MECHANICAL ENGINEERING

PAPER-II

1. In a queuing problem, if the arrivals are completely random, then the probability distribution of number of arrivals in a given time follows
   a. Poisson distribution
   b. normal distribution
   c. binomial distribution
   d. exponential distribution

2. Consider the following statements in respect of assignment method of optimization :
   1. The matrix format of the method must be a square matrix.
   2. Some type of rating has to be given to the performance of each pairing.

   Which of the statements given above is/are correct ?
   a. Only 1
   b. Only 2
   c. Both 1 and 2
   d. Neither 1 nor 2

3. Which one of the following is not the solution method of transportation problems ?
   a. Hungarian method
   b. Northwest corner method
   c. Least cost method
   d. Vogel's approximation method

4. In a linear programming problem, if a basic solution has no more than m positive x_j (j = 1, 2 , n), it is called
   a. Basic feasible solution
   b. Unbounded solution
   c. Non-degenerate basic feasible solution
   d. None of the above

5. Consider the following statements in respect of PERT and CPM:
   1. PERT is event-oriented while CPM is activity-oriented.
   2. PERT is probabilistic while CPM is deterministic.
   3. Levelling and smoothing are the techniques related to resource scheduling in CPM.

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

6. In case of solution of linear programming problem using graphical method, if the constraint line of one of the non-redundant constraints is parallel to the objective function line, then it indicates
   a. an infeasible solution
   b. a degenerate solution
   c. an unbound solution
   d. a multiple number of optimal solutions

7. Which one of the following statements is correct ?

   Standard time is obtained from normal time by adding the policy allowance and
   a. personal allowances only
   b. fatigue allowances only
   c. delay allowances only
   d. personal, fatigue and delay allowances

8. Which one of the following is not a technique under Predetermined Motion Time System (PMTS)?
   a. Work factor
   b. Synthetic data
   c. Stopwatch time study
   d. MTM

9. Which one of the following is not a necessary information input to Material Requirements Planning ?
   a. Inventory on hand
   b. Bill of materials
   c. Sequence of operations on a job
   d. Master production schedule (MPS)

10. If the annual demand of an item becomes half, ordering cost double, holding cost one-fourth and the unit cost twice, then what is the ratio of the new EOQ and the earlier EOQ?
    a. $\frac{1}{2}$

b. $\frac{1}{\sqrt{2}}$

c. $\sqrt{2}$

d. 2

11. In the ABC method of inventory control, Group A constitutes costly items. What is the usual percentage of such items of the total items ?

a. 10 to 20%

b. 20 to 30%

c. 30 to 40%

d. 40 to 50 %

12. Which one of the following is an inventory system that keeps a running record of the amount in storage and replenishes the stock when it drops to a certain level by ordering a fixed quantity ?

a. EOQ

b. Periodic

c. Peripheral

d. ABC

13. In a network, what is total float equal to ?

a. $LFT_j - EST_i + t_{i-j}$

b. $EST_j - LFT_i - t_{i-j}$

c. $EST_j - LFT_i - t_{i-j}$

d. $LFT_j - EST_i - t_{i-j}$

where, LFT = latest finish time of an activity; EST = earliest start time of an activity; t_{i-j}, = time of activity i–j.

14. Manufacturing a product requires processing on four machines A, B, C, D in the order A–B–C–D. The capacities of four machines are A = 100, B = 110, C = 120 and D = 130 units per shift. If the expected output is 90% of the system capacity, then what is the expected output?

a. 90 units

b. 99 units

c. 108 units

d. 117 units

15. If the total investment is Rs. 5,00,000 for a target production, the income for the current year is Rs. 3,00,000 and total operating cost is Rs. 1,00,000; what is the economic yield ?

a. 10 %

b. 30 %

c. 20 %

d. 40%

16. In a Mohr's circle, the radius of the circle is taken as :

a. $\sqrt{\left(\frac{\sigma_x - \sigma_y}{2}\right)^2 + (\tau_{xy})^2}$

b. $\sqrt{\left(\frac{\sigma_x - \sigma_y}{2}\right)^2 + (\tau_{xy})^2}$

c. $\sqrt{\left(\frac{\sigma_x - \sigma_y}{2}\right)^2 - (\tau_{xy})^2}$

d. $\sqrt{(\sigma_x - \sigma_y)^2 - (\tau_{xy})^2}$

where, σ_x and σ_y, are normal stresses along x and y directions respectively, and τ_{xy} is the shear stress.

17. Disruptive strength is the maximum strength of a metal, when

a. subjected to 3 principal tensile stresses at right angles to one another and of equal magnitude

b. loaded in tension

c. loaded in compression

d. loaded in shear

18. E, G, K and μ represent the elastic modulus, shear modulus, bulk modulus and Poisson's ratio respectively of a linearly elastic, isotropic and homogeneous material. To express the stress-strain relations completely for this material, at least

a. E, G and μ must be known

b. E, K and μ must be known

c. any two of the four must be known

d. All the four must be known

19. Principal strains at a point are 100×10^{-6} and -200×10^{-6}. What is the maximum shear strain at the point ?

a. 300×10^{-6}

b. 200×10^{-6}

c. 150×10^{-6}

d. 100×10^{-6}

20. A metal rod is rigidly fixed at its both ends. The temperature of the rod is increased by 100°C. If the coefficient of linear expansion and elastic modulus of the metal rod are $10 \times 10^{-6}/^{o}C$ and 200 GPa respectively, then what is the stress produced in the rod ?

a. 100 MPa (tensile)

b. 200 MPa (tensile)

c. 200 MPa (compressive)

d. 100 MPa (compressive)

21.

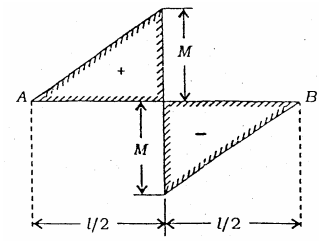


Figure shown above represents the BM diagram for a simply supported beam. The beam is subjected to which one of the following?

a. A concentrated load at its mid-length
b. A uniformly distributed load over its length
c. A couple at its mid-length
d. Couple at 1/4 of the span from each end

22. Which one of the following statements is correct ?

Beams of uniform strength vary in section such that

a. bending moment remains constant
b. deflection remains constant
c. maximum bending stress remains constant
d. shear force remains constant

23. In the case of beams with circular cross-section, what is the ratio of the maximum shear stress to average shear stress ?

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

24. What is the maximum torque transmitted by a hollow shaft of external radius R and internal radius r ?

a. $\frac{\pi}{16}\left(R^3 - r^3\right) f_s$

b. $\frac{\pi}{2R}\left(R^4 - r^4\right) f_s$

c. $\frac{\pi}{8R}\left(R^4 - r^4\right) f_s$

d. $\frac{\pi}{32}\left(\frac{R^4 - r^4}{R}\right) f_s$

(f_s = maximum shear stress in the shaft material)

25. Consider the following statements at given point in the case of thick cylinder subjected to fluid pressure :

1. Radial stress is compressive.
2. Hoop stress is tensile..
3. Hoop stress is compressive.
4. Longitudinal stress is tensile and it varies along the length.
5. Longitudinal stress is tensile and remains constant along the length of the cylinder.

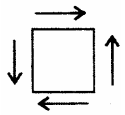
Which of the statements given above are correct ?

a. Only 1, 2 and 4
b. Only 3 and 4
c. Only 1, 2 and 5
d. Only 1, 3 and 5

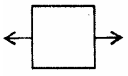
26. Match List - I with List - II and select the correct answer using the code. given below the Lists :

List - I (State of Stress)

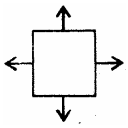
A.



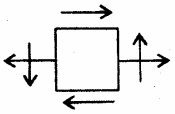
B.



C.



D.



List - II (Kind of Loading)

1. Combined bending and torsion of circular shaft
2. Torsion of circular shaft
3. Thin cylinder subjected. to internal pressure
4. Tie bar subjected to tensile force

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

27. What is the expression for the crippling load for a column of length *1* with one end fixed and other end free ?

a. $P = \frac{2\pi^2 EI}{l^2}$

b. $P = \frac{\pi^2 EI}{4l^2}$

c. $P = \frac{4\pi^2 EI}{l^2}$

d. $P = \frac{\pi^2 EI}{l^2}$

28. Match List-I (Theory of Failure) with List-Il (Predicted Ratio of Shear Stress to Direct Stress at Yield Condition for Steel Specimen) and select the correct answer using the code given below the Lists:

List-I

A. Maximum shear stress theory
B. Maximum energy distortion theory
C. Maximum principal stress theory
D. Maximum principal strain theory

List-II

1. 1.0
2. 0.77
3. 0.62
4. 0.50

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

29. What is the strain energy stored in a body of volume V with stress a due to gradually applied load ?

a. $\frac{\sigma E}{V}$

b. $\frac{\sigma E^2}{V}$

c. $\frac{\sigma V^2}{E}$

d. $\frac{\sigma^2 V}{2E}$

where, E = Modulus of Elasticity

30. Gang milling is a

a. milling process for generating hexagonal surfaces
b. process of cutting gears
c. process in which two or more cutters are used simu1taneousl'
d. milling operation combined with turning

31. Which of the following cannot be cut by hobbing process?

a. Helical gears
b. Bevel gears
c. Worm gears
d. Spur gears

32. It is required to cut screw threads with double start and 2 mm pitch on a lathe having lead screw pitch of 6 mm. What is the speed ratio between lathe spindle and lead screw ?

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

33. Which item best describes a CAM technology?

a. Geometric modelling
b. Documentation
c. Drafting
d. Numerical control

34. Flexible manufacturing allows for:

a. tool design and production
b. automated design
c. quick and inexpensive product change
d. quality control

35. Which one of the following is the third basic component of robots besides power supply and control (memory) console?

a. Software
b. Coaxial cable
c. Mechanical unit arm
d. Microcomputer

36. Which of the following is a single point cutting tool ?

a. Hacksaw blade
b. Milling cutter
c. Grinding wheel
d. Parting tool

37. Which of the following values of index n is associated with carbide tools when Taylor's tool life equation, V. T_n =constant is applied ?

a. 0.1 to 0.15
b. 0.2 to 0.4
c. 0.45 to 0.6
d. 0.65 to 0.9

38. In the selection of optimal cutting conditions, the requirement of surface finish would put a limit on which of the following?
    a. The maximum feed
    b. The maximum depth of cut
    c. The maximum speed
    d. The maximum number of passes
39. During ultrasonic machining, the metal removal is achieved by
    a. high frequency eddy currents
    b. high frequency sound waves
    c. hammering action of abrasive particles
    d. rubbing action between tool and workpiece
40. Which of the following is an interference fit?
    a. Push fit
    b. Running fit
    c. Sliding fit
    d. Shrink fit
41. The M and E-system in metrology are related to measurement of :
    a. screw threads
    b. flatness
    c. angularity
    d. surface finish
42. Consider the following statements
    1. A large rake angle means lower strength of the cutting edge.
    2. Cutting torque decreases with rake angle.

    Which of the statements given above is/are correct ?
    a. Only 1
    b. Only 2
    c. Both 1 and 2
    d. Neither 1 nor 2
43. Which one of the following is a qualitative technique of demand forecasting ?
    a. Correlation and regression analysis
    b. Moving average method
    c. Delphi technique
    d. Exponential smoothing
44. Consider the following statements
    1. C functions can return arrays.
    2. C functions can return functions.
    3. An array element can be void.
    4. An array element can be a function.

    Which of the statements given above is/are correct ?
    a. Only 1 and 4
    b. Only 1 and 3
    c. Only 2
    d. Only 3
45. Which one of the following statements is not correct for the exponential smoothing method of demand forecasting ?
    a. Demand for the most recent data is given more weightage
    b. This method requires only the current demand and forecast demand
    c. This method assigns weight to all the previous data
    d. This method gives equal weightage to all the periods
46. In an assembly line, when the workstation times are unequal, the overall production rate of an assembly line is determined by the :
    a. fastest station time
    b. slowest station time
    c. average of all station times
    d. average of slowest and fastest station times
47. Match List-I (Parameter) with List-II (Definition) and select the correct answer using the code given below the Lists:

    List-I
    A. Total work content
    B. Workstation process time
    C. Cycle time
    D. Balance decay

    List-II
    1. Aggregate of all the work elements to be done on line
    2. Line inefficiency which results from the idle time due to imperfect allocation of work among stations
    3. Time interval between parts coming off the line
    4. Sum of the times of the work elements done at a station

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

48. Which of the following are the advantages of subroutines in a program?

1. They reduce execution time of the program.
2. They make the program more maintainable.
3. Modular development can be achieved.
4. They can be parameterized.

Select the correct answer using the codes given below

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

49. Assertion (A) : Sampling plans with acceptance number greater than zero are generally better than sampling plans with acceptance number equal to zero.

Reason (R) : Sampling plans with acceptance number greater than zero have a larger sample size as compared to similar sampling plans with acceptance number equal to zero.

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

50. Assertion (A) : Forging dies are provided with taper or draft angles on vertical surfaces.

Reason (R) : It facilitates complete filling of die cavity and favorable grain 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

51. Assertion (A) : In Addition Polymerization method, polymer is produced by adding a second monomer to the first, then a third monomer to this dimer and so on.

Reason (R) : There must exist at least one double bond in the monomer for Addition Polymerization reaction.

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

52. Assertion (A) : Concentric cylindrical helical springs are used to have greater spring force in a limited space.

Reason (R) : Concentric helical springs are wound in opposite directions to prevent locking of coils under heavy dynamic loading.

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

53. Assertion (A) : In anti-friction bearings, the frictional resistance is very low as the shaft held by it remains in floating condition by the hydrodynamic pressure developed by the lubricant.

Reason (R) : In hydrodynamic journal bearings hydrodynamic pressure is developed because of flow of lubricant in a converging-diverging channel.

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

54. Assertion (A) : Crowning is provided on the surface of a flat pulley to prevent slipping of the belt sideways.

Reason (R) : Belt creep, which is the reason for slip of the belt sideways, is fully compensated by providing crowning on the pulley.

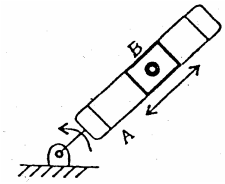
a. Both A and R are individually true and R is the correct explanation of A.
b. Both A and R are individually true but R is not the correct explanation of A.
c. A is true but R is false
d. A is false but R is true

55. Assertion (A) Aluminium has poor weldability.

Reason (R) : Aluminium has high thermal conductivity and high affinity to oxygen.

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

56. Assertion (A) : In case of hot working of metals, the temperature at which the process is finally stopped should not be above the recrystallization temperature.
Reason (R) : If the process is stopped above the recrystallization temperature, grain growth will take place again and spoil the attained structure.
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

57. 

Assertion (A) : Link A experiences Coriolis acceleration relative to the fixed link.
Reason (R) : Slotted link A is rotating with angular velocity ω and the Block B slides in the slot of A.
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

58. Given J = 2, K = –4, A = –5, B = 0.4, C = 10.5
What are the values of the FORTRAN variables
JIP = J*K + J**K, IVAL = A + B + C ?
a. 15.3 and 5.9, respectively
b. –7.83 and 5.9, respectively
c. –7.83 and 5, respectively
d. –8 and 5, respectively

59. For taper turning on centre lathes, the method of swiveling the compound rest is preferred for
a. long jobs with small taper angles
b. long jobs with steep taper angles
c. short jobs with small taper angles
d. short jobs with steep taper angles

60. Which of the following are the advantages of indirect addressing over direct addressing ?
1. The program length is shorter.
2. The program takes lesser time to execute.
3. It allows the flexibility of using pointers.
4. It allows more efficient use of the cache.
Select the correct answer using the codes given below :
a. Only 1, 2 and 3
b. Only 1 and 3
c. Only 2, 3 and 4
d. Only 1 and 2

61. Match the terms under the List-I with their description under the List-II in respect of computer organization and select the correct answer using the code given below the Lists :
List-I
A. Distributed system
B. MIMD
C. SIMD
D. Pipelined machine
List-II
1. Multiple control units
2. Different steps of instruction are executed in separate stages with latches
3. Independent processors which are networked together
4. Lock-step synchronization between multiple functional units

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

62. Consider the following statements:
The objective of value analysis is :
1. to reduce the cost
2. to increase the profit
3. to improve quality
Which of the statements given above are correct ?
a. Only 1 and 2
b. Only 1 and 3
c. Only 2 and 3
d. 1, 2 and 3

63. Consider the following statements in respect of flexible couplings :

1. The flanges of flexible coupling are usually made of grey cast iron FG200.
2. In the analysis of flexible coupling, it is assumed that the power is transmitted by the shear résistance of the pins.
3. Rubber bushes with brass lining are provided to absorb misalignment between the two shafts.

Which of the statements given above are correct ?

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

64. In case of belt drives, the effect of the centrifugal tension is to:

a. cause the belt to leave the pulley and increase the power to be transmitted
b. cause the belts to stay on the pulley and increase the power to be transmitted
c. reduce the driving power of the belt
d. stretch the belt in longitudinal direction

65. Which one of the following statements is not correct?

a. Hooke's joint is used to connect two rotating co-planar, non-intersecting. shafts
b. Hooke's joint is used to connect two rotating co-planar, intersecting shafts
c. Oldham's coupling is used to connect two parallel rotating shafts
d. Hooke's joint is used in the steering mechanism for automobiles

66. Stresses in a screw thread are estimated by considering the thread to be :

a. long cantilever beam projecting from the pitch cylinder
b. long cantilever beam projecting from the root cylinder
c. short cantilever beam projecting from the root cylinder
d. short cantilever beam projecting from the pitch cylinder

67. Match List-I (Parts to be Joined) with List-II (Type of Joint) and select the correct answer using the code given below :

List-I

A. Two rods having relative axial motion
B. Strap end of the connecting rod
C. Piston rod and cross head
D. Links of four-bar chain

List-II

1. Pin Joint
2. Knuckle Joint
3. Gib and Cotter Joint
4. Cotter Joint

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

68. In a gib and cotter joint, the gib and cotter are subjected to

a. single shear only
b. double shear only
c. single shear and crushing
d. double shear and crushing

69. What is the number of nodes in a shaft carrying three rotors?

a. Zero
b. 2
c. 3
d. 4

70. Match List-I (Property) with List-II (System) and select the correct answer using the code given below the Lists :

List-I

A. Resonance
B. On-off control
C. Natural frequency
D. Feedback signal

List-II

1. Closed-loop control system
2. Free vibrations
3. Excessively large amplitude
4. Mechanical brake

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

71. In case of partial balancing of single-cylinder reciprocating engine, what is the primary disturbing force along the line of stroke?

a. $cmr\omega^2 \cos\theta$
b. $(1 - c^2)\, mr\omega^2 \cos\theta$
c. $(1 - c)\, mr\omega^2 \cos\theta$
d. $(1 - c)\, m\omega^2 r \cos 2\theta$

where, c = Fraction of reciprocating mass to be balanced; ω = Angular velocity of crankshaft; θ = Crank angle.

72. Consider the following statements :
1. The condition of stability of a governor requires that the slope of the controlling force curve should be less than that of the line representing the centripetal force at the equilibrium speed under consideration.
2. For a centrifugal governor when the load on the prime mover drops suddenly, the sleeve should at once reach the lower-most position.

Which of the statements given above is/are correct ?
a. Only 1
b. Only 2
c. Both 1 and 2
d. Neither 1 nor 2

73. What is the number of instantaneous centres of rotation for a 6-link mechanism?
a. 4
b. 6
c. 12
d. 15

74. In which one of the following is a flywheel generally employed?
a. Lathe
b. Electric motor
c. Punching machine
d. Gearbox

75. What is the value of pressure angle generally used for involute gears ?
a. 35°
b. 30°
c. 25°
d. 20°

76. Consider the following statements :
1. A stub tooth has a working depth larger than that of a full-depth tooth.
2. The path of contact for involute gears is an arc of a circle.

Which of the statements given above is/are correct ?
a. Only 1
b. Only 2
c. Both 1 and 2
d. Neither 1 nor 2

77. Consider the following statements :

Cam followers are generally classified according to
1. the nature of its motion
2. the nature of its surface in contact with the cam
3. the speed of the cam

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

78. Consider the following statements:

Radius of friction circle for a journal bearing depends upon
1. coefficient of friction
2. radius of the journal
3. angular speed of rotation of the shaft

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

79. What is the maximum acceleration of a cam follower undergoing simple harmonic motion?

a. $\frac{h}{2}\left(\frac{\pi\omega}{\phi}\right)^2$

b. $4h\left(\frac{\omega^2}{\phi^2}\right)$

c. $4h\left(\frac{\omega^2}{\phi}\right)$

d. $\frac{2h\pi\omega^2}{\phi^2}$

Where, h = Stroke of the follower ; ω = Angular velocity of the cam; ϕ = Cam rotation angle for the maximum follower displacement.

80. Consider the following statements :
1. Lower pairs are more resistant than the higher pairs in a plane mechanism.
2. In a 4-bar mechanism (with 4 turning pairs), when the link opposite to the shortest link is fixed, a double rocker mechanism results.

Which of the statements given above is/are correct ?

a. Only 1
b. Only 2
c. Both 1 and 2
d. Neither 1 nor 2

81. In Zinc Blende structure, each atom is surrounded by four atoms of the opposite kind which are located at the corners of which one of the following?
a. Tetrahedron
b. Hexahedron
c. Cube
d. Orthorhombic

82. Match List-I (Fe-Fe_3C Phase Diagram Characteristic) with List-II (Phase) and select the correct answer using the code given below the Lists :

List-I
A. Alpha (α) iron
B. Iron carbide having crystal lattice with 3 iron and 1 carbon atom
C. BCC pure allotrope of iron is stable between 1388 °C and is melting point at 1535 °C

List – II
1. δ iron
2. Eutectic
3. Ferrite
4. Cementite

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

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

Space Lattice	Relation between Atomic Radius r and Edge element a
a. Simple cubic structure	$a^2 = 4r^2$
b. Body-centred cubic structure	$3a^2 = 16r^2$
c. Triclinic	$2a^2 = 3r^2$
d. Face-centred cubic structure	$a^2 = 8r^2$

84. What is the planar density of (100) plane in FCC (face-centred cubic) crystal with unit cell side a equal to ?
a. $\frac{1.484}{a^2}$
b. $\frac{2}{a^2}$
c. $\frac{1}{a^2}$
d. $\frac{\sqrt{2}}{a^2}$

85. Match List-I (Element) with List-II (Crystal Structure) and select the correct answer using the code given below the Lists :

List-I
A. Alpha Iron
B. Copper
C. Zinc
D. Glass

List - II
1. Hexagonal closed packed
2. Body-centred cubic
3. Amorphous
4. Face-centred cubic

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

86. Which one of the following factors is more relevant to represent complete solubility of two metals in each other?
a. Chemical affinity
b. Valency factor
c. Crystal structure factor
d. Relative size factor

87. Match List-I (Effect of Cooling) with List-II (Cooling Medium) and select the correct answer using the code given below:

List-I
A. Martensite
B. Very fine pearlite
C. Fine pearlite
D. Coarse pearlite

List - II
1. Water quenched
2. Air cooled
3. Furnace cooled
4. Oil quenched

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

88. 30 C 8 steel has its yield strength of 400 N/mm^2 and modulus of elasticity of 2 ×

10^5 MPa. Assuming the material to obey Hooke's law up to yielding, what is its proof resilience ?

a. 0.8 N/mm^2
b. 0.4 N/mm^2
c. 0.6 N/mm^2
d. 0.7 N/mm^2

89. Which one of the following is the process to refine the grains of metal after it has been distorted by hammering or cold working?

a. Annealing
b. Softening
c. Re-crystallizing
d. Normalizing

90. Tempering is a process of annealing

a. martensite at low temperatures
b. martensite at higher temperatures
c. bainite at low temperatures
d. bainite at higher temperatures

91. What is the efficiency of a self-locking power screw ?

a. 70%
b. 60%
c. 55%
d. < 50%

92. In case of power screws, what is the combination of materials used for the screw and the nut ?

a. Cast iron screw and mild steel nut
b. Carbon steel screw and phosphor bronze nut
c. Cast iron screw and cast iron nut
d. Aluminium screw and alloy steel nut

93. In power transmission shafts, if the polar moment of inertia of a shaft is doubled, then what is the torque required to produce the same angle of twist ?

a. 1/4 of the original value
b. 1/2 of the original value
c. Same as the original value
d. Double the original value

94. What is sunk key made in the form of a segment of a circular disc of uniform thickness, known as ?

a. Feather key
b. Kennedy key
c. Woodruff key
d. Saddle key

95. Autofrettage is a method of:

a. improving the transmission of power from engine to the axle in automobiles
b. improving the strength of welded joints
c. pre-stressing the cylinders before putting them in service
d. improving the strength of riveted joints

96. Match List-I (Type of Gears) with List-II (Characteristics) and select the correct answer using the code given below the Lists :

List-I

A. Helical gearing
B. Herringbone gearing
C. Worm gearing
D. Hypoid gearing

List-II

1. Zero axial thrust
2. Non-inter-changeable
3. Skew shafts
4. Parallel shafts

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

97. In heavy-duty gear drives, proper heat treatment of gears is necessary. in order to:

a. avoid interference
b. prevent noisy operation
c. minimize wear of gear teeth
d. provide resistance against impact loading on gear teeth

98. Which of the following is/are used for cutting internal gears?

1. Gear hobber
2. Gear shaper
3. Rack cutter
4. Jig borer

Select the correct answer using the codes given below :

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

99. Match List-I (Type of Anti-friction Bearing) with List-II (Specific Use) and select the correct answer using the code given below the Lists :

List-I

A. Self-aligning ball bearing

B. Taper roller bearing
C. Deep groove ball bearing
D. Thrust ball bearing

List-II
1. For pure axial load
2. For hinged condition
3. For pure radial load
4. For axial and radial load

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

100. Satisfactory hydrodynamic film in a journal bearing is formed when
a. journal speed is low, unit pressure on the bearing is high and viscosity of lubricant used is low
b. journal speed is low, unit pressure on the bearing is low and viscosity of lubricant used is low
c. journal speed is high, unit pressure on the bearing is high and viscosity of lubricant used is high
d. appropriate combination of journal speed, unit pressure on bearing and lubricant viscosity exists resulting in low coefficient of friction

101. A body is subjected to a pure tensile stress of 100 units.
What is the maximum shear produced in the body at some oblique plane due to the above ?
a. 100 units
b. 75 units
c. 50 units
d. 0 unit

102. While transmitting the same power by a shaft, if its speed is doubled, what should be its new diameter if the maximum shear stress induced iii the shaft remains same ?
a. $\frac{1}{2}$ of the original diameter
b. $\frac{1}{\sqrt{2}}$ of the original diameter
c. $\sqrt{2}$ of the original diameter
d. $\frac{1}{(2)^{1/3}}$ of the original diameter

103. In a tensile test, near the elastic limit zone
a. tensile stress increases at a faster rate
b. tensile stress decreases at a faster rate
c. tensile stress increases in linear proportion to the stress
d. tensile stress decreases in linear proportion to the stress

104. In a strained material, normal stresses on two mutually perpendicular planes are σ_x and σ_y (both alike) accompanied by a shear stress τ_{xy}. One of the principal stresses will be zero, only if
a. $\tau_{xy} = \frac{\sigma_x \times \sigma_y}{2}$
b. $\tau_{xy} = \sigma_x \times \sigma_y$
c. $\tau_{xy} = \sqrt{\sigma_x \times \sigma_y}$
d. $\tau_{xy} = \sqrt{\sigma_x^2 \times \sigma_y^2}$

105. Two tapering bars of the same material are subjected to a tensile load P. The lengths of both the bars are the same. The larger diameter of each of the bars is D. The diameter of the bar A at its smaller end is D/2 and that of the bar B is D/3. What is the ratio of elongation of the bar A to that of the bar B?
a. 3 : 2
b. 2 : 3
c. 4 : 9
d. 1 : 3

106. The pattern known as Widmanstätten structure is encountered in :
a. tempering
b. normalizing
c. spheroidizing
d. annealing

107. Phenol formaldehyde is a / an
a. thermoplastic polymer
b. thermoset polymer
c. elastomer
d. rubber

108. An orthotropic material, under plane stress condition will have:
a. 15 independent elastic constants
b. 4 independent elastic constants
c. 5 independent elastic constants
d. 9 independent elastic constants

109. Match List-I (Composition) with List-II (Application) and select the correct answer using the code given below the Lists :
List-I
A. Commercial bronze (10% Zn)

B. Red brass (15% Zn)
C. Aluminium brass (22% Zn, 2% Al)
D. P-bronze (11% tin, small amount of P)

List-II
1. Radiator
2. Spring metal
3. Forging and stamping
4. Power plant and chemical equipment

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

110. Which one of the following is a continuous bending process in which opposing rolls are used to produce long sections of formed shapes from coil or strip stock?
a. Stretch forming
b. Roll forming
c. Roll bending
d. Spinning

111. Which of the following are the limitations of powder metallurgy?
1. High tooling and equipment costs.
2. Wastage of material.
3. It cannot be automated.
4. Expensive metallic powders.

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

112. In which of the following are metal moulds used ?
a. Greensand mould
b. Dry sand mould
c. Die casting process
d. Loam moulding

113. Which of the following materials are used for making patterns in investment casting method ?
1. Wax
2. Rubber
3. Wood
4. Plastic

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

114. Shell moulding can be used for :
a. producing milling cutters
b. making gold ornaments
c. producing heavy and thick walled casting
d. producing thin casting

115. According to Chvorinov's equation, the solidification time of a casting is proportional to
a. υ^2
b. υ
c. $1/\upsilon$
d. $1/\upsilon^2$

where, υ = volume of casting

116. In which of the following welding processes, flux is used in the form of granules ?
a. AC arc welding
b. Submerged arc welding
c. Argon arc welding
d. DC arc welding

117. Which one of the following is not a fusion welding process ?
a. Gas welding
b. Arc welding
c. Brazing
d. Resistance welding

118. Fabrication weldability test is used to determine
a. mechanical properties required for satisfactory performance of welded joint
b. susceptibility of welded joint for cracking
c. suitability for joint design
d. appropriate machining process

119. Which one of the following welding processes consists of minimum heat affected zone (HAZ)?
a. Shielded Metal Arc Welding (SMAW)
b. Laser Beam Welding (LBW)
c. Ultrasonic Welding (USW)
d. Metal Inert Gas Welding (MIG)

120. What does hydrostatic pressure in extrusion process improve?
a. Ductility
b. Compressive strength
c. Brittleness
d. Tensile strength