

DO NOT OPEN THIS TEST BOOKLET UNTIL YOU ARE ASKED TO DO SO

I.B.C. : B-FRF-M-LBB

Test Booklet Series

Serial No. {

**TEST BOOKLET**  
**MECHANICAL ENGINEERING**  
**PAPER—II**



Time Allowed : Two Hours

Maximum Marks : 200

**INSTRUCTIONS**

1. IMMEDIATELY AFTER THE COMMENCEMENT OF THE EXAMINATION, YOU SHOULD CHECK THAT THIS TEST BOOKLET **DOES NOT** HAVE ANY UNPRINTED OR TORN OR MISSING PAGES OR ITEMS, ETC. IF SO, GET IT REPLACED BY A COMPLETE TEST BOOKLET.
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3. You have to enter your Roll Number on the Test Booklet in the Box provided alongside. **DO NOT** write *anything else* on the Test Booklet.
4. This Test Booklet contains **120** items (questions). Each item comprises four responses (answers). You will select the response which you want to mark on the Answer Sheet. In case, you feel that there is more than one correct response, mark the response which you consider the best. In any case, choose **ONLY ONE** response for each item.
5. You have to mark your responses **ONLY** on the separate Answer Sheet provided. See directions in the Answer Sheet.
6. All items carry equal marks.
7. Before you proceed to mark in the Answer Sheet the response to various items in the Test Booklet, you have to fill in some particulars in the Answer Sheet as per instructions sent to you with your Admission Certificate.
8. After you have completed filling in all your responses on the Answer Sheet and the examination has concluded, you should hand over to the Invigilator **only the Answer Sheet**. You are permitted to take away with you the Test Booklet.
9. Sheets for rough work are appended in the Test Booklet at the end.
10. **Penalty for wrong answers :**  
THERE WILL BE PENALTY FOR WRONG ANSWERS MARKED BY A CANDIDATE.
  - (i) There are four alternatives for the answer to every question. For each question for which a wrong answer has been given by the candidate, **one-third** of the marks assigned to that question will be deducted as penalty.
  - (ii) If a candidate gives more than one answer, it will be treated as **wrong answer** even if one of the given answers happens to be correct and there will be same penalty as above to that question.
  - (iii) If a question is left blank, i.e. no answer is given by the candidate, there will be **no penalty** for that question.

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1. The minimum number of links in a constrained planer mechanism involving revolute pairs and two higher pairs is :
  - (a) 3
  - (b) 4
  - (c) 5
  - (d) 6
  
2. A ball is thrown upwards and it returns to the ground describing a parabolic path which of the following remains constant ?
  - (a) Kinetic energy of the ball
  - (b) Speed of the ball
  - (c) Horizontal component of velocity
  - (d) Vertical component of velocity
  
3. A man is climbing up a ladder which is resting against a vertical wall. When he was exactly half way up, the ladder started slipping. The path traced by the man is :
  - (a) Parabola
  - (b) Hyperbola
  - (c) Ellipse
  - (d) Circle
  
4. Consider the following statements regarding motions of various points of the same link of a mechanism :
  1. The magnitude of the relative velocity of a point A with respect to a point B on a rotation of link is given by multiplication of angular velocity with distance between the points.
  2. The direction of the relative velocity of a point A with respect to a point B on a rotating link is perpendicular to AB.
  3. The resultant acceleration of a point A with respect to a point B of the same link is perpendicular to AB.
 Which of these statements are correct ?
  - (a) 1, 2 and 3
  - (b) 1 and 3 only
  - (c) 1 and 2 only
  - (d) 2 and 3 only
  
5. Consider the following statements regarding radial cam nomenclature :
  1. Motion of the trace point describes movement of the follower
  2. The curve generated by the locus of trace point is called cam profile
  3. Actual working curve of cam is called pitch curve
  4. Smallest circle that can be drawn tangential to cam profile is called base circle
 Which of these statements are correct ?
  - (a) 1, 2 and 3
  - (b) 1, 3 and 4
  - (c) 1 and 4 only
  - (d) 3 and 4 only
  
6. In circular arc cam with a flat faced reciprocating follower, the contact between the follower and the nose of cam is only maintained if :
  - (a) External spring force is less than the inertia force of the follower
  - (b) External spring force is greater than the inertia force of the follower
  - (c) External spring force is zero
  - (d) The inertia force is more than the spring force
  
7. In the case of a circular arc cam with a flat-faced reciprocating follower, when the follower is in contact with nose of cam, the external spring force required for maintaining the contact between follower and cam is :
  - (a) Greater than the force due to gravity of mass of the follower
  - (b) Greater than the inertia force of the follower
  - (c) Smaller than the inertia force of the follower
  - (d) Greater than the weight of the follower

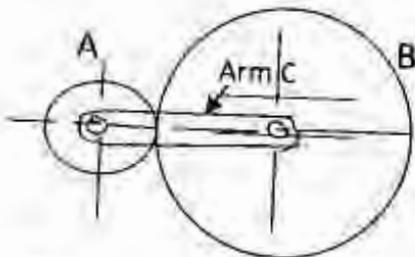
8. Two spur gears of  $20^\circ$  full depth involute system are transmitting motion with a gear ratio of 2. The ratio of the base circle radii of the gears would be :

- (a) 0.5
- (b) 0.68
- (c) 0.72
- (d) 1.00

9. The arc of contact and the path of contact are, respectively 27 mm and 25.4 mm, in a pair of involute spur gears. The pressure angle would be :

- (a)  $14.5^\circ$
- (b)  $17.2^\circ$
- (c)  $19.8^\circ$
- (d)  $20.5^\circ$

10. The figure shows an epicyclic gear train with gears A and B having 40 and 50 teeth, respectively. If the arm C rotates at 200 rpm in anticlockwise direction about the centre of gear A which is fixed, then speed of revolution of gear B in rpm would be :



- (a) 160
- (b) 250
- (c) 360
- (d) 450

11. If the speed of an engine varies between 390 and 410 rpm in a cycle of operation, the coefficient of fluctuations of speed would be :

- (a) 0.01
- (b) 0.02
- (c) 0.04
- (d) 0.05

12. In a centrifugal governor, the controlling force is observed to be 14 N when the radius of rotation is 2 cm and 38 N. When the radius of rotation is 6 cm, the governor :

- (a) is a stable governor
- (b) is an unstable governor
- (c) is an isochronous governor
- (d) cannot be said of what type with the given data

13. In a Watt governor the weight of the ball is 50 N and the friction at the sleeve is 10 N. The coefficient of detention would be :

- (a) 5.0
- (b) 0.5
- (c) 0.2
- (d) 0.1

14. If the radius is doubled and the speed is reduced to half of its original value, the centrifugal force would become :

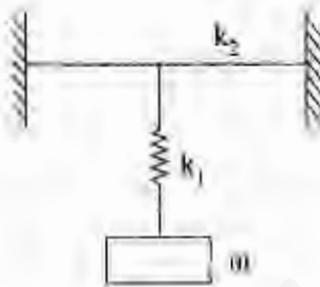
- (a) 2.0 times the original value
- (b) 0.5 times the original value
- (c) 0.2 times the original value
- (d) 0.1 times the original value

(Contd.)

15. The sleeve and each rotating mass of a Porter governor weigh respectively, 200 N and 50 N. If the friction at the sleeve is 10 N then the coefficient of detention would be :
- 0.20
  - 0.40
  - 0.04
  - 0.05
16. The governor is said to be stable when :
- For each speed within the working range there is only one radius of rotation for the governor ball
  - The equilibrium speed is constant for all radii rotation of the balls within working range
  - There is a slightest increase in speed, the governor balls will fly to this maximum radius
  - The governor admits either maximum or minimum amount of energy to the engine and will not admit an amount of energy between these two extremes
17. When the speed of the engine fluctuate continuously above and below the mean speed, then the governor is said to be
- Stable
  - Unstable
  - Isochronous
  - Hunting
18. An unbalanced couple of magnitude 300 N-m is noticed on a shaft of length 200 cm. The dynamic reactions at the bearings are :
- 300 N and -300 N
  - 300 N and 300 N
  - 150 N and 150 N
  - 150 N and -150 N
19. A rigid rotor supported on two bearings which are 2.75 m apart, is found to have an unbalanced couple of magnitude 300 N-m. The dynamic reactions at each bearing would be nearly :
- 55 N
  - 109 N
  - 190 N
  - 219 N
20. When the engine is running at 750 rpm, the magnitude of primary forces is observed to be 500 N. If the crank and connecting rod are of lengths, 250 mm and 1000 mm, respectively, the magnitude of secondary force would be :
- 125 N
  - 250 N
  - 350 N
  - 450 N
21. A cantilever beam of negligible mass is having a point mass  $m$  at its free end. The mass  $m$  is also supported by an elastic support of stiffness  $k_1$ . If  $k_2$  is the bending stiffness of the cantilever, then the natural frequency of the mass  $m$  would be :
- $\sqrt{\frac{k_1 k_2}{m(k_1 + k_2)}}$
  - $\sqrt{\frac{k_1 + k_2}{m}}$
  - $\sqrt{\frac{k_1 - k_2}{m}}$
  - $\frac{1}{2} \left[ \sqrt{\frac{k_1}{m}} + \sqrt{\frac{k_2}{m}} \right]$

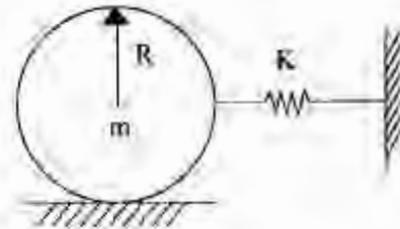
22. In a vibrating system the spring has stiffness 32 N/m and the mass 2 kg. The system is having a damper whose coefficient of viscous damping is 8 N-s/m. The system is :
- Over damped system
  - Under damped system
  - Critical damped system
  - Un-damped system

23. A mass  $m$  is suspended through a spring of stiffness  $k_1$  from a beam of bending stiffness  $k_2$  as shown in the figure. If the mass is slightly displaced and left, then the frequency of oscillations in rad/s may be given as :



- $\left[ \frac{1}{m} \cdot \frac{k_1 k_2}{k_1 + k_2} \right]^{\frac{1}{2}}$
- $\left[ \frac{k_1 + k_2}{m} \right]^{\frac{1}{2}}$
- $\left[ \frac{k_1 - k_2}{m} \right]^{\frac{1}{2}}$
- $\frac{1}{2} \left[ \left( \frac{k_1}{m} \right)^{\frac{1}{2}} + \left( \frac{k_2}{m} \right)^{\frac{1}{2}} \right]$

24. A circular cylinder of mass  $m$  and radius  $r$  is connected by a spring of modulus  $K$  as shown. If it is free to roll on the rough horizontal surface without slipping, what will be its natural frequency ?



- $\omega_n = \left( \frac{2K}{3m} \right)^{\frac{1}{2}}$  rad/s
- $\omega_n = \left( \frac{K}{3m} \right)^{\frac{1}{2}}$  rad/s
- $\omega_n = \left( \frac{4K}{3m} \right)^{\frac{1}{2}}$  rad/s
- $\omega_n = \left( \frac{K}{m} \right)^{\frac{1}{2}}$  rad/s

25. A vibrating system with mass 3 kg, stiffness 21 N-s/m and damper having damping coefficient 10 N-s/m. When an exciting force of magnitude  $27 \sin 2t$  is acting, what would be the time period of oscillations ?
- 0.78 s
  - 1.56 s
  - 3.14 s
  - 3.89 s

26. Transmissibility ratio will be equal to unity for all values of damping factor, if  $\frac{\omega}{\omega_n}$  is equal to :
- 1
  - 2
  - $\sqrt{2}$
  - $\pi$
27. When a rotor of mass 100 kg is mounted on a shaft, a bending deflection of 0.1 mm is observed at the place where the rotor is placed. What is the dangerous speed of the rotor ?
- 100 rpm
  - 750 rpm
  - 1495 rpm
  - 2990 rpm
28. The shoulder provided on the shaft using antifriction bearings is to prevent :
- Axial movement of the shaft
  - Tangential movement of the shaft
  - Rotation of the outer sleeve of the bearing
  - Axial movement of the outer sleeve
29. In the assembly of pulley, key and shaft :
- Pulley is made the weakest
  - Key is made the weakest
  - Key is made the strongest
  - All the three are designed for equal strength
30. Which of the following is a joint formed by interference fits ?
- Joint of cycle axle and its bearing
  - Joint between I.C. Engine piston and cylinder
  - Joint between a pulley and shaft transmitting power
  - Joint of lathe spindle and its bearing
31. Universal or Hooke's joint is used to connect two non-coaxial rotating shafts transmitting power and intersecting at a small angle transmitting power. For a constant rotating speed of the driving shaft, the maximum fluctuation of instantaneous speed of the driven shaft :
- Varies as the square of the angle (in radian) between the two shafts
  - Varies as the angle (in radian) between the two shafts
  - Varies as the inverse of the angle (in radian) between the two shafts
  - is nil
32. Considering the effect of centrifugal tension in a flat belt drive with  $T_1$  = tight side tension and  $T_c$  = centrifugal tension and  $m$  = mass per unit length of the belt, the velocity of the belt for maximum power transmission is given by :
- $V = \sqrt{\frac{T_1}{3m}}$
  - $V = \sqrt{\frac{T_c}{3m}}$
  - $V = \sqrt{\frac{(T_1 - T_c)}{3m}}$
  - $V = \sqrt{\frac{(T_1 + T_c)}{3m}}$
33. In a power screw square threads, the torque required to raise the given load is found to be 8800 N-m. The core diameter of the screw is 40 mm. The shear stress due to this torque in the power screw is :
- 350 N/mm<sup>2</sup>
  - 700 N/mm<sup>2</sup>
  - 175 N/mm<sup>2</sup>
  - 525 N/mm<sup>2</sup>

34. Consider the following statements :

The basic reason why shafts are made of steel and its alloys is :

1. The shaft is subjected to normal stress.
2. The shaft stress alternates with respect to time.
3. The shaft is subjected to pure compressive stress.
4. The shaft is subjected to stress of constant intensity.

Which of these statements are correct ?

- (a) 1 and 2
- (b) 2 and 3
- (c) 3 and 4
- (d) 4 and 1

35. In the design of connecting rod small end bearing, the value of permissible bearing pressure to be used is :

- (a) Less than that used for big end bearing
- (b) More than that used for big end bearing
- (c) Equal to that used for big end bearing
- (d) None of the above

36. In case of hydrodynamic lubrication in a journal bearing the attitude is the ratio of :

- (a) Minimum film thickness and diametral clearance
- (b) Eccentricity and minimum film thickness
- (c) Eccentricity and diametral clearance
- (d) Eccentricity and radial clearance

37. The bearing characteristic number depends on :

- (a) Length and diameter of the bearing and the radial load
- (b) Length and diameter of the bearing, bearing load and speed of rotation
- (c) Length and diameter of the bearing, bearing load and viscosity of the lubricant
- (d) Length and diameter of the bearing, bearing load, speed of rotation and viscosity of the lubricant

38. If the load on a ball bearing is reduced to one third, then its life would increase by :

- (a) 3 times
- (b) 9 times
- (c) 27 times
- (d) 81 times

39. Removal of metal particles from the raceway of a rolling contact bearing is a kind of failure of bearing, known as :

- (a) Pitting
- (b) Wearing
- (c) Spalling
- (d) Scuffing

40. Consider the following statements :

When a thick plate is subjected to external loads :

1. State of plane stress occurs at the surface
2. State of plane strain occurs at the surface
3. State of plane stress occurs in the interior part of the plate
4. State of plane strain occurs in the interior part of the plate

Which of these statements are correct ?

- (a) 1 and 3
- (b) 2 and 4
- (c) 1 and 4
- (d) 2 and 3

41. The state of plane stress at a point in a loaded member is given by :

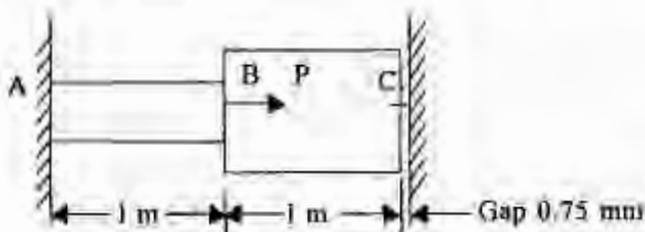
$$\sigma_x = +800 \text{ MPa}$$

$$\sigma_y = +200 \text{ MPa}$$

$$\tau_{xy} = \pm 400 \text{ MPa}$$

The maximum principal stress and maximum shear stress are given by :

- (a)  $\sigma_{\max} = 800 \text{ MPa}$  and  $\tau_{\max} = 400 \text{ MPa}$   
 (b)  $\sigma_{\max} = 800 \text{ MPa}$  and  $\tau_{\max} = 500 \text{ MPa}$   
 (c)  $\sigma_{\max} = 1000 \text{ MPa}$  and  $\tau_{\max} = 500 \text{ MPa}$   
 (d)  $\sigma_{\max} = 1000 \text{ MPa}$  and  $\tau_{\max} = 400 \text{ MPa}$
42. Mohr's circle construction is valid for both stress, as well as the area moment of inertia because :
- (a) Both are tensors of first order  
 (b) Both are tensors of second order  
 (c) Both are axial vectors  
 (d) Both occur under plane stress condition
43. In the arrangement as shown in the figure, the stepped steel bar ABC is loaded by a load P. The material has Young's modulus  $E = 200 \text{ GPa}$  and the two portions AB and BC have area of cross section  $1 \text{ cm}^2$  and  $2 \text{ cm}^2$  respectively. The magnitude of load P required to fill up the gap of  $0.75 \text{ mm}$  is :



- (a) 10 kN  
 (b) 15 kN  
 (c) 20 kN  
 (d) 25 kN

44. Consider the following statements :  
 Modulus of rigidity and bulk modulus of a material are found to be  $60 \text{ GPa}$  and  $140 \text{ GPa}$  respectively. Then :

1. Elasticity modulus is nearly  $200 \text{ GPa}$
2. Poisson's ratio is nearly  $0.3$
3. Elasticity modulus is nearly  $158 \text{ GPa}$
4. Poisson's ratio is nearly  $0.25$

Which of these statements are correct ?

- (a) 1 and 3  
 (b) 2 and 4  
 (c) 1 and 4  
 (d) 2 and 3

45. A  $16 \text{ mm}$  diameter bar elongates by  $0.04\%$  under a tensile force of  $16 \text{ kN}$ . The average decrease in diameter is found to be  $0.01\%$ . Then :

1.  $E = 210 \text{ GPa}$  and  $G = 77 \text{ GPa}$
2.  $E = 199 \text{ GPa}$  and  $\nu = 0.25$
3.  $E = 199 \text{ GPa}$  and  $\nu = 0.30$
4.  $E = 199 \text{ GPa}$  and  $G = 80 \text{ GPa}$

Which of these values are correct ?

- (a) 3 and 4  
 (b) 2 and 4  
 (c) 1 and 3  
 (d) 1 and 4

46. In a body, thermal stress is induced because of the existence of :

- (a) Latent heat  
 (b) Total heat  
 (c) Temperature gradient  
 (d) Specific heat

47. A beam simply supported at equal distance from the ends carries equal loads at each end. Which of the following statements is true ?
- The bending moment is minimum at the mid-span
  - The bending moment is minimum at the support
  - The bending moment varies gradually between the supports
  - The bending moment is uniform between the supports
48. A simply supported beam of length  $l$  is loaded by a uniformly distributed load  $w$  over the entire span. It is propped at the mid span so that the deflection at the centre is zero. The reaction at the prop is :
- $\frac{5}{16} wl$
  - $\frac{1}{2} wl$
  - $\frac{5}{8} wl$
  - $\frac{1}{10} wl$
49. If  $E$  = elasticity modulus,  $I$  = moment of inertia about the neutral axis and  $M$  = bending moment in pure bending under the symmetric loading of a beam, the radius of curvature of the beam :
- Increases with  $E$
  - Increases with  $M$
  - Decreases with  $I$
  - Decreases with  $M$
- Which of these are correct ?
- 1 and 3
  - 2 and 3
  - 3 and 4
  - 1 and 4
50. A rotating shaft carrying a unidirectional transverse load is subjected to :
- Variable bending stress
  - Variable shear stress
  - Constant bending stress
  - Constant shear stress
51. A closely coiled spring of 20 cm mean diameter is having 25 coils of 2 cm diameter. Modulus of rigidity of the material is  $10^7$  N/cm<sup>2</sup>. Stiffness of spring is :
- 50 N/cm
  - 250 N/cm
  - 100 N/cm
  - 500 N/cm
52. The compliance of the spring is the :
- Reciprocal of the spring constant
  - Deflection of the spring under compressive load
  - Force required to produce a unit elongation of the spring
  - Square of the stiffness of the spring
53. A bumper consisting of two helical springs of circular section brings to rest a railway wagon of mass 1500 kg and moving at 1 m/s. While doing so, the springs are compressed by 150 mm. Then, the maximum force on each spring (assuming gradually increasing load) is :
- 2500 N
  - 5000 N
  - 7500 N
  - 3000 N

54. A hole of diameter  $d$  is to be punched in a plate of thickness  $t$ . For the plate material, the maximum crushing stress is 4 times the maximum allowable shearing stress. For punching the biggest hole, the ratio of diameter of hole to plate thickness should be equal to
- $\frac{1}{4}$
  - $\frac{1}{2}$
  - 1
  - 2
55. What is the safe working pressure for a spherical pressure vessel 1.5 m internal diameter and 1.5 cm wall thickness, if the maximum allowable tensile stress is 45 MPa ?
- 0.9 MPa
  - 3.6 MPa
  - 2.7 MPa
  - 1.8 MPa
56. The end conditions of a column for which length of column is equal to the equivalent length are :
- Both the ends are hinged
  - Both the ends are fixed
  - One end fixed and other end free
  - One end fixed and other end hinged
57. Determine the ratio of the buckling strength of a solid steel column to that of a hollow column of the same material having the same area of cross section. The internal diameter of the hollow column is half of the external diameter. Both columns are of identical length and are pinned or hinged at the ends :
- $\frac{P_s}{P_h} = \frac{2}{5}$
  - $\frac{P_s}{P_h} = \frac{3}{5}$
  - $\frac{P_s}{P_h} = \frac{4}{5}$
  - $\frac{P_s}{P_h} = 1$
58. A power transmission solid shaft of diameter  $d$  length  $l$  and rigidity modulus  $G$  is subjected to a pure torque. The maximum allowable shear stress is  $\tau_{max}$ . The maximum strain energy/unit volume in the shaft is given by :
- $\frac{\tau_{max}^2}{4G}$
  - $\frac{\tau_{max}^2}{2G}$
  - $\frac{2\tau_{max}^2}{3G}$
  - $\frac{\tau_{max}^2}{3G}$

59. Consider the following statements regarding material :
1. In micro structure external form of the crystal may reflect the internal symmetry of atom
  2. Electronic structure is arrangement of electrons in different orbit of atom
  3. A crystal is formed by a non repeating cell in uni-direction
  4. Nuclear structure can be studied by Mossbauer studies
- Which of these statements are correct ?
- (a) 1, 2 and 3
  - (b) 1, 2 and 4
  - (c) 1, 3 and 4
  - (d) 2, 3 and 4
60. When an alloy solidifies over a range of temperature, the resulting casting structure is :
- (a) Wholly equi-axed
  - (b) Wholly columnar
  - (c) Partially columnar partially equi-axed
  - (d) Dendritic
61. For the crystal class, which one of the following statements is correct ?
- (a) If a restraint is imposed on the growth of crystal, it will have an external symmetrical shape only.
  - (b) The molecules are arranged in an irregular manner but in a repetitive pattern.
  - (c) The shape will be symmetrical only if it possesses all the elements of symmetry.
  - (d) The shape will be symmetrical only about a plane if it divides the shape in two identical halves.
62. Edge dislocation is a :
- (a) Point imperfection
  - (b) Line imperfection
  - (c) Surface imperfection
  - (d) Volume imperfection
63. In Eutectoid reaction a solid phase transforms into two other solid phases upon cooling. Which one of the following is correct in the case of Eutectoid reaction occurring in Iron-Carbon phase diagram ?
- (a) Austenite converts to Ferrite and Cementite
  - (b) Ferrite converts to Cementite and Martensite
  - (c) Cementite converts to Austenite and Ferrite
  - (d) Martensite converts to Ferrite and Cementite
64. Which of the following phase of steel is NOT present in Iron-Carbon phase diagram ?
- (a) Ferrite
  - (b) Cementite
  - (c) Austenite
  - (d) Martensite
65. Vanadium in high speed steels :
- (a) Has a tendency to promote decarburization
  - (b) Form very hard carbides and thereby increases the wear resistance of the tool
  - (c) Helps in achieving high hot hardness
  - (d) Has a tendency to promote retention of Austenite

66. The correct order of cooling media for decreasing cooling rate is :
- Air, Water, Oil and Fused salt
  - Water, Air, Fused salt and Oil
  - Oil, Fused salt, Air and Water
  - Water, Oil, Fused salt and Air
67. Zirconium is a material of choice for nuclear applications as it :
- is transparent to neutrons
  - is ductile
  - has good wear properties
  - absorbs radiation
68. Which of the following methods are used for protection against fracture ?
- Avoid sharp corners and notches in the part to eliminate points of stress concentration
  - Provide better finish to the surface by polishing
  - Introduce residual tensile stresses on the surface
- Which of these statements are correct ?
- 1, 2 and 3
  - 1 and 3 only
  - 2 and 3 only
  - 1 and 2 only
69. Flame hardening is NOT suitable for surfaces of low carbon steel components due to :
- Low carbon steels are non-heat treatable alloys
  - Melting of components due to high heat energy
  - Distortion of components during heat treatment
  - Inability to produce Martensite structure in component surfaces
70. Which of the following statements are correct with reference to glass fiber reinforced composite ?
- They are isotropic
  - Coefficient of expansion of fiber should match closely to that of the plastic material
  - The fiber and plastic material should be chemically compatible to each other
- 1, 2 and 3
  - 1 and 2 only
  - 2 and 3 only
  - 1 and 3 only
71. Consider the following statements for a composite material :
- It is considered to be any multiple material that exhibits a significant proportion of the properties of both constituents.
  - Constituent phases in a composite must be chemically similar.
  - A matrix combined with a reinforcing material is used in composite.
  - Thermosetting epoxy resin is used as matrix for some kinds of composition.
- Which of these statements are correct ?
- 1, 2 and 3
  - 1, 2 and 4
  - 1, 3 and 4
  - 2, 3 and 4
72. ABS plastic is :
- Monomer
  - Copolymer
  - Homopolymer
  - Terpolymer

73. Sialon ceramic is used as :

- (a) Cutting tool material
- (b) Creep resistant
- (c) Furnace linens
- (d) High strength

74. Consider the following statements pertaining to the open-die forging of a cylindrical specimen between two flat dies :

- 1. Lubricated specimens show more surface movement than unlubricated ones.
- 2. Lubricated specimens show less surface movement than unlubricated ones.
- 3. Lubricated specimens show more barreling than unlubricated ones.
- 4. Lubricated specimens show less barreling than unlubricated ones.

Which of these statements are correct ?

- (a) 1 and 3
- (b) 1 and 4
- (c) 2 and 3
- (d) 2 and 4

75. In the forging process

- 1. The metal structure is refined
- 2. Original unidirectional fibers are distorted
- 3. Poor reliability, as flaws are always there due to intense working
- 4. Part are shaped by plastic deformation of material

- (a) 1, 2 and 3
- (b) 1, 3 and 4
- (c) 1, 2 and 4
- (d) 2, 3 and 4

76. The 'carbon boil' is an important part of refining of steel in melting furnaces, Which of the following statements are correct for carbon boil ?

- 1. Agitating the bath, causes thorough mixing
- 2. Reduction of carbon, nitrogen and hydrogen
- 3. Bring non-metallic into contact with slag and hence cleans the metal

- (a) 1 and 2 only
- (b) 1 and 3 only
- (c) 1, 2 and 3
- (d) 2 and 3 only

77. Weldability depends on :

- 1. Thermal conductivity
- 2. Surface condition
- 3. Change in microstructure

- (a) 1 and 2 only
- (b) 1 and 3 only
- (c) 2 and 3 only
- (d) 1, 2 and 3

78. Consider the following statements :

In metal arc welding

- 1. Utilizes a consumable electrode
- 2. A welding torch used is connected to acetylene gas supply
- 3. The electrode and work-piece are connected to the welding power supply

Which of these statements are correct ?

- (a) 1, 2 and 3
- (b) 1 and 2 only
- (c) 1 and 3 only
- (d) 2 and 3 only

79. A milling operation which involves the use of a combination of more than two cutters, mounted on a common arbor for milling a number of flat and vertical surfaces of a work-piece simultaneously is called :
- Gang milling
  - Straddle milling
  - Slab milling
  - Face milling
80. What is the correct order of the development of the following ?
- Numerical control
  - Computer numerical control
  - Direct numerical control
  - Distributed numerical control
- 1, 2, 3 and 4
  - 4, 2, 3 and 1
  - 1, 3, 2 and 4
  - 4, 3, 2 and 1
81. When NC (Numerical Control) processing is integrated with CAD systems, the association of tool paths generated with the CAD geometric model is known as :
- Associativity
  - Design for manufacturing
  - Computer integrated manufacturing
  - DNC system
82. The positioning accuracy of robotic arm is the highest in the following type/ configuration of a robot :
- Cartesian robot
  - Cylindrical robot
  - Articulated jointed arm robot
  - Spherical co-ordinate robot
83. Carbide tool is used to machine a 30 mm diameter steel shaft at a spindle speed of 1000 revolutions per minute. The cutting speed of the above turning operation is :
- 1000 rpm
  - 1570 m/min
  - 94.2 m/min
  - 47.1 m/min
84. A carbide tool (having  $n = 0.25$ ) with a mild steel work-piece was found to give life of 1 hour 21 minutes while cutting at 60 m/min. The value of C in Taylor's tool life equation  $VT^n = C$  would be equal to :
- 200
  - 180
  - 150
  - 100
85. Forecasting which assumes a static environment in the future is :
- Passive forecasting
  - Active forecasting
  - Long term forecasting
  - Short term forecasting
86. If N is the period of moving average the number of demand data to be stored for calculating the moving average for a period is the demand of last :
- (N + 1) periods
  - (N - 1) periods
  - (N) periods
  - (N - 2) periods
87. Travel chart mainly helps
- Improving the existing plant layout
  - While selecting plant location
  - While introducing new products
  - None of the above

88. At break-even point, inventory carrying cost is :
- Four times the preparatory cost
  - Three times the preparatory cost
  - Two times the preparatory cost
  - Equal to the preparatory cost
89. A dummy activity is used in PERT network for :
- Precedence relationship
  - Necessary time delay
  - Resource restriction
  - Resource idleness
90. Purification of inventory means :
- Cleaning of inventories
  - Disposing of inventories
  - Processing of inventories
  - Storing of inventories in bins
91. Large size of inventory is a sign of :
- Better planning
  - Inefficiency
  - Reliable control of vendors
  - Better scheduling
92. What is the ratio of annual order cost to annual cost when the order size is determined using economic order quantity (EOQ) model ?
- 0.5
  - 0.25
  - 0.75
  - 1
93. Bucket is a term used in MRP systems. It is a :
- Principal unit of time measurement
  - Demand for a raw material
  - Product mix
  - Material in hand
94. The objective of work measurement is to :
- Plan and schedule the production
  - Estimate the selling price and delivery date
  - Formulate a proper incentive scheme
  - All of the above
95. In value engineering 'worth' is value of :
- Product
  - Service
  - System
  - Function
96. An interrupt in which the external device supplies its address as well as the interrupt request is called :
- Vectored interrupt
  - Maskable interrupt
  - Non-maskable interrupt
  - Designated interrupt
97. Data bases that support the major business process of an organisation are :
- Direct database access
  - Operational database
  - Data warehouse
  - External database
98. Developing database and maintaining standards and controls for an organization's databases is called :
- End user database
  - Hypermedia database
  - Data resource management
  - Database administration
99. Consider the following statements regarding FORTRAN :
- It was developed for scientific and mathematical applications.
  - It is one of the oldest high level languages
  - It is a problem oriented language
  - It requires extensive internal documentation
- Which of these statements are correct ?
- 1, 2 and 3
  - 1, 2 and 4
  - 1, 3 and 4
  - 2, 3 and 4

100. Which of the following formulae can be used to add the contents of C2 and D3 in Lotus 1-2-3 ?

1.  $C2 + D3$
  2.  $+C2 + D3$
  3.  $SUM (C2, D3)$
  4.  $(C2 + D3)$
- (a) 1 and 2  
(b) 2 and 4  
(c) 1 and 3  
(d) 3 and 4

101. A function can return more than one value by :

- (a) Passing parameters by value  
(b) Using more than one 'return' statement in the function  
(c) Passing parameters by reference  
(d) Since a function can return only one value, this is not possible

102. Modular programming involves :

1. Modules that solve individual tasks
  2. Processing from particular to general
  3. Problems decomposed into logical sub-problems
- (a) 1, 2 and 3  
(b) 1 and 2 only  
(c) 1 and 3 only  
(d) 2 and 3 only

**Directions :—**

Each of the next **EIGHTEEN (18)** items consists of two statements, one labeled as the 'Statement (I)' and the other as 'Statement (II)'. You are to examine these two statements carefully and select the answers to these items using the codes given below :

**Codes :**

- (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

103. Statement (I) : If a centrifugal governor is stable at a particular position, it would be stable at all other positions in the working range of operation.

Statement (II) : Porter governor is a stable governor throughout its range of operation.

104. Statement (I) : The journal while rotating inside a bearing automatically shifts its center to one side and thus the journal is eccentric inside the bearing.

Statement (II) : The wedge shape of oil film gives rise to thin film lubrication, which is considered as stable lubrication.

105. Statement (I) : Concentric springs are used when outside diameter is limited and higher load carrying capacity is required.
- Statement (II) : Adjacent springs in concentric springs should be wound with opposite hand helices.
106. Statement (I) : A circular cross section column with diameter 'd' is to be axially loaded in compression. For this the core of the section is considered to be a concentric circulation area of diameter ' $\frac{d}{4}$ '.
- Statement (II) : We can drill and take out a cylindrical volume of material with diameter ' $\frac{d}{4}$ ' in order to make the column lighter and still maintaining the same buckling (crippling) load carrying capacity.
107. Statement (I) : The internal structure of a material gives the information about the arrangement of material atoms.
- Statement (II) : The properties of bulk matter of all kinds are independent of the nature and distribution of imperfection.
108. Statement (I) : Repetition of unit cell in all possible directions results in a crystal structure.
- Statement (II) : If a crystal structure is converted into non-crystalline in nature, hardness and brittleness increases.
109. Statement (I) : At higher strain rate and lower temperature structural steel tends to become brittle.
- Statement (II) : At higher strain rate and lower temperature the yield strength of structural steel tends to increase.
110. Statement (I) : The Vickers hardness number of a given material is independent of the applied load.
- Statement (II) : The test involves indentation by a pyramid shaped diamond tool with an angle of  $136^\circ$  between opposite faces.
111. Statement (I) : The phenomenon of creep is observed in metals, amorphous materials and glass.
- Statement (II) : The material deforms slowly and progressively with time at constant stress.
112. Statement (I) : The dies used in the forging process are made in pair.
- Statement (II) : The material is pressed between two surfaces and the compression force applied, gives it a shape.

113. Statement (I) : In high velocity forming process, high energy can be transferred to metal with relatively small weight.  
Statement (II) : The kinetic energy is the function of mass and velocity.
114. Statement (I) : The deflection of Arc from its intended path is called 'Arc blow'.  
Statement (II) : The chances of Arc blow is common in A.C. Arc welding.
115. Statement (I) : Non consumable electrodes, used in arc welding are made of high melting point temperature materials, even then the length of electrode goes on decreasing with passage of time.  
Statement (II) : The electrode material gets oxidized and melts on the weld material to form a strong flux.
116. Statement (I) : In power forging energy is provided by compressed air or oil pressure or gravity.  
Statement (II) : The capacity of the hammer is given by the total weight, which the falling pans weigh.
117. Statement (I) : In electrolytic process of producing metal powders, Metal plates placed in a tank of electrolyte acts as anode and cathode.  
Statement (II) : High electric current produces powdery deposit on anode.
118. Statement (I) : Mould walls of a permanent mould are kept thick.  
Statement (II) : The thicker mould walls retain maximum heat increasing flow of molten metal.
119. Statement (I) : In semi centrifugal casting a particular shape of the casting is produced by mould, core and the centrifugal force of molten metal.  
Statement (II) : The centrifugal force aids to proper feeding to produce the casting free from porosity.
120. Statement (I) : Gear hobbing is not used if the quantities to be produced are large and require more accurate gear.  
Statement (II) : The gear shaper are used to produce internal splines in blind holes.

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