MECHANICAL ENGINEERING

PAPER-II

1. Machine tool manufacturers prefer grey cast-iron grade 40 for producing machine columns and tables because grey cast-iron is

   1. Heavy
   2. Easily castable
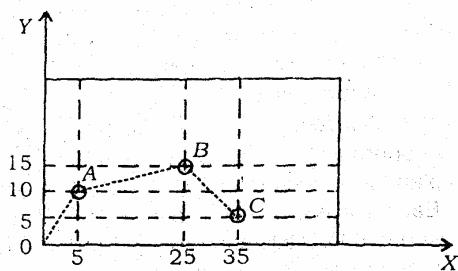   3. Easily weldable
   4. Having good damping capacity

   Select the correct answer using the codes given below :

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

2. Which one of the following mechanisms is employed for indexing of turret in an automatic lathe ?

   a. Whitworth
   b. Rack and pinion
   c. Ratchet and pawl
   d. Geneva wheel

3.

   While part programming in CNC machines, the input of dimensional information for the tool path can be given in the absolute co-ordinate system or in incremental coordinate system. The above figure shows the route to be followed by the tool from 0 to C, i.e., 0 – A – B – C. If incremental coordinate system is used, the co-ordinates of each point A, B and C are

   a. A : X 5.0, Y 10.0
   B : X 20.0, Y 5.0
   C : X 10.0, Y – 10.0

   b. A : X 5.0, Y 10.0
   B : X 25, Y 15.0
   C : X 35, Y 5.0

   c. A : X 10.0, Y 5.0
   B : X 15.0, Y 25.0
   C : X 5.0, Y 35.0

   d. A : X 10.0, Y 5.0
   B : X 5.0, Y 20.0
   C : X 10.0, Y 10.0

4. Standard time is

   a. Normal time + Allowances
   b. (Normal time × Rating) + Allowances
   c. $\left(\dfrac{\text{Normal time}}{\text{Rating}} \right) + \text{Allowances}$
   d. Normal time + (Allowances × Rating)

5. Which one of the following is not a technique of Predetermined Motion Time Systems?

   a. Work factor system
   b. MTM
   c. Synthetic data
   d. Stopwatch time study

6. An operations consultant for an automatic car wash wishes to plan for enough capacity of stalls to handle 60 cars per hour. Each car will have a wash time of 3 minutes, but there is to be a 20% allowance for set-up time, delays and payment transactions. How many car wash stalls should be installed ?

   a. 3
   b. 4
   c. 5
   d. 6

7. Which one of the following types of layout is used for the manufacture of huge aircrafts ?

a. Product layout

b. Process layout

c. Fixed position layout

d. Combination layout

8. A furniture company is maintaining a constant work force which can produce 3000 tables, per quarter. The annual demand is 12000 units and is distributed seasonally in accordance with the quarterly indexes $Q_1 = 0.80$, $Q_2 = 1.40$, $Q_3 = 1.00$ and $Q_4 = 0.80$. Inventories are accumulated when demand is less than the capacity and are used up during periods of strong demand to supply the total demand. To take into account any seasonal demand the inventories on hand at the beginning of the first quarter should be at least

a. 0

b. 600

c. 1200

d. 2400

9. The span of control refers to the

a. Total amount of control which can be exercised by the supervisor

b. Total number of persons which report to any one supervisor

c. Delegation of authority by the supervisor to his subordinates

d. Delegation of responsibility by the supervisor to his subordinates

10. Match List I (Trend/Defect) with List II (Chart) and select the correct answer :

List I

A. Trend

B. Dispersion

C. Number of defects

D. Number of defectives

List II

1. R-Chart

2. C-Chart

3. $\overline{X}$-Chart

4. np-Chart

5. u-Chart

	A	B	C	D
a.	5	3	2	4
b.	3	1	4	2
c.	3	1	2	4
d.	3	4	5	2

11. Which one of the following statements is correct ?

a. Time series analysis technique of forecasting is used for very long range forecasting

b. Qualitative techniques are used for long, range forecasting and quantitative techniques, for short and medium range forecasting

c. Coefficient of correlation is calculated in case of time series technique

d. Market survey and Delphi techniques are used for short range forecasting

12. In the solution of linear programming problems by Simplex method, for deciding the leaving variable

a. The maximum negative coefficient in the objective function row is selected

b. The minimum positive ratio of the right-hand side to the first decision variable is selected

c. The maximum positive ratio of the right-hand side to the coefficients in the key column is selected

d. The minimum positive ratio of the right hand side to the coefficient in the key column is selected

13. Consider the following statements on transportation problem :

1. In Vogel's approximation method, priority allotment is made in the cell with lowest cost in the column or row with least penalty.

2. The North-West corner method ensures faster optimal solution.

3. If the total demand is higher than the supply, transportation problem cannot by solved

4. A feasible solution may not be an optimal solution.

Which of these statements are correct ?

a. 1 and 4

b. 1 and 3

c. 2 and 3

d. 2 and 4

14. At a self-service store, a cashier can serve 10 customers in 5 minutes. On an average 15 customers arrive every 10 minutes. If the arrivals are as per Poisson distribution and services as per exponential distribution, the probability that the cashier would be idle is

a. 0.5

b. 0.75

c. 0.25

d. 0

15. ABC analysis in materials management is a method of classifying the inventories based on

a. The value of annual usage of the items

b. Economic order quantity

c. Volume of material consumption

d. Quantity of materials used

16. Consider the following steps which are involved in constructing a function analysis system technique of value engineering:

1. Find the critical path

2. Prepare a function worksheet

3. Listing of functions

4. Diagram layout

Which of the following gives the correct sequence of steps?

a. 1, 3, 2, 4

b. 2,1,3,4

c. 4, 2, 3, 1

d. 3, 2, 4, 1

17. Consider the following statements in respect of double sampling plan :

1. Average number of pieces inspected is double that of single sampling.

2. Average number of pieces inspected is less than that for single sampling.

3. Decision to accept or reject the lot is taken only after the inspection of both samples.

4. Decision to accept or reject the lot is reached sometimes after one sample and sometimes after two samples.

Which of these statements are correct ?

a. 1, 2 and 3

b. 2 and 4

c. 1 and 4

d. 2 and 3

18. The variance of the completion time for a project is the sum of variances of

a. All activity times

b. Non-critical activity times

c. Critical activity times

d. Activity times of first and last activities of the project

19.
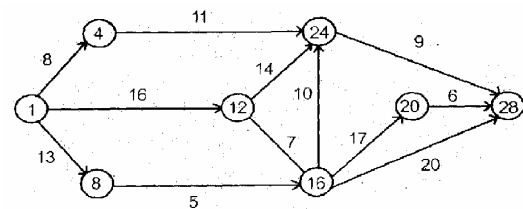
The earliest time of the completion of the last event in the above network in weeks is

a. 41

b. 42

c. 43

d. 46

20. The indirect cost of a plant is Rs. 4,00,000 per year. The direct cost is Rs. 20 per product. If the average revenue per product is Rs. 60, the break-even point is

a. 10000 products

b. 20000 products

c. 40000 products

d. 60000 products

21. Which one of the following statements correctly defines the term 'dispatching'?

a. Maintaining the record of time of starting and completion of each operation

b. The appraisal and evaluation of human work in terms of time

c. Taking all such steps which are meant to affect and implement the programmes of production according to plans

d. Moving the work after completion to the next process or machine on the route

22. In computer application, if a direct dialogue is carried on between computer and user, it is referred to as

a. Real-time application

b. Decision application

c. Batch processing application

d. Interfacing

23.
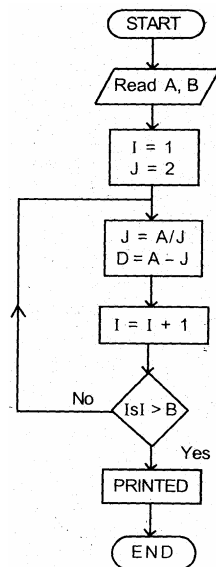
In the above flow chart, if the values of inputs are, A = 64 and B = 3; the value of D is

a. 2

b. 30

c. 32

d. 60

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

a. Every C-language programme contains a function 'Main'

b. \n symbol in C-language tells the computer programme to print a new line

c. In a C-language programme, there is no need to declare the variable types

d. In C-language the text enclosed in /* and */ is a comment

25. For deleting a record from a dBase III plus file, the command(s) given is/are

a. delete

b. delete followed by pack

c. delete followed by done

d. delete followed by modify

26. Consider the following statements related to computer applications in mechanical engineering :

1. Computer can solve any problem that is impossible to be solved by conventional calculation methods.

2. The optimization techniques involving numerical calculations can be easily employed using computers.

3. The speed of calculations in computers depends on speed of input-output devices

4. The central processor unit mainly co-ordinates the functions of various parts of the computer system.

Which of these statements is/are correct ?

a. 1, 2, 3 and 4

b. 2, 3 and 4

c. 3 only

d. 2 only

27. Assertion (A) : Slider-crank chain is an inversion of the four-bar mechanism.

Reason (R) : Slider-crank chain often finds applications in most of the reciprocating machinery.

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

28. Assertion (A) : The maximum efficiency

$$\left(\eta = \frac{1 - \sin \phi}{1 + \sin \phi} \right)$$

of a screw jack is same, where ϕ is the friction angle, for both motion up and motion down the plane.

Reason (R) : The condition for the maximum efficiency for motion up and motion down the plane is same, given by $\alpha = \frac{\pi}{4} - \frac{\phi}{2}$ where $\alpha =$ helix angle.

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

29. Assertion (A) : A Woodruff key is an easily adjustable key.

Reason(R) : The Woodruff key accommodates itself to any taper in the hub or boss of the mating piece.

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

30. Assertion (A) : In case of friction clutches, uniform wear theory should be considered for power transmission calculation rather than the uniform pressure theory.

Reason (R) : The uniform pressure theory gives a higher friction torque than the uniform wear theory.

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

31. Assertion (A) : In a simply supported beam subjected to a concentrated load P at mid-span, the elastic curve slope becomes zero under the load.

Reason (R) : The deflection of the beam is maximum at mid-span.

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

32. Assertion (A) : Unlike in the case of ionic bonds, the co-ordination numbers for covalently bonded atoms are not controlled by the radii ratio.

Reason (R) : A covalent bond has a specific direction of bending in space.

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

33. Assertion (A) : The machinability of steels improves by adding sulphur to obtain so called 'Free Machining Steels'.

Reason(R) : Sulphur in steel forms manganese sulphide inclusion which helps to produce thin ribbon like continuous chip.

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

34. Assertion (A) : Water jet machining uses high pressure and high velocity water stream which acts like a saw and cuts a narrow groove in the material.

Reason (R) : The force required for cutting is generated from sudden change in the momentum of the water stream.

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

35. Assertion (A) : While rolling metal sheet in rolling mill, the edges are sometimes not straight and flat but are wavy.

Reason (R) : Non-uniform mechanical properties of the flat material rolled out result in waviness of the edges.

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

36. Assertion (A) : In case of control charts for variables, the average of readings of a sub-group of four and more is plotted rather than the individual readings.

Reason (R) : Plotting of individual readings needs a lot of time and effort.

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

37. Assertion (A) : In the solution of transportation problem, for application optimality test, the number of allocations required is m + n – 1 and these should be in independent positions.

Reason (R) : If the number of allocations is not m + n – 1, values of all oddments, i.e. u_i and v_j cannot be found.

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

38.

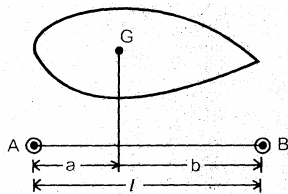Figure shows a rigid body of mass m having radius of gyration k about its centre of gravity. It is to be replaced by an equivalent dynamical system of two masses placed at A and B. The mass at A should be

a. $\dfrac{a \times m}{a+b}$

b. $\dfrac{b \times m}{a+b}$

c. $\dfrac{m}{3} \times \dfrac{a}{b}$

d. $\dfrac{m}{2} \times \dfrac{b}{a}$

39. $f = 3 (n – 1) – 2j$. In the Grubler's equation for planar mechanisms given, j is the

a. Number of mobile links

b. Number of links

c. Number of lower pairs

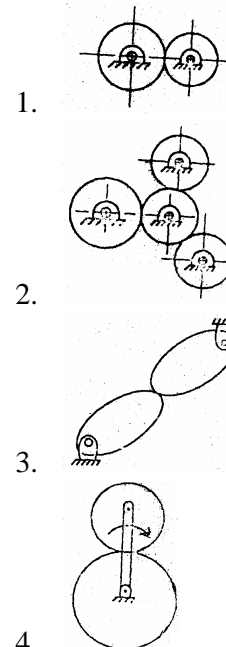d. Length of the longest link

40. Which of the following are examples of forced closed kinematic pairs ?

1. Cam and roller mechanism

2. Door closing mechanism

3. Slider-crank mechanism

4. Automotive clutch operating mechanism

Select the correct answer using the codes given below :

a. 1, 2 and 4

b. 1 and 3

c. 2, 3 and 4

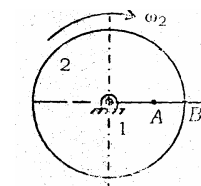d. 1, 2, 3 and 4

41.

1.

2.

3.

4.

Which of the mechanisms shown above do/does not have single degree of freedom?

a. 3 and 4

b. 2 and 3

c. 3 only

d. 4 only

42.

Two points, A and B located along the radius of a wheel, as shown in the figure above, have velocities of 80 and 140 m/s, respectively. The distance between points A and B is 300 mm. The radius of wheel is
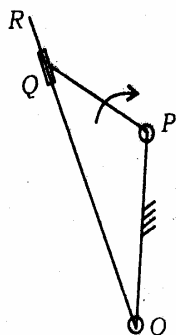
a. 400 mm

b. 500 mm

c. 600 mm

d. 700 mm

43. In a slider-crank mechanism, the velocity of piston becomes maximum when
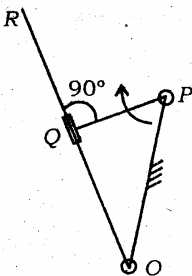
a. Crank and connecting rod are in line with each other

b. Crank is perpendicular to the line of stroke of the piston

c. Crank and connecting rod are mutually perpendicular

d. Crank is 120^0 with the line of stroke
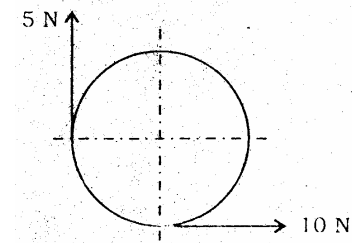
44.

1.

2.

3.

Three positions of the quick-return mechanism are shown above. In which of the cases does the Coriolis component of acceleration exist ?

Select the correct answer using the codes given below :

a. 1 only

b. 1 and 2

c. 1, 2 and 3

d. 2 and 3

45.

The above figure shows a circular disc of 1 kg mass and 0.2 m radius undergoing unconstrained planar motion under the action of two forces as shown. The magnitude of angular acceleration α of the disc is

a. 50 rad/s^2

b. 100 rad/s^2

c. 25 rad/s^2

d. 20 rad/s^2

46. For a slider-crank mechanism with radius of crank r, length of connecting rod *l*, obliquity ratio n, crank rotating at an angular velocity ω; for any angle 0 of the crank, match List I (Kinematic Variable) with List II (Equation) and select the correct answer :

List I

A. Velocity of piston

B. Acceleration of piston

C. Angular velocity of connecting rod

D. Angular acceleration of connecting rod

List II

1. $\dfrac{\omega}{n}.\cos\theta$

2. $\omega^2 r.\left(\cos\theta + \dfrac{\cos 2\theta}{n}\right)$

3. $-\dfrac{\omega^2}{n}.\sin\theta$

4. $\omega r\left(\sin\theta + \dfrac{\sin 2\theta}{n}\right)$

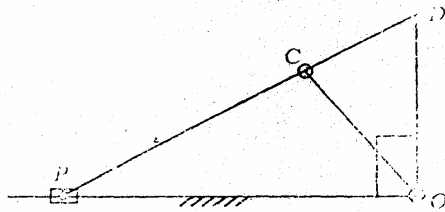|	A	B	C	D
a.	4	2	3	1
b.	2	4	3	1
c.	4	2	1	3
d.	2	4	1	3

47.

Figure shows Klein's construction for slider-crank mechanism OCP drawn to full scale. What velocity does CD represent?

a. Velocity of the crank pin

b. Velocity of the piston

c. Velocity of the piston with respect to crank pin

d. Angular velocity of the connecting rod

48. The maximum fluctuation of energy E_f, during a cycle for a flywheel is

a. $I\left(\omega_{max}^2 - \omega_{min}^2\right)$

b. $\frac{1}{2}.I.\omega_{av}\left(\omega_{max} - \omega_{min}\right)$

c. $\frac{1}{2}.I.K_{es}.\omega_{av}^2$

d. $I.\omega_{av}^2.K_{es}$

(where I = Mass moment of inertia of the flywheel

ω_{av} = Average rotational speed

K_{es} = Coefficient of fluctuation of speed)

49. For minimising speed fluctuations of an engine as a prime mover, it must have

a. Only a flywheel fitted to the crankshaft

b. A governor provided in the system

c. Both a flywheel and a governor provided in the system

d. Neither a flywheel nor a governor

50. Effect of friction at the sleeve of a centrifugal governor is to make it

a. More sensitive

b. More stable

c. Insensitive over a small range of speed

d. Unstable

51.
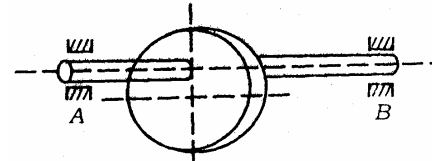
A circular disc having a mass of 30 kg is mounted symmetrically between two bearings A and B as shown above in the figure. It is used as an eccentric cam with an eccentricity of 0.01 m. If the shaking force on each of the bearings is not to exceed 1500 N, the speed of rotation of the cam should not exceed

a. 10 rad/s

b. 100 rad/s

c. 70.7 rad/s

d. 140 rad/s

52.
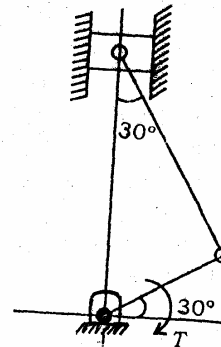
The above figure shows the schematic diagram of an IC engine producing a torque T = 40 N-m at the given instant. The Coulomb friction coefficient between the cylinder and the piston is 0.08. If the mass of the piston is 0.5 kg and the crank radius is 0.1 m, the Coulomb friction force occurring at the piston cylinder interface is

a. 16 N

b. 0.4N

c. 4 N

d. 16.4 N

53. Consider the following modifications regarding avoiding the interference between gears :

1. The centre distance between meshing gears be increased.
2. Addendum of the gear be modified.
3. Teeth should be undercut slightly at the root.
4. Pressure angle should be increased.
5. Circular pitch be increased.

Which of these are effective in avoiding interference?

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

54. In a reverted gear train, two gears P and Q are meshing, Q-R is a compound gear and R and S are meshing. The modules of P and R are 4 mm and 5 mm respectively. The numbers of teeth in P, Q and R are 20, 40 and 25 respectively. The number of teeth in S is

a. 23
b. 35
c. 50
d. 53

55. When two spur gears having involutes profiles on their teeth engage, the line of action is tangential to the

a. Pitch circles
b. Dedendum circles.
c. Addendum circles
d. Base circles

56. If the annular wheel of an epicyclic gear train has 100 teeth and the planet wheel has 20 teeth, the number of teeth on the sun wheel is
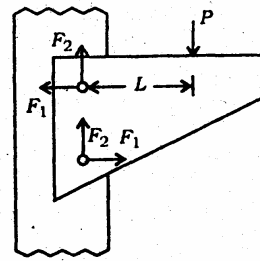
a. 80
b. 60
c. 40
d. 20

57. The piston rod and the crosshead in a steam engine are usually connected by means of

a. Cotter joint
b. Knuckle joint
c. Ball joint
d. Universal joint

58.

A riveted joint has been designed to support an eccentric load P. The load generates value of F_1 equal to 4 kN and F_2 equal to 3 kN. The cross-sectional area of each rivet is 500 mm^2. Consider the following statements:

1. The stress in the rivet is 10 N/mm^2.
2. The value of eccentricity L is 100 mm.
3. The value of load P is 6 kN.
4. The resultant force in each rivet is 6 kN.

Which of these Statements are correct?

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

59. Match List I (Phenomenon) with List II (Significant Parameters/Phenomenon) and select the correct answer:

List I
A. Interference fit
B. Cyclic loading
C. Gear meshing
D. Lubricating of bearings

List II
1. Viscosity index
2. Interference
3. Notch sensitivity
4. Induced compressive .stress

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

60. The hemispherical end of a pressure vessel is fastened to the cylindrical portion of the pressure vessel with the help of gasket, bolts and lock nuts. The bolts are subjected to
   a. Tensile stress
   b. Compressive stress
   c. Shear stress
   d. Bearing stress

61. For bolts of uniform strength the shank diameter is made equal to
   a. Major diameter of threads
   b. Pitch diameter of threads
   c. Minor diameter of threads
   d. Nominal diameter of threads

62. Match List I (Device) with List II (Component/Accessory) and select the correct answer :

   List I
   A. Lifting machine
   B. Fibre rope drive
   C. Differential gear
   D. Belt drive

   List II
   1. Idler of jockey pulley
   2. Sun wheel
   3. Sheave
   4. Power screw

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

63. A pulley is connected to a power transmission shaft of diameter d by means of a rectangular sunk key of width w and length l. The width of the key is taken as d/4. For full power transmission, the shearing strength of the key is equal to the torsional shearing strength of the shaft. The ratio of the length of the key to the diameter of the shaft (l/d) is
   a. $\pi/4$
   b. $\pi/\sqrt{2}$
   c. $\pi/2$

64. A circular solid rod of diameter d welded to a rigid flat plate by a circular fillet weld of throat thickness t is subjected to a twisting moment T. The maximum shear stress induced in the weld is
   a. $T/\pi td^2$
   b. $2T/\pi td^2$
   c. $4T/\pi td^2$
   d. $2T/\pi td^3$

65. A 6×19 rope implies that there are
   a. 6 wires in each strand and 19 strands in the rope
   b. 6 strands and 19 wires in each strand
   c. 6 large diameter wires and 19 small diameter wires
   d. 19 large diameter wires and 6 small diameter wires

66. Consider the following statements
   1. Flywheel and governor of an engine are the examples of an open loop control system
   2. Governor is the example of closed loop control system
   3. The thermostate of a refrigerator and relief valve of a boiler are the examples of closed loop control system

   Which of these statements is/are correct ?
   a. 1 only
   b. 2 and 3
   c. 3 only
   d. 2 only

67. In a multiple disc clutch if n_1 and n_2 are the number of discs on the driving and driven shafts, respectively, the number of pairs of contact surfaces will be
   a. $n_1 + n_2$
   b. $n_1 + n_2 - 1$
   c. $n_1 + n_2 + 1$
   d. $\dfrac{n_1 + n_2}{2}$

68. Match List I (Gears) with List II (Configurations) and select the correct answer :

   List I
   A. Spur

B. Bevel

C. Helical

D. Mitre

List II

1. Connecting two non-parallel or, intersecting but coplanar shafts.

2. Connecting two parallel and coplanar shafts with teeth parallel to the axis of the gear wheel

3. Connecting two parallel and coplanar shafts with teeth inclined to the axis of the gear wheel

4. Connecting two shafts whose axes are mutually perpendicular to each other

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

69. Two shafts A and B in the same straight line are geared together through an intermediate parallel shaft. The parameters relating to the gears and pinions are given in the table :

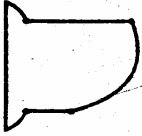| Item	Speed	Teeth	PCD	Module
Driving wheel A	N_A	T_A	D_A	m
Driven wheel B	N_B	T_B	D_B	m
Driven wheel C	N_C	T_C	D_C	m
Driving wheel D on the intermediate shaft, in mesh with B	N_D	T_D	D_D	m

Which of the following relations is not valid for kinematic design considerations ?

a. $\dfrac{N_A}{N_B} = \dfrac{T_C}{T_A} \times \dfrac{T_B}{T_D}$

b. $\dfrac{N_A}{N_B} = \dfrac{T_A}{T_C} \times \dfrac{T_D}{T_B}$

c. $D_A + D_C = D_B + D_D$

d. $T_A + T_C = T_B + T_D$

70. The gears employed for connecting two non-intersecting and non-parallel, i.e., non-coplanar shafts are

a. Bevel gears

b. Spiral gears

c. Helical gears

d. Mitre gears

71. The rolling element bearings are

a. Hydrostatic bearings

b. Squeeze film bearings

c. Antifriction bearings

d. Grease lubrication bearings

72. On the motors with low starting torque, the type of the clutch to be used is

a. Multiple-plate clutch

b. Cone clutch

c. Centrifugal clutch

d. Single-plate clutch with both sides effective

73. Which one of the following is not a friction clutch?

a. Disc or plate clutch

b. Cone clutch

c. Centrifugal clutch

d. Jaw clutch

74. Two-dimensional state of stress at a point in a plane stressed element is represented by a Mohr circle of zero radius. Then both principal stresses

a. are equal to zero

b. are equal to zero and shear stress is also equal to zero

c. are of equal magnitude but of opposite sign

d. are of equal magnitude and of same sign

75. Which of the following materials generally exhibits a yield point?

a. Cast iron

b. Annealed and hot-rolled mild steel

c. Soft brass

d. Cold-rolled steel

76. A cube having each side of length a, is constrained in is all directions and is heated uniformly so that the temperature is raised to T°C. If α is the thermal coefficient of expansion of the cube material and E the modulus of elasticity, the stress developed in the cube is

a. $\alpha TE / \gamma$

b. $\alpha TE /(1 - 2\gamma)$

c. αTE / 2γ

d. αTE /(1 + 2γ)

77. A simply supported beam has equal over-hanging lengths and carries equal concentrated loads P at ends. Bending moment over the length between the supports

a. is zero

b. is a non-zero constant

c. varies uniformly from one support to the other

d. is maximum at mid-span

78. Consider the following statements :

In a cantilever subjected to a concentrated load at the free end

1. The bending stress is maximum at the free end.

2. The maximum shear stress is constant along, the length of the beam.

3. The slope of the elastic curve is zero at the fixed end.

Which of these statements are correct?

a. 1, 2 and 3

b. 2 and 3

c. 1 and 3

d. 1 and 2

79.

The shear stress distribution over a beam cross-section is shown in the figure above. The beam is of

a. Equal flange I-section

b. Unequal flange I-section

c. Circular cross-section

d. T-section

80. Slenderness ratio of a column is defined as the ratio of its length to its

a. Least, radius of gyration

b. Least lateral dimension

c. Maximum lateral dimension

d. Maximum radius of gyration

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

a. Point defect in crystal lattice : Self intersitials

b. Linear defect in crystal lattice : Grain boundary

c. Planar defect in crystal lattice : External surface

d. Volume defect in crystal lattice : Other phases

82. A screw, dislocation

1. Lies parallel to its Burger's vector

2. Lies perpendicular to its Burger's vector

3. Moves in a perpendicular direction to the Burger's vector

4. Moves in an inclined direction to the Burger's vector

Select the correct answer using the codes given below :

a. 1 and 4

b. 1 and 3

c. 2 and 3

d. 2 and 4

83. According to Gibbs' phase rule, the number of degrees of freedom of an eutectic point in a binary system is

a. 1

b. 2

c. 0

d. 3

84. An orthogonal cutting operation is being carried out under the following conditions : cutting speed = 2 m/s, depth of cut = 0.5 mm, chip thickness = 0.6 mm. Then the chip velocity is

a. 2.0 m/s

b. 2.4 m/s

c. 1.0 m/s

d. 1.66 m/s

85. The angle of inclination of the rake face with respect to the tool base measured in a plane, perpendicular to the base and parallel to the width of the tool is called

a. Back rake angle

b. Side rake angle

c. Side cutting edge angle

d. End cutting edge angle

86. The correct sequence of cutting tools in the ascending order of their wear resistance is
    a. HSS-Cast non-ferrous alloy (Stellite)-Carbide-Nitride
    b. Cast non-ferrous alloy (Stellite)-HSS-Carbide-Nitride
    c. HSS-Cast non-ferrous alloy (Stellite)-Nitride-Carbide
    d. Cast non-ferrous alloy (Stellite)-Carbide-Nitride-HSS

87. In orthogonal cutting test, the cutting force = 900 N, the thrust force = 600 N and chip shear angle is 30°. Then the chip shear force is
    a. 1079.4 N
    b. 969.6 N
    c. 479.4 N
    d. 69.6 N

88. The time taken to face a work piece of 72 mm diameter, if the spindle speed is 80 r.p.m. and cross-feed is 0.3 mm/rev, is
    a. 1 .5 minutes
    b. 3.0 minutes
    c. 5.4 minutes
    d. 8.5 minutes

89. The purpose of helical grooves in a twist drill is to
    1. Improve the stiffness,
    2. Save a tool, material ,
    3. Provide space for chip removal
    4. Provide rake angle for the cutting edge
    Select the correct answer using the codes given below :
    a. 1 and 2
    b. 2 and 3
    c. 3 and. 4
    d. 1 and 4

90. Which one of the following is not a synthetic abrasive material?
    a. Silicon Carbide
    b. Aluminium Oxide
    c. Titanium Nitride
    d. Cubic Boron Nitride

91. In milling machine, the cutting tool is held in position by
    a. Chuck
    b. Spindle
    c. Arbor
    d. Tool holder

92. A spur gear of 40 teeth is machined in a gear hobbing machine using a double start hob cutter. The speed ratio between the hob and the blank is
    a. 1 : 20
    b. 1 : 40
    c. 40 : 1
    d. 20 : 1

93. Match List I (Materials) with List II (Machining) and select the correct answer:
    List I
    A. Machining of conducting materials
    B. Ruby rod
    C. Electrolyte
    D. Abrasive slurry
    List II
    1. ECM
    2. EDM
    3. USM
    4. LBM

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

94. Cold working produces the following effects:
    1. Stresses are set up in the metal
    2. Grain structure gets distorted
    3. Strength and hardness of the metal are decreased
    4. Surface finish is reduced
    Which of these statements are correct?
    a. 1 and 2
    b. 1, 2 and 3
    c. 3 and 4
    d. 1 and 4

95. A gatting ratio of 1 : 2 : 4 is used to design the gating system for magnesium alloy casting. This gating ratio to the cross-

section areas of the various gating elements as given below :

1. Down sprue
2. Runner bar
3. Ingates

The correct sequence of the above elements in the ratio 1 : 2 : 4 is

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

96. Match List I (Products) with List II (Casting process) and select the correct answer :

List I

A. Hollow statues
B. Dentures
C. Aluminium alloy pistons
D. Rocker arms

List II

1. Centrifugal Casting
2. Investment Casting
3. Slush Casting
4. Shell Moulding
5. Gravity Die Casting

	A	B	C	D
a.	3	2	4	5
b.	1	3	4	5
c.	1	2	3	4
d.	3	2	5	4

97. Match List I (Welding Defects) with List II (Causes) and select the correct answer :

List I

A. Spatter
B. Distortion
C. Slag inclusion

List II

1. Damp electrodes
2. Arc blow
3. Improper cleaning in multipass welding
4. Poor joint selection

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

98. High speed electron beam of electron beam welding is focused on the weld spot using

a. Vacuum lens
b. Inert gas lens
c. Optical lens
d. Magnetic lens

99. In resistance welding, heat is generated due to the resistance between

a. Electrode and workpiece
b. Asperities between touching plates
c. Two dissimilar metals being in contact
d. Interatomic forces

100. A forging method for reducing the diameter of a bar and in the process making it longer is termed as

a. Fullering
b. Punching
c. Upsetting
d. Extruding

101. Consider the following steps in forging a connecting rod from the bar stock :

1. Blocking
2. Trimming
3. Finishing
4. Edging

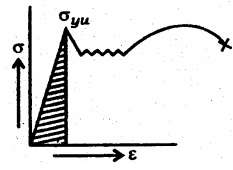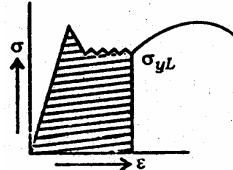Select the correct sequence of these operations using the codes given below:

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

102. The extrusion process(es) used for the production of toothpaste tube is/are

1. Tube extrusion
2. Forward extrusion
3. Impact extrusion

Select the correct answer using the codes given below :

a. 1 only
b. 1 and 2

c. 2 and 3

d. 3 only

103. A circular shaft subjected to twisting moment results in maximum shear stress of 60 MPa. Then the maximum compressive stress in the material is

   a. 30 MPa

   b. 60 MPa

   c. 90 MPA

   d. 120 MPa

104. One-half length of 50 mm diameter steel rod is solid while the remaining half is hollow having a bore of 25 mm. The rod is subjected to equal and opposite torque at its ends. If the maximum shear stress in solid portion is τ, the maximum shear stress in the hollow portion is

   a. $(15/16)\,\tau$

   b. τ

   c. $(4/3)\,\tau$

   d. $(16/15)\,\tau$

105. A thick cylinder with internal diameter d and outside diameter 2d is subjected to internal pressure p. Then the maximum hoop stress developed in the cylinder is

   a. p

   b. $(2/3)\,p$

   c. $(5/3)p$

   d. 2p

106. The volumetric strain in case of a thin cylindrical shell of diameter d, thickness t, subjected to internal pressure p is

   a. $\dfrac{pd}{2tE}\cdot(3-2\mu)$

   b. $\dfrac{pd}{3tE}\cdot(4-3\mu)$

   c. $\dfrac{pd}{4tE}\cdot(5-4\mu)$

   d. $\dfrac{pd}{4tE}\cdot(4-5\mu)$

   (where E = Modulus of elasticity, μ = Poisson's ratio for the shell material)

107. The commonly used technique of strengthening thin pressure vessel is

   a. Wire winding

   b. Shrink fitting

   c. Auto-frettage

   d. Multi-layered construction

108. Under axial load, each section of a close-coiled helical spring is subjected to

   a. Tensile stress and shear stress due to load

   b. Compressive stress and shear stress due to torque

   c. Tensile stress end shear stress due to torque

   d. Torsional and direct shear stresses

109. A bar having length L and Uniform cross-section with area A is subjected to both tensile force P and torque T. If G is the shear modulus and E is the Young's modulus, the internal strain energy stored in the bar is

   a. $\dfrac{T^2L}{2GJ}+\dfrac{P^2L}{AE}$

   b. $\dfrac{T^2L}{GJ}+\dfrac{P^2L}{2AE}$

   c. $\dfrac{T^2L}{2GJ}+\dfrac{P^2L}{2AE}$

   d. $\dfrac{T^2L}{GJ}+\dfrac{P^2L}{AE}$

110. Toughness for mild steel under uniaxial tensile loading is given by the shaded portion of the stress-strain diagram as shown in

a.

b.

c.

d.
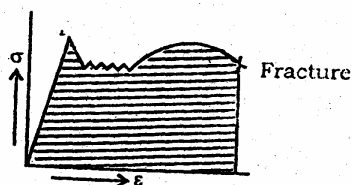
111. Monel metal is an alloy of
    a. Iron and carbon
    b. Copper and zinc
    c. Aluminium and copper
    d. Copper and nickel

112. Primary object of full annealing is to
    a. Increase toughness and yield point
    b. Reduce ductility and resilience
    c. Remove foreign impurities and improve surface finish
    d. Increase ductility and machinability

113. Globular form of cementite in the structure of steel is Obtained through
    a. Normalising
    b. Malleabilising
    c. Spheroidising
    d. Carbonising

114. Gunmetal, which is used in journal bearings, contains
    a. 88% Cu, 10% Sn, 2% Zn
    b. 80% Cu, 10% Zn, 10% Al
    c. 85% Cu, 5%, Mg, 10% Al
    d. 85% Cu, 5% Sn, 10% Pb

115. The correct sequence of elements of 18-4-1 HSS tool is
    a. W, Cr, V
    b. Mo, Cr, V
    c. Cr, Ni, C
    d. Cu, Zn, Sn

116. Teflon is a
    a. Thermosetting fluorocarbon polymer
    b. Thermo-plastic fluorocarbon polymer
    c. Inorganic compound of fluorine and carbon
    d. Laminated phenolic material

117. In the case of rubber, vulcanization refers to the process of producing a
    a. Linear polymer
    b. Branched polymer
    c. Cross-linked polymer
    d. Net work polymer

118. Polyesters can be defined as the condensation products of
    a. Dicarboxylic acids with dihydroxy alcohols
    b. Bisphenol-A and epichlorohydrin
    c. Phenol and formaldehydrin
    d. Benzene and toluene

119. The coordination number for FCC crystal structure is
    a. 4
    b. 8
    c. 12
    d. 16

120. Match List I (Crystal Structure) with List II (Example) and select the correct answer:

    List I
    A. Simple Cubic
    B. Body-centered Cubic
    C. Face-centered Cubic
    D. Hexagonal Close Packed

    List II
    1. Zinc
    2. Copper
    3. Alpha iron at room temperature
    4. Manganese

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