

UPPSC AE ME 2013 Paper 1

1. 3-2-1 principle is related with

- A. design of locating devices.
- B. tool design
- C. plant layout design
- D. work sampling

2. Which of the following non-conventional machining methods does not cause tool wear?

- A. Anode mechanical machining
- B. Ultrasonic machining
- C. Eléctro-discharge machining
- D. Electro-Chemical machining

3. In a blanking operation, the clearance is provided

- A. 50 % on punch and 50 % on die
- B. only on die
- C. only on punch
- D. clearance not needed

4. The relationship between blank diameter D and cup diameter d during deep drawing process is given as

A. $D = \sqrt{d^2 + 4dh}$

B. $D = \sqrt{d^2 + 2dh}$

C. $D = \sqrt{d^2 + \frac{dh}{2}}$

D. $D = \sqrt{d^2 + dh}$

Where h = height of the cup

5. The force F required to cut a sheet metal is given by

A. $F = \tau_s p/t$

B. $F = \tau_s pt^2$

C. $F = \tau_s pt$

D. $F = \tau_s / pt$

Where τ_s = shear strength of sheet metal.

p = perimeter of the cut

t = thickness of the sheet metal

6. In a tool life test, doubling the cutting speed reduces the tool life to $1/8^{\text{th}}$ of the original value. The Taylor's tool life index is

A. 1

B. $1/2$

C. $1/3$

D. $1/4$

7. The chip thickness ratio 'r' is given by

A. $\frac{\cos \phi}{\sin(\phi - \alpha)}$

B. $\frac{\sin(\phi - \alpha)}{\cos \phi}$

C. $\frac{\cos(\phi - \alpha)}{\sin \alpha}$

D. $\frac{\sin \phi}{\cos(\phi - \alpha)}$

Where ϕ = shear plane angle, and α = rake angle

8. In Electro Discharge Machining better surface finish is obtained at

A. low frequency and low discharge current.

B. low frequency and high discharge current.

C. thihg frequency and low discharge current.

D. high frequency and high discharge current.

9. Which of the following statements is incorrect about the continuous chip ?

A. It is formed while machining ductile, materials at high cutting speeds.

B. It is formed when feed and depth of cut are low.

C. It results in good surface finish.

D. None of the above.

10. Consider the following work piece materials:

(i) Carbides

(ii) Glass

(iii) Copper and

(iv) Ceramics

Which of the above material/s are best suited for ultrasonic Machining.

A. (ii) only

B. (ii) and (iii)

C. (i), (ii) and (iv)

D. (ii), (iii) and (iv)

11. To prolong the life of shaper tools, after they are ground they should be undergone through the following operation

A. sand blasting

B. shot peening

C. lapping

D. hardening

12. An Operating Characteristics curve (OC-curve) is a plot between

A. consumer's risk and producer's risk.

B. probability of acceptance and probability of rejection.

C. percentage of defective and probability of acceptance.

D. average outgoing quality and probability of acceptance.

13. An \bar{X} chart uses the following data

A. count data

B. attribute measurement data

C. variable measurement data

D. None of the above

14. Which of these would not be a reason for using acceptance sampling ?

- A. a very high inspection cost
- B. boredom and fatigue
- C. a process needing statistical control
- D. destructive testing

15. For a $M/M/1/\infty/\infty/FCFS$ queue model, the mean arrival rate is equal to 10 per hour and the mean service rate is 15 per hour. The expected queue length is

- A. 1.33
- B. 1.53
- C. 2.75
- D. 3.20

16. ABC analysis, as an input, requires

- A. annual usage and cost of the items.
- B. cost and criticality of the items.
- C. criticality and availability of the items.
- D. availability and annual usage of items.

17. The finite production rate inventory model relaxes which of the following EOQ assumptions?

- A. instantaneous replenishment
- B. constant lead time
- C. fixed deterministic demand
- D. no variation in unit time.

18. In a time study the observed time is 0.75 min, performance rating factor is 110 % and allowances are 20 % of the normal time. The standard time is

- A. 0.82 min
- B. 0.975 min
- C. 0.99 min
- D. 1.03 min

19. 'Value engineering' is used in

- A. understanding customer's requirements.
- B. designing products according to the customer's requirements.
- C. producing products according to the customer's requirements.
- D. providing products to customer with enhanced functionality at no additional cost.

20. Which type of control chart should be used to directly monitor the number of defectives in a process for making iron castings?

- A. \bar{X} - chart
- B. P - chart
- C. C - chart
- D. R - chart

21. A production line is to be designed to make 2400 items/week for atleast the next 3 months. The line operates 40 hours/week. The standard time required to assemble each item is 244 second. What is the smallest number of work station required?

- A. 5
- B. 6
- C. 7
- D. 8

22. A basic feasible solution in a linear programming problem with m, constraints and n variables will have

- A. at the most m variables with non zero values.
- B. atleast m variables with non zero values.
- C. at the most n variables with non zero values.
- D. atleast n variables with non zero values.

23. The maximum value of the average outgoing quality for all possible values of proportion defective is called

- A. Average Outgoing Quality (AOQ)
- B. Acceptable Quality Level (AQL)
- C. Average Outgoing Quality Limit (AOQL)

D. Lot Tolerance Proportion Defective (LTPD)

24. 20 samples of size 100 are taken. The total number of defective items is 200 . What is the upper control limit of 3sigma P-chart ?

- A. 0.13
- B. 0.16
- C. 0.19
- D. None of the above

25. Which of the following is not an underlying assumption of the basic EOQ model ?

- A. Stochastic demand,
- B. Instant replenishment
- C. Fixed lead time
- D. No shortages

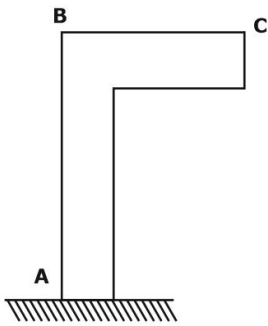
26. The error estimate (e) in work sampling varies with sample size (n) as

- A. $e \propto \frac{1}{n}$
- B. $e \propto \frac{1}{\sqrt{n}}$
- C. $e \propto \sqrt{n}$
- D. $e \propto \frac{1}{n^2}$

27. The producer's risk is the probability with which a consumer will,

- A. reject a bad lot :
- B. reject a good lot
- C. accept a good lot
- D. accept a bad lot

28. What is the thrust at the point 'A' in the post shown in the figure ?

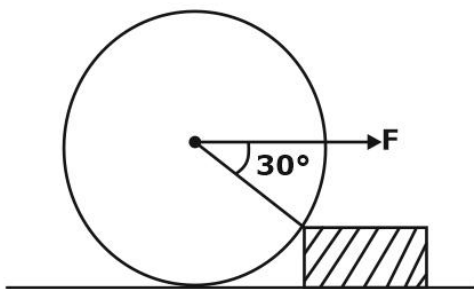


- A. 0.866 kN
- B. 0.5 kN
- C. 1.388 kN
- D. 1kN

29. The possible loading in various members framed structure are

- A. buckling or shear
- B. compression of tension
- C. shear or tension
- D. bending

30. A roller of wight W is to be rolled over a wooden block as shown in the figure. The pull F required to just cause the said motion



- A. $\frac{W}{2}$
- B. W
- C. $\sqrt{3}W$
- D. 2 W

31. In virtual work equation some forces are neglected. Select the most appropriate answer from the following:

- A. Reaction of a rough surface on a body which rolls on it without slipping.
- B. Reaction of any smooth surface with which the body is in contact.
- C. Reaction at a point or on an axis, fixed in space, around which a body is constrained to turn.
- D. All of the above.

32. A circular disc rolls down without slipping on an inclined plane. The ratio of its rotational kinetic energy to the total kinetic energy is

- A. $\frac{1}{4}$
- B. $\frac{1}{2}$
- C. $\frac{1}{3}$
- D. $\frac{2}{3}$

33. Two masses 2 kg and 8 kg are moving with equal kinetic energy. The ratio of magnitude of their momentum is

- A. 0.25
- B. 0.50
- C. 0.625
- D. 1.00

34. The efficiency of a screw jack is maximum, when

- A. $\alpha = 45^\circ + \frac{\phi}{2}$
- B. $\alpha = 45^\circ - \frac{\phi}{2}$
- C. $\alpha = 90^\circ + \phi$
- D. $\alpha = 90^\circ - \phi$

Where α = Helix angle and ϕ = Angle of friction.

35. 'When two bodies collide without the presence of any other force or force fields?

- A. Their total kinetic energy must be conserved.
- B. Their total momentum must be conserved.
- C. Their collision must be direct.
- D. Both (a) and (b)

36. The tension in the cable supporting a lift is more when the lift is

- A. moving downwards with uniform velocity.
- B. moving upwards with uniform velocity.
- C. moving upwards with acceleration.
- D. moving downwards with acceleration.

37. The angle between two forces P and Q is α . The resultant of these forces is

- A. $\sqrt{P^2 + Q^2 + 2PQ \sin \alpha}$
- B. $\sqrt{P^2 + Q^2 + 2PQ \cos \alpha}$
- C. $\sqrt{P^2 + Q^2}$
- D. $\sqrt{P^2 + Q^2 - 2PQ \cos \alpha}$

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

- A. 2
- B. 3
- C. 4
- D. 5

39. For high speed engines, the cam follower should move with

- A. uniform velocity
- B. simple harmonic motion
- C. uniform acceleration and retardation

D. cycloidal motion

40. A flywheel is fitted to the crank shaft of an engine having W amount of indicated work per revolution. Permissible limits of coefficient of fluctuation of energy and speed are C_E and C_S respectively. The kinetic energy of the flywheel is given by

A. $2 \frac{W.C_E}{C_S}$

B. $\frac{W.C_E}{2C_S}$

C. $\frac{W.C_E}{C_S}$

D. $\frac{W.C_S}{2C_E}$

41. If the ratio of length of connecting rod to crank radius increases, then

A. primary unbalanced force increases.

B. primary unbalanced force decreases.

C. secondary unbalanced force increases.

D. secondary unbalanced force decreases.

42. A system in dynamic balance implies that

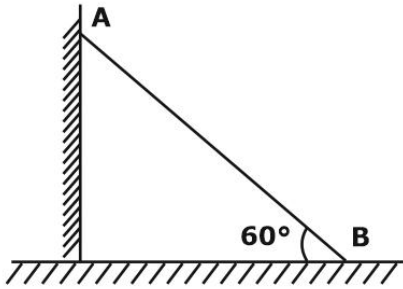
A. the system is critically damped.

B. the system is at its critical speed:

C. the system is also statically balanced.

D. there will be no wear of bearings.

43. A rod AB of length 1 m is sliding as shown in the figure. At an instant when the rod makes 60° angle with the horizontal plane, the downwards velocity of point A is 1 m/s. What is the angular velocity of the rod at that, instant?



- A. 2.0 rad/s
- B. 1.5 rad/s
- C. 0.5 rad/s
- D. 0.75 rad/s

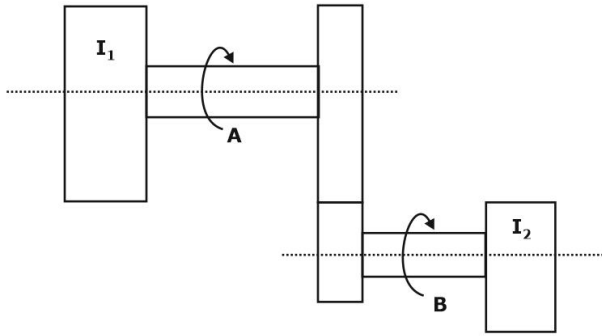
44. Isochronism in a governor is desirable when

- A. the engine operates at low speeds.
- B. the engine operates at high speeds.
- C. only one speed is desired to be kept at all loads.
- D. the engine operates at variable speeds.

45. A rigid body can be replaced by two masses placed at fixed distance apart. The two masses form an equivalent dynamic system, if (select the most appropriate answer).

- A. the sum of the two masses is equal to the total mass of the body.
- B. the centre of gravity of two masses coincide with that of the body.
- C. the sum of the mass moment of inertia of the masses about their centre of gravity is equal to the mass moment inertia of the body.
- (d) All of the above.

46. A torsional system with discs of moment of inertia I_1 and I_2 are shown in figure, which are gear driven. The ratio of speed of shaft B to shaft A is G. The equivalent moment of inertia of disc on shaft B at the speed of shaft 'A' is equal to



- A. $G I_2$
- B. $G^2 I_2$
- C. I_2 / G
- D. $I_2 G^2$

47. Identify lower pair/s. Select the most appropriate answer.

- A. ball and socket
- B. cam and follower
- C. piston and cylinder
- D. Forth (a) and (c)

48. In a spring dash pot, mass system if m = mass, k = spring stiffness and ω_n = natural frequency of vibration, then critical damping is equal to

- A. $2\sqrt{km}$
- B. $2 m \omega_n$
- C. both A and B
- D. neither A nor B

49. An imaginary circle which by pure rolling action gives the same motion as the actual gear is called

- A. addendum circle
- B. dedendum circle
- C. pitch circle
- D. base circle

50. The pressure angle in a cam depends on

- A. the angle of ascent
- B. the lift of the follower
- C. offset between centre lines of cam and follower
- D. All of the above

51. The centrifugal tension in belt drive,

- A. increases power transmitted.
- B. decreases power transmitted.
- C. has no effect on the power transmitted.
- D. increases power transmitted upto a certain speed and then decreases.

52. If there are several unbalanced masses in a rotor in different planes, the minimum number of balancing masses required is

- A. 1
- B. 2
- C. 3
- D. 4

53. The tractive force is maximum or minimum when the angle of inclination of the crank to the line of stroke is equal to

- A. 90° and 225°
- B. 135° and 180°
- C. 180° and 225°
- D. 135° and 315°

54. The number of instantaneous centres of rotation in a quick return motion mechanism are

- A. six
- B. eight
- C. twelve
- D. fifteen

55. In a forced vibration system, for which value of frequency ratio $\left(\frac{\omega_f}{\omega_n}\right)$, the transmissibility is same for all the values of damping factors

- A. 1
- B. 2
- C. $\sqrt{2}$
- D. $\frac{1}{2}$

Where ω_f = forced frequency and

ω_n = natural frequency

56. Constant velocity ratio between two shafts can be obtained, if they are connected by

- A. V-belts and pulleys
- B. Sprocket and chains
- C. Gears
- D. Universal joint

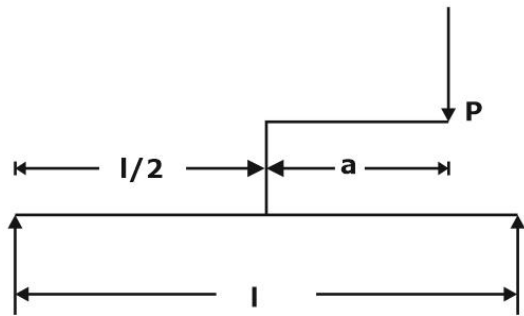
57. Differential gear is used in an automobile to

- A. transmit power from the engine to driving wheels.
- B. multiply the available engine torque.
- C. enable the vehicle negotiate curves properly.
- D. serves all the three functions as mentioned in A, B and C above.

58. The point of contraflexure is a point where,

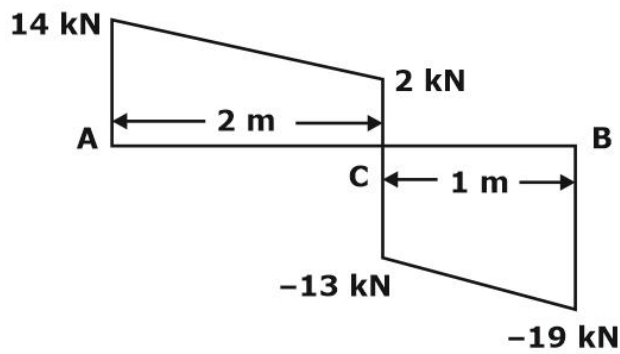
- A. shear force changes sign
- B. bending moment is zero or changes sign.
- C. shear force is maximum
- D. bending moment is maximum

59. A simply supported beam carries a load 'P' through a bracket as shown in figure. The maximum bending moment in the beam is



- A. $P \frac{l}{2}$
- B. $P \frac{l}{2} + \frac{a.P}{2}$
- C. $P \frac{l}{2} + a.P$
- D. $P \frac{l}{2} - a.P$

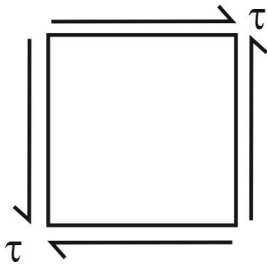
60. The shear force diagram of a loaded beam is shown in the following figure. The maximum bending moment in the beam is



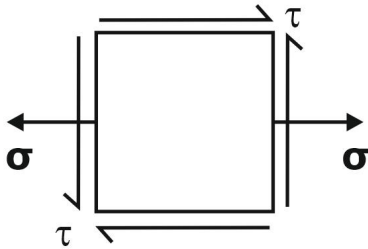
- A. 16 kN-m
- B. 11 kN-m
- C. 28 kN-m
- D. 8 kN-m

61. In which of the following two dimensional state of stress, Mohr's stress circle takes the shape of a point.

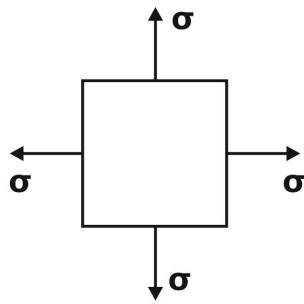
A.



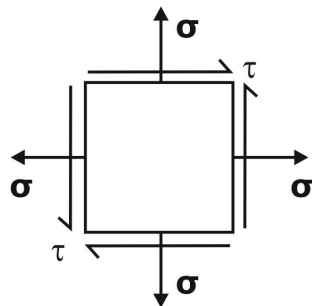
B.



C.



D.



62. If the shear force diagram for a beam is triangle with length of the beam as its base, the beam is

- A. a cantilever with a point load at its free end.
- B. a cantilever with uniformly distributed load over its whole span.
- C. a simply supported beam with a point load at its mid-point.
- D. a simply supported beam with uniformly distributed load over its whole span.

63. The torque transmitted by a solid shaft of diameter d and maximum allowable shear stress τ is

A. $\frac{\pi}{4} \tau d^3$

B. $\frac{\pi}{16} \tau d^3$

C. $\frac{\pi}{32} \tau d^3$

D. $\frac{\pi}{64} \tau d^3$

64. A thick cylinder, having r_o and r_i as outer and inner radii, is subjected to an internal pressure P . The maximum tangential stress at the inner surface of the cylinder is

A. $\frac{P(r_o^2 + r_i^2)}{r_o^2 - r_i^2}$

B. $\frac{P(r_o^2 - r_i^2)}{r_o^2 + r_i^2}$

C. $\frac{2Pr_i^2}{(r_o^2 - r_i^2)}$

D. $\frac{P(r_o^2 - r_i^2)}{r_i^2}$

65. A thin cylindrical shell of diameter d and thickness t is subjected to an internal pressure P . The Poisson's ratio is ν . The ratio of longitudinal strain to volumetric strain is

A. $\frac{1 - \nu}{2 - \nu}$

B. $\frac{2 - \nu}{1 - \nu}$

C. $\frac{1 - 2\nu}{3 - 4\nu}$

D. $\frac{1 - 2\nu}{5 - 4\nu}$

66. In a compression test, the fracture in cast iron specimen would occur along

A. the axis of the load

B. an oblique plane

- C. at right angle to the axis of specimen
- D. None of the above

67. The Ericksen cupping number of a metal sheet indicates its

- A. ductility
- B. hardenability
- C. toughness
- D. drawing ability

68. In an I-section of a beam subjected to transverse shear force, the maximum shear stress is developed at

- A. the bottom edges of the top flange.
- B. the top edges of the top flange.
- C. the centre of the web.
- D. the upper edges of the bottom flange.

69. The equivalent length of a column supported firmly at both ends is (l = length of the column)

- A. $0.5l$
- B. $0.707l$
- C. l
- D. $2l$

70. A circular shaft is subjected to a twisting moment T and a bending moment M . The ratio of maximum bending stress to maximum shear stress is given by

- A. $2M/T$
- B. M/T
- C. $2T/M$
- D. $M/2T$

71. The strain energy in a beam subjected to bending moment M is

- A. $\int \frac{M^2}{2EI} dx$

B. $\int \frac{M^2}{4EI} dx$

C. $\int \frac{M^2}{EI} dx$

D. $\int \frac{2M^2}{EI} dx$

Where the terms have their usual meaning.

72. Maximum deflection in a cantilever due to pure bending moment M at its end is

A. $\frac{MI^2}{2EI}$

B. $\frac{MI^2}{3EI}$

C. $\frac{MI^2}{4EI}$

D. $\frac{MI^2}{8EI}$

The terms have their usual meaning

73. The expression $EI \frac{d^3y}{dx^3}$ at a section of a beam represents

A. shear force

B. rate of loading

C. bending moment

D. slope

74. Compound tubes are used in internal pressure cases, for following reasons

A. For increasing the thickness.

B. For increasing the outer diameter of the tube.

C. The strength is more.

D. It evens out stresses.

75. Normal stress on a plane, the normal to which is inclined at an angle θ with the line of action of applied uniaxial stress σ is given by

- A. $\sigma / \sin^2\theta$
- B. $\sigma / \cos^2\theta$
- C. $\sigma \cos^2\theta$
- D. $\sigma \sin^2\theta$

76. A shaft of 20 mm diameter and length 1 m is subjected to a twisting moment, due to which shear strain on the surface of the shaft is 0.001. The angular twist in the shaft is

- A. 0.1 radian
- B. 0.01 radian
- C. 0.05 radian
- D. 0.5 radian

77. A beam of uniform strength is one in which

- A. bending moment is same throughout the beam.
- B. deflection is the same throughout the length.
- C. bending stress is same in every section along the longitudinal axis.
- D. shear stress is uniform throughout the beam.

78. Increase in ferrite phase in steel increases

- A. strength
- B. hardness
- C. ductility
- D. brittleness

79. The co-ordination number for FCC crystal structure is

- A. 4
- B. 8
- C. 12
- D. 16

80. Which of the following elements determine maximum attainable hardness in the steel?

1. Chromium
2. Manganese
3. Carbon
4. Molybdenum

Select the correct answer using codes given below;

- A. 1 only
- B. 1 and 2
- C. 3 only
- D. 2 and 4

81. How many space lattices does the Bravais lattices consist of ?

- A. 3
- B. 7
- C. 9
- D. 14

82. Schottky imperfection is a

- A. Point imperfection
- B. Line imperfection
- C. Surface imperfection
- D. Volume imperfection

83. Match the List-1 with the List - II and select the correct answer using the codes given below:

	List-I (Crystal Structure)		List-II (Packing Efficiency)
A.	Simple cubic	1.	34
B.	Diamond cubic	2.	74
C.	Body centred cubic D. Face centred cubic	3.	52
D.	Face centric cubic	4.	68

Select the correct answer using the codes given below :

Codes:

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

84. Which of the following tests is also called 'Micro hardness Test' ?

- A. Brinell test
- B. Rockwell test
- C. Knoop test
- D. Vickers test

85. S-N curves are connected with

- A. toughness
- B. hardness
- C. creep
- D. fatigue

86. Which one of the following is a basic refractory material ?

- A. Dolomite
- B. Quartz
- C. Sand
- D. Silicon carbide

87. Creep plays an important role in the design of which of the followings?

- A. boiler tubings
- B. I.C. Engine cylinders
- C. Gas turbine blades
- D. Steam turbine blades

88. Babbit metal is an alloy of

- A. Sn and Cu.
- B. Sn, Cu, Sb and Pb
- C. Sn, Cu and Pb
- D. Sn, Cu and Sb

89. Thermoplastic polymers are

- (i) formed by addition polymerization.
- (ii) formed by condensation polymerization.
- (iii) softened on heating and hardened on cooling for any number of times.
- (iv) moulded by heating and cooling.

Of these statement, select the correct answer from the options given below:

- A. (ii) and (iii) are true
- B. (ii) and (iv) are true
- C. (i) and (iv) are true
- D. (i) and (iii) are true

90. The true strain ϵ_t and the engineering strain e relationship is

- A. $\epsilon_t = \log_n (1 - \epsilon)$
- B. $\epsilon_t = \log_n (1 + \epsilon)$
- C. $\epsilon_t = \log_n (1 - 2 \epsilon)$
- D. $\epsilon_t = \log_n \frac{1}{(1 - \epsilon)}$

91. The metal powder used in a thermite welding of steel.

- A. Al
- B. Cu
- C. Pb
- D. W

92. Which of the following material is used for manufacturing of extrusion nozzles?

- A. Grey cast iron
- B. Malleable cast iron
- C. White cast iron
- D. Nodular cast iron

93. The main purpose of Chaplet is

- A. to support core
- B. to ensure directional solidification
- C. to provide efficient venting
- D. to align the mould box parts

94. Which is the main reason for poor surface finish?

- A. heavy depth of cut
- B. high cutting speed
- C. high feed
- D. low side rake angle

95. In a machining operation chip thickness ratio is 0.3 and tool back rake angle is 10. The value of shear strain is

- A. 0.86
- B. 2.24
- C. 3.10
- D. 3.34

96. Grinding of hard materials requires

- A. fine grit size and hard grades.
- B. fine grit size and soft grades.
- C. coarse grit size and hard grades.
- D. coarse grit size and soft grades.

97. Crater wear occurs mainly on the

- A. nose part, front and side relief faces of the cutting tool.
- B. face of the cutting tool at a short distance from the cutting edge only.
- C. cutting edge only.
- D. front face only.

98. High speed steel contains carbon

- A. 0.15 to 0.3 %
- B. 0.6 to 1.0 %
- C. 4 to 6 %
- D. 6 to 10 %

99. The rake angle required for machining brass by high speed steel tool is

- A. 0°
- B. 10°
- C. -5°
- D. -10°

100. Consider the following statements:

- (i) Mechanical comparators are used for higher accuracy.
- (ii) Optical comparators use both optical and mechanical means to get magnification.
- (iii) Pneumatic comparators are used for very high magnification.
- (iv) Dial indicator is the most widely used mechanical comparator.

Of these statements:

- A. (ii), (iii) and (iv) are true.
- B. (iii) is true.
- C. (i), (ii) and (iii) are true.
- D. (i) and (ii) are true.