MECHANICAL ENGINEERING

1. Why is enriched Uranium required as fuel when ordinary water is used as a moderator?
   a. Ordinary water has low moderating efficiency
   b. Ordinary water has high neutron absorption
   c. Ordinary water has high moderating efficiency
   d. Ordinary water has low neutron absorption

2. Which one of the following gases is normally not used as a coolant in nuclear reactor?
   a. Hydrogen
   b. Helium
   c. Carbon dioxide
   d. Nitrogen

3. Match List-I with List-II and select the correct answer using the code given below the lists:
   List-I
   A. Specific speed of pump
   B. Low specific speed of turbine
   C. Pumping viscous oil
   D. Draft tube
   List-II
   1. $\left(\frac{N(Q)}{H^{3/4}}\right)$
   2. Screw pump
   3. Reaction turbine
   4. Turbine Pump
   5. Very high specific speed
   6. $\left(\frac{N(P)}{H^{5/4}}\right)$
   7. Impulse turbine
   Codes:

	A	B	C	D
a.	1	3	2	5
b.	6	7	4	3
c.	1	7	2	3
d.	6	3	4	5

4. Match List-I with List-II and select the correct answer using the code given below the lists:
   List-I
   A. Draft tube
   B. Surging
   C. Air Vessel
   D. Nozzle
   List-II
   1. Impulse turbine
   2. Reciprocating pump
   3. Reaction turbine
   4. Centrifugal pump
   Codes;

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

5. Match List-I with List-II and select the correct answer using the code given below the lists:
   List-I (Name of Boiler)
   A. Stirling
   B. Cochran
   C. Lancashire
   D. Benson
   List-II (Type)
   1. Bent water tube
   2. Once through flow
   3. Vertical fire tube
   4. Incline water tube
   5. Horizontal fire tube
   Codes;

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

6. In a steam power plant, what is the outcome of regenerative feed heating?
   1. Increase in specific output
   2. Increase in cycle efficiency
   3. Improved quality of exhaust steam
   4. Reduced condenser load
   Select the correct answer using the code given below
   a. 1 and 3, only
   b. 2 only
   c. 2 and 4

d. 1, 2 and 3

7. Consider the following statements in the context of high pressure boilers:
   1. The tendency of scale formation is eliminated due to high velocity of water through tubes.
   2. The heat transfer coefficient is increased by increasing the velocity of water through tubes.
   3. The steam can be raised quickly to meet the variable load.

   Which of the statements given above are correct?
   a. 1 and 2, only
   b. 2 and 3, only
   c. 1 and 3, only
   d. 1, 2 and 3

8. Which one of the following is the shock that occurs for an airplane traveling at supersonic speed?
   a. Normal shock
   b. Oblique shock
   c. Bow shock
   d. Air shock

9. What does choked flow through a steam nozzle mean?
   1. Discharge is maximum
   2. Discharge is zero
   3. Throat velocity is sonic.
   4. Exit pressure is less than or equal to critical pressure

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

10. When a convergent-divergent nozzle is subjected to a pressure ratio p_2/p_1 greater than the critical pressure ratio, what does the divergent section exhibit?
    a. Decreasing pressure
    b. Flow separation
    c. Normal shock
    d. Increasing pressure

11. Which one of the following is the correct statement?
    In a two-stage gas turbine plant with inter-cooling and reheating
    a. both work ratio and thermal efficiency improve
    b. work ratio improves but thermal efficiency decreases
    c. thermal efficiency improves but work ratio decreases
    d. both work ratio and thermal efficiency decrease

12. In a Bell Coleman cycle refrigeration plant, compression and expansion of air are isentropic. If the temperatures of air entering and leaving the expander are 300 K and 180 K respectively, what is the coefficient of performance of the plant?
    a. 1.5
    b. 2.0
    c. 2.5
    d. 3.0

13. Match List-I with List-II and select the correct answer using the code given below the lists
    List-I
    A. Bell Coleman refrigeration
    B. Reversed Carnot Cycle
    C. Milk chilling plant
    D. Superheating in refrigeration cycle
    List-II
    1. Expansion cylinder
    2. Heat Pump
    3. Decreases COP
    4. Compressor
    5. Brine
    6. Vortex Refrigerator
    7. Increases COP

    Codes;

	A	B	C	D
a.	1	6	5	3
b.	4	2	3	7
c.	1	2	5	3
d.	4	6	3	7

14. The workmen in an engineering company are expected to work for 400 minutes in a shift of 8 hours. The remaining time is meant for rest and personal needs etc. What is the standard time/piece of a job whose normal time is 2 minute?
    a. 2.40 minutes
    b. 4.80 minutes
    c. 1.08 minutes
    d. 1.5 minutes

15. Match List-I with List-II and select the correct answer using the code given below the lists:
    List -I
    A. Work cycle motions should be habitual

B. Hand motions should be confined to lowest possible classification with which it is possible to perform the job
C. Rhythm is essential for smooth and automatic performance of an operation

List-II
1. Tools, material and controls should be located close to arid directly in front of worker
2. There should be a definite and fixed place for all tools and materials
3. Materials and tools should be located to permit best possible sequence of motion

Codes;

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

16. Speed and direction of workers' movements can be better recorded by which one of the following?
a. Flow chart
b. Chronocycle graph
c. Chronometer
d. Flow diagram

17. Which of the following are important tools and techniques helpful in the layout analysis?
1. Process charts
2. Travel charts
3. Templates
4. Gantt charts

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

18. Which one of the following is the correct statement?
In cost estimation at the break even point, the cost of production is
a. greater than the sales
b. less than the sales
c. equal to total sales
d. profit sales

19. Which one of the following is not an advantage of a product layout?
a. Reduced material handling
b. Better utilization of machines and men
c. Less floor area is occupied by the material in transit and for temporary storage
d. Less capital investment

20. Which one of the following factors does not affect the plant location decision?
a. Organization's objectives
b. Resources
c. Socio-economic environment
d. Organizational structure

21. Which one of the following is the basic objective of a good plant layout?
a. New plant construction
b. Better use of labour
c. Improvement in production process as a whole
d. To meet customer's expectations

22. Match List-I (Material to be handled) with List-II (Appropriate Material Handling Equipment) and select the correct answer using the code given below the lists

List-I
A. Large castings
B. Granular material
C. Auto engine block
D. Small engine parts

List-II
1. Screw conveyor
2. Belt conveyor
3. Overhead crane
4. Roller conveyor

Codes;

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

23. Match List-I (Method in Capital Budgeting) with List-II (Characteristics) and select the correct answer using the code given below the lists:

List-I
A. Pay Back Period
B. Net Present Value
C. Internal rate of return

List-II
1. Discount rate that equates present values of expected cash flows
2. Cash provision is made to replace asset at the end of its life
3. Project pays for itself in some years

4. Value of future cash inflows discounted at a rate compared with investment

Codes:

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

24. Which one of the following is capital budgeting?
   a. Working capital management
   b. Floating of shares
   c. Financial planning
   d. Finance control

25. Assertion (A): The coefficient of discharge of a venturimeter is higher than that of an orifice meter.
Reason (R): Orifice meter produces eddies and crosscurrents in the fluid floe, which dissipate energy.
   a. Both A and R are individually true and R is the correct explanation of A.
   b. Both A and R are individually 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

26. Assertion (A): Velocity compounding is used for high pressure end of a multi-stage steam turbine.
Reason (R): Shock wave losses are reduced in high pressure end.
   a. Both A and R are individually true and R is the correct explanation of A.
   b. Both A and R are individually 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

27. Assertion (A): A mixture of gaseous air in equilibrium with liquid air is a pure substance.
Reason (R): A pure substance has a homogeneous and invariable chemical composition.
   a. Both A and R are individually true and R is the correct explanation of A.
   b. Both A and R are individually 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

28. Assertion (A): Production planning and control in continuous production is usually far simpler than in job or batch production.
Reason (R): Extensive effort is required for detailed planning before production starts, but both scheduling and control need not usually be very elaborate.
   a. Both A and R are individually true and R is the correct explanation of A.
   b. Both A and R are individually 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

29. Assertion (A): Motion of arms should be made in opposite and symmetrical directions and simultaneously.
Reason (R): Such motion of arms reduces total work done by the worker.
   a. Both A and R are individually true and R is the correct explanation of A.
   b. Both A and R are individually 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

30. Assertion (A): Laminar sub-layer exists beneath the turbulent boundary layer.
Reason (R): No Slip condition should exist near the surface for viscid flow.
   a. Both A and R are individually true and R is the correct explanation of A.
   b. Both A and R are individually 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

31. Consider the following statements
   1. Boundary-layer thickness in laminar flow is greater than that of turbulent flow.
   2. Boundary-layer thickness of turbulent flow is greater than that of laminar flow.
   3. Velocity distributes uniformly in a turbulent boundary layer.
   4. Velocity has a gradual variation in a laminar boundary layer.

Which of the statements given above are correct?
   a. 1, 3 and 4 only
   b. 1, 2, 3 and 4
   c. 1 and 2 only
   d. 2, 3 and 4 only

32. Which one of the following is the correct statement?
The velocity profiles for fully developed laminar and turbulent flow, respectively, in a pipe are

a. parabolic and parabolic
b. parabolic and elliptic
c. linear and 1/7 power law
d. parabolic and 1/7 power law

33. Which one of the following is the correct statement?
For the case of laminar flow between two fixed parallel plates, the shear stress is
a. constant across the passage
b. maximum at the centre and zero at the boundary
c. zero all through the passage
d. maximum at the boundary and zero at the centre

34. Consider the following statements:
The coefficient of discharge C_d of a venturimeter takes into account
1. the effect of roughness of the surface
2. non-uniform velocity distributions at inlet and throat section
3. Reynolds number of flow
4. discharge
5. length of throat
6. diameter of throat
7. diameter ratio
Which of the statements given above are correct?
a. 1, 2, 4 and 5
b. 1, 2, 3 and 7
c. 1, 4, 5 and 6
d. 2, 6 and 7

35. Which one of the following expresses the error in discharge due to error in the measurement of head over a triangular notch?
a. $\frac{dQ}{Q}=\frac{5}{2}\frac{dH}{H}$
b. $\frac{dQ}{Q}=\frac{5}{2}\frac{dH}{H}$
c. $\frac{dQ}{Q}=\frac{1}{2}\frac{dH}{H}$
d. $\frac{dQ}{Q}=\frac{1}{2}\frac{dH}{H}$

36. Which one of the following is the correct statement?
A differential manometer connected to a pitot-static tube used for measuring fluid velocity gives
a. static pressure
b. total pressure
c. dynamic pressure
d. difference between total pressure and dynamic pressure

37. Which one of the following correctly represents the shear stress distribution across a section of a circular pipe having a viscous flow?
a. $\tau=\frac{\partial p r^2}{\partial x}$
b. $\tau=\frac{\partial p(r/2)}{\partial x}$
c. $\tau=-\frac{\partial p(r/2)}{\partial x}$
d. $\tau=\frac{\partial p(r)}{\partial x}$

38. A pipe of diameter (D) conveying a discharge Q is to be replaced by two parallel pipes of smaller diameter (d) to discharge the same quantity. What will be the ratio of D/d? (f is same for all pipes)
a. D/d = 2
b. D/d = $\sqrt{2}$
c. D/d = $4^{1/5}$
d. D/d = $4^{1/3}$

39. Match List-I (Forms of Bernoulli's Equation) with List-II (Units of these forms) and select the correct answer using the code given below the lists:
List-I
A. $p+wz+\frac{pV^2}{2}$
B. $\frac{p}{p}+gz+\frac{V^2}{2}$
C. $\frac{p}{w}+z+\frac{V^2}{2g}$
List II
1. total energy per unit volume
2. total energy per unit mass
3. total energy per unit weight
Codes:

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

40. Which one of the following is the correct statement?
A frictionless, incompressible fluid flows steadily through a convergent nozzle, then its
a. energy must decrease
b. velocity must decrease

c. pressure must decrease
d. momentum must decrease

41. Which one of the following statements is correct?
For stability of a floating body,
a. M should lie between G and B (in that order)
b. M should lie above B and G (in that order)
c. M should lie below B and G (in that order)
d. M should coincide with B and G

42. Consider the following statements
A rectangular block of wood of size L×B×H will float in water in such a way that
1. the longest dimension is vertical
2. the longest dimension is horizontal
3. the metacentre is above the centre of gravity
4. the centre of buoyancy is above the centre of gravity
Which of the statements given above are correct?
a. 1 only
b. 2 and 3, only
c. 2, 3 and 4
d. 1, 3 and 4

43. Which one of the following systems combines microelectronics and mechanical engineering to bring economics of scale to batch production?
a. Job-shop production
b. Group technology
c. Flexible manufacturing
d. Mass production

44. Which one of the following analysis is not associated with inventory management?
a. ABC
b. [illegible]
c. [illegible]
d. [illegible]

45. What are the properties of a thermodynamic system, whose value for the entire system is equal to the sum of their values for individual parts of the system?
a. Thermodynamic properties
b. Extensive properties
c. Intensive properties
d. None of the above

46. A new temperature scale in degrees N is to be defined. The boiling and freezing point of water on this scale are 400°N and 100°N respectively. What will be the reading on new scale corresponding to 60°C?
a. 110° N
b. 180° N
c. 210° N
d. 280° N

47. Which of the following thermodynamic properties relate to the Clausius-Clapeyron equation?
1. Pressure
2. Temperature
3. Entropy
4. Specific volume
5. Enthalpy
6. Internal energy
Select the correct answer using the code given below
a. 1, 2, 6, 5
b. 4, 2, 3, 5
c. 6, 4, 1, 3
d. 3, 2, 1, 5

48. Which one of the following is heat absorbed or rejected during a polytrophic process?
a. $\left(\frac{\gamma-n}{\gamma-1}\right)$ × work done
b. $\left(\frac{\gamma-n}{\gamma-1}\right)^2$ × work done
c. $\left(\frac{\gamma-n}{\gamma-1}\right)^n$ × work done
d. $\left(\frac{\gamma-n}{\gamma-n}\right)$ × work done

49. During a cycle comprising four processes, the heat transfers during three processes are +45 kJ, -30 kJ, -25 kJ. What should be the heat transfer during the fourth process so that the net work done during the cycle is zero?
a. Zero
b. + 10 kJ
c. - 10 kJ
d. - 20 kJ

50. Which thermometer is independent of the substance or material used in its construction?
a. Memory thermometer
b. Alcohol thermometer
c. Ideal gas thermometer
d. Resistance thermometer

51. A closed system undergoes a process during which 150 kJ of heat is added to it. The system is then restored in its initial state. If the heat transfer and work transfer for the second process are -50 kJ and +75 kJ respectively, what is the work transfer for the first process?
    a. 25 kJ
    b. 50 kJ
    c. 75 kJ
    d. 100 kJ

52. A heat engine working in a thermodynamic cycle draws 500 kJ of heat energy from a source of 1000 K per cycle and rejects certain amount of heat energy at 300 K per cycle. Then, which one of the following is correct?
    a. The amount of heat energy rejected must be 150 kJ
    b. The amount of heat energy rejected must be less than 150 kJ
    c. The amount of heat energy rejected must be greater than 150 kJ
    d. It is not possible to make any statements regarding the amount of heat energy rejected per cycle from the data given

53. An ideal heat pump and an ideal refrigerator which are reversible in operation operate between same upper and lower temperature limits. If the coefficient of performance of the refrigerator is 4.5, then what is the coefficient of performance of the heat pump?
    a. 3.5
    b. 5.5
    c. 2.5
    d. 6.5

54. Air standard diesel cycle has a compression ratio of 14 and cut off takes place at 8% of the stroke. What is the cut off ratio?
    a. 0.60
    b. 0.78
    c. 1.78
    d. None of the above

55. The thermal efficiency of the carnot engine is 0.5. If the engine is operated as refrigerator, what is the C.O.R of the refrigerator?
    a. 0.5
    b. 1.0
    c. 2.0
    d. 25.

56. Which one of the following is correct?
    De Laval turbine is a
    a. simple reaction turbine
    b. simple impulse turbine
    c. velocity compounded impulse turbine
    d. pressure compounded impulse turbine

57. Which one of the following is the correct statement?
    Reheating of steam under ideal conditions takes place at constant
    a. entropy
    b. enthalpy
    c. pressure
    d. temperature

58. A refrigerating machine in heat pump mode has a C.O.R of 4. If it is worked in refrigerator mode with a power input of 3 kW, what is the heat extracted from the food kept in the refrigerator?
    a. 180 kJ/min.
    b. 360 kJ/min.
    c. 540 kJ/min.
    d. 720 kJ/min.

59. Which one of the following information cannot be obtained from the static tensile test of a mild steel specimen?
    a. Modulus of elasticity
    b. Qualitative determination of toughness
    c. Ductility
    d. Weld ability

60. What type of fracture occurs when a brittle material is under torsion?
    a. Cup and cone
    b. Granular transverse
    c. Granular helicoidally
    d. Smooth transverse

61. Consider the following statements relating to Rockwell Hardness Testing Method:
    1. It is a quick method to determine hardness of industrial components.
    2. Polishing of test sample is necessary.
    3. Test load is applied in two stages.
    4. Hardness of relatively softer metals cannot be determined by this method.
    5. Inverted pyramid type of indenter is used.

    Which of the statements given above are correct?
    a. 1, 2, 3 and 4
    b. 3, 4 and 5
    c. 1, 2 and 3, only

d. 2, 4 and 5

62. The criterion of constraint of a chain connecting the number of binary joints (J), number of higher pairs (H) and the number of links (L) is: $J + \frac{H}{2} = \frac{3L}{2} - 2$. When is the chain locked?
a. L.H.S. = R.H.S.
b. L.H.S. > R.H.S.
c. L.H.S. < R.H.S.
d. The chain will never get locked

63. Which one of the following statements is correct?
Transmission angle is the angle between
a. the output link and the frame
b. the output link and the coupler
c. the input link and the coupler
d. the input link and the frame

64. In typical power transmission with reduction from an induction motor of speed 1450 rpm to a speed as low as 1 rpm, which one of the following orders of reduction is desirable?
a. Worm drive-spur drive-belt drive
b. Belt drive-spur drive-worm drive
c. Worm drive-belt drive-spur drive
d. Spur drive-worm drive-belt drive

65. Which one of the following is the correct statement?
The relative velocity of sliding in the teeth of gears in mesh is zero at
a. the point of engagement
b. the point of disengagement
c. the pitch point
d. the point between point of engagement and pitch point

66. Which one of the following is the correct statement?
The consequence of a slight increase in the centre distance between two mating involutes gears is that
a. the law of gearing is not satisfied perfectly
b. interference occurs
c. pressure angle increases
d. pressure angle decreases

67. Which one of the following correctly relates the life of a roller bearing in millions of revolutions (L) the load P and the basic dynamic load rating for 1 million revolutions (C)?
a. $L = (C/P)^3$
b. $L = (C/P)^{10/3}$
c. $L = (P/C)^3$
d. $L = (C/P)^{1/3}$

68. If the frequency of fluctuations in engine speed coincides with the natural frequency of oscillations of the governor, then, due to resonance, the amplitude of oscillations becomes very high. Consequently, the governor tends to intensify the speed variations. What is such a situation?
a. Sensitiveness
b. Stability
c. Isochronism
d. Hunting

69. What is the minimum number of arbitrarily chosen parallel planes in which the balancing masses may be placed for complete dynamic balance of a system of unbalanced revolving masses in different transverse planes of a rotating shaft?
a. 1
b. 2
c. 3
d. 4

70. Which one of the following is realized by hydraulic dashpot shock absorbers?
a. Viscous damping
b. Structural damping
c. Coulomb damping
d. Spring damping

71. Which one of the following is the correct statement? Transmissibility is defined as the ratio of the
a. force applied to the machine to the force transmitted to the foundation
b. force transmitted to the foundation to the force applied to the machine
c. force applied to the machine to the vector sum of spring forces
d. damping forces to the spring forces

72. Consider the following statements about reactors:
1. Candu reactor is natural uranium fuelled, heavy water cooled and moderated reactor.
2. In a pressurized water reactor the coolant water boils in the core of the reactor.
3. Liquid metal is preferred as a coolant in case of a homogeneous reactor.
4. Which of the statements given above is/are correct?
a. 1 only

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

73. What is the material of thick walled canisters in which nuclear waste is buried deep?
a. Zirconium
b. Lead
c. Stainless steel
d. Tin

74. Consider the following refrigerants:
1. Ammonia
2. Carbon dioxide
3. Dichlorodifluoro methane
4. Tetrafluoromethane
Which one of the following is the correct order of their boiling points in the descending order?
a. 1 – 2 – 3 – 4
b. 2 – 3 – 4 – 1
c. 3 – 1 – 2 – 4
d. 2 – 4 – 1 – 3

75. Evaporator is used sometimes to dehumidify the air for conditioning purpose.
Which one of the following is the correct statement? In this situation the evaporator temperature should be kept
a. lower than the cooling fluid temperature
b. more than the apparatus dew point temperature
c. lower than the apparatus dew point temperature
d. lower than the boiling temperature of fluid

76. To maintain comfort in an air conditioned space, how can a small increase in temperature be compensated?
a. By dehumidification
b. By ventilation
c. By increasing air velocity
d. By decreasing air velocity

77. Where is an oil separator in vapour compression refrigeration system installed?
a. Between compressor and condenser
b. Between expansion valve and receiver tank
c. Inside compressor machinery
d. Outside compressor machinery

78. Which one eco-friendly refrigerant out of the following is used in many domestic and car air-conditioners nowadays?
a. R-22
b. R-113
c. R-123
d. R-134a

79. Which one of the following is the correct statement?
Adiabatic saturation process for a moist air involves
a. cooling and humidification
b. cooling and dehumidification
c. change in dew point temperature
d. constant relative humidity

80. Which one of the following is the correct statement?
In domestic air conditioners air undergoes the process of
a. sensible cooling
b. cooling and humidification
c. cooling and dehumidification
d. dehumidification

81. Which one of the following is the correct statement?
Sensible heating of moist air will not affect the
a. relative humidity
b. absolute humidity
c. specific humidity
d. wet bulb temperature

82. Which one of the following is the correct statement? When moist air passes through a cooling tower the process is:
a. evaporative cooling
b. adiabatic saturation
c. cooling and dehumidification
d. heating and humidification

83. Which one of the following is the correct statement?
During sensible cooling process for a moist air,
a. specific humidity will decrease
b. specific humidity will increase
c. relative humidity will decrease
d. specific humidity will increase

84. During a comfort air conditioning process, the moisture content of the air may start decreasing.
Which one of the following is the correct statement?

In order to maintain the same level of comfort,

a. WBT should be decreased
b. DBT should be increased
c. air velocity should be decreased
d. moisture content should be increased

85. The comfort air conditioning can be obtained by innumerable combinations of DBT and relative humidity. Which one the following combinations within the comfort zone recommended to save the energy?

a. Higher DBT and lower relative humidity
b. Lower DBT and lower relative humidity
c. Lower DBT and higher relative humidity
d. Higher DBT and higher relative humidity

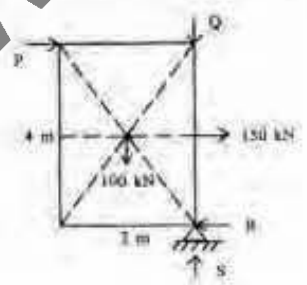
86. Bernoulli's equation is derived by making which one of the following assumptions?

a. The flow is steady only
b. The flow is uniform and incompressible
c. The flow is non-viscous, uniform and steady
d. The flow is steady, non-viscous incompressible and irrigational

87. A skater weighing 1000 N skates at a speed of 20 m/s on ice maintained at 0°C. The average skating area supporting the skater is 0.001 m^2 and the coefficient of friction between the skate and ice is 0.02. What will be the average thickness of a film of water existing at the interface between the skater and ice? (Take dynamic viscosity of water as 0.001 Ns/m^2).

a. 10^{-5} m
b. 10^{-6} m
c. 10^{-7} m
d. Not possible to estimate since there cannot be a possibility of formation of a thin film of water at the interface

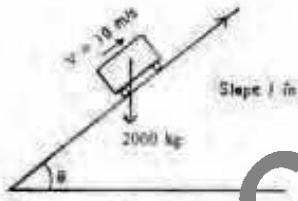
88.



A rectangular plate is held in equilibrium by the application of forces as shown in the figure. What is the magnitude of the force P?

a. 35 kN
b. 50 kN
c. 100 kN
d. 200 kN

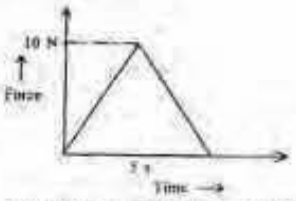
89.



The car shown in the above figure moves with a uniform velocity. If the resistance due to friction, air etc. is 30 N/kg mass of the car, what is the approximate power of the engine?

a. 2 kW
b. 6 kW
c. 15 kW
d. 31 kW

90.



Variation of force acting on a particle of mass 5 kg is shown in the figure above. What is the final velocity of the particle if it is initially at rest?

a. 2 m/s
b. 2.5 m/s
c. 5 m/s
d. 10 m/s

91. Which one of the following is rupture stress?

a. Breaking stress
b. Maximum load/original cross-sectional area (A)
c. Load at breaking point/A
d. Load at breaking point/neck area

92. A straight uniform rod is subjected to axial load.

Which one of the following is the correct statement?

a. It induces maximum shearing stress on a transverse plane

b. It induces maximum normal stress on a plane inclined at 45° to the axis of the rod
c. It induces maximum shear stress on a plane inclined at 45° to the axis of the rod
d. It includes zero shear stress on any inclined plane to the axis of the rod

93. A 2 m long rod of diameter 2 mm is subjected to an axial pull of 1 kN. The rod is extended by 0.5 cm. What is the approximate value of the modulus of elasticity of the material of the rod?
a. 127 G Pa
b. 180 G Pa
c. 125 G Pa
d. 200 G Pa

94. Which one of the following is the preferable cross-section of a beam for bending loads?
a. Circular
b. Annular circular
c. Rectangular
d. I section

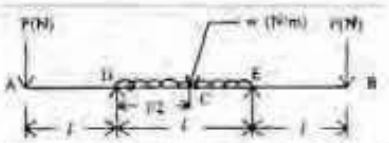
95. Which one of the following is the correct statement?
The point of contra flexure in a beam is a point on its length where
a. the shear force is zero
b. the bending moment is maximum
c. the bending moment changes its algebraic sign and is zero at that point
d. the shear force changes its algebraic sign

96. Consider the following statements for simple bending of beams:
1. Neutral axis always passes through the centroid of the beam cross-section.
2. Bending stress on a fibre is a longitudinal stress.
3. Bending stress is zero on the neutral axis.
4. Shearing stress is always zero on the neutral axis.
Which of the statements given above are correct?
a. 1, 2 and 3, only
b. 1, 2, 3 and 4
c. 2, 3 and 4, only
d. 1 and 4, only

97. Which one of the following temperatures is exactly suited to carry out hot working processes?
a. Room temperature
b. Temperature of recovery stage
c. Temperature above recrystallization stage
d. Temperature of grain growth stage

98. Match List-I with List-II and select the correct answer using the code given below the lists:
List-I (Nature of Failure)
A. Structural member fails in axial compression
B. A member fails along a 45° helical plane subjected to torsion
C. A structural member bends and collapses under axial compression load
D. A member fails in double shear for a joint
List-II (Nature of Member)
1. Knuckle joint
2. Long column
3. Strut
4. Cast iron round bar subjected to tension
Codes:

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

99. 

An overlapping beam AB has simple supports at D and E as shown in the figure above. It carries concentrated loads P at its free ends and a uniformly distributed load of intensity w (N/m) over its length DE. If bending moment at the middle point C of the beam is to be zero, then what is the value of P?
a. $\frac{wl}{2}$
b. $\frac{wl}{4}$
c. $\frac{wl}{8}$
d. $\frac{wl}{16}$

100. What is the value of volumetric strain in a thin walled cylindrical vessel with

modulus of elasticity E, Poisson's ratio μ and of diameter 'd', wall thickness 't' and subjected to internal fluid pressure p?

a. $\frac{pd}{4tE}.(5-4\mu)$

b. $\frac{pd}{3tE}.(4-3\mu)$

c. $\frac{pd}{2tE}.(3-2\mu)$

d. $\frac{pd}{tE}.(2-\mu)$

101. A closed coiled helical tension spring having 20 coils is cut in two parts such that part A has 8 coils and part B has 12 coils. What is the ratio of stiffness of the spring A to the stiffness of the spring B?

a. 1
b. 1/2
c. 3/2
d. 3/4

102. Which one of the following material has the highest ultimate tensile strength?

a. Mild steel
b. Cast iron
c. Spring steel
d. Wrought iron

103. Which one of the following is correct for shaft carrying two rotors at its ends?

a. It has no node
b. It has one node
c. It has two nodes
d. It has three nodes

104.

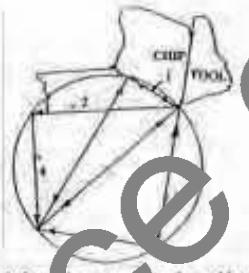
The figure given above shows the locations of the roots of the characteristic function of a second order, linear, closed-loop control system. What is the natural frequency of the system?

a. 10 rad/s
b. 36 rad/s
c. 48 rad/s
d. 64 rad/s

105. A type-2 system has its transfer function for open loop represented by $G(s)H(s)=\frac{4(1+s)}{s^2(1+0.1s)}$ in the s-plane. Nyquist plot shows that there are no poles within the path of values of s. It further shows that there is no encirclement of -1 + j.0. Then what is the number of zeros at the said plot?

a. 1
b. 0
c. 2
d. 3

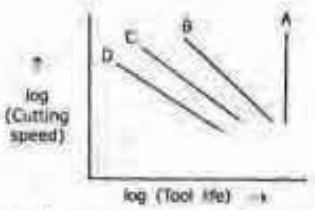
106.



Merchant circle diagram of forces during machining is presented in the above figure. What is the correct sequence of notation of normal force, shear force, cutting force and friction?

a. 1 — 2 — 3 — 4
b. 3 — 4 — 1 — 2
c. 2 — 3 — 4 — 1
d. 4 — 1 — 2 — 3

107.



In the figure given above, for which of the following does the curve 'C' hold good?

a. H.S.S. tools
b. Cemented carbide tools
c. Ceramic tools
d. Ideal material tools

108. Which one of the following does not affect the selection of optimum cutting speed for minimum cost?

a. Labour cost
b. Machine maintenance cost
c. Tool cost
d. Job handling cost

109. What is the variation of cutting speed with tool life on Log-Log scale?

a. Parabolic variation
b. Straight line variation

c. Hyperbolic variation
d. Elliptical variation

110. In a milling machine two side milling cutters are mounted with a desired distance between them so that both sides of the work piece can be milled simultaneously. What is this set-up called?
a. Gang million
b. Straddle milling
c. String milling
d. Side milling

111. The ratio of time of return stroke to time of forward stroke of a shaping machine is 0.6. The stroke is 250 mm and it makes 30 double strokes per minute. What is the overall average speed of operation?
a. 3.75 m/min.
b. 5.0 m/min.
c. 7.5 m/min.
d. 12 m/mm.

112. Which one of the following processes necessarily requires mandrel of requisite diameter to form the internal hole?
a. Hydrostatic extrusion
b. Tube drawing
c. Swaging
d. Wire drawing

113. Which one of the following is the correct relationship between surface velocity of the rolls (V_r), entrance velocity of work (V_0) and exit velocity of work (V_f) in rolling?
a. $V_0 < V_r < V_f$
b. $V_f < V_r < V_0$
c. $V_r < V_f < V_0$
d. $V_0 < V_f < V_0$

114. Which one of the following statements in extrusion processes is not correct?
a. In forward extrusion, the problem of friction is prevalent because of relative motion between heated metal billet and cylinder wall
b. In backward extrusion, the problem of friction is completely eliminated
c. Forward cold extrusion is similar to forward hot extrusion process except extrusion ratios are higher and extrusion pressures are less
d. Cold extrusion forging is similar to impact extrusion except that side walls are much thicker and their height is smaller

115. In drawing operation if D_i = initial diameter and D_0 = outgoing diameter, then what is the degree of drawing equal to?
a. $\frac{D_i - D_0}{D_i}$
b. $\frac{D_0 - D_i}{D_0}$
c. $\frac{D_i^2 - D_i'^2}{D_i'^2}$
d. $\sqrt{\frac{D_i^2 - D_0^2}{D_i^2}}$

116. Which one of the following processes consists of central sprue to feed metal into the cavities through a number of radial gates?
a. Centrifuging
b. Semi centrifugal casting
c. True centrifugal casting
d. Precision casting

117. In which one of the following welding techniques is vacuum environment required?
a. Plasma arc welding
b. Laser beam welding
c. Electron beam welding
d. Ultrasonic welding

118. Consider the following steps involved in conditioning of metal powders in powder metallurgy techniques
1. Pulverization
2. Blending or mixing
3. Screening
4. Heat Treatment
Which one of the following is the correct sequence of the above steps?
a. 1 — 2 — 3 — 4
b. 2 — 3 — 1 — 4
c. 4 — 1 — 3 — 2
d. 4 — 3 — 2 — 1.

119. The tooling cost is highest in which one of the following methods of plastic processing?
a. Extrusion
b. Casting
c. Compression moulding
d. Injection moulding

120. Which one of the following is the correct statement? The accuracy of time estimates in work sampling depends upon
a. type of activity only
b. number of observations only
c. randomness of observation only
d. all of the above