b. expansion and compression are isentropic
c. maximum temperature is higher
d. heat rejection is lower

47. Isothermal efficiency of a reciprocating compressor is defined as
a. $\frac{\text{actual work done during compression}}{\text{isothermal work done during compression}}$
b. $\frac{\text{adiabatic work done during compression}}{\text{isothermal work done during compression}}$
c. $\frac{\text{isothermal work done during compression}}{\text{actual work done during compression}}$
d. $\frac{\text{isothermal work done during compression}}{\text{actual work done during adiabatic compression}}$

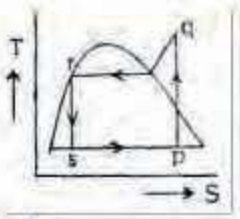
48. Match List I with List II and select the correct answer using the codes given below lists

List I

A.


B.


C



List II

1. Vapour compression cycle using expansion valve
2. Bell-Coleman cycle (gas compression cycle)
3. Vapour compression cycle using expansion engine

Codes:

	A	B	C
a.	1	2	3
b.	2	3	1
c.	2	1	3

49. In the absorption refrigeration cycle, the compressor of the vapour compression refrigeration cycle is replaced by
   a. liquid pump
   b. generator
   c. absorber and generator
   d. absorber, liquid pump and generator

50. The C.O.P. of a Carnot refrigeration cycle decreases on
   a. decreasing the difference in operating temperatures
   b. keeping the upper temperature constant and increasing the lower temperature
   c. increasing the upper temperature and keeping the lower temperature constant
   d. increasing the upper temperature and decreasing the lower temperature

51. Desert coolers are suitable for hot and very dry outside conditions because
   a. water is recirculated in the spray
   b. heat is neither added nor removed from the water
   c. wet bulb depression (t — t') is very large
   d. large quantity of air can be conditioned

52. In an auditorium, the heat generated due to the occupants and the electric lights and other equipment is 100 kW. The rate of generation of excess moisture is 60 kg/hr. If an air- conditioner is supplying conditioned air to the auditorium at the rate of 500 m^3/min, then the sensible heat factor (SHF) for the auditorium is
   a. 0.27
   b. 0.40
   c. 0.73
   d. 0.95

53. A room air is at a DBT of T_r and relative humidity ϕ_r. The effective temperature of the room is
   a. the temperature at which the room air is saturated but gives the same feeling of comfort as the actual state of the room air
   b. the temperature at which the room air is at 50% relative humidity but gives the same feeling of comfort as the actual state of the room air
   c. the temperature at which the room air is completely dry but gives the same feeling of comfort as the actual state of the room air
   d. none of the above

54. Consider the following statements
   1. Low value of the bypass factor for an air- conditioning equipment signifies high performance of the equipment.
   2. Bypass factor for an air-conditioning equipment signifies the fraction of ambient air mixed with the air to be conditioned.
   3. Bypass factor for an air-conditioning equipment signifies the fraction of the air to be conditioned coming in contact with the conditioning surface.

   Of these statements
   a. 1 and 3 are correct
   b. 1 and 2 are correct
   c. 3 alone is correct
   d. 2 alone is correct

55. It is desired to condition the outside air from 70% RH and 45°C dry bulb to 50% RH and 25°C. dry room condition. The practical arrangement would be
   a. cooling and dehumidification
   b. dehumidification and pure sensible cooling
   c. cooling and humidification
   d. dehumidification

56. Consider- the following statements
   1. Boilers rated above 500 MW are not necessarily supercritical boilers.
   2. Power plant boilers are generally once-through boilers.
   3. Blow down at regular intervals is done to remove solids.

   Of these statements
   a. 1, 2 and 3 are correct

b. 1 and 2 are correct
c. 2 and 3 are correct
d. 1 and 3 are correct

57. In a boiler, feed water supplied per hour is 205 kg while coal fired per hour is 23 kg. Net enthalpy rise per kg of water is 145 kJ for conversion to steam. If the calorific value of coal is 2050 kJ/kg then the boiler efficiency will be
a. 78%
b. 74%
c. 62%
d. 59%

58. The degree of reaction of a turbine is the ratio of enthalpy drop in
a. moving blades to enthalpy drop in the stage
b. fixed blades to enthalpy drop in the stage
c. moving blades to enthalpy drop in fixed blades
d. fixed blades to enthalpy drop in moving blades

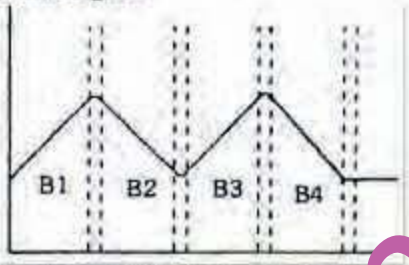
59. With reference to supersaturated flow through a steam nozzle, which of the following statements are true?
1. Steam is subjoined.
2. Mass flow rate is more than the equilibrium rate of flow.
3. There is loss in availability.
4. Index of expansion corresponds to wet steam conditions.
5. Select the correct answer using the codes given below.

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

60. Consider the following statements
1. Almost all flow losses take place in the converging part of a nozzle.
2. Normal shocks are likely to occur in the converging part of a nozzle.
3. Efficiency of reaction turbines is higher than that of impulse turbines.

Of these statements
a. 1, 2 and 3 are correct
b. 2 and 3 are correct
c. 1 and 2 are correct
d. 1 and 3 are correct

61. In the given figure, B1, B2, B3 and B4 represent blade passages in an impulse turbine. Consider the following statements in this regard



1. The solid line represents velocity variation.
2. The solid line represents pressure variation.
3. B2 and B4 are rotor passages.
4. B1 and B3 are rotor passages.

Of These statements
a. 1 and 3 are correct
b. 1 and 4 are correct
c. 2 and 3 are correct
d. 2 and 4 are correct

62. The impulse turbine rotor efficiency will have a maximum value of $0.5 \cos^2 \alpha_1$ where α_1 is the nozzle exit flow angle, if the
a. blades are equiangular
b. blade velocity coefficient is unity
c. blades are equiangular and frictionless
d. blade solidity is 0.65

63. Energy conversion takes place only in one row of nozzle blades and later the steam glides over the rotor and guide blade rows in the case of
a. De Laval turbine
b. Rateau turbine
c. Parson's turbine
d. Curtis turbine

64. In a 50% reaction turbine stage, the tangential component of absolute velocity at rotor inlet is 537 m/s and blade velocity is 454 m/s. The power output in kW per kg of steam will be
a. 302
b. 282
c. 260
d. 248

65. Q. 65. Which of the following statements are false?
1. Soot blowers are used generally in oil fired boilers.
2. There will be at least three safety valves on the boiler drum.

3. Recuperative heating is better than regenerative heating in the case of air pre-heaters.

Select the correct answer using the codes given below codes:

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

66. Match List I with II List and select the correct answer using the codes given below the lists

List I

A. Propeller turbine
B. Tangential turbine
C. Reaction is zero
D. Reaction turbine

List II

1. Impulse turbine
2. Kaplan turbine
3. Gas turbine
4. Pelton turbine.

Codes:

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

67. A jet o water issues from a nozzle wi a velocity of 20 m/s and it impinge normally on a flat plate moving away from it at 10 m/s. If the cross-sectional area of the jet is 0.02 m^2 and the density of water is taken as 1000 kg/m^3 then the force developed on the plate will b
a. 10 N
b. 100 N
c. 1000 N
d. 200 N

68. In the case of Pelton turbine installed in a hydraulic power plant, the gross head available is the vertical distance between
a. forebay and tail race
b. reservoir level and turbine inlet
c. forebay and turbine inlet
d. reservoir level and tail race

69. The moderator used in a last breeder nuclear reactor is
a. graphite or liquid sodium
b. graphite or beryllium oxide
c. graphite, liquid sodium or beryllium oxide
d. none of the above

70. Match List I with List II and select the correct answer using the codes given below the lists

List I (Turbines)

A. Kaplan turbine
B. Francis turbine
C. Pelton wheel with single jet
D. Pelton wheel with two or more jets

List II (Specific speeds in MKS units)

1. 10 to 35
2. 35 to 60
3. 60 to 300
4. 300 to 1000

Codes:

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

71. A hydraulic coupling belongs to the category of
a. power absorbing machines
b. power developing machines
c. energy generating machines
d. energy transfer machines

72. For pumping molasses, it is preferable to employ a
a. reciprocating pump
b. centrifugal pump with double shrouds
c. open impeller pump
d. multistage centrifugal pump

73. In the case of a centrifugal pump, cavitations will occur if
a. it operates above the minimum net positive suction head
b. it operates below the minimum net positive suction head
c. the pressure at the inlet of the pump is above the atmospheric pressure
d. the pressure at the inlet of the pump is equal to the atmospheric pressure

74. A circular disc of radius 'r' is submerged vertically in a static fluid up to a depth 'h' from the free surface. If $h > r$, then the position of centre of pressure will
a. be directly proportional to h
b. be inversely proportional to h
c. be directly proportional to r
d. not be a function of h or r

75. If a cylindrical wooden pole, 20 cm in diameter and 1 m in height is placed in a pool of water in a vertical position (the

specific gravity of wood is 0.6), then it will
a. float in stable equilibrium
b. float in unstable equilibrium
c. float in neutral equilibrium
d. start moving horizontally

76. An inclined manometer inclined at 30° to the horizontal, measures the pressure differential between two locations of pipe carrying water. If the manometric liquid is mercury (specific gravity 13.6) and the manometer showed a level difference of 20 cm, then the pressure head difference of water between the two tappings will be
a. 1.26 m
b. 1.36 m
c. 2.52 m
d. 2.72 m

77. An open tank contains water to a depth of 2 m and oil over it to a depth of 1 m. If the specific gravity of oil is 0.8, then the pressure intensity at the interface of the two fluid layers will be
a. 7848 N/m^2
b. 8720 N/m^2
c. 9347 N/m^2
d. 9750 N/ m^2

78. Consider the following statements For a body totally immersed in a fluid,
1. the weight acts through the centre of gravity of the body
2. the up thrust acts through the centroid of the body

Of these statements
a. both 1 and 2 are true
b. 1 is true but 2 is false
c. 1 is false but 2 is true
d. neither 1 nor 2 is true

79. The components of velocity u and v along the x- and y- directions in a 2-D flow problem in an incompressible fluid are
1. $u = x^2 \cos y$; $v = -2x \sin y$
2. $u = x + 2$; $v = 1 - y$
3. $u = xy$; $v = x^2 - y^2/2$
4. $u = \ln x + y$; $v = xy - y/x$

Those which would satisfy the continuity equation would include
a. 1, 2 and 3
b. 2, 3 and 4
c. 3 and 4
d. 1 and 2

80. A simple Pitot tube can be used to measure which of the following quantities?
1. Static head
2. Datum head
3. Dynamic head
4. Friction head
5. Total head

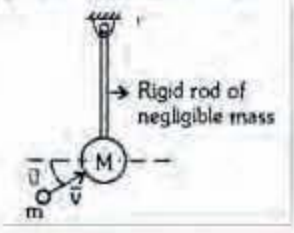
Select the correct answer using the codes given below codes:
a. 1, 2 and 4
b. 1, 3 and 5
c. 2, 3 and 4
d. 2, 3 and 5

81. Flow takes place at Reynolds number of 1500 in two different pipes with relative roughness of 0.001 and 0.002. The friction factor
a. will be higher in the case of pipe with relative roughness of 0.001
b. will be higher in the case of pipe having relative roughness of 0.002
c. will be the same in both the pipes
d. in the two pipes cannot be compared on the basis of data given

82. A fluid jet is discharging from a 100 mm nozzle and the vena contracta formed has a diameter of 90 mm. If the coefficient of velocity is 0.95, then the coefficient of discharge for the nozzle is
a. 0855
b. 081
c. 0.9025
d. 0.7695

83. The shear stress in turbulent flow is
a. linearly proportional to the velocity gradient
b. proportional to the square of the velocity gradient
c. dependent on the mean velocity of flow
d. due to the exchange of energy between the molecules

84. As shown in the given figure, a bullet of mass m and initial velocity $\bar{v}$ hits M and gets embedded into M.



Assertion (A): Just before and after collision, the total linear momentum of m and M together is conserved only in the horizontal direction and not in the vertical direction.
Reason (R): The total kinetic energy of m and M together is not conserved.
a. Both A and R are true and R is the correct explanation of A
b. Both A and R are true but R is not a correct explanation of A
c. A is true but R is false
d. A is false but R is true

85. Assertion (A): A cam and follower is an example of a higher pair.
Reason (R): The two elements have surface contact when the relative motion takes place.
a. Both A and R are true and R is the correct explanation of A
b. Both A and R are true but R is not a correct explanation of A
c. A is true but R is false
d. A is false but R is true

86. Assertion (A): Every rotating shaft has whirling speeds.
Reason (R): Eccentricity of rotors or rotating shafts is unavoidable.
a. Both A and R are true and R is the correct explanation of A
b. Both A and R are true but R is not a correct explanation of A
c. A is true but R is false
d. A is false but R is true

87. Assertion (A): Endurance limits for all materials are always less than the ultimate strength of the corresponding materials.
Reason (R): Stress concentration ma machine part due to any dislocation is very damaging when the part is subjected to varia[illegible]ding.
a. Both A and R are true and R is the correct explanation of A
b. Both A and R are true but R is not a correct explanation of A
c. A is true but R is false
d. A is false but R is true

88. Assertion (A): In a loaded beam, if the shear force diagram is a straight line parallel to the beam axis, then the bending moment diagram is a straight line inclined to the beam axis.
Reason (R): When shear force at any section of a beam is zero or changes sign, the bending moment at that section s maximum.
a. Both A and R are true and R is the correct explanation of A
b. Both A and R are true but R is not a correct explanation of A
c. A is true but R is false
d. A is false but R is true

89. Assertion (A): The characteristic feature of High Speed Steel is its red hardness.
Reason (R): Chromium and cobalt in High Speed Ste& promote martensite formation when the tool is cold worked.
a. Both A and R are true and R is the correct explanation of A
b. Both A and R are true but R is not a correct explanation of A
c. A is true but R is false
d. A is false but R is true

90. Assertion (A): Cemented carbide tool tips are produced by powder metallurgy.
Reason (R): Carbides cannot be melted and cast.
a. Both A and R are true and R is the correct explanation of A
b. Both A and R are true but R is not a correct explanation of A
c. A is true but R is false
d. A is false but R is true

91. Assertion (A): Gang process chart is an aid in studying the activities of a group of people working together.
Reason (R): Gang process chart analyses the cycle or routine followed by each member of the gang.
a. Both A and R are true and R is the correct explanation of A
b. Both A and R are true but R is not a correct explanation of A
c. A is true but R is false
d. A is false but R is true

92. Assertion (A): Job shop production leads to large work-in-process inventory.
Reason (R): Jobbing production is used to manufacture medium demand variety production.
a. Both A and R are true and R is the correct explanation of A
b. Both A and R are true but R is not a correct explanation of A
c. A is true but R is false

d. A is false but R is true

93. Assertion (A): FIFO rules for sequencing are accepted easily by all as it appears fair to all.
Reason (R): FIFO rule is optimum for most scheduling situations.
a. Both A and R are true and R is the correct explanation of A
b. Both A and R are true but R is not a correct explanation of A
c. A is true but R is false
d. A is false but R is true

94. Assertion (A): Although a heat pump is a refrigerating system, the coefficient of performance differs when it is operating on the heating cycle.
Reason (R): It is the condenser heat that is useful (the desired effect) instead of the refrigerating effect.
a. Both A and R are true and R is the correct explanation of A
b. Both A and R are true but R is not a correct explanation of A
c. A is true but R is false
d. A is false but R is true

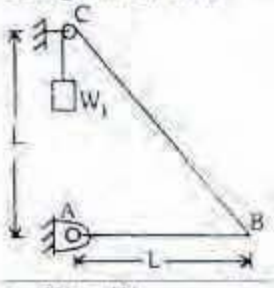
95. Assertion (A): Freon-12 is odourless and its leakage cannot be easily detected. However, it is preferred in comfort air conditioning.
Reason (R): It is almost impossible for Freon 12 leakage to attain a fatal concentration.
a. Both A and R are true and R is the correct explanation of A
b. Both A and R are true but R is not a correct explanation of A
c. A is true but R is false
d. A is false but R is true

96. Assertion (A): A gas turbine power plant is very sensitive to turbine and compressor inefficiencies.
Reason (R): In a gas turbine power plant, a large portion of the turbine work is consumed by the compressor.
a. Both A and R are true and R is the correct explanation of A
b. Both A and R are true but R is not a correct explanation of A
c. A is true but R is false
d. A is false but R is true

97. Assertion (A): For the same limits of boiler pressure and temperature, the specific steam consumption of ideal Carnot cycle is less than that of ideal Rankine cycle.
Reason (R): For the same limits of boiler pressure and temperature, Carnot cycle is more efficient than Rankine cycle.
a. Both A and R are true and R is the correct explanation of A
b. Both A and R are true but R is not a correct explanation of A
c. A is true but R is false
d. A is false but R is true

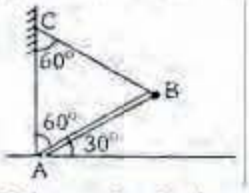
98. Assertion (A): Entropy change for a reversible adiabatic process is zero.
Reason (R): There is no heat transfer in an adiabatic process.
a. Both A and R are true and R is the correct explanation of A
b. Both A and R are true but R is not a correct explanation of A
c. A is true but R is false
d. A is false but R is true

99. A uniform heavy rod AB of length L and weight W is hinged at A and tied to a weight W_1 by a string at B.
The mass less string passes over a frictionless pulley (of negligible dimension) at C as shown in the figure. If the rod is in equilibrium at horizontal configuration, then



a. $W_1 = W$
b. W_1 W/2
c. $W_1 = \sqrt{2}\,W$
d. $W_1 = W/\sqrt{2}$

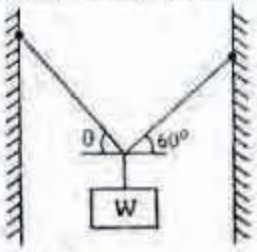
100. A uniform boom AB (see given figure) pinned at A is held by the cable BC in the position shown.



If the tension in the cable is 200 kgf, then the weight of the boom and the reaction of the pin at A on the boom are respectively

a. 300 kgf; 100 $\sqrt{3}$ kgf, 30°
b. 400 kgf; 100 $\sqrt{3}$ kgf, 60°
c. 300 kgf; 200 $\sqrt{3}$ kgf, 30°
d. 400 kgf; 200 $\sqrt{3}$ kgf, 60°

101. A weight W is supported by two cables as shown in the given figure. The tension in the cable making angle θ will be the minimum when the value of θ is

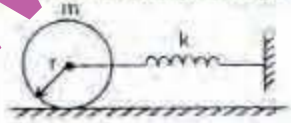


a. 0°
b. 30°
c. 45°
d. 60°

102. An elevator weighing 10,000 kgf attains an upward velocity of 4 m/s in two seconds with uniform acceleration. The tension in the cable wall be approximately
a. 8,000 kgf
b. 10,000 kgf
c. 12,000 kgf
d. 20,000 kgf

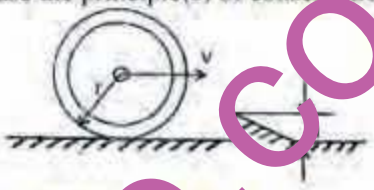
103. A body in motion will be subjected to Cariole's acceleration when that body is
a. in plane rotation with variable velocity
b. in plane translation with variable velocity
c. in plane motion which is resultant of plane translation and rotation
d. restrained to rotate while sliding over another body

104. A disc of mass 'm' and radius 'r' is attached to a spring of stiffness 'k'. During its motion the disc rolls on the ground. When released from some stretched position the centre of the disc will execute harmonic motion with a time period of



a. $2\pi\sqrt{\frac{m}{2k}}$
b. $2\pi\sqrt{\frac{m}{k}}$
c. $2\pi\sqrt{\frac{3m}{2k}}$
d. $2\pi\sqrt{\frac{3m}{k}}$

105. A wheel of centroidal radius of gyration 'k' is rolling on a horizontal surface with constant velocity. It comes across an obstruction of height 'h'. Because of its rolling speed, it just overcomes the obstruction. To determinate v, one should use the principle(s) of conservation of



a. energy
b. linear momentum
c. energy and linear momentum
d. energy and angular momentum

106. A cord is wrapped around a Cylinder of radius 'r' and mass 'm' as shown in the given figure. If the cylinder is released from rest, the velocity of the cylinder, after it has moved through a distance 'h' will be

a. $\sqrt{2gh}$
b. $\sqrt{gh}$
c. $\sqrt{4gh/3}$
d. $\sqrt{gh/3}$

107. Consider the following statements
1. A round bar in a round hole forms a turning pair.
2. A square bar in a square hole forms a sliding pair.
3. A vertical shaft in a footstep bearing forms a successful constraint

Of these statements
a. 1 and 2 are correct
b. 2 and 3 are correct
c. 1 and 3 are correct
d. 1, 2 and 3 are correct

108. The connection between the piston and cylinder in a reciprocating engine corresponds to
a. completely constrained kinematics pair

b. incompletely constrained kinematics pair
c. successfully constrained kinematics pair
d. single link

109. A bicycle remains stable in running through a bend because of
a. gyroscopic action
b. Carioles acceleration
c. centrifugal action
d. radius of curved path

110. The Whitworth quick return mechanism is formed in a slider-crank chain when the
a. coupler link is fixed
b. longest link is a fixed link
c. slider -is a fixed link
d. smallest link is a fixed link

111. For an involutes gear, the ratio, pitch circle radius/ base circle radius is (is the pressure angle)
a. sin ϕ
b. cos ϕ
c. sec ϕ
d. cosec ϕ

112. The most suitable, bearing for carrying very heavy loads with slow speed is
a. hydrodynamic bearing
b. ball bearing
c. roller bearing
d. hydrostatic bearing

113. Thrust bearings of the sliding type are often provided with multiple [illegible]-shaped bearing pads of the tilting type instead of a continuous annular bearing surface in order to
a. distribute the thrust load more non-uniformly
b. provide [illegible] adjustments to shaft misalignments
c. enable the formation of a wedge-shaped oil film
d. enable lubricating oil to come into contact with the total bearing area

114. A 50 kW motor using six vee belts is used in a pulp mill. If one of the belts breaks after a month of continuous running, then
a. the broken belt is to be replaced by a similar belt
b. all the belts are to be replaced
c. the broken belt and two adjacent belts are to be replaced
d. the broken belt and one adjacent belt are to be replaced

115. Static balancing is satisfactory for low speed rotors, but with increasing speeds, dynamic balancing becomes necessary. This is because, the
a. unbalanced couples are caused only at higher speeds
b. unbalanced forces are not dangerous at higher speeds
c. effects of unbalances are proportional to the square of the speed
d. effects of unbalances are directly proportional to the speed

116. The assumption of viscous damping in practical vibrating systems is
a. one of reality
b. to make the resulting differential equation linear
c. to make the resulting differential equation nonlinear
d. to make the response of the mass linear with time

117. The ratio of the maximum dynamic displacement due to a dynamic force to the deflection due to the static force of the same magnitude is called the
a. displacement ratio
b. deflection ratio
c. force factor
d. magnification factor

118. For effective vibration isolation, the natural frequency ω_n of the system must be (ω is the forcing frequency)
a. $\omega/44$
b. ω
c. 4ω
d. 10ω

119. A reed type tachometer uses the principle of
a. torsional vibration
b. longitudinal vibration
c. transverse vibration
d. damped free vibration

120. Consider the following statements
The critical speed of a shaft is affected by the
1. eccentricity of the shaft
2. span of the shaft
3. diameter of the shaft
Of these statements
a. 1 and 2 are correct
b. 1 and 3 are correct
c. 2 and 3 are correct
d. 1, 2 and 3 are correct