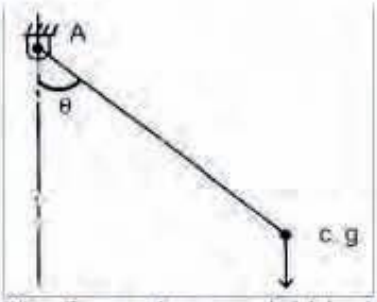
MECHANICAL ENGINEERING

1.



The figure shows a rigid body oscillating about the pivot A. If J is mass moment of inertia of the body about the axis of rotation, its natural frequency for small oscillations is proportional to

a. J
b. J^2
c. $1/J$
d. $1\sqrt{J}$

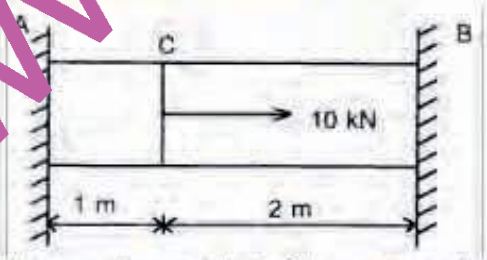
2. Consider the following statements:
Two rotors mounted on a single shaft can be considered to be equivalent to a geared shaft system having two rotors provided

1. the kinetic energy of the equivalent system is equal to that of the original system.
2. the strain energy of the equivalent system is equal to that of the original system.
3. the shaft diameters of the two systems are equal.

Which of these statements are correct?

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

3.



The reactions at the rigid supports at A and B for the bar loaded as shown in the figure are, respectively

a. 20/3 kN, 10/3 kN
b. 10/3 kN, 20/3 kN
c. 5 kN, 5 kN
d. 6 kN, 4 kN

4. The bending moment for a loaded beam is shown below

The loading on the beam is represented by which one of the following diagrams?

(a)

(b)

(c)

(d)

5. In a loaded beam under bending

a. both the maximum normal and the maximum shear stresses occur at the skin fibres
b. both the maximum normal and the maximum shear stresses occur at the neutral axis
c. the maximum normal stress occurs at the skin fibres while the maximum shear stress occurs at the neutral axis
d. the maximum normal stress occurs at the neutral axis while the maximum shear stress occurs at the skin fibers

6. Two shafts having the same length and material are joined in series. If the ratio of the diameter of the first shaft to that of the second shaft is 2, then the ratio of the angle of twist of the first shaft to that of the second shaft is

a. 16
b. 8
c. 4
d. 2

7. Which one of the following pairs is not correctly matched?

a. Slenderness : The ratio of length of the column to the ratio least radius of gyration
b. Buckling : The ratio of maximum load to the factor permissible axial load on the column
c. Short column : A colum for which slenderness ratio < 32
d. Strut : A member of a structure in any position and carrying on axial compressive load

8. The volumetric strain of a thin cylindrical shell with flat ends and subjected to internal pressure is the sum of
a. longitudinal and hoop strain
b. longitudinal and diametrical strain
c. hoop strain and twice the longitudinal strain
d. longitudinal strain and twice the hoop strain

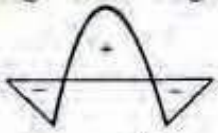
9. On a plane, resultant stress is inclined at an angle of 45° to the plane If the normal stress is 100 N/mm^2, the shear stress on the plane is
a. 71.5 N/mm^2
b. 100 N/mm^2
c. 86.6 N/mm^2
d. 120 8 N/mm^2

10. A steel rod 10 mm in diameter and 1 m long is heated from 20°C to 120°C. If E = 200 GPa and $\alpha = 12 \times 10^{-6}$ per °C, and the rod is not free to expand, the thermal stress developed is
a. 120 MPa (tensile)
b. 240 MPa (tensile)
c. 120 MPa (compressive)
d. 240 MPa (compressive)

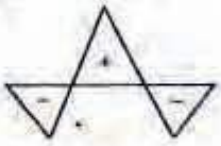
11.

The shear force diagram is shown above for a loaded beam. The corresponding bending moment diagram is represented by

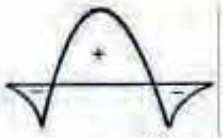
(a)



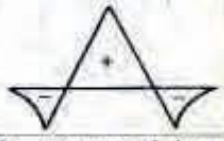
(b)



(c)



(d)



12. A simply supported beam of span l is subjected to a uniformly varying load having zero intensity at the left support and w N/m at the right support. The reaction at the right support is
a. wl/2
b. wl/5
c. wl/4
d. wl/3

13. Consider the following statements:
1. When frequency ratio is <2, the force transmitted to the foundations is more than the exciting force.
2. When frequency ratio is > 2, the force transmitted to the foundations increases as the damping is decreased
3. The analysis of base-excited vibrations is similar to that of forced vibrations.
Which of these statements are correct?
a. 1 and 2
b. 2 and 3
c. 1 and 3
d. 1,2 and 3

14. Consider the following statements:
1. Thermoplastics possess a strong intermolecular bonding compared to that of thermosetting plastics
2. Plastics have a high creep under continuous loading.
3. Embrittlement occurs in plastics at low temperature
Which of these statements are correct?
a. 1 and 2
b. 2 and 3
c. 1 and 3
d. 1, 2 and 3

15. In orthogonal cutting, shear angle is the angle between
a. shear plane and the cutting velocity vector
b. shear plane and the rake plane
c. shear plane and the vertical direction
d. shear plane and the direction of elongation of crystals in the chip

16. Match List I with List II and select the correct answer:
List (Material)

A. Plastics
B. Cast iron (medium)
C. Stainless steel
D. Aluminium

List II (Rated Cutting Speed in m/min)
1. 305
2. 15
3. 20 – 30
4. 450
5. 220

Codes:

	A	B	C	D
a.	1	3	2	4
b.	4	2	5	1
c.	1	2	5	4
d.	4	3	2	1

17. Tool material not suited to resistance welding is
a. Aluminium oxide
b. Stellite
c. High speed steel
d. Masonite

18. Consider the following statements
Chipping of a cutting tool is due to
1. tool material being too brittle
2. hot hardness of the tool material
3. high positive rake angle of the tool
Which of these statements are correct?
a. 1, 2 and 3
b. 1 and 3
c. 2 and 3
d. 1 and 2

19. Match List I with List II and select the correct answer
List I (Operation)
A. Reaming
B. Boring
C. Counter boring
D. Counter sinking
List II (Application)
1. Used for enlarging the end of a hole to give it a conical shape for a short distance
2. Used for enlarging only a limited portion of the hole
3. Used for finishing a hole
4. Used for enlarging a hole

Codes:

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

20. A milling cutter of 70 mm diameter with 12 teeth is operating at a cutting speed of 22 m/min and a feed of 0.05 mm/tooth The feed per minute is
a. 110 mm/min
b. 35 mm/min
c. 6 mm/min
d. 60 mm/min

21. Match List (Material to be Cast) with List II (Shrinkage Allowance in mm/m) and select the correct answer:
List I
A. Grey cast iron
B. Brass
C. Steel
D. Zinc
List II
1. 7 - 10
2. 15
3. 20
4. 4
Codes:

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

22. Which one of the following is not a feature of gear hobbling process?
a. High rate of production
b. Generation of helical gears
c. Very accurate tooth profile
d. Generation of internal gears

23. The spring back" effect in press working is
a. elastic recovery of the sheet metal after removal of the load
b. regaining the original shape of the sheet metal
c. release of stored energy in the sheet metal
d. partial recovery of the sheet metal

24. Match List with List II and select the correct answer:
List I (Press-part)
A. Punch plate
B. Stripper
C. Stopper
D. Knock out
List II (Function)
1. Assisting withdrawal of the punch
2. Advancing the work-piece through correct distance
3. Ejection of the work-piece from die cavity

4. Holding the small punch in the proper position

Codes:

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

25. The continuity equation in a differential form is

a. $\frac{dA}{A}+\frac{dV}{V}+\frac{d\rho}{\rho}=\text{constant}$

b. $\frac{A}{dA}+\frac{V}{dV}+\frac{\rho}{d\rho}=\text{constant}$

c. $\frac{dA}{A}+\frac{dV}{V}+\frac{d\rho}{\rho}=0$

d. $A\,dA+A\,dV+\rho\,d\rho=0$

26. 26. Velocity defect in boundary layer theory is defined as

a. the error in the measurement of velocity at any point in the boundary layer

b. the difference between the velocity at a point within the boundary layer and the free stream velocity

c. the difference between the velocity at any point within the boundary layer and the velocity nearer the boundary

d. the ratio between the velocity at a point in the boundary layer and the free stream velocity

27. 27. Which one of the following statements is correct?

a. Dehumidifier coil surface temperature is above the dew point temperature but below the freezing point temperature

b. Dehumidifier coil surface temperature is below the dew point temperature but above the freezing point temperature

c. Dehumidifier coil surface temperature is below both the dew point temperature and the freezing point temperature

d. Dehumidifier coil surface temperature is above both the dew point temperature and the freezing point temperature

28. Total heat transfer from a wetted surface depends upon

a. difference in temperature between surface and air

b. difference in humidity ratio of air and air saturated at wet surface temperature

c. difference in enthalpy between saturated air at surface temperature and that of air

d. difference in entropy between saturated air at surface temperature and that of air

29. The drag coefficient for laminar flow varies with Reynolds number (Re) as

a. $Re^{1/2}$

b. Re

c. Re^{-1}

d. $Re^{-1/2}$

30. Match List I with List II and select the correct answer:

List I (Basic Ideal Flow)

A. Superposition of a uniform flow over a doublet

B. Superposition of a uniform flow over a source and a sink

C. Superposition of a uniform flow over a source

D. Superposition of a free vortex flow along with a uniform flow over a doublet

List II (Example)

1. Flow over a half Rankine body
2. Flow over a Rankine oval
3. Flow over a rotating body
4. Flow over a stationary body

Codes:

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

31. The square root of the ratio of inertia force to gravity force is called

a. Reynolds number

b. Froude number

c. Mach number

d. Euler number

32. The thickness of turbulent boundary layer at a distance x from the leading edge over a flat plate varies as

a. $x^{4/5}$

b. $x^{1/2}$

c. $x^{1/5}$

d. $x^{3/5}$

33. For two-dimensional fluid element in x - y plane the rotational component is given by

a. $\omega_z=\frac{1}{2}\left(\frac{\partial u}{\partial x}\quad\frac{\partial v}{\partial y}\right)$

b. $\omega_z = \frac{1}{2}\left(\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y}\right)$

c. $\omega_z = \frac{1}{2}\left(\frac{\partial v}{\partial x} + \frac{\partial u}{\partial y}\right)$

d. $\omega_z = \frac{1}{2}\left(\frac{\partial v}{\partial x} - \frac{\partial u}{\partial y}\right)$

34. Assertion (A): The speeds of machine tool spindle are usually designed to follow geometrical progression.
Reason (R): It is easier to achieve speeds in geometrical progression through gearing.
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 the correct explanation of A
c. A is true but R is false
d. A is false but R is true

35. Assertion (A): The use of servo-controls in machine tools helps in achieving better machining accuracy.
Reason (R): The stability of the system automatically improves due to the introduction of feedback control.
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 the correct explanation of A
c. A is true but R is false
d. A is false but R is true

36. Assertion (A): In the case of spur gears, the mating teeth execute pure rolling motion with respect to each other from the commencement of engagement to its termination.
Reason (R): The involutes profiles of the mating teeth are conjugate profiles which obey the laws of gearing.
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 the correct explanation of A
c. A is true but R is false
d. A is false but R is true

37. Assertion (A): Spot welding is adopted to weld two overlapped metal pieces between two electrode points.
Reason (R): In this process when current is switched on, the lapped pieces of metal are heated in a restricted area.
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 the correct explanation of A
c. A is true but R is false
d. A is false but R is true

38. Assertion (A): Semi-centrifugal casting process is similar to true centrifugal casting except that the central core is used in it to form inner surface.
Reason (R): In semi-centrifugal casting process the axis of spin is always vertical.
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 the correct explanation of A
c. A is true but R is false
d. A is false but R is true

39. Assertion (A): For a ductile material stress strain curve is a straight line upto the yield point.
Reason (R): The material follows Hooker's law
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 the correct explanation of A
c. A is true but R is false
d. A is false but R is true

40. Assertion (A): Atomization method for production of metal powders consists of mechanical disintegration of molten stream into fine particles.
Reason (R): Atomization method is an excellent means of making powders from high temperature metals.
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 the correct explanation of A
c. A is true but R is false
d. A is false but R is true

41. Assertion (A): Companies investing in countries with high inflation rates use payback period method for capital budgeting.
Reason (R): The operating cash flows in such investments are precisely and easily determined.
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 the correct explanation of A
c. A is true but R is false
d. A is false but R is true

42. Assertion (A): Chronocycle graph is useful in get-hug the direction as well as speed of the movement of the human body elements.
Reason (R): A record of path of movement is affected by a continuous source of light.
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 the correct explanation of A
c. A is true but R is false
d. A is false but R is true

43. Assertion (A): Energy grade line lies above the hydraulic grade line and is always parallel to it.
Reason (R): The vertical difference between energy grade line and hydraulic grade line is equal to the velocity head.
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 the correct explanation of A
c. A is true but R is false
d. A is false but R is true

44. Assertion (A): Water will freeze at a higher temperature if the pressure is increased.
Reason (R): Water expands on freezi[illegible] which by Clapeyron's equation gives negative slope for the melting curv[illegible]
a. Both A and R are true and R is th[illegible] correct explanation of A
b. Both A and R are true but [illegible]t the correct explanation [illegible]
c. A is true but R is f[illegible]
d. A is false but R is t[illegible]

45. Assertion (A): [illegible]pass factor of a cooling decreases wi[illegible]decrease in face velocity.
Reason (R): [illegible] more time to contact the coo[illegible]g [illegible]t lower face velocity.
a. [illegible]th A and R are true and R is the c[illegible]explanation of A
b. [illegible] A and R are true but R is not the correct explanation of A
c. A is true but R is false
d. A is false but R is true

46. Assertion (A): Head loss for sudden expansion is more than the head loss for a sudden contraction for the same diameter ratio.
Reason (R): Head loss varies as the square of the ratio of the upstream and downstream velocities in the pipe fitted with sudden expansion or sudden contraction.
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 the correct explanation of A
c. A is true but R is false
d. A is false but R is true

47. Consider the following statements:
1. From design consideration[illegible]it is always advantageous to pla[illegible]cast iron ribs on the tension side rather than on the compression side.
2. Cast iron is an exc[illegible]lent choice for machine tool gu[illegible]es and [illegible]mes.
3. Cast iron pa[illegible] ha[illegible] low notch sensitivity.
Which of th[illegible]tatements are correct?
a. 1, 2 a[illegible]3
b. 2 [illegible]3
c. [illegible] and 3
d. 1 [illegible]nd 2

48. C[illegible]ider the following statements:
1. Critical or whirling speed of the shaft is the speed at which it tends to vibrate violently in the transverse direction.
2. To find the natural frequency of a shaft carrying several loads, the energy method gives approximate results.
3. Dunker ley's method gives accurate results of the natural frequency of a shaft carrying several loads.
Which of these statements is/are correct?
a. 1 only
b. 2 and 3
c. 1 and 3
d. 1, 2 and 3

49. Match List I with List II and select the correct answer:
List I (Mechanical Property)
A. Strength (Fluctuating load)
B. Toughness
C. Stiffness
D. Ductility
List II (Measured in Terms of)
1. Percentage elongation
2. Modulus of elasticity
3. Endurance limit
4. Impact strength
Codes:

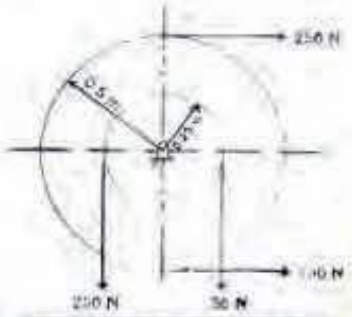
	A	B	C	D
a.	2	1	3	4
b.	3	4	2	1
c.	2	4	3	1

d. 3 1 2 4

50. 50. Consider the following statements:
1. Distortion-energy theory is in better agreement for predicting the failure of ductile materials.
2. Maximum normal stress theory gives good prediction for the failure of brittle materials.
3. Moduli of elasticity in tension and compression are assumed to be different in the stress analysis of curved beams.

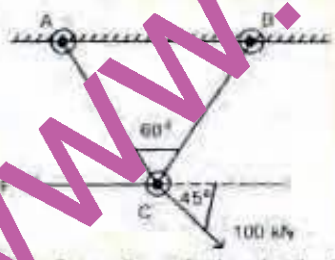
Which of these statements is/are correct?
a. 1, 2 and 3
b. 1 and 2
c. 3 only
d. 1 and 3

51.



A differential pulley is subjected to b tensions as shown in the diagram. The resulting force and moment w transferred to the centre of the pulle ar respectively
a. 400 N and 0 Nm
b. 400 N and 100 Nm
c. 500 N and 0 Nm
d. 500 N and 100 Nm

52.



F force F such that both the bars AC and BC (AC and BC are equal in length) as shown in the figure are identically loaded, is
a. 70.7 N
b. 100 N
c. 141.4 N
d. 168 N

53.

For the arrangement shown in e fig e, what is the force with w ch a person weighing 500 N pulls the rope downward at A to support himself wi out f ling?
a. 166.7 N
b. 200 N
c. 250 N
d. 500 N

54. If s, v, t, F m and represent displacement, velo y ime force, mass and acce eratio respectively. Match List I (Exp ssio) with List II (Feature / P ple) and select the correct answer:
List
A. $v = 6t^2 - 9t$
B. $v = 9t + 12$
C. $s = 4t$
D. $F - ma = 0$
List II
1. Constant acceleration
2. Variable acceleration
3. D'Alembert's principle
4. Uniform motion
Codes:

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

55. A circular disc rolls down without slip on an incline plane. The ratio of its rotational kinetic energy to the total energy is
a. 1/4
b. 1/2
c. 1/3
d. 2/3

56. Consider the following statements:
Carioles acceleration component appears in the acceleration analysis of the following planar mechanisms:
1. Whitworth quick-return mechanism
2. Slider-crank mechanism
3. Scotch-Yoke mechanism
Which of these statements is/are correct?

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

57. Which one of the following is an exact straight line mechanism using lower pairs?
a. Watt's mechanism
b. Grasshopper mechanism
c. Robert's mechanism
d. Paucellier's mechanism

58. Consider the following statements in respect of four- bar mechanisms:
1. It is possible to have the length of one link greater than the sum of lengths of the other three links.
2. If the sum of the lengths of the shortest and the longest links is less than the sum of lengths of the other two, it is known as Grass Hoff's linkage.
3. It is possible to have the sum of the lengths of the shortest and the longest links greater than that of the remaining two links.

Which of these statements is/are correct?
a. 1, 2 and 3
b. 2 and 3
c. 2 only
d. 3 only

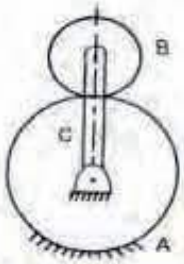
59. The height of Watt's governor is
a. directly proportional to the speed
b. directly proportional to the (speed)
c. inversely proportional to the speed
d. inversely proportional to the (speed)^2

60.

The figure shows a critically damped spring mass system undergoing single degree of freedom vibrations. If m 5 kg and k 20 N/m, the value of viscous damping coefficient is
a. 10 Ns/m
b. 20 Ns/m
c. 4 Ns/m
d. 8 Ns/m

61. In a system subjected to damped forced vibrations, the ratio of maximum displacement to the static deflection is known as
a. Critical damping ratio
b. Damping factor
c. Logarithmic decrement
d. Magnification factor

62.

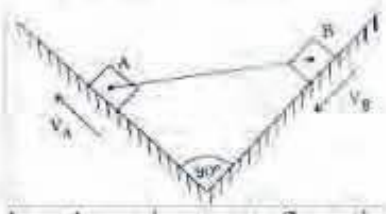


In the epicyclical gear train shown in the figure, T_A = 40, T_B = 20. For three revolutions of the arm, the gear B will rotate through
a. 6 revolutions
b. 2.5 revolutions
c. 3 revolutions
d. 9 revolutions

63. Which one of the following statements in respect of involute profiles for gear teeth is not correct?
a. Interference occurs in involute profiles
b. Involute tooth form is sensitive to change in centre distance between the base circles
c. Basic rack for involute profile has straight line form
d. Pitch circle diameters of two mating involute gears are directly proportional to the base circle diameters

64. Traffic control on the roads by lights where the timing mechanism operates irrespective of the intensity of traffic is an example of
a. Closed loop control
b. Under-damped control
c. Open loop control
d. Over-damped control

65.



In the given configuration of the mechanism as shown in the figure, V_A = 40 m/s and V_B = 30 m/s. The magnitude of velocity of slider B relative to the slider A is
a. 30 m/s
b. 40 m/s
c. 50 m/s

d. 30.5 m/s

66. Oldham's coupling is an inversion of the kinematics chain used in
a. Whitworth quick-return mechanism
b. Elliptical trammel
c. Rotary engine
d. Universal joint

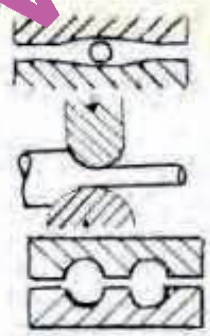
67. In balancing of 4-stroke in-line engines, firing order helps to control the magnitude of
a. Primary forces only
b. Secondary forces only
c. Primary forces and primary couples only
d. Primary and secondary couples only

68. The method of direct and reverse cranks is used in engines for
a. the control of speed fluctuations
b. balancing of forces and couples
c. kinematic analysis
d. vibration analysis

69. Which one of the following is not an electric resistance method of welding?
a. Electro slag welding
b. Percussion welding
c. Seam welding
d. Flash welding

70. In one setting of rolls in a 3-high rolling mill, one gets
a. one reduction in thickness
b. two reductions in thickness
c. three reductions in thickness
d. two or three reductions in thickness depending upon the setting

71. Match List I (Forging Operation) with List II (View of the Forging Operation) and select the correct answer:
List I
A. Edging
B. Fullering
C. Drawing
D. Swaging
List II

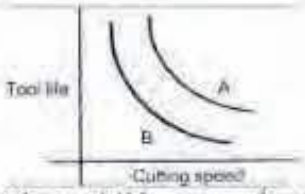


72. Which of the following are the characteristics of extrusion process?
1. Faster speed of production
2. Good surface finish
3. Dimensions can be maintained with close tolerances
4. Mechanical properties of the extruded products are inferior to that of the rolled products

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

73. At room temperature, which one of the following is the correct sequence of increasing hardness of the tool materials?
a. Cast alloy - HSS - Ceramic - Carbide
b. HSS - Cast alloy - Ceramic - Carbide
c. HSS - Cast alloy - Carbide - Ceramic
d. Cast alloy - HSS - Carbide - Ceramic

74.



The tool life curves for two tools A and B are shown in the figure and they follow the tool life equation $VT^n = C$. Consider the following statements
1. Value of n for both the tools is same
2. Value of C for both the tools is same
3. Value of C for tool A will be greater than that for the tool B
4. Value of C for tool B will be greater than that for the tool A

Which of these statements is/are correct?
a. 1 and 3
b. 1 and 4
c. 2 only
d. 4 only

75. As the cutting speed increases

a. more heat is transmitted to the work piece and less heat is transmitted to the tool
b. more heat is carried away by the chip and less heat is transmitted to the tool
c. more heat is transmitted to both the chip and the tool
d. more heat is transmitted to both the work piece and the tool

76. Which of the following are produced by powder metallurgy process?
1. Cemented carbide dies
2. Porous bearings
3. Small magnets
4. Parts with intricate shapes
Select the correct answer using the codes given below:
a. 1, 2 and 3
b. 1, 2 and 4
c. 2, 3 and 4
d. 1, 3 and 4

77. In parts produced by powder metallurgy process, presintering is done to
a. increase the toughness of the component
b. increase the density of the component
c. facilitate bonding of non-metallic particles
d. facilitate machining of the part

78. Consider the following statements in respect of fabrication of plastic products
1. Compression moulding is analogous to hot pressing of powdered metals
2. Jet moulding is a modification of compression moulding
3. Injection moulding is analogous to die casting of metals
4. Transfer moulding is similar to hydraulic extrusion
Which of the statements are correct?
a. 1 and 2
b. 1 and 3
c. 3 and 4
d. 2, 3 and 4

79. Consider the following constituent steps of capital budgeting:
1. Short range capital budgeting
2. Long range capital budgeting
3. Search for opportunities and sources
4. Measurement of worth and selection
The correct sequence of these steps from the commencement is
a. 3, 2, 1, 4
b. 2, 3, 4, 1
c. 3, 1, 2, 4
d. 2, 4, 3, 1

80. Which one of the following does not form a part of the direct cost of a component?
a. Cost of special tooling used
b. Cost of material used
c. Cost of material wasted
d. Wages of the labour actually involved

81. Match List I with List II and select the correct answer
List I (Cost Element)
A. Discount
B. Preparation of the machine for a product
C. Negotiations with vendors
D. Rent for the warehouse
List II (Type of Cost)
1. Ordering cost
2. Material cost
3. Set up cost
4. Carrying cost
Codes:

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

82. Which one of the following correctly represents the average inventory turnover ratio for raw materials?
a. Annual sales/annual inventory
b. Average working process volume/ total production volume
c. Annual consumption/annual inventory
d. Volume of spare parts/total annual sale

83. 83. Which of the following are the elements of disbursements in capital budgeting?
1. Dividend
2. Profits retained
3. Loan to other companies
4. Depreciation
5. New investments
Select the correct answer using the codes given below
a. 1, 2 and 3
b. 2, 3 and 4
c. 1, 3 and 5
d. 2, 4 and 5

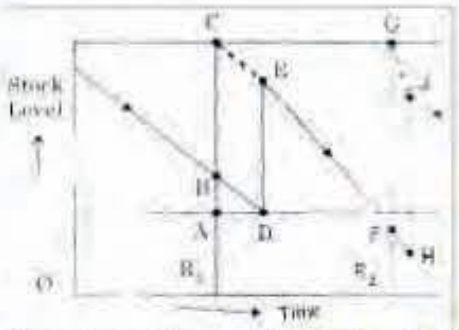
84. The layout of ship-building industry should be
a. Process layout
b. Group layout
c. Fixed location layout

d. Product layout

85. 85. Motions of limbs are through
1. Elbow
2. Finger
3. Hip
4. Shoulder
5. Wrist

What is the correct sequence in descending order of motion in terms of time and fatigue involved?
a. 3, 4, 1, 5, 2
b. 2, 5, 1, 4, 3
c. 5, 2, 3, 1, 4
d. 4, 3, 2, 1, 5

86.



The given figure shows the details of stock-level in the periodic review inventory control system. Match List I (Characteristics) with List II (Lin[illegible]) and select the correct answer:
List I
A. Lead time
B. Ordered quantity
C. Safety stock
D. Review period
List II
1. DE
2. FH
3. CG
4. [illegible]
[illegible]
Codes:

	A	B	C	D
a.	3	4	2	5
b.	5	1	4	3
c.	3	1	4	5
d.	5	4	2	3

87. Which of the following is the expression for the market price?
a. Selling price + discount to distributor
b. Selling price - discount to distributor
c. Total cost + discount to distributor
d. Office cost + selling and distribution expenses

88. In respect of time study, match List I (Situations) with List II (Allowance) and select the correct answer:
List I
A. To allow for personal needs
B. To meet legitimate delay in work
C. Offered under special circumstances to add to the earnings
List II
1. Contingency allowance
2. Policy allowance
3. Injury allowance
4. Relaxation allowance
Codes:

	A	B	C
a.	4	1	2
b.	[illegible]	[illegible]	4
c.	4	2	3
[illegible]	3	1	2

89. Match List with List II and select the correct answer:
List I (Charts)
A. Operation process chart
B. Flow process chart
C. Flow diagram
D. PERT chart
List II (Applications)
1. Scheduling project operations
2. To study backtracking and traffic congestion
3. To analyze indirect costs such as material handling cost
4. To study relations between operations
Codes:

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

90. Which of the following are the characteristics of job order production?
1. High degree of production control is required
2. Division of labour is effective
3. Detailed schedule is needed for each component
4. A flexible layout is preferred

Select the correct answer using the codes given below

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

91. The heat generated in metal cutting can conveniently be determined by
a. installing thermocouple on the job
b. installing thermocouple on the tool
c. calorimetric set up
d. using radiation pyrometer

92. Identify the process of change of a closed system in which the work transfer is maximum
a. Isothermal
b. Isochoric
c. Isentropic
d. Polytrophic

93. A system executes a cycle during which there are four heat transfers $Q_{12} = 220$ kJ, $Q_{23} = -25$ kJ, $Q_{34} = -180$ kJ, $Q_{41} = 50$ kJ. The work during three of the processes is $W_{12} = 15$ kJ, $W_{23} = -10$ kJ, $W_{34} = 60$ kJ. The work during the process 4 - 1 is
a. - 230 kJ
b. 0 kJ
c. 230 kJ
d. 130 kJ

94. Which one of the following statements is not correct?
a. Change in entropy during a reversible adiabatic process is zero
b. Entropy increases with the addition of heat
c. Throttling is a constant entropy expansion process
d. Change in entropy when a gas is heated under constant pressure is given by $s_2 - s_1 = nC_p \log_e T_2/T_1$

95. If u, T, v, s, h and p refer to internal energy, temperature, volume, entropy, enthalpy and pressure respectively; and subscript 0 refers to environmental conditions, the availability function for a closed system is given by
a. $u + p_0v - T_0s$
b. $u - p_0v + T_0s$
c. $h + p_0v - T_0s$
d. $h - p_0v + T_0s$

96. If h, p, T and v refer to enthalpy, pressure, temperature and specific volume respectively; and subscripts g and f refer to saturation conditions of vapour and liquid respectively, then Clausius-Clapeyron equation applied to change of phase from liquid to vapour states is
a. $\frac{dp}{dt} = \frac{(h_g - h_f)}{(v_g - h_f)}$
b. $\frac{dp}{dt} = \frac{(h_g - h_f)}{T(v_g - h_f)}$
c. $\frac{dp}{dt} = \frac{(h_g - h_f)}{T}$
d. $\frac{dp}{dt} = \frac{(h_g - h_f)T}{(h_g - h_f)}$

97. A gas turbine cycle with infinitely large number of stages during compression and expansion approaches
a. Stirling cycle
b. Atkinson cycle
c. Ericsson cycle
d. Brayton cycle

98. The COP of a refrigerator on a reversed Carnot cycle is 5. The ratio of higher absolute temperature to the lower temperature (i.e. T_2/T_1) is
a. 1.25
b. 1.3
c. 1.4
d. 1.2

99. For an ideal gas, the expression $\left[T\left(\frac{\partial s}{\partial T}\right)_v - T\left(\frac{\partial v}{\partial T}\right)_p\right]$ is equal to
a. zero
b. C_p/C_v
c. R
d. RT

100. For a non-flow constant pressure process the heat exchange is equal to
a. zero
b. the work done
c. the change in internal energy
d. the change in enthalpy

101. For a real thermodynamic cycle
a. $\oint dQ/T = 0 \text{ but } < \infty$
b. $\oint dQ/T < 0$
c. $\oint dQ/T = 0$
d. $\oint dQ/T = \infty$

102. A higher value of Van der Waals' constant for a gas indicates that the

a. molecules of the gas have smaller diameter
b. gas can be easily liquefied
c. gas has higher molecular weight
d. gas has lower molecular weight

103. Consider an actual regenerative Rankine cycle with one open feed water heater. For each kg steam entering the turbine, m kg steam with a specific enthalpy of h_1 is bled from the turbine. Specific enthalpy of water entering the heater is h_2. The specific enthalpy of saturated liquid leaving the heater is equal to
a. $mh_1 - (h_2 - h_1)$
b. $h_1 - m(h_2 - h_1)$
c. $h_2 - m(h_2 - h_1)$
d. $mh_2 - (h_2 - h_1)$

104. In the case of supersaturated steam flow through a nozzle, which of the following statements are correct?
1. Availability increases
2. Mass flow coefficient is greater than unity
3. Nozzle velocity coefficient is less than unity

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

105. Which of the following thermal power plants will have the highest overall thermal efficiency?
a. Steam power plant
b. Gas turbine power plant
c. Combined gas and steam power plant
d. Diesel power plant

106. The function of the moderator in a nuclear reactor is
a. to stop chain reaction
b. reduce the speed of the neutrons
c. absorb neutrons
d. reduce temperature

107. Match List I with List II and select the correct answer:
List I (Feature)
A. Single stage impulse turbine
B. Pressure compounding
C. Velocity compounding
D. Reaction turbine
List II (Turbine I Staging)
1. Parsons turbine
2. de Laval turbine
3. Rateau staging
4. Curtis staging

Codes;

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

108. In steam and other vapour cycles, the process of removing non-condensable is called
a. Scavenging process
b. Desecration process
c. Exhaust process
d. Condensation process

109. Which of the following relations must hold for an irrotational two-dimensional flow in the x - y plane?
a. $\frac{\partial u}{\partial x} - \frac{\partial v}{\partial x} = 0$
b. $\frac{\partial u}{\partial z} - \frac{\partial w}{\partial x} = 0$
c. $\frac{\partial w}{\partial y} - \frac{\partial v}{\partial z} = 0$
d. $\frac{\partial v}{\partial x} - \frac{\partial u}{\partial y} = 0$

110. The coefficient of friction 'f' in terms of shear stress 'to' is given by
a. $f = \rho v^2/2\tau_0$
b. $f = \tau_0/\rho v^2$
c. $f = 2/\rho v^2$
d. $f = 2\rho v^2/\tau_0$

111. Velocity distribution in a turbulent boundary layer follows
a. Logarithmic law
b. Parabolic law
c. Linear law
d. Cubic law

112. Performance of a reciprocating compressor is expressed by
a. $\frac{\text{Isothermal work}}{\text{Indicated work}}$
b. $\frac{\text{Indicated work}}{\text{Isothermal work}}$
c. $\frac{\text{Adiabatic work}}{\text{Indicated work}}$
d. $\frac{\text{Indicated work}}{\text{Adiabatic work}}$

113. Consider the following statements:
If moist air is adiabatically saturated in an air washer than
1. wet bulb temperature remains constant
2. relative humidity increases
3. dry bulb temperature decreases
4. humidity ratio decreases
Which of these statements are correct?
a. 1, 2 and 3
b. 1, 2 and 4
c. 2, 3 and 4
d. 1, 3 and 4

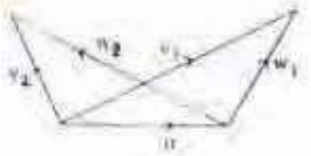
114. A solid P floats with half of its volume immersed in water and solid Q floats with two-thirds of its volume immersed in water. The densities of solids P and Q are in the ratio
a. 1 : 2
b. 1 : 3
c. 2 : 3
d. 3 : 4

115. Which one of the following is the most important function of thermostatic expansion valve?
a. To control the degree of superheat
b. To control the evaporator temperature
c. To control the pressure drop
d. To control the evaporator pressure

116. If k is the ratio of the rate of production of neutrons to the rate of loss of neutrons, the reactor is called a critical reactor when
a. $k = 0$
b. $0 < k < 1$
c. $k = 1$
d. $k > 1$

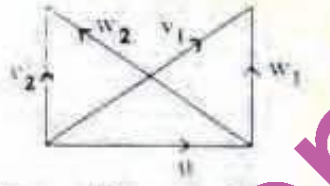
117. u, v, w represent the peripheral, absolute and relative velocities, respectively, and suffix 1 and 2 refer to inlet and outlet, then which one of the following velocity triangles would be a reaction turbine stage with reaction more than 50%?
a.

b.



c.

d.



118. The Bernoulli's equation refers to conservation of
a. mass
b. linear momentum
c. angular momentum
d. energy

119. In a normal shock wave in one-dimensional flow
a. pressure, density and temperature increase
b. velocity, temperature and density increase
c. pressure, density and temperature decrease
d. velocity, pressure and density decrease

120. Consider the following statements in respect of centrifugal pumps
1. Head developed is proportional to the square of the speed of rotation.
2. Backward curved bladed impellers are generally used in centrifugal pumps.
3. These pumps generally do not require priming.
4. Multistage pumps would give higher discharge proportional to the number of stages.
Which of these statements are correct?
a. 1 and 2
b. 2 and 3
c. 3 and 4
d. 1 and 4