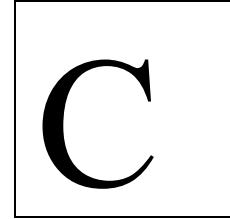


**IES-2011 UPSC (ESE)  
MECHANICAL ENGINEERING  
Paper II**



**INSTRUCTIONS**

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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.
2. ENCODE CLEARLY THE TEST BOOKLET SERIES A, B, C OR D AS THE CASE MAY BE IN THE APPROPRIATE PLACE IN THE ANSWER SHEET.
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 all your response **ONLY** on the separate Answer Sheet provided. See direction 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 IN THE OBJECTIVE TYPE QUESTION PAPERS.
  - (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 (0.33) 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 a 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.

01. Which one of the following is the major alloying element in Invar?

- (A) Aluminium                      (B) Nickel                      (C) Vanadium                      (D) Copper

**Ans: (b)**

02. In the designation of Aluminium casting A514.0 indicates :

- (A) Aluminium purity                      (B) Aluminium content  
(C) Percentage of alloy element                      (D) Magnesium Content

**Ans: (d)**

03. Columbium is a :

- (A) Nuclear material                      (B) Automobile material  
(C) Film material                      (D) Foam material

**Ans: (a)**

04. Consider the following statements :

1. Any metal will require some time to undergo complete plastic deformation particularly if deforming metal has to fill cavities and corners of small radii.
2. For larger work piece of metals that can retain toughness at forging temperature it is preferable to use forge press rather than forge hammer.

- (A) 1 and 2 are correct and 2 is the reason for 1  
(B) 1 and 2 are correct and 1 is the reason for 2  
(C) 1 and 2 are correct but unrelated  
(D) 1 only correct

**Ans: (b)**

05. Which of the following processes belong to forging operation ?

1. Fullering
2. Swaging
3. Welding

- (A) 1 and 2 only                      (B) 2 and 3 only                      (C) 1 and 3 only                      (D) 1, 2 and 3 only

**Ans: (a)**

06. Match List –I with List –II and select the correct answer using the code given below the lists :

- List –I**  
 A. Connecting rods  
 B. Pressure vessels  
 C. Machine tool beds  
 D. Collapsible tubes

- List –II**  
 1. Welding  
 2. Extrusion  
 3. Forming  
 4. Casting

**Codes**

|     | A | B | C | D |     | A | B | C | D |
|-----|---|---|---|---|-----|---|---|---|---|
| (a) | 2 | 1 | 4 | 3 | (b) | 3 | 1 | 4 | 2 |
| (c) | 2 | 4 | 1 | 3 | (d) | 3 | 4 | 1 | 2 |

**Ans: (b)**

07. Consider the following statements :

1. Hot chamber machine is used for casting zinc, tin and other low melting alloys.
2. Cold chamber machine is used for die casting of ferrous alloys
3. Rapid cooling rate in die casting produces high strength and quality in many alloys.

Which of these statements are correct?

- (A) 1, 2 and 3      (B) 1 and 2 only      (C) 2 and 3 only      (D) 1 and 3 only

**Ans: (a)**

08. Consider the following advantages of die casting over sand casting :

1. Rapidity of the process
2. Smooth surface
3. Strong dense metal structure

Which of these advantages are correct ?

- (A) 1, 2 and 3      (B) 1 and 2 only      (C) 2 and 3 only      (D) 1 and 3 only

**Ans: (b)**

09. The proper sequence of investment casting steps is :

- (A) Slurry coating – pattern melt out-Shakeout – Stucco coating
- (B) Stucco coating – Slurry coating – Shakeout – Pattern melt out
- (C) Slurry coating – Stucco coating – Pattern melt out – Shakeout
- (D) Stucco coating – Shakeout – Slurry coating – Pattern melt out

**Ans: (c)**

10. The method of casting for producing ornamental pieces are:



15. Match List –I with List –II and select the correct answer using the code given below the lists:

- | List-I                   | List –II   |
|--------------------------|--|
| A. Laser beam welding    | 1. Can be applied for welding or refractory metals like niobium, tantalum, molybdenum and tungsten.  |
| B. Electron beam welding | 2. A sound and clean welded joint is created due to rubbing of two parts against each other with adequate speed and pressure producing intense heat raising temperature above melting point. |
| C. Ultrasonic welding    | 3. Clean heat source created much away from job, a narrow spot is heated, work chamber operates in a high vacuum.  |
| D. Friction welding      | 4. Clean heat source very quick heating, very small focal spot, no vacuum chamber is required.   |

**Codes :**

|     | A | B | C | D |
|-----|---|---|---|---|
| (a) | 4 | 3 | 1 | 2 |
| (b) | 2 | 3 | 1 | 4 |
| (c) | 4 | 1 | 3 | 4 |
| (d) | 2 | 1 | 3 | 4 |

**Ans: (a)**

16. Cold-cracking in steel weldments depends on

1. Carbon equivalent
  2. Heat input
  3. Effective thickness
  3. Hydrogen content in weld pool
- (A) 1, 2 and 3 only      (B) 1, 2 and 4 only      (C) 2, 3 and 4 only      (D) 1, 2, 3 and 4

**Ans: (b)**

17. In Norton type feed gearbox for cutting Whitworth standard threads with a standard TPI Leadscrew, power flows from:

- (A) Spindle to Tumbler gear to Norton cone to Meander drive to Leadscrew
- (B) Spindle to Norton cone to Tumbler gear to Meander drive to Leadscrew
- (C) Spindle to Tumbler gear to Meander drive to Norton cone to Leadscrew

(D) Spindle to Norton cone to Meander drive to Tumbler gear to Leadscrew

**Ans: (a)**

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

|    | List –I          | List –II              |
|----|------------------|-----------------------|
| A. | Lathe            | 1. Flute              |
| B. | Shaper           | 2. Universal indexing |
| C. | Drilling machine | 3. Leadscrew          |
| D. | Milling machine  | 4. Rocker arm         |

| Codes: | A | B | C | D |
|--------|---|---|---|---|
| (a)    | 2 | 4 | 1 | 3 |
| (b)    | 3 | 4 | 1 | 2 |
| (c)    | 2 | 1 | 4 | 3 |
| (d)    | 3 | 1 | 4 | 2 |

**Ans: (b)**

19. Trajectory of a robot mean :

- (A) Path traced by the end effectors      (B) Kinematics of Robot  
(C) Robot joints      (D) Robot programming

**Ans: (a)**

20. Typical coolants used for machining aluminium are :

1. Kerosene oil      2. Soda water  
3. Air      4. Paraffin oil  
(A) 1, 2, 3 and 4      (B) 2 and 3 only  
(C) 1 and 2 only      (D) 3 and 4 only

**Ans: (c)**

21. In flowcharting, the connector symbol is a

- (A) Parallelogram      (B) Square      (C) Diamond      (D) Circle

**Ans: (d)**

22. Which of the following statement(s) is/are correct?

1. Bus is a group of wires carrying information.

2. Bus can carry data

3. Bus cannot carry address

4. A bus can be shared by more than one device

(A) 1, 2, 3 and 4      (B) 1, 2 and 4 only      (C) 1, 2 and 4 only      (D) 2, 3 and 4

only

**Ans: (c)**

23. Refreshing circuit is required in

(A) ROM      (B) Static RAM      (C) Dynamic RAM      (D) All of the

above

**Ans: (c)**

24. The number of RAM chips of size (256 kx1) required to build a 2 Mbyte memory is

(A) 16      (B) 32      (C) 64      (D) 128

**Ans: (c)**

25. Which of the following are the advantages of MOS devices over bipolar devices?

1. Easy to fabricate

2. Allows higher bit densities

3. Cost effective

4. Operational speed.

(A) 1, 2, 3 and 4      (B) 1, 2 and 3 only      (C) 2, 3 and 4 only      (D) 1, 3 and 4 only

**Ans: (b)**

26. In the queuing theory, if the arrivals in a single server model follow Poisson distribution, the time between arrivals will follow a:

(A) Gamma distribution      (B) Exponential distribution

(C) Binomial distribution      (D) Weibull distribution

**Ans: (b)**

27. For a single server queue, the mean arrival rate is equal to 8/hr and the mean service rate is 12/hr. The expected number in waiting line is equal to

A) 0.5      (B) 1.33      (C) 2      (D) 3

**Ans: (b)**

28. When the ordering cost is increased to 4 times, the EOQ will be increased to :  
 (A) 2 times      (B) 3 times      (C) 8 times      (D) Remain same

**Ans: (a)**

29. An unbound solution of a linear programming problems is reflected in the simplex method, when:  
 (A) All the ratio of 'right hand sides' to coefficients in key column become negative  
 (B) All the ratios of right hand sides to coefficients in key columns become zero  
 (C) All right hand sides become negative  
 (D) All right hand sides become zero

**Ans: (a)**

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

|    | List – I |  | List – II                 |
|----|----------|--|---------------------------|
| A. | R        |  | 1. Ranges                 |
| B. | p        |  | 2. Number of defects/unit |
| C. | c        |  | 3. Number of defects      |
| D. | u        |  | 4. Fraction defectives    |

**Codes:-**

|     | A | B | C | D |     | A | B | C | D |
|-----|---|---|---|---|-----|---|---|---|---|
| (a) | 1 | 4 | 3 | 2 | (b) | 2 | 4 | 3 | 1 |
| (c) | 1 | 3 | 4 | 2 | (d) | 2 | 3 | 4 | 1 |

**Ans: (a)**

31. Which of the following method is NOT used for obtaining the initial basic feasible solution in transportation problems?  
 (A) North west corner method      (B) Least cost entry method  
 (C) Vogel's approximation method      (D) MODI method

**Ans: (d)**

32. Consider the following terms used to study the functions of the material :  
 1. Use value

- 2. Esteem value
- 3. Exchange value
- 4. Scrap value

Which of these are used to identify in the value engineering approach ?

- (A) 1, 2, 3 and 4
- (B) 1, 3 and 4 only
- (C) 1, 2 and 3 only
- (D) 2, 3 and 4 only

**Ans: (c)**

33. A basic feasible solution of an  $m \times n$  transportation problem is said to be non degenerate if the allocations are in independent positions and starting basic feasible solution contains exactly following number of individual allocations:

- (A)  $m + n$
- (B)  $m \times n$
- (C)  $m + n - 1$
- (D)  $m + n + 1$

**Ans: (c)**

34. The component reliability is usually measured by : reliability (CR), failure rates (FR) and mean time between failures (MTBF). The MTBF is :

- (A) Number of failure/unit-hours of operation
- (B) Unit-hours of operation/number of failures
- (C) Number of failures/number of tested
- (D) Number of failures x unit-hours of operation

**Ans: (b)**

35. Which one of the following statement is NOT correct with reference to the purposes and effects of rake angle of a cutting tool?

- (A) To guide the chip flow direction
- (B) To reduce the friction between the tool flanks and the machined surface
- (C) To add keenness or sharpness to the cutting edges.
- (D) To provide better thermal efficiency.

**Ans: (b)**

36. The under capacity of a manufacturing company is preferred when:

- (A) The rate of obsolescence of the plant and equipment is high
- (B) The time required to add capacity is long
- (C) The fixed cost of the capacity is not very high
- (D) Shortage of the products affects the company.



42. Interference fit joints are provided for:

- (A) Assembling bush bearing in housing                      (B) Mounting heavy duty gears on shafts  
(C) Mounting pulley on shafts                                      (D) Assembly of flywheels on shafts

**Ans: (a)**

43. In a bolt of uniform strength :

- (A) Nominal diameter of thread is equal to the diameter of shank of the bolt  
(B) Nominal diameter of thread is larger than the diameter of shank of the bolt  
(C) Nominal diameter of thread is less than the diameter of shank of the bolt  
(D) Core diameter of threads is equal to the diameter of shank of the bolt.

**Ans: (d)**

44. An axle is a machine part that is subjected to :

- (A) Transverse loads and bending moment                      (B) Twisting moment only  
(C) Twisting moment and axial load                                      (D) Bending moment and axial load

**Ans: (b)**

45. Consider the following statements pertaining to V belts in power transmission:

1. Standard V belts are available in 7 sizes of cross section A to G
2. Standard V belts are available in 5 sizes of cross section A to E
3. Standard V belts are available in 5 sizes of cross section A to E with A having largest cross section.
4. The included angle for the belt groove is usually around  $35^\circ$

Which of these statements are correct?

- (A) 1 only                      (B) 2 and 4                      (C) 3 and 4                      (D) 1 and 4

**Ans: (b)**

46. If there are  $n_1$  discs on the driving shaft and  $n_2$  discs on the driven shaft in a multi-plate clutch, then the number of pairs of contact surfaces is :

- (A)  $n_1 + n_2$                       (B)  $n_1 + n_2 - 1$                       (C)  $n_1 + n_2 - 2$                       (D)

$n_1 + n_2 + 1$

**Ans: (b)**

47. A rope has been designated as 6 x 9. The numbers 6 and 19 respectively stand for :

- (A) Rope diameter and the number of wires
- (B) Rope diameter and the number of strands
- (C) Number of strands and the number of wires
- (D) Number of wires and the number of strands

**Ans: (c)**

48. In hydrodynamic journal bearings, if the clearance ratio is halved then the sommerfeld number S and the coefficient of friction  $\mu$  will change as

- (A) S becomes double and  $\mu$  is halved
- (B) S becomes four times and  $\mu$  is doubled
- (C) S becomes four times and  $\mu$  is halved
- (D) S becomes double and  $\mu$  is also doubled.

**Ans: (b)**

49. Rayleigh's method of computing the fundamental natural frequency is based on

- (A) Conservation of energy
- (B) Conservation of momentum
- (C) Conservation of masses
- (D) Laws of statics

**Ans: (a)**

50. Consider the following statements.

Transmissibility of vibrations:

1. Is more than 1, when  $\frac{\omega}{\omega_n} < \sqrt{2}$

2. Is less than 1, when  $\frac{\omega}{\omega_n} > \sqrt{2}$

3. Increases as the damping is increased

Which of these statements are correct?

- (A) 1, 2 and 3
- (B) 1 and 2 only
- (C) 2 and 3 only
- (D) 1 and 3 only

**Ans: (b)**

51. Which of the following type of viscous damping will give periodic motion to the vibrating body?

- 1. Under damping
- 2. Critical damping
- 3. Over damping

- (A) 1 only
- (B) 2 only
- (C) 3 only
- (D) 1 and 2

**Ans: (a)**

52. Large field guns which come to initial position after firing in shortest possible time are:  
(A) Under damped (B) Critically damped (C) Over damped (D) un-damped

**Ans: (b)**

53. Given below are four Vee twin engines with different included angles between cylinder axes. Which one of these engines can be completely balanced for primary forces by attaching a single revolving mass opposite to the crank pin?  
(A) Vee 45° twin engine (B) Vee 90° twin engine  
(C) Vee 60° twin engine (D) Vee 120° twin engine

**Ans: (b)**

54. A four stroke six – cylinder in line engine symmetrical about centre line can be balanced for :  
(A) Primary inertia forces and couples only  
(B) Primary and secondary inertia forces only  
(C) Secondary inertia forces and couples only  
(D) All forces and couples

**Ans: (d)**

55. Introduction of the flywheel in a rotating system smoothness:  
(A) The bending moment on the rotating shaft (B) The twisting moment on the shaft  
(C) The bending stress on the shaft (D) The axial force along the shaft

**Ans: (b)**

56. Flywheel absorbs energy during those periods of crank rotation when:  
(A) The twisting moment is greater than the resisting moment  
(B) The twisting moment is equal to the resisting moment  
(C) The twisting moment is less than the resisting moment  
(D) The load on the engine falls

**Ans: (a)**

57. The advantages of involute profile over cycloidal are given below. Which of these is NOT correct?

- (A) The interference is inherently absent in the involute system
- (B) In the involute system, the pressure angle is constant from commencement to end of engagement.
- (C) The straight teeth of the basic rack for the involute profile-admits of simple tools.
- (D) The profile for the flank and face is a single curve in the involute system.

**Ans: (a)**

58. The number of degrees of freedom of an epicyclic gear train is

- (A) zero
- (B) One
- (C) Two
- (D) Three

**Ans: (c)**

59. Consider the following statements pertaining to an example for a cylindrical pair:

1. Piston and cylinder of an IC engine
2. Shaft supported by a foot step bearing
3. Doctor's injection syringe
4. A screw driver operating on a screw

Which of these statements are correct ?

- (A) 1 and 4
- (B) 2 and 3
- (C) 1 and 3
- (D) 3 and 4

**Ans: (b)**

60. Total number of instantaneous centers of rotation for a mechanism having  $n$  links is

- (A)  $\frac{n(n-1)}{2}$
- (B)  $\frac{n}{2}$
- (C)  $n-1$
- (D)  $n$

**Ans: (a)**

61. In wire ropes which one of the following statements is correct?

- (A) Bending stress is directly proportional to the wire diameter and inversely proportional to the sheave diameter.
- (B) Both fatigue and wear are due to the tensile stress on the wires bearing against the sheave.
- (C) Bending stress is inversely proportional to the wire diameter and directly proportional to sheave diameter.
- (D) Both fatigue and wear are due to shear stress on the wires bearing against the sheave.

**Ans: (a)**

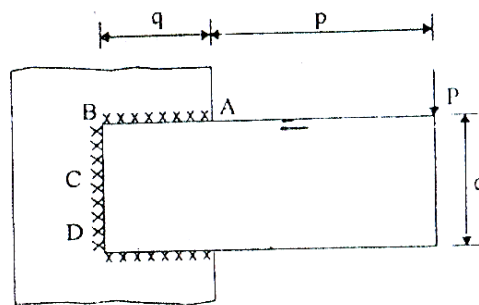
62. A compound fillet welded joint is loaded by P as shown. The maximum shearing stress occurs at pint?

(A) A and D

(B) B and D

(C) A only

(D) C only



**Ans: (c)**

63. A fillet weld is loaded parallel to its length  $l$  by a load  $P$ . If the weld leg is  $h$ , the average shear stress on the throat area is :

(A)  $\frac{P}{hl}$

(B)  $\frac{P}{0.5hl}$

(C)  $\frac{2P}{hl}$

(D)  $\frac{1.414P}{hl}$

**Ans: (d)**

64. Bevel gears having equal number of teeth and equal pitch angles connect two orthogonally intersecting shafts. This system of gears is known as:

(A) Crown gears

(B) Hypoid gears

(C) Worm gears

(D) Mitre gears

**Ans: (d)**

65. A solid steel shaft of diameter  $d$  and length  $l$  is subjected to twisting moment  $T$ . Another shaft B of brass having same diameter  $d$ , but length  $l/2$  is also subjected to the same moment. If shear modulus of steel is two times that of brass, the ratio of the angular twist of steel to that of brass shaft is :

(A) 1:2

(B) 1:1

(C) 2:1

(D) 4:1

**Ans: (c)**

66. A high pressure angle for spur gears leads to

- (A) Minimum axial thrust                      (B) Greater backlash  
 (C) More interference                          (D) Wide base and stronger tooth

**Ans: (b)**

67. Match List –I with List-II and select the correct answer using the code given below the lists:

| List –I               | List –II   |
|-----------------------|------------|
| A. Unwin’s Formula    | 1. Bearing |
| B. Wahl factor        | 2. Rivets  |
| C. Reynold’s equation | 3. Gears   |
| D. Lewis form factor  | 4. Springs |

**Codes**

|     | A | B | C | D |     | A | B | C | D |
|-----|---|---|---|---|-----|---|---|---|---|
| (a) | 3 | 1 | 4 | 2 | (b) | 2 | 1 | 4 | 3 |
| (c) | 3 | 4 | 1 | 2 | (d) | 2 | 4 | 1 | 3 |

**Ans: (d)**

68. Antifriction bearing are normally used in shafts.

1. Running at 20,000 to 40,00 rpm
2. Running at speeds up to 6,000 rpm
3. Of diameters up to 500 mm
4. Of diameter more than 500 mm

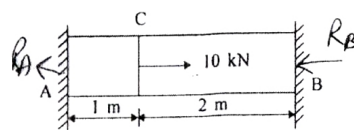
- (A) 1 and 3                      (B) 2 and 3                      (C) 2 and 4                      (D) 1 and 4

**Ans: (b)**

69. A prismatic bar, as shown in figure is supported between rigid supports.

The support reactions will be :

- (A)  $R_A = \frac{10}{3} \text{ kN}$  and  $R_B = \frac{20}{3} \text{ kN}$   
 (B)  $R_A = \frac{20}{3} \text{ kN}$  and  $R_B = \frac{10}{3} \text{ kN}$





75. Match List –I with List –II and select the correct answer using the code given below the lists:

| List –I   | List –II          |
|---|-------------------|
| A. Subjected to bending moment at the end of a cantilever   | 1. Triangle       |
| B. Cantilever carrying uniformly Distributed load over the whole length                           | 2. Cubic parabola |
| C. Cantilever carrying linearly varying load from Zero at the free end to maximum at the supports | 3. Parabola       |
| D. A beam having load at centre and supported at the Ends   | 4. Rectangular    |

**Codes**

|     | A | B | C | D |
|-----|---|---|---|---|
| (a) | 1 | 2 | 3 | 4 |
| (b) | 4 | 3 | 2 | 1 |
| (c) | 1 | 3 | 2 | 4 |
| (d) | 4 | 2 | 3 | 1 |

**Ans: (b)**

76. A T-section beam is simply supported and subjected to a uniform distributed load over its whole span. Maximum longitudinal

- (A) Top fibre of the flange                      (B) The junction of web and flange  
 (C) The mid-section of the web                (D) The bottom fibre of the web

**Ans: (d)**

77. For the two shafts connected in parallel ;

- (A) Torque in each shaft is the same  
 (B) Shear stress in shaft is the same  
 (C) Angle of twist of each shaft is the same  
 (D) Torsional stiffness of each shaft is the same

**Ans: (c)**

78. Two equal lengths of steel wires of the same diameter are made into two springs  $S_1$  and  $S_2$  of mean diameters 75 mm and 60 mm respectively. The stiffness ratio of  $S_1$  to  $S_2$  is

- (A)  $\left(\frac{60}{75}\right)^2$                       (B)  $\left(\frac{60}{75}\right)^3$                       (C)  $\left(\frac{75}{60}\right)^2$                       (D)  $\left(\frac{75}{60}\right)^3$

**Ans: (b)**

79. Solid material chemical bonds are :

- (A) Ionic, molecular and fusion                      (B) Covalent, fusion and fission  
(C) Ionic, covalent and molecular                      (D) Fission, molecular and ionic

**Ans: (c)**

80. Cleavage fracture is a form of

- (A) Brittle fracture                                      (B) Ductile fracture  
(C) Elastic fracture                                      (D) Viscoelastic fracture

**Ans: (a)**

81. Admiralty Brass is used for

- (A) Condenser Tubes              (B) Rivets              (C) Piston rods              (D) Utensils

**Ans: (a)**

82. Windows of aeroplane are made of :

- (A) PVC              (B) PTFE              (C) PMMA              (D) PEEK

**Ans: (d)**

83. Kevlar Epoxy composite is widely used in :

- (A) Automobiles              (B) Aerospace              (C) Navy              (D) Interior Decoration

**Ans: (b)**

84. Lead is widely used in:

- (A) Transformers              (B) Switch gear              (C) Galvanized pipes              (D) Batteries

**Ans: (d)**

85. Match List –I with List-II and select the correct answer using the code given below the lists:

- | List –I            | List –II          |
|--------------------|-------------------|
| A. Gun Metal       | 1. Worm wheel     |
| B. Phosphor bronze | 2. Cylinder block |
| C. Gray cast iron  | 3. Piston         |

D. Al alloy

4. Bushings

**Codes**

|     | A | B | C | D |
|-----|---|---|---|---|
| (a) | 3 | 1 | 2 | 4 |
| (b) | 4 | 1 | 2 | 3 |
| (c) | 3 | 2 | 1 | 4 |
| (d) | 4 | 2 | 1 | 3 |

**Ans: (a)**

86. Aluminium Bronze is also known as :

- (A) Muntz metal                      (B) White metal                      (C) Duraluminium                      (D) Imitation gold

**Ans: (b)**

87. Injection moulding process used to produce thermoplastic matrix composites with fibre reinforcement normally gives:

- (A) Short fibre composites                      (B) Two layer structure composites  
(C) Continuous fibre composites                      (D) Single layer composites

**Ans: (a)**

88. 'Whiskers' are

- (A) Very thin metallic particles                      (B) Very thin single crystals  
(C) Very thin polycrystals                      (D) Fiber particles of aspect ratio less than 10

**Ans: (d)**

89. Which one of the following statements is NOT correct for normalizing?

- (A) It is often applied to casting to relieve stresses  
(B) It increases strength of medium carbon steel to some extent  
(C) Better surface finish can be obtained in machining  
(D) It increases grain size

**Ans: (d)**

90. The relationship between total freezing time  $t$ , volume of the casting  $V$  and its surface area  $A$ , according to Chvorinov's rule is :

(A)  $t = K\left(\frac{V}{A}\right)$       (B)  $t = K\left(\frac{A}{V}\right)$       (C)  $t = K\left(\frac{A}{V}\right)^2$       (D)  $t = K\left(\frac{V}{A}\right)^2$

Where K is a constant

**Ans: (d)**

91. Match List – I with List - II and select the correct answer using the code given below the lists:

|              | List –I         |   | List –II  |   |
|--------------|-----------------|---|---|---|
|              | A. Elasticity   |   | 1. Deform non elastically without fracture            |   |
|              | B. Malleability |   | 2. Undergo plastic deformation under tensile load     |   |
|              | C. Ductility    |   | 3. Undergo plastic deformation under compressive load |   |
|              | D. Plasticity   |   | 4. Return to its original shape on unloading          |   |
| <b>Codes</b> | A               | B | C   | D |
| (a)          | 1               | 2 | 3   | 4 |
| (b)          | 4               | 2 | 3   | 1 |
| (c)          | 1               | 3 | 2   | 4 |
| (d)          | 4               | 3 | 2   | 1 |

**Ans: (d)**

92. Match List –I with List –II and select the correct answer using the code given below the lists:

|              | List –I      |   | List –II                   |   |
|--------------|--------------|---|----------------------------|---|
|              | A. Copper    |   | 1. Corrosion               |   |
|              | B. Nickel    |   | 2. Demagnetization         |   |
|              | C. Manganese |   | 3. Non Sparking            |   |
|              | D. Vanadium  |   | 4. Deformation restriction |   |
| <b>Codes</b> | A            | B | C                          | D |
| (a)          | 1            | 2 | 3                          | 4 |
| (b)          | 4            | 3 | 2                          | 1 |
| (c)          | 1            | 3 | 2                          | 4 |
| (d)          | 4            | 2 | 3                          | 1 |

**Ans: (a)**

93. During tensile testing it has been observed that for some material the deformation is fully recoverable and time-independent, but does not obey Hook’s law. The material is :

- (A) Elastomer                      (B) Rubber                      (C) Polymer                      (D) Aluminium alloy

**Ans: (a)**

94. Resilience of material becomes important when it is subjected to :

- (A) Fatigue (B) Thermal stresses  
(C) Shock loading (D) Pure static loading

**Ans: (c)**

95. Babbitt is an alloy of

- (A) Sn, Cu, Sb and Pb (B) Sn and Cu  
(C) Sn, Cu and Pb (D) Sn, Cu and Sb

**Ans: (a)**

96. Match List –I with List –II and select the correct answer using the code given below the lists:

- List –I  
A. System  
B. Phase  
C. Phase equilibrium  
D. Components

- List –II  
1. Free energy is a minimum  
2. Chemical elements or chemical compounds  
3. Consists of solids, liquids or gasses or their combination  
4. Homogeneous portion of a system that has uniform physical characteristics

| Codes | A | B | C | D |
|-------|---|---|---|---|
| (a)   | 2 | 1 | 4 | 3 |
| (b)   | 3 | 1 | 4 | 2 |
| (c)   | 2 | 4 | 1 | 3 |
| (d)   | 3 | 4 | 1 | 2 |

**Ans: (d)**

97. Liquid + solid (1) on cooling converting solid (2) reaction is known as:

- (A) Eutectoid reaction (B) Eutectic reaction  
(C) Peritectic reaction (D) Peritectic reaction

**Ans: (c)**

98. Structure of common glass is

- (A) Amorphous (B) Partially crystalline  
(C) Fully crystalline (D) None of the above

**Ans: (a)**

99. In a triclinic unit cell :

(A)  $\alpha = \beta = \gamma = 90^\circ$

(B)  $\alpha = \beta = 90^\circ, \gamma = 120^\circ$

(C)  $\alpha = \beta = 90^\circ \neq \gamma$

(D)  $\alpha \neq \beta \neq 90^\circ \neq \gamma$

**Ans: (d)**

100. Match List –I with List –II and select the correct answer using the code given below the lists:

| List –I       |  | List –II     |  |
|---------------|--|--------------|--|
| A. Alpha iron |  | 1. FCC       |  |
| B. Zinc       |  | 2. BCC       |  |
| C. Glass      |  | 3. HCP       |  |
| D. Copper     |  | 4. Amorphous |  |

| Codes | A | B | C | D |
|-------|---|---|---|---|
| (a)   | 1 | 4 | 3 | 2 |
| (b)   | 2 | 4 | 3 | 1 |
| (c)   | 1 | 3 | 4 | 2 |
| (d)   | 2 | 3 | 4 | 1 |

**Ans: (d)**

101. Which of the following are the advantages of flowchart?

1. A flowchart is independent of language
2. It is easy to develop a program with flowchart
3. If there are any changes in the program, it is very easy to make changes

(A) 1 and 2 only      (B) 1 and 3 only      (C) 2 and 3 only      (D) 1, 2 and 3

**Ans: (a)**

102. In following, a parallelogram would be used to represent?

- (A) Getting a keyboard entry from the user
- (B) The beginning of the flowchart
- (C) A decision point that determines which of two branches to follow
- (D) A mathematical calculation

**Ans: (a)**

103. USM has good machining performance for :

- (A) Al      (B) Steel      (C) Super alloys      (D) Refractory material

**Ans: (d)**

104. Consider the following statements:

1. Create a database alias
2. Create the database needed
3. Create indexes
4. Create a directory for the tables

What is the correct sequence of order for creating a new database in dBase?

- (A) 4-2-1 and 3    (B) 3-1-2 and 4    (C) 4-1-2 and 3    (D) 3-2-1 and 4

**Ans: (c)**

105. Match List –I with List –II and select the correct answer using the code given below the lists:

|    | List –I   |  | List –II       |
|----|-----------|--|----------------|
| A. | Worksheet |  | 1. dBase III   |
| B. | Records   |  | 2. C language  |
| C. | Pointers  |  | 3. FORTRAN     |
| D. | Compiler  |  | 4. Lotus 1-2-3 |

| Codes | A | B | C | D |
|-------|---|---|---|---|
| (a)   | 4 | 2 | 1 | 3 |
| (b)   | 3 | 2 | 1 | 4 |
| (c)   | 4 | 1 | 2 | 3 |
| (d)   | 3 | 1 | 2 | 4 |

**Ans: (c)**

106. High energy rate forming process used for forming components from thin metal sheets or deform thin tubes is:

- (A) Petro-forming                      (B) Magnetic pulse forming  
(C) Explosive forming                (D) electro-hydraulic forming

**Ans: (c)**

107. In the 3-2-1 principle of fixture 3 refers to number of :

- (A) Setups possible                      (B) Clamps required  
(C) Positions on primary face    (D) Locating positions

**Ans: (d)**

108. The optimum cutting speed is one which should have;

1. High metal removal rate
2. High cutting tool life
3. Balance the metal removal rate and cutting tool life

(A) 1, 2 and 3                      (B) 1 and 2 only                      (C) 2 and 3 only                      (D) 3 only

**Ans: (d)**

109. Stellite is a non-ferrous cast alloy composed of:

- (A) Cobalt, chromium and tungsten
- (B) Tungsten, vanadium and chromium
- (C) Molybdenum, tungsten and chromium
- (D) Tungsten, molybdenum, chromium and vanadium

**Ans: (a)**

110. External threads can be produced by :

1. Rolling
2. Grinding
3. Milling

(A) 1 and 3 only                      (B) 1 and 2 only                      (C) 2 and 3 only                      (D) 1, 2 and 3

**Ans: (a)**

111. Match List –I with List –II and select the correct answer using the code given below the lists:

| List –I         | List –II                             |
|-----------------|--------------------------------------|
| A. Top gate     | 1. Heavy and large castings          |
| B. Bottom gate  | 2. Most widely used and economical   |
| C. Parting gate | 3. Turbulence                        |
| D. Step gate    | 4. Unfavourable temperature gradient |

| Codes | A | B | C | D |
|-------|---|---|---|---|
| (a)   | 3 | 4 | 2 | 1 |
| (b)   | 1 | 4 | 2 | 3 |
| (c)   | 3 | 2 | 4 | 1 |
| (d)   | 1 | 2 | 4 | 3 |

**Ans: (a)**

**Directions:-**

Each of the next Nine (9) items consist of two statements, one labeled as the ‘Assertion(A)’ and the other as “Reason(R)”, You are to examine these two statements carefully and select the answers to these items using the codes given below:

**Codes:**

- (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

112. Assertion (A) : The centrifugal tension in a belt  $T_c = mv^2$

Reason (R) : Since this expression is independent of the cross-section, it follows that  $T_c$  is independent of the belt size.

**Ans: (c)**

113. Assertion (A) : Hot tears occur during forging because of inclusions in the blank material

Reason (R) : Bonding between the inclusions and the parent material is through physical and chemical bonding.

**Ans: (a)**

114. Assertion (A): Lead, Zinc and Tin are always hot worked.

Reason (R) : If they are worked in cold state they cannot retain their mechanical properties.

**Ans: (a)**

115. Assertion (A): Excess defects are created by hammering the crystalline materials.

Reason (R) : The thermal fluctuations create the point defects in crystalline materials.

**Ans: (b)**

116. Assertion (A) : Solid solutions of metal are crystal whose properties are close to those of the solvent.

Reason (R) : They retain the same crystal lattice and type of bond.

**Ans: (c)**

117. Assertion (A): Carburizing is used for machine elements which have to have a wear resistant working surface.

Reason (R) : The composition of surface layers are changed in carburizing.

**Ans: (a)**

118. Assertion (A) : The steel when heated above a certain temperature and cooled to room temperature, structure adjustment stabilizes.

Reason (R) : The modification is mainly based on cooling rate.

**Ans: (a)**

119. Assertion (A) : The plastic organic materials can be easily shaped or moulded by mechanical action.

Reason (R): It is widely in use as it can be permanently moulded.

**Ans: (c)**

120. Assertion (A) : A composite is a multiphase material which is artificially made as one that occurs naturally.

Reason (R): Technology of modern age requires a material with unusual combination of properties that cannot be met by metal or alloys.

**Ans: (a)**