Mechanical Engineering

3rd Sept 2017 CBRT

1. A fan consumes $20\ W$ of electric power and discharges air from a ventilated room at $0.25\ kg/s$. The maximum air outlet velocity is nearly

    (a) $4.7\ m/s$

    (b) $8.7\ m/s$

    (c) $10.2\ m/s$

    (d) $12.7\ m/s$

2. Which one of the following statements is correct?

    (a)   A machine which violates Clausius statement will violate the first law of thermodynamics

    (b)   A machine which violates Kelvin-Plank statement will violate the first law of thermodynamics

    (c)   A machine which violates the second law of thermodynamics will violate the first law of thermodynamics

    (d)   A machine which violates Kelvin-Plank statement will violate the Clausius statement

3. $150\ kJ$ of heat is transferred from a heat source of $527^{\circ}C$ to a heat sink at $127^{\circ}C$. If the ambient temperature is $47^{\circ}C$, the loss of available energy during the process will be

    (a) $40\ kJ$

    (b) $50\ kJ$

    (c) $60\ kJ$

    (d) $70\ kJ$

4. Which one of the following is correct in the context of change of entropy of a system undergoing a reversible adiabatic process?

    (a) Positive for expansion process and negative for compression process

    (b) Positive for compression process and negative for expansion process

    (c) Negative for both the processes

    (d) Positive for both the processes

5. Consider the following devices:

    1. Internal combustion engine working on Otto cycle

    2. Internal combustion engine working on Diesel cycle

    3. Gas turbines

    4. Steam turbines

    In which of the above devices, the equation $dQ = dU + Pdv$ is not applicable?

    (a) 2 and 3

    (b) 1 and 4

    (c) 3 and 4

    (d) 1 and 2

6.	Consider the following statements with reference to gas turbine cycle:

    1.	Regeneration increases thermal efficiency

    2.	Reheating decreases thermal efficiency

    3.	Cycle efficiency increases when the maximum temperature of the cycle is increased

Which of the above statements are correct?

(a)	1, 2 and 3

(b)	1 and 2 only

(c)	2 and 3 only

(d)	1 and 3 only

7.	For the same pressure ratio during compression, compressing in two-stage compressor with perfect inter-cooling instead of a single-stage compressor is characterized by:

    1.	Increase in volumetric efficiency

    2.	Decrease in work input

    3.	Decrease in discharge temperature

Which of the above statements are correct?

(a)	1 and 2 only

(b)	1 and 3 only

(c)	2 and 3 only

(d)	1, 2 and 3

8. What is the compression ratio of a 4-stroke engine whose capacity is 245 cc, clearance volume is 27.2 cc and diameter of bore is 10 % higher than stroke?

   (a) 9

   (b) 10

   (c) 11

   (d) 12

9. Thorium breeder reactors are more promising for India essentially because

   (a) They develop more power

   (b) The technology thereof is simple

   (c) Thorium deposits are abundantly available in the country

   (d) These can be easily designed

10. If Nusselt number is 4000 with corresponding Reynolds and Prandtl numbers as 40 and 20 respectively, the relevant Stanton number will be

   (a) 40

   (b) 20

   (c) 10

   (d) 5

11. The dimensionless number relevant to transient heat conduction is

    (a)   Fourier number

    (b)   Reynolds number

    (c)   Prandtl number

    (d)   Stanton number

12. In a furnace the thickness of the refractory wall lining is $150\ mm$ and the average thermal conductivity of the refractory material is $0.05\ W/mK$. If the temperature difference between the inner and outer sides of the furnace is $150\degree C$, the heat loss per unit area to the surroundings will be:

    (a) $50\ W/m^2$

    (b) $70\ W/m^2$

    (c) $90\ W/m^2$

    (d) $120\ W/m^2$

13. A pipe carrying hot gases is insulated with a material having a thermal conductivity of $0.15\ W/mK$. The average local heat transfer coefficient by convection to the ambient air is $3\ W/m^2K$. The critical diameter of the pipe under these conditions is

    (a) $100\ mm$

    (b) $130\ mm$

    (c) $160\ mm$

    (d) $200\ mm$

14. In solving a lumped parameter problem, which one of the following pair of non-dimensional numbers is used?

   (a) Grashoff number and Biot number

   (b) Prandtl number and Nusselt number

   (c) Biot number and Fourier number

   (d) Fourier number and Reynolds number

15. In a heat exchanger, hot gasses enter with a temperature of $250°C$ and leave at $50°C$. On the other side, air enters at a temperature of $50°C$ and leaves at $90°C$. The effectiveness of the exchanger is to be quoted as:

   (a) 0.15

   (b) 0.20

   (c) 0.25

   (d) 0.30

16. Statement (I): Knocking and pre-ignition are the two words explaining the

   same phenomena.

   Statement (II): Pre-ignition occurs only in petrol engines.

   (a) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)

   (b) Both Statement (I) and Statement (II) are individually true but Statement (II) is _NOT_ the correct explanation of Statement (I)

   (c) Statement (I) is true but Statement (II) is false

   (d) Statement (I) is false but Statement (II) is true

17. An ideal refrigerator has a capacity of $6\ tons$, with a COP of 6. The capacity of the prime mover to run the machine should be at least

   (a) $2.5\ kW$

   (b) $3.5\ kW$

   (c) $4.5\ kW$

   (d) $5.5\ kW$

18. In a vapour compression system, superheating of the refrigerant decreases COP, the reason being:

   1.   Increase of work input to the compression

   2.   It does not depend on refrigeration effect

   Which of the above statements is/are correct?

   (a)   1 only

   (b)   2 only

   (c)   Both 1 and 2

   (d)   Neither 1 nor 2

19. A heat pump working on a reversed Carnot cycle has a COP of 5. If it works as a refrigerator and consumes $2\ kW$ power, the heat absorbed by the refrigerator will be

   (a) $6\ kW$

   (b) $7\ kW$

   (c) $8\ kW$

   (d) $9\ kW$

20. The conditioned air supplied to the room must have the capacity to take up

    (a)   Room sensible heat load only

    (b)   Room latent heat load only

    (c)   Both room sensible heat load and room latent heat load

    (d)   Neither room sensible heat load nor room latent heat load

21. An addition of manganese to aluminium results in the improvement of:

    (a)   Strength characteristics

    (b)   Corrosion resistance

    (c)   Hardernability

    (d)   Toughness system

22. A fluid when acted upon by a shear stress will deform

    (a)   When the applied shear stress is greater than the weight of the fluid

    (b)   When the applied shear stress is greater than the viscous strength of the fluid

    (c)   When the applied shear stress is greater than the yield strength of the fluid

    (d)   Independent of rate of shear strain

23. Statement (I): The radiation emitted by earth is of longer wavelength than that

emitted by the sun.

 Statement (II): Earth is at a lower temperature than the sun.

(a) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)
(b) Both Statement (I) and Statement (II) are individually true but Statement (II) is *NOT* the correct explanation of Statement (I)
(c) Statement (I) is true but Statement (II) is false
(d) Statement (I) is false but Statement (II) is true

24.　Consider the following statements:

1.　Stream lines and path lines are instantaneous lines

2.　Path lines and streak line are generated by passage of time

3.　Path line can be found by time exposure of a marked particle

4.　Stream lines, path lines and streak lines are identical in steady flow

Which of the above statements are correct?

(a)　1, 2 and 3 only

(b)　2, 3 and 4 only

(c)　1 and 4 only

(d)　1, 2, 3 and 4

25.　A fluid jet discharging from $20\ mm$ diameter orifice has a diameter $17.5\ mm$ at its Vena-Contracta. The coefficient of contraction will be nearly:

(a)　0.98

(b)　0.88

(c)　0.77

(d)　0.67

26. A laminar boundary layer has a velocity distribution given by $\frac{u}{U} = \frac{y}{\delta}$. The displacement thickness for this boundary layer will be

(a) δ

(b) $\frac{\delta}{2}$

(c) $\frac{\delta}{3}$

(d) $\frac{\pi\delta}{4}$

27. Consider the following statements:

1. In model testing, the same fluid must be used in prototype and also the model

2. Models should be smaller than prototype for geometric similarity

3. Geometrically similar boundaries do not necessarily imply kinematically homogeneous flows

4. Existence of geometric similarity does not imply dynamic similarity

Which of the above statements are correct?

(a) 1 and 2 only

(b) 2 and 3 only

(c) 3 and 4 only

(d) 1 and 4 only

28. Statement (I): For measurement of pressure at a section of a pipe running full,

   several openings round the periphery of pipe are often

   connected to a manometer through a common annulus.

   Statement (II): Manometer connections to a pipe should be perpendicular to

   the axis of flow, edges smooth and free from burrs.

   (a) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)
   (b) Both Statement (I) and Statement (II) are individually true but Statement (II) is _NOT_ the correct explanation of Statement (I)
   (c) Statement (I) is true but Statement (II) is false
   (d) Statement (I) is false but Statement (II) is true

29. Consider the following statements regarding throttling process:

   1. In throttling process there is neither heat transfer nor work transfer

   2. In throttling process enthalpy before is equal to enthalpy after

   3. Throttling process is an isentropic process

   Which of the above statements are correct?

   (a) 1 and 2 only

   (b) 1 and 3 only

   (c) 2 and 3 only

   (d) 1, 2 and 3

30. Whenever a thermodynamic system undergoes a cycle, which of the following values are possible? (Notations have standard meaning)

1. $\oint \frac{\delta Q}{T} > 0$

2. $\oint \frac{\delta Q}{T} = 0$

3. $\oint \frac{\delta Q}{T} < 0$

(a) 1 and 2 only

(b) 2 and 3 only

(c) 1 and 3 only

(d) 1, 2 and 3

31. The discharge through a converging-diverging nozzle reaches its maximum value when the flow becomes

(a) Sonic at the exit

(b) Sonic at the throat

(c) Supersonic at the throat

(d) Subsonic at the throat

32. The speed of a reaction turbine is $250\ rpm$ when working under a head of $120\ m$. The speed of the turbine when the head is changed to $90\ m$ will be

(a) $167\ rpm$

(b) $197\ rpm$

(c) $217\ rpm$

(d) $237\ rpm$

33. Consider the following statements regarding reciprocating pump:

    1.   Frictional losses are maximum at the middle of the stroke

    2.   Maximum inertia effect occurs in place with zero frictional losses

    3.   Negative slip may occur when the delivery head is high

  Which of the above statements are correct?

  (a)   1, 2 and 3

  (b)   1 and 3 only

  (c)   2 and 3 only

  (d)   1 and 2 only

34. 'Shockless entry' of water in hydraulic turbines is of much significance from the standpoint of

  (a)   Hydraulic efficiency

  (b)   Mechanical efficiency

  (c)   Both hydraulic efficiency and mechanical efficiency

  (d)   Neither hydraulic efficiency nor mechanical efficiency

35. Statement (I): Non viscous flow between two plates is an example for

                 irrotational flow.

  Statement (II): Forced vortex is irrotational in nature.

  (a) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)
  (b) Both Statement (I) and Statement (II) are individually true but Statement (II) is *NOT* the correct explanation of Statement (I)
  (c) Statement (I) is true but Statement (II) is false
  (d) Statement (I) is false but Statement (II) is true

36. A turbine is to operate under a head of $30\ m$ while running at $120\ rpm$ using $12\ m^3/s$ discharge at 90 % efficiency. Which one of the following turbine types would suit the conditions?

   (a)   Pelton

   (b)   Kaplan

   (c)   Francis

   (d)   Turgo

37. Consider the following statements:

   1.   The specific speed of a two stage centrifugal pump is twice that of a single stage pump

   2.   The specific speed of a double end suction pump is half that of a single end suction pump

   3.   The specific speed is not a dimensionless number

   Which of the above statements are correct?

   (a)   1, 2 and 3

   (b)   1 only

   (c)   2 only

   (d)   3 only

38. The fusible plug of a boiler is an example of

   (a)   Safe life approach

   (b)   Fail safe approach

   (c)   Reliability approach

   (d)   Maintainability approach

39. Consider the following statements:

    1.   The head produced in the primary of a fluid coupling is more than the corresponding centrifugal head

    2.   When the two speeds are equal, the torque transmitted is zero

Which of the above statements is/are correct?

(a)   1 only

(b)   2 only

(c)   Both 1 and 2

(d)   Neither 1 nor 2

40. Consider the following statements:

    1.   For a given power, a fire tube boiler occupies less space than a water tube boiler,

    2.   Steam at a high pressure and in large quantities can be produced with a simple vertical boiler

    3.   A simple vertical boiler has a fire tube

Which of the above statements is/are correct?

(a)   1 only

(b)   2 only

(c)   3 only

(d)   1, 2 and 3

41. Consider the following statements with regard to reheat Rankine cycle:

1. All the steam is taken out of the turbine after partial expansion for reheating at constant volume

2. The cycle permits the use of very high pressure without excessive moisture at condenser inlet

3. The efficiency of the reheat cycle may or may not exceed that of a simple cycle operating between the same maximum temperature and pressure

4. If the reheat pressure is more than 80% of the maximum system pressure, the thermal efficiency will be more than that for a simple cycle

Which of the above statements are correct?

(a) 2, 3 and 4 only

(b) 1 and 2 only

(c) 1, 3 and 4 only

(d) 1, 2, 3 and 4

42. A cam-and-follower system with the follower having a constant velocity is not suitable in practice because

1. The cam rotates with a uniform angular velocity

2. The follower moves with constant velocity

3. Inertial forces are large at the beginning as well as at the end of follower motion

Which of the above statements is/are correct?

(a) 1 only

(b) 2 only

(c) 3 only

(d) 1, 2 and 3

43. An aeroplane moving with a velocity of $300\ kmph$ negotiates a turn along a circular path of radius $600\ m$. If the angular velocity of the rotating parts of the plane is $120\ rad/s$ and the moment of inertia of the rotating parts is $60\ kg.m^2$, the gyroscopic couple is

(a) $500\ N.m$

(b) $1000\ N.m$

(c) $3000\ N.m$

(d) $5000\ N.m$

44. For a Hartnell governor, the loads on the spring at the lowest and highest equilibrium speeds are $1150\ N$ and $85\ N$, respectively. If the lift of the governor is $1.5\ cm$, then spring stiffness would be

(a) $700\ N/cm$

(b) $710\ N/cm$

(c) $725\ N/cm$

(d) $690\ N/cm$

45. The direction of motion of the driven gear of a simple gear train having an odd number of idler gears will be

(a)   Same as that of the driving gear

(b)   Opposite to that of the driving gear

(c)   Dependent upon the number of teeth on the driving gear

(d)   Dependent upon the number of teeth on the driven gear

46. A fixed gear having 200 *teeth* meshes with another gear having 50 *teeth*. The two gears are connected by an arm. The number of turns made by the smaller gear for one revolution of the arm about the centre of the bigger gear is

(a) 8

(b) 7

(c) 6

(d) 5

47. Gears with involute profile have become popular in comparison to those with cycloidal profiles because:

    1.   They are interchangeable

    2.   They are insensitive to centre-distance variation

    3.   Involute rack cutter is straight-sided

    4.   They occupy lesser space

Which of the above statements are correct?

(a) 1 and 2 only

(b) 2 and 3 only

(c) 3 and 4 only

(d) 1 and 4 only

48. In case of two meshing gears both with involute tooth profiles, contact is made when the tip of the:

(a) Driven wheel touches the flank of a tooth of the driving wheel

(b) Driven wheel touches the face of a tooth of the driving wheel

(c) Driving wheel touches the face of a tooth of the driven wheel

(d) Driving wheel touches the flank of a tooth of the driven wheel

49. A spur gear with 32 *teeth* and module 4 *mm* is rotating at 400 *rpm*. The circular pitch is:

    (a) $7\,\pi\,mm$

    (b) $6\,\pi\,mm$

    (c) $5\,\pi\,mm$

    (d) $4\,\pi\,mm$

50. The coefficient of fluctuation of speed for a flywheel is defined as

    (a)   The ratio of the maximum fluctuation of speed to the mean speed

    (b)   The ratio of the mean speed to the maximum fluctuation with speed

    (c)   Difference between the maximum and minimum speeds during a complete cycle

    (d)   The square root of product of the maximum and minimum speeds during a complete cycle

51. Balancing of industrial rotors in a balancing machine is usually done at speeds between 400 *rpm* and 700 *rpm*, because:

    1.   Industrial rotors have lateral critical speeds more than 5000 *rpm*

    2.   The rotor has critical speed generally less than 100 *rpm*

    3.   Speeds lower than 400 *rpm* do not create centrifugal forces of magnitudes measurable in this set up

    4.   Balanced rotors have no critical speed

    Which of the above statements are correct?

    (a)   1 and 4 only

    (b)   1 and 3 only

    (c)   2 and 3 only

    (d)   2 and 4 only

52. A shaft of diameter $50\ mm$, length $900\ mm$ and torsional stiffness $87\ N.m/rad$, carries two flywheels of mass moments of inertia $10\ kg.m^2$ and $30\ kg.m^2$ respectively. The distance of the node from smaller flywheel end is:

   (a) $300\ mm$

   (b) $425\ mm$

   (c) $550\ mm$

   (d) $675\ mm$

53. Transmissibility is defined as

   (a)   Ratio of force applied to the force transmitted to the foundation

   (b)   Ratio of force transmitted to the foundation to the input force

   (c)   Sum of the forces applied and the force transmitted to the foundation

   (d)   Difference of force applied vis-a-vis the force transmitted to the foundation

54. Statement (I): In ordinary drop-forging with flash, die cavity is properly filled

with metal.

   Statement (II): Forging load increases by increasing flash thickness.

   (a) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)
   (b) Both Statement (I) and Statement (II) are individually true but Statement (II) is _NOT_ the correct explanation of Statement (I)
   (c) Statement (I) is true but Statement (II) is false
   (d) Statement (I) is false but Statement (II) is true

55. Which one of the following key types is pressed against the shaft for power transmission by friction between the key and the shaft?

(a) Feather key

(b) Square key

(c) Flat key

(d) Saddle key

56. The factor of safety provided for the cotter is less than that for the spigot and socket end because

1. There is stress concentration in the cotter

2. There is no stress concentration in the cotter

3. The cotter is not as weaker as the spigot and socket end

4. The cotter has been made from materials different from that of the spigot and socket end

Which of the above statements are correct?

(a) 1 and 3 only

(b) 1 and 4 only

(c) 2 and 3 only

(d) 2 and 4 only

57. What is the preferred order of sequence for the following drives from high speed to low speed?

(a) Rack and pinion, spur gears, worm and worm wheel

(b) Worm and worm wheel, spur gears, rack and pinion

(c) Worm and worm wheel, rack and pinion, spur gears

(d) Spur gears, worm and worm wheel, rack and pinion

58. Design load factor for (i) a helical gear is smaller than that for (ii) a straight tooth spur gear because

   (a)   Load concentration factor may be same in both but dynamic load factor is smaller in (i)

   (b)   Both load concentration factor and dynamic load factor are smaller in (i)

   (c)   Load concentration factor is smaller even though dynamic load factor may be higher in (i)

   (d)   Load concentration factor is smaller in (i) even as the dynamic load factor is the same for both

59. An elevator weighing $10\ kN$ attains an upward velocity of $4\ m/s$ in $2\ sec$ with uniform acceleration. The tension in the wire rope is nearly

   (a) $6\ kN$

   (b) $8\ kN$

   (c) $10\ kN$

   (d) $12\ kN$

60. For a single row angular contact ball bearing, the basic dynamic capacity is $55\ kN$ and the dynamic equivalent load is $3950\ N$. The rated life of the bearing is:

   (a)   2700 Million revolutions

   (b)   2200 Million revolutions

   (c)   1700 Million revolutions

   (d)   1200 Million revolutions

61. Pressure angles more than $25°$ are not used in involute profiles because

    1.   The gears are difficult to manufacture

    2.   Minimum number of teeth for under cutting increases enormously

    3.   Bearing radial load from normal reaction between gears will be very high

(a)   1 only

(b)   2 only

(c)   3 only

(d)   1, 2 and 3

62. The normal stresses at a point are $\sigma_x = 10\ MPa$, $\sigma_y = 2\ MPa$; and the shear stress at this point is $3\ MPa$. The maximum principal stress at this point would be

(a) $15\ MPa$

(b) $13\ MPa$

(c) $11\ MPa$

(d) $09\ MPa$

63. At a point in a bi-axially loaded member, the principal stresses are found to be $60\ MPa$ and $80\ MPa$. If the critical stress of the material is $240\ MPa$, what could be the factor of safety according to the maximum shear stress theory?

(a)   2

(b)   3

(c)   4

(d)   5

64. The difference between member of a truss and of a beam is:

   (a) The members of a truss take their loads along their length whereas a beam takes loads at right angles to its length

   (b) The member of the truss takes load lateral to its length whereas the beam along the length

   (c) The member of the truss can be made of C.I where as the beam is of structural steel only

   (d) The member of the truss can have a circular cross-section whereas the beam can have any cross-section

65. Statement (I): When a liquid is poured in different shaped vessels with base

   area same and equal height, the apparent contradiction of equal

   force at base, but different weights of liquids is hydrostatic

   paradox.

   Statement (II): Bernoulli's equation is valid for inviscid liquids.

   (a) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)
   (b) Both Statement (I) and Statement (II) are individually true but Statement (II) is *NOT* the correct explanation of Statement (I)
   (c) Statement (I) is true but Statement (II) is false
   (d) Statement (I) is false but Statement (II) is true

66. A bar of mild steel $200\ mm$ long and $50\ mm \times 50\ mm$ in cross section is subjected to an axial load of $200\ kN$. If E is $200\ GPa$, the elongation of the bar will be

   (a) $0.16\ mm$

   (b) $0.08\ mm$

   (c) $0.04\ mm$

   (d) $0.02\ mm$

67. A simply supported beam of span l carries over its full span a load varying linearly from zero at each end to $W\ N/m$ at midspan. The maximum bending moment is

(a) $\dfrac{W\ l^2}{12}$

(b) $\dfrac{W\ l^2}{8}$

(c) $\dfrac{W\ l^2}{4}$

(d) $\dfrac{W\ l^2}{2}$

68. A cantilever beam of length l carries a load $(W = \omega l)$ uniformly distributed over its entire length. If the same total load W is placed at the free end of the same cantilever, then the ratio of maximum deflection in the beam in the first case to that in the second case will be:

(a) $\dfrac{3}{12}$

(b) $\dfrac{3}{8}$

(c) $\dfrac{3}{4}$

(d) $\dfrac{3}{2}$

69. In theory of simple bending an assumption is made that plane sections before bending remain plane even after bending. This assumption implies that

(a) Strain is uniform across the section

(b) Stress is uniform across the section

(c) Stress in any layer is proportional to its distance from the neutral axis

(d) Strain in any layer is directly proportional to its distance from the

neutral axis

70. Consider the following statements about I sections:

      1.   The flange carries maximum bending load

      2.   The web carries maximum bending load

      3.   It is ideal in one unique plane of bending

      4.   It is ideal for both planes of bending normal to each other

Which of the above statements are correct?

(a)   2 and 3 only

(b)   2 and 4 only

(c)   1 and 3 only

(d)   1 and 4 only

71. Statement (I): When variables are a few, then Rayleigh method is used in dimensional analysis.

Statement (II): When variables are more, then Buckingham π-method is used since the Rayleigh method becomes cumbersome in dimensional analysis.

(a) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)

(b) Both Statement (I) and Statement (II) are individually true but Statement (II) is *NOT* the correct explanation of Statement (I)

(c) Statement (I) is true but Statement (II) is false

(d) Statement (I) is false but Statement (II) is true

72. Consider the following assumptions made in developing Euler's column theory:

1. The column material obeys Hooke's law

2. The failure of the column occurs due to buckling

3. The column is 'long' compared to its cross-sectional dimensions

Which of the above statements are correct?

(a) 1 and 2 only

(b) 1 and 3 only

(c) 2 and 3 only

(d) 1, 2 and 3

73. Plastic deformation by twinning mechanism occurs in metals due to the movement of atoms where:

1. Atoms move through distances proportional to their (original) distance from the twinning plane

2. Atoms move in integral steps of full atomic distances from their adjacent planes

3. Atoms jumps from one plane to another

Which of the above statements is/are correct?

(a) 1 only

(b) 2 only

(c) 3 only

(d) 1, 2 and 3

74. The volume of atoms in a simple cubical structure unit cell divided by the volume of the unit cell is called

   (a)   Volume ratio of the unit cell

   (b)   Volume density of the unit cell

   (c)   Atomic packing factor

   (d)   Planar density

75. Which of the following are zero dimensional defects?

   1.   Vacancy

   2.   Interstitial defect

   3.   Substitutional defect

   (a)   1 and 2 only

   (b)   1 and 3 only

   (c)   2 and 3 only

   (d)   1, 2 and 3

76. Which of the following is/are the characteristic features of eutectic alloys?

   1.   They possess the lowest melting temperature

   2.   They undergo phase transformation at the same temperature while heating as well as cooling

   (a)   1 only

   (b)   2 only

   (c)   Both 1 and 2

   (d)   Neither 1 nor 2

77. If plain carbon steel in the austenitic condition is quenched in water to room temperature, its structure changes from 'austenite' to

    (a)   Pearlite

    (b)   Martensite

    (c)   Cementite

    (d)   Ferrite

78. Consider the following statements:

    1.   Ferrite is the softest constituent's phase of steel

    2.   Pearlite is the mixture of Bainite and Ledeburite

    Which of the above statements is/are correct?

    (a)   1 only

    (b)   2 only

    (c)   Both 1 and 2

    (d)   Neither 1 nor 2

79. Brittle fracture takes place without any appreciable deformation and by rapid crack propagation. The direction of crack propagation is very nearly:

    1.   Perpendicular to the direction of the applied tensile stress

    2.   Parallel to the direction of the applied tensile stress

    3.   At an angle $45°$ to the direction of the applied tensile stress

    Which of the above statements is/are correct?

    (a)   1 only

    (b)   2 only

    (c)   3 only

    (d)   1, 2 and 3

80. Which one of the following heat treatment process improves machinability?

   (a)   Annealing

   (b)   Process annealing

   (c)   Normalizing

   (d)   Spheroidizing

81. Which of the following ceramic materials are used for piezoelectric applications?

   (a)   Alumina and zirconium oxides

   (b)   Boron titanate and silicon carbide

   (c)   Barium titanate and lead-zirconate-titanate

   (d)   Porcelain and fused silica glass

82. Statement (I): Both oblique shock and normal shock can be viewed as two

   different regions of a flow over a plate with a deflection section.

   Statement (II): Variation of the deflection angle from a zero to a positive value

   results in oblique shock. Further changing the deflection angle

   to a negative value results in expansion waves.

   (a) Both Statement (I) and Statement (II) are individually true and Statement
       (II) is the correct explanation of Statement (I)
   (b) Both Statement (I) and Statement (II) are individually true but Statement
       (II) is NOT the correct explanation of Statement (I)
   (c) Statement (I) is true but Statement (II) is false
   (d) Statement (I) is false but Statement (II) is true

83. In the metal forming processes, the stresses encountered are, less than the:

    1.   Yield strength of the material

    2.   Fracture strength of the material and greater than yield strength

Which of the above statements is/are correct?

(a)   1 only

(b)   2 only

(c)   Both 1 and 2

(d)   Neither 1 nor 2

84. Consider the following objectives of sintering in powder metallurgy:

    1.   To achieve good bonding of powder particles

    2.   To produce a dense and compact structure

    3.   To achieve high strength

    4.   To produce parts free of any oxide

Which of the above objectives are correct?

(a)   1, 2 and 3 only

(b)   1, 2 and 4 only

(c)   3 and 4 only

(d)   1, 2, 3 and 4

85. In any casting process, shrinkage allowance on the pattern is provided in order to compensate for shrinkage when

   (a) The temperature of the liquid metal drops from the pouring to its freezing temperature

   (b) The metal changes from the liquid to the solid state at its freezing temperature

   (c) The temperature of solid phase drops from its freezing temperature to room temperature

   (d) The temperature of metal drops from its pouring temperature to room temperature

86. Investment casting is used for

   (a) Mass production

   (b) Shapes that are made with difficulty using complex patterns in sand casting

   (c) Stainless steel parts

   (d) Shapes which are complex, intricate and cannot be cast by any other method

87. Statement (I): The efficiency of steam turbine considerably reduces if throttle governing is carried out at lower loads.

   Statement (II): Nozzle control can only be applied to the first stage of turbine.

   (a) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)
   (b) Both Statement (I) and Statement (II) are individually true but Statement (II) is *NOT* the correct explanation of Statement (I)
   (c) Statement (I) is true but Statement (II) is false
   (d) Statement (I) is false but Statement (II) is true

88. Consider the following statements with regard to the feeding system for a casting:

       1.   The feeder should be thermally adequate

       2.   The feeder should be volumetrically adequate

       3.   The feeder should have adequate feeding range

Which of the above statements are correct?

(a)   1 and 2 only

(b)   1 and 3 only

(c)   2 and 3 only

(d)   1, 2 and 3

89. Consider the following statements:

       1.   Depth of penetration of a weld depends on the electron speed which is dependent on the accelerating voltage

       2.   The output of the Ruby Laser is normally in 'pulses'

       3.   Joints with curvatures cannot be welded conveniently

Which of the above statements are relevant to Electron Beam Welding process?

(a)   1 and 2 only

(b)   1 and 3 only

(c)   2 and 3 only

(d)   1, 2 and 3

90. The difference between (i) a horizontal borer and (ii) a lathe is

    (a)   In (i) the spindle is horizontal; in (ii) it is vertical

    (b)   In (i) the tool rotates; in (ii) the object rotates

    (c)   In (i) the object rotates; in (ii) tool rotates

    (d)   (i) produces a plain surface; (ii) produces a cylindrical surface

91. The chip thickness during slab milling process is directly proportional to

    (a)   Cutter's rotational speed

    (b)   Angle of contact of the tooth

    (c)   Number of teeth of the cutter

    (d)   Feed rate of work piece

92. Consider the following statements with regard to lapping process:

    1.   Any type of flat material can be lapped to any shape

    2.   As the parts are not clamped during lapping no heat is generated so there is no warping

    3.   No burrs are produced

    Which of the above statements are correct?

    (a)   1 and 2 only

    (b)   1 and 3 only

    (c)   2 and 3 only

    (d)   1, 2 and 3

93. Consider the following statements in the context of a CNC lathe machine:

1. The X axis controls the cross motion of the cutting tool

2. The Z axis controls the travel of the carriage towards or away from the headstock

3. The Y axis controls the motion of the job

4. The X-Y-Z axes are used for rotational movement of the table

Which of the above statements are correct?

(a) 1 and 3

(b) 1 and 2

(c) 3 and 4

(d) 2 and 3

94. Consider the following statements with respect to Laws of Robotics:

1. A robot may not injure a human being or, through inaction, allow a human being to come to harm

2. A robot must obey orders to it by human beings, except where such orders would conflict with the above first law

3. A robot may or may not obey any order given to it by human beings

Which of the above statements are correct?

(a) 1, 2 and 3

(b) 1 and 3 only

(c) 1 and 2 only

(d) 2 and 3 only

95. Which is the property of a tool that prevents plastic deformation at its cutting edge during machining process?

    (a)   High value of fracture toughness

    (b)   High value of hardness under heating

    (c)   Chemical stability

    (d)   Adhesion resistance

96. The strength of a single point cutting tool depends upon:

    1.   The clearance angle

    2.   The rake angle

    3.   The lip angle

    (a)   1 and 2 only

    (b)   1 and 3 only

    (c)   2 and 3 only

    (d)   1, 2 and 3

97. Statement (I): A cold bend part has no spring back because deformation is

    plastic.

    Statement (II): In cold bending, parts are normally over-bent slightly.

    (a) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)
    (b) Both Statement (I) and Statement (II) are individually true but Statement (II) is *NOT* the correct explanation of Statement (I)
    (c) Statement (I) is true but Statement (II) is false
    (d) Statement (I) is false but Statement (II) is true

98. Which of the following are the principal functions of a CNC machine?

      1.   Machine tool control

      2.   In process compensation

      3.   Improved programming and operating features

(a)   1 and 2 only

(b)   1 and 3 only

(c)   2 and 3 only

(d)   1, 2 and 3

99. Which of the following are the advantages of electrical discharge machining?

      1.   Fragile and slender workpieces can be machined

      2.   Fine holes can be easily drilled

      3.   Extremely hard workpieces can be machined

      4.   Sharp corners can be produced

(a)   1, 2, 3 and 4

(b)   1, 2 and 4 only

(c)   3 and 4 only

(d)   1, 2 and 3

100. Which of the following aspects are relevant product characteristics in product development?

      1.   Functional aspects

      2.   Operational aspects

      3.   Durability and dependability aspects

      4.   Aesthetic aspects

(a)   1, 2 and 3 only

(b)   1, 2 and 4 only

(c)   3 and 4 only

(d)   1, 2, 3 and 4