MECHANICAL ENGINEERING

PAPER–II

1. Match List I with List II and select the correct answer using the codes given below the Lists

List I

A. Open loop system

B. Closed loop system

C. Step input

D. Sinusoidal input

List II

1. Frequency domain analysis
2. More stable
3. Less stable
4. Time domain analysis

Codes;

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

2. Consider the following statements regarding improvement of efficiency of worm gear drive

1. Efficiency can be improved by increasing the spiral angle of worm thread to 450 or more
2. Efficiency can be improved by adopting proper lubrication
3. Efficiency can be improved by adopting worm diameter as small as practicable to reduce sliding between worm-threads and wheel teeth
4. Efficiency can be improved by adopting convex tooth profile both for worm and wheel

Which of the statements given above are correct?

a. 1, 2 and 3

b. 1, 2 and 4

c. 2, 3and 4

d. 1, 3 and 4

3. Match List I (Items in joints) with List II (Type of failure) and select the correct answer using the codes given below the Lists

List I

A. Bolts in bolted joints of engine cylinder cover plate

B. Cotter in potter joint

C. Rivets in lap joints

D. Bolts holding two flanges in a flange coupling

List II

1. Double transverse shear
2. Torsional shear
3. Single transverse shear
4. Tension

Codes;

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

4. Which one of the following statements is correct?

While designing a parallel sunk key it is assumed that the distribution of force along the length of the key

a. Varies linearly

b. Is uniform throughout

c. Varies exponentially, being more at the torque input end

d. Varies exponentially, being less at torque output end

5. match list I (Different systems) with List II (Associated terminology) and select the correct answer using the codes given below the lists:

List I

A. Riveted joints

B. Welded joints

C. Leaf springs

D. Knuckle joints

List II

1. Nipping

2. Angular movement
3. Fullering
4. Fusion

Codes;

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

6. In a cotter joint, the width of the cotter at the centre is 50 mm and its thickness is 12 mm. The load acting on the cotter is 60 kN. What is the shearing stress developed in the cotter?
   a. 120 N/mm^2
   b. 100 N/mm^2
   c. 75 N/mm^2
   d. 50 N/mm^2
7. Match List I (Coupling) with List II (Purpose) and select the correct answer using the codes given below the Lists:

   List I

   A. Muff coupling
   B. Flange coupling
   C. Oldham's coupling
   D. Hooker's joint

   List II

   1. To transmit power between two parallel shafts
   2. To transmit power between two intersecting shafts with flexibility
   3. For rigid connection between two aligned shafts for power transmission
   4. For flexible connection between two shafts with some misalignment for transmitting power

   Codes;

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

8. Which one of the following is the correct expression for the torque transmitted by a conical clutch of outer radius R, inner radius r and semi—cone angle u. assuming uniform pressure? (Where W = total axial load and μ = coefficient of friction)
   a. $\dfrac{\mu W(R+r)}{2\sin\alpha}$
   b. $\dfrac{\mu W(R+r)}{3\sin\alpha}$
   c. $\dfrac{2\mu W(R^3-r^3)}{3\sin\alpha(R^2-r^2)}$
   d. $\dfrac{3\mu W(R^3-r^3)}{4\sin\alpha(R^2-r^2)}$
9. Which one of the following is the value of helix angle for maximum efficiency of a square threaded screw?

   $\phi = \tan^{-1} u$)

   a. $45° + \phi$
   b. $45° - \phi$
   c. $45° - \phi/2$
   d. $45° + \phi/2$
10. Which types of gears are used for shaft axes having an offset?
    a. Mitre gears
    b. Spiral bevel gears
    c. Hypoid gears
    d. Zerol gears
11. Which one of the following statements is correct?

    Certain minimum number of teeth on the involute pinion is necessary in order to

    a. provide an economical design
    b. avoid interference
    c. reduce noise in operation
    d. overcome fatigue failure of the teeth
12. Match List I (Types of gear failure) with List II (Reasons) and select the correct answer using the codes given below the Lists

    List I

    A. Scoring
    B. Pitting
    C. Scuffing
    D. Plastic flow

    List II

    1. Oil film breakage,
    2. Yielding of surface under heavy loads
    3. Cyclic loads causing high surface stress
    4. Insufficient lubrication

    Codes:

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

13. A helical gear has the active face width equal to b pitch p and helix angleα. What should be the minimum value of b in order that contact is maintained across the entire active face of the gear?
    a. $p\cos\alpha$
    b. $p\sec\alpha$
    c. $p\tan\alpha$
    d. $p\cot\alpha$

14. Which one of the following statements is correct?
    Shifts used in heavy duty speed reducers are generally subjected to
    a. bending stress only
    b. shearing stress only
    c. combined bending and shearing stresses
    d. bending, shearing and axial thrust simultaneously

15. The diameter of a shaft is increased from 30 mm to 60 mm, all other conditions remaining unchanged. How many times is its torque carrying capacity increased?
    a. 2 times
    b. 4 times
    c. 8 times
    d. 16 times

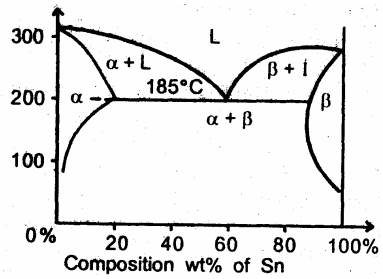
16. It is seen from the curve that there is a minimum value of the coefficient of friction (μ) for a particular value of the Bearing Characteristic Number denoted by α. What is this value of the Bearing Characteristic Number called?
    a. McKee Number
    b. Reynolds Number
    c. Bearing Modulus
    d. Summerfield Number

17. An iron — carbon binary alloy has 0.5% C by weight.
    What is this alloy called?
    a. Eutectoid alloy
    b. Eutectic alloy
    c. Hypo eutectoid alloy
    d. Hypereutectoid alloy

18. Match List I (Name of alloy) with List II (Major alloying elements) and select the correct answer using the codes given below the Lists:
    List I
    A. Invar
    B. Hadfield steel
    C. Stellite
    D. Stainless steel
    List II
    1. Manganese
    2. Chromium
    3. Nickel
    4. Tungsten
    5. Molybdenum
    Codes:

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

19. Consider the following lead – tin phase diagram given below:



    For which one of the following alloy compositions, the alloy will have the lowest melting point at 185°C?
    a. 20% Sh and 80% Pb by weight
    b. 60% Sn and 40% Pb by weight
    c. 97% Sn and 3% Pb by weight
    d. 40% Sn and 60% Pb by weight

20. Match List I (Name of treatment) with List II (Media used) and select the correct answer using the odes given below the Lists
    List
    A. Pack carburizing
    B. Gas carburizing
    C. Cyaniding
    D. Nitriding
    List II
    1. Ammonia gas
    2. Sodium cyanide

3. Carburizing compound
4. Ethane

Codes;

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

21. Consider the following pairs:

Heat treatment and Effects on medium carbon steel

1. Normalizing: Grain refinement
2. Full annealing: Uniform grain structure
3. Martempering: Decreased ductility
4. Spheroldizing: Maximum softness

Which of the pairs given above are correctly matched?

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

22. Match List I (material) with List II (Typical use) and select the correct answer using the codes given below the List:

List I

A. Branched polyethylene
B. Polyester
C. Polyvinylidene chloride
D. Linear Polyethylene

List II

1. Bottles
2. Textile fibres
3. Films for packaging
4. Transparent film

Codes;

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

23. Match List I (Type of moulding) with List II (mechanism involved) and select the correct answer using the codes given below the Lists:

List I

A. Compression moulding
B. Injected moulding
C. Jet moulding
D. Extrusion moulding

List II

1. Mould cavity must be heated to cure the plastic forced into it
2. Similar to Hydraulic extrusion
3. Analogous to hot pressing of powdered metals
4. Analogous to die casting of metals

Codes;

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

24. Match List I (Steel type) with List II (Product) and select the correct answer using the codes given below the Lists

List I

A. Mild steeJ
B. Tool steel
C. Medium carbon steel
D. High carbon steel

List II

List II

1. Screws
2. Commercial beams
3. Crane hooks
4. Blanking dies

Codes;

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

25. Match List I (Alloy) with List II (Application) arid select the, correct answer using the codes given below the Lists:

List I

A. Silicon steel
B. High carbon steel
C. High speed steel
D. Monel metal

List II

1. Marine bearings
2. Cutting tools
3. Springs
4. Transformer laminations

Codes;

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

26. Consider the following statements

In comparison to hot working, in cold working,

1. higher forces are required
2. no heating is required
3. less ductility is required
4. better surface finish is obtained

Which of the statements given above are correct?

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

27. Consider the following factors :

1. Size and shape that can' be produced economically
2. Porosity of the parts produced
3. Available press capacity '
4. High density

Which of the above are limitations of powder metallurgy?

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

28. Match List I (Welding problems) with List II (Causes) and select the correct answer using the codes given below the Lists

List I

A. Cracking of weld metal
B. Cracking of base metal
C. Porosity
D. Inclusions

List II

1. Excessive stresses
2. High joint rigidity
3. Failure to remove slag from previous deposit
4. Oxidation
5. Excessive H_2, O_2, N_2, in the welding atmosphere

Codes;

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

29. Consider the following statements:

The size of the heat affected zone (HAZ) will increase with

1. increased st&ting temperature
2. increased welding speed
3. increased thermal conductivity of the' base metal
4. increase in base metal thickness

Which of the statements given above are correct?

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

30. Consider the following statements: The magnitude of residual stresses 'in welding depends upon

1. design of weldment
2. support and clamping of components
3. welding process used
4. amount of metal melted/deposited

Which of the statements given above are correct?

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

31. The cutting speed of a milling cutter while cutting brass is

a. 45 to 60 m/mm
b. 30 to 40 m/mm
c. 25 to 35 m/mm
d. 15 to 20 m/mm

32. In a machining operation chip thickness ratio is 0.3 and the back rake angle of the tool is. 100. What is the value of the shear strain?

a. 0.31
b. 0.13
c. 3.00
d. 3.34

33. Consider the following statements:

The helical flute in a twist drill provides the necessary

1. clearance angle for the cutting edge
2. rake angle for the cutting edge
3. space for the chip to come out during drilling
4. guidance for the drill to enter into the work piece

Which of the statements given above are correct?

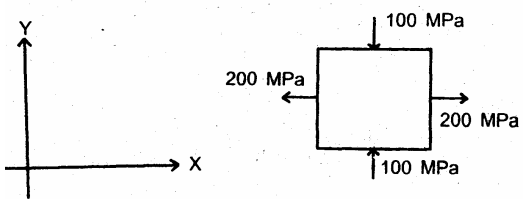
a. 1 and 2
b. 2 and 3
c. 3 and 4
d. 1 and 4

34. Which one of the following statements is correct?

Antifriction bearings are

a. sleeve bearings
b. gas lubricated bearings
c. ball and roller bearings
d. journal bearings

35. Consider a two dimensional state of stress given for an element as shown in the diagram given below



What are the coordinates of the centre of Mohr's circle?

a. (0, 0)
b. (100, 200)
c. (200, 100)
d. (50, 0)

36. The modulus of elasticity for a material is 200 GN/m^2 and Poisson's ratio is 025.

What is the modulus of rigidity?

a. 80 GN/m^2
b. 125 GN/m^2
c. 250 GN/m^2
d. 320 GN/m^2

37. Which one of the following is correct in respect of Poisson's ratio (v) limits for an isotropic elastic solid?

a. $- \leq v \leq \infty$
b. $1/4 \leq v \leq 1/3$
c. $1 \leq v \leq 1/2$
d. $1/2 \leq v \leq 1/2$

38. A bar of length L tapers uniformly from diameter 1.1 D at one end to 0.9 D at the other end. The elongation due to axial pull is computed using mean diameter D. What is the approximate error in computed elongation?

a. 10%
b. 5%
c. 1%
d. 0.5%

39. A bar of copper and steel form a composite system. They are heated to a temperature of 40°C. What type of stress is induced in the copper bar?

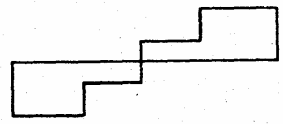
a. Tensile
b. Compressive
c. Both tensile and compressive
d. Shear

40. A cube with a side length of 1 cm is heated uniformly 1°C above the room temperature and all the sides are free to expand. What will be the increase in volume of the cube? (Given coefficient of thermal expansion is a per °C)

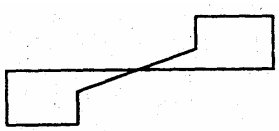
a. 3 α cm^3
b. 2 a cm^3
c. α cm^3
d. zero

41. A beam of length 4 L is simply supported on two supports with equal overhangs of L on either sides and carries three equal loads, one each at free ends and the third at the mid--span. Which one of the following diagrams represents correct distribution of shearing force on the beam?

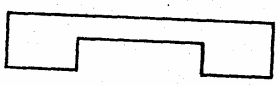
a.



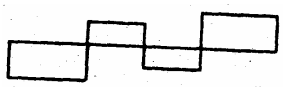
b.



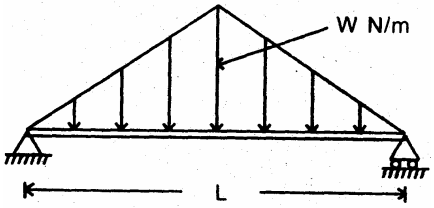
c.



d.



42. A simply supported beam is subjected to a distributed loading as shown in the diagram given below



What is the maximum shear force in the beam?

a. WL/4
b. WL/2
c. WL/3
d. WL/6

43. A cantilever beam of length *l* is subjected to a concentrated load P at a distance of *l*/3 from the free end. What is the deflection of the free end of the beam? (E*l* is the flexural rigidity)

a. $\frac{2Pl^3}{81El}$
b. $\frac{3Pl^3}{81El}$
c. $\frac{14Pl^3}{81El}$
d. $\frac{15Pl^3}{81El}$

44. What is the nature of distribution of shear stress in a rectangular beam?

a. Linear
b. Parabolic
c. Hyperbolic
d. Elliptic

45. A solid circular rod AB of diameter D and length L is fixed at both ends. A torque T is applied at a section X such that AX = L/4 and BX = 3L/4. What is the maximum shear stress developed in the rod?

a. $16\ T/\pi\ D^3$
b. $12\ T/\pi\ D^3$
c. $8\ T/\pi\ D^3$
d. $4\ T/\pi\ D^3$

46. A spring with 25 active coils cannot be accommodated within a given space. Hence 5 coils of the spring are cut. What is the stiffness of the new spring?

a. Same as the original spring.
b. 1.25 times the original spring
c. 0.8 times the original spring
d. 0.5 times the original spring

47. A closely coiled helical spring of 20 cm mean diameter is having 25 coils of 2 cm diameter rod. The modulus of rigidity of the material if 10^7 N/cm^2. What is the stiffness for the spring in N/cm?

a. 50
b. 100
c. 250
d. 500

48. A shaft is subjected to simultaneous action of a torque T, bending moment M and an axial thrust F. Which one of the following statements is correct for this situation?

a. One extreme end of the vertical diametral fibre is subjected to maximum compressive stress only
b. The opposite extreme end of the vertical diametral fibre is subjected to tensile/compressive stress only
c. Every point on the surface of the shaft is subjected to maximum shear stress only
d. Axial longitudinal fibre of the shaft is subjected to compressive stress only

49. A member is subjected to the combined action of bending moment 400 Nm and torque 300 Nm. What respectively are the equivalent bending moment and equivalent torque?

a. 450 Nm and 500 Nm
b. 900 Nm and 350 Nm
c. 900 Nm and 500 Nm
d. 400 Nm and 500 Nm

50. Match List I with Lint II and select the correct answer using the codes given below the Lists:

List I

A. Wire winding
B. Lame's theory
C. Solid sphere subjected to uniform pressure on the surface
D. Autofrettage

List II

1. Hydrostatic stress

2. Strengthening of thin cylindrical shell
3. strengthening of thick cylindrical shell
4. Thick cylinders

Codes;

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

51. A thin cylindrical shell of diameter d length *l* and thickness t is subjected to an internal pressure p. What is the ratio of longitudinal strain to hoop strain in terms of Poisson's ratio (1/m)?

a. $\frac{m-2}{2m+1}$

b. $\frac{m-2}{2m-1}$

c. $\frac{2m-1}{m-2}$

d. $\frac{2m+1}{m-1}$

52. A thick cylinder of internal radius a and external radius b is subjected to internal pressure p as well as external pressure p Which One of the following statements is correct?

The magnitude of circumferential stress developed is

a. maximum at radius r = a
b. maximum at radius r b
c. maximum at radius r = $\sqrt{ab}$
d. constant

53. Pour columns of same material and same length are of rectangular cross—section of same breadth b. The depth of the cross—section and the end conditions are, however different are given as follows

Column	***Depth***	***End conditions***
1. 0.6	b	Fixed—Fixed
2. 0.8	b	Fixed—hinged
3. 1.0	b	Hinged—Hinged
4. 2.6	b	Fixed—Free

Which of the above columns has the maximum value of Euler buckling load?

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

54. A metal has FCC structure. Suppose its atomic weight and atomic radius is A and r respectively. Let N denotes Avogadro's number. What is the density of the material?

a. $\frac{A}{2\sqrt{2}r^3N}$

b. $\frac{A}{4\sqrt{2}\,r^3N}$

c. $\frac{A}{8\sqrt{2}\,r^3N}$

d. $\frac{A}{16\sqrt{2}\,r^3N}$

55. Consider the following temperature ranges:

1. Room temperature
2. 0 to 9 10°C
3. 910°C to 1400°C
4. 1400°C to below melting point

In which of the above temperature ranges ferrite with body centered cubic structure is indicated in the Fe-Fe_3C phase diagram?

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

56. Consider the following statements with respect to control charts for attributes

1. The lower control limit is non-negative
2. Normal distribution is the order for this data
3. The lower control limit is not significant
4. These charts give the average quality characteristics

Which of the statements given above are correct?

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

57. In case of solution of a two variable linear programming problem by graphical method one constraint line comes parallel to the objective function line. Which one of the following is correct? The problem will have

a. infeasible solution

b. unbounded solution
c. degenerate solution
d. infinite number of optimal solutions

58. Match List I (Techniques / Methods) with List II (Models) and select the correct answer using the codes given below the Lists

List I
A. Vogel's approximation method
B. Floods technique
C. Two phase4flethEd
D. Crashing

List II
1. Assignment model
2. Transportation model
3. PERT and CPM
4. Linear programming

Codes;

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

59. The maximum distortion energy theory of failure is suitable to predict the failure of which one of the following types of materials?
a. Brittle materials
b. Ductile materials
c. Plastics
d. Composite materials

60. Which one of the following conditions should be satisfied for the application of optimality test on an initial solution of transportation model?
a. Number of allocations should be less then m + n - 1
b. Number of allocations should be equal to m + n - 1
c. Number of allocations should be equal to m + n
d. Number of allocations should be more than m + n

61. Customers arrive at a counter randomly at the rate of 6 customers per hour. The service is provided at the counter by a server. The mean time of the service is 4 minutes per customer. The services are exponentially distributed. What is the probability that a newly arrived customer has to wait?
a. 0.40
b. 0.6
c. 0.66
d. 0.8

62. Which one of the following statements is correct?

Queuing theory is applied best in situations where
a. Arrival rate of customers equal to service rate
b. Average service time is greater than average arrival time
c. There is only one channel of arrival at random and the service time is constant
d. The arrival and service rate cannot be analyzed through any standard statistical distribution

63. Match List I (Symbols in Flowcharts) with List II (Actions) and select the correct answer using the codes given below the lists:

List I
A. Parallelogram
B. Diamond shaped box
C. Ellipse
D. Rectangle

List II
1. Decision
2. Stop
3. Processing
4. Input/output

Codes;

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

64. Which one of the following statements is correct?

If the size of a flywheel in a punching machine is increased
a. then the fluctuation of speed and fluctuation of energy will both decrease
b. then the fluctuation of speed will decrease and the fluctuation of energy will increase

c. then the fluctuation of speed will increase and the fluctuation of energy will decrease

d. then the fluctuation of speed and fluctuation of energy both will increase

65. Which one of the following drives is used for a constant velocity ratio, positive drive with large centre distance between the driver and driven shafts?

a. Gear drive

b. Flat belt drive.

c. Chain drive

d. V -belt drive

66. What is the value of the radius of gyration of disc type flywheel as compared to rim type flywheel for the same diameter?

a. $\sqrt{2}$ times

b. $1/\sqrt{2}$ times

c. 2 times

d. 1/2 times

67. Consider the following statements

1. RAM is the place in a computer where the operating system, application programs, and data in current use are kept
2. Data in RAM stays there only as long as the computer is running

Which of the statements given above is/are correct?

a. 1 only

b. 2 only

c. Both 1 and 2

d. Neither 1 nor 2

68. A circular rod of diameter d is welded to a flat plate along its circumference by fillet weld of thickness t Assubming τ_w as the allowable shear stress for the weld material, what is the value of the safe torque that can be transmitted?

a. $\pi d^2.t.\tau_w$

b. $\frac{\pi d^2}{2} t\ \tau_w$

c. $\frac{\pi d^2}{2\sqrt{2}} t\ \tau_w$

d. $\frac{\pi d^2}{\sqrt{2}} t\ \tau_w$

69. The rated life of a ball bearing varies inversely as which one of the following?

a. load

b. $(\text{load})^2$

c. $(\text{load})^3$

d. (load)3.33

70. Assuming atoms to be perfect spheres, what is the value of the highest possible atomic packing factor (APE) in metals?

a. 0.95

b. 0.74

c. 0.66

d. 0.5

71. For improving the strength of steel at elevated temperatures, which one of the following alloying element is used?

a. Copper

b. Tungsten

c. Aluminium

d. Zinc

72. Consider the following statements

1. The operating system must be designed to work with the particular processor's set of instructions
2. The term processor has generally replaced the term CPU

Which of the statements given above is/are correct?

a. 1 only

b. 2, only

c. Both 1 or 2

d. Neither 1 nor 2

73. Consider the following statements:

1. The data in ROM is lost when the computer power is turned off
2. ROM contains the programming that allows the computer to be booted up each time it is turned on

Which of the statements given above is/are correct?

a. 1 only

b. 2 only

c. Both 1 or 2

d. Neither 1 nor 2

74. Assertion (A): All motor vehicles have differential gear mechanism at the back axle.

Reason (R): This mechanism is fitted to enable the vehicles to run on bumpy roads.

a. Both A and R are individually true and R. is the correct explanation of A

b. Both A and Rare 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

75. Assertion (A): A sound welded joint should not only be strong enough but should also exhibit a good amount of ductility.
Reason (R): Welding process is used for fabricating mild steel components only.
a. Both A and R are individually true and R. is the correct explanation of A
b. Both A and Rare 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

76. Assertion (A): Ductile materials generally absorb more impact loading than a brittle material.
Reason (R): Ductile materials generally have higher ultimate strength than brittle materials.
a. Both A and R are individually true and R. is the correct explanation of A
b. Both A and Rare 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

77. Assertion (A): Cold working of metals results in increase of strength and hardness.
Reason (R): Cold working reduces the total number of dislocations per unit volume of the material
a. Both A and R are individually true and R. is the correct explanation of A
b. Both A and Rare 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

78. Assertion (A): In electron beam welding process, vacuum is an essential process parameter
Reason (R): Vacuum provides a highly efficient shield on weld zone.
a. Both A and R are individually true and R. is the correct explanation of A
b. Both A and Rare 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

79. Assertion (A): The ratio of uncut chip thickness to actual chip thickness is always less than one and is termed as cutting ratio in orthogonal cutting.
Reason (R): The frictional force is very high due to the occurrence of sticking friction rather than sliding friction.
a. Both A and R are individually true and R. is the correct explanation of A
b. Both A and Rare 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

80. One brand of milling machine has the following two index plates supplied along with the indexing head :
Plate 1 : 15, 16, 17, 18, 19, 20 hole circles.
Plate 2 : 21, 23, 27, 29, 31, 33 hole circles.
It is proposed to mill a spur gear of 28 teeth using simple indexing method. Which one of the following combinations of index plate and number of revolutions is correct?
a. Plate 1: 1 revolution and 9 holes in 18 hole circles
b. Plate 2 : 1 revolution and 9 holes in 21 hole circles
c. Plate 2 : 1 revolution and 9 holes in 33 hole circles
d. Plate 1: 1 revolution and 9 holes in 15 hole circles

81. Match List I (Cutting tools) with List II (Features) and select the correct answer using the codes given below the Lists:
List I
A. Turning tool
B. Reamer
C. Milling cutter
List II
1. Chisel edge
2. Flutes
3. Axial relief
4. Side relief
Codes;

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

82. Match List I (Milling problem) with List II (Probable causes) and select the correct answer using the codes given below the Lists

List I

A. Chatter
B. Poor surface finish
C. Loss of accuracy
D. Cutter burrs

List II

1. Too high feed
2. Lack of rigidity in machine, fixtures, bar or workplace
3. High cutting load
4. Radial relief too great
5. Not enough lubricant

Codes;

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

83. Consider the following characteristics

1. Single machine tool
2. Manual materials handling system
3. Computer control
4. Random sequencing of parts to machines

Which of the above characteristics are associated with flexible manufacturing system?

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

84. Consider the following statements with respect to the relief angle of cutting tool

1. This affects the direction of chip flow
2. This reduces excessive friction between the tool and work piece
3. This affects tool life
4. This allows better access of coolant to the tool — work piece interface

Which of the statements given above are correct?

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

85. Consider the following statements :

During the third stage of tool—wear, rapid deterioration of tool edge takes place because

1. flank wear is only marginal
2. flank wear is large
3. temperature of the tool increases gradually
4. temperature of the tool increases drastically

Which of the statements given above are correct?

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

86. Match List I with List II and select the correct answer using the codes given below the Lists

List I

A. Plan approach angle
B. Rake angle
C. Clearance angle
D. Wedge angle

List II

1. Tool face
2. Tool flank
3. Tool face and flank
4. Cutting edge.
5. Tool nose

Codes;

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

87. Match List I (Cutting tool materials) with List II (manufacturing methods) and select the correct answer using the codes given below the Lists:

List I

A. HSS
B. Stellite
C. Cemented carbide
D. UCON

List II

1. Casting
2. Forging
3. Rolling

4. Extrusion
5. Powder metallurgy

Codes;

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

88. The rake angle of a cutting tool is 15°, shear angle 45° and cutting velocity 35 m/min. What is the velocity of chip along the tool face?
   a. 28.5 m/min
   b. 27.3 m/min
   c. 25.3 m/min
   d. 23.5 m/min

89. A medium carbon steel workpiece is turned on a lathe at 50 m/mm cutting speed, 0 8 mm/rev feed and 1 5 mm depth of cut. What is the rate of metal removal?
   a. 1000 mm^3/min
   b. 60,000 mm^3/min
   c. 20,000 mm^3/min
   d. Can not be calculated with the given data

90. Consider the following statements
   1. As the cutting speed increases, the cost of production initially reduces, then after an optimum cutting speed it increases
   2. As the cutting speed increases the cost of production also increases and after a critical value it reduces
   3. Higher feed rate for the same cutting speed reduces cost of production
   4. Higher feed rate for the same cutting speed increases the cost of production

   Which of the statements given above is/are correct?
   a. 1 and 3
   b. 2 and 3
   c. 1 and 4
   d. 3 only

91. Match List I (Machining processes) with List II (Operating media) and select the correct answer using the codes given below the Lists

   List I
   A. Abrasive jet machining
   B. Electron beam machining
   C. Electro—chemical machining
   D. Electro—discharge machining

   List II
   1. Dielectric
   2. Electrolyte
   3. Abrasive slurry
   4. Vacuum
   5. Air

   Codes;

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

92. Consider the following fits
   1. I.C. engine cylinder and piston.
   2. Ball bearing outer race and housing
   3. Ball bearing inner race and shaft

   Which of the above fits are based on the shaft basis system?
   a. 1 and 2
   b. 2 and 3
   c. 1 and 3
   d. 1, 2 and 3

93. Consider the following alignment tests on' machine tools
   1. Straightness
   2. Flatness
   3. Run out
   4. Parallelism

   Which of the above alignment tests on machine toots are common to both lathe and shaper?
   a. 1 and 2
   b. 2 and 3
   c. 3 and 4
   d. 1 and 4

94. It is given that the' actual demand is 59 units; a previous for cast 64 units and smoothening factor 0.3. What will be the forecast for next period, using exponential smoothing?
   a. 36.9 units
   b. 57.5 units
   c. 60.5 units
   d. 62.5 units

95. The' demand for a product in the month of March turned out to be 20 units against an earlier made forecast of 20 units. The

actual demand for April and May turned to be 25 and 26 units respectively. What will be the for cast for the month of June, using exponential smoothing method and taking smoothing constant a as 0.2?

a. 20 units
b. 22 units
c. 26 units
d. 28 units

96. Consider' the following statements:

1. Preparation of master production schedule is an iterative process '
2. Schedule charts are made with .respect to jobs while load charts are made with respect to machines
3. MRP is done before master production scheduling

Which of the statements given above are correct?

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

97. Match List I (PPC functions) with List II (Activity) and select the correct answer using the codes given below the Lists

List I

A. Capacity planning
B. Shop floor control
C. Master production schedule
D. Material requirement planning

List II

1. Listing products to be assembled and when to be delivered
2. Rescheduling orders based on production priorities
3. Closure tolerances
4. Monitor progress of orders and, report their status
5. Planning of labour and equipment

Codes;

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

98. Process X has fixed cost of Rs. 40,000 and variable cost of Rs. 9 per unit whereas process Y has fixed cost of Rs. 16,000 and variable cost of Rs. 24 per unit. At what production quantity, the total cost of X and Y are equal?

a. 1200 units
b. 1600 units
c. 2000 units
d. 2400 units

99. Which one of the following information combinations has lowest break—even point?

	Fixed cost (in Rs.)	***Variable cost /unit (in Rs.)***	***Revenue/ unit (in Rs.)***
a.	30,000	10	40
b.	40,000	15	40
c.	50,000	20	40
d.	60,000	30	40

100. A company has four work centers A, B, C and D, with per day capacities of 450 units, 390 units, 360 units and 400 units respectively. The machines are laid down in order A, B, C, and D and product has to be operated on all these machines for getting converted into finished product. The actual output turns to be 306 units per day. What is the system efficiency?

a. 68%
b. 78%
c. 80%
d. 85%

101. Consider the following statements with respect to PERT:

1. It consists of activities with uncertain time phases
2. This is evolved from Gantt chart.
3. Total slack along the 'critical path is not zero
4. There can be more than one critical path in PERT network
5. It is similar to electrical network

Which of the statements given above are correct?

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

102. Match List I (Study) with List II (Related factors) and select the correct answer using the codes given below the Lists:

List I

A. Job enrichment
B. Job evaluation,

C. Method study
D. Time study

List II

1. Gilbreth's principles
2. Movement of limbs by work factor system
3. Hertzberg motivators
4. Jacques time span of discretion

Codes;

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

103. Match List I (Quality control concepts) with List II (Quality control techniques) and select the correct answer using the codes given below the lists:

List I

A. Tightened and reduced inspection
B. Lot tolerance percent defective
C. Poisson distribution
D. Normal distribution

List II

1. Dodge Romig tables
2. Control chart for variables
3. MIL standards
4. Control chart for number of nonconformities

Codes;

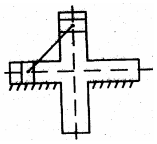
	A	B	C	D
a.	2	1	4	3
b.	3	4	1	2
c.	2	4	1	3
d.	3	1	4	2

104. Quality control chart for averages was maintained for a dimension of the product. After the control was established, it was found that the standard deviation (σ) of the process was 1.00 mm. The dimension of the part is 70 ± 2.5 mm. Parts above 72.5 mm can be reworked but parts below 67.5 mm have to be scrapped. What should be the setting of the process to ensure production of no scrap and to minimize the rework?

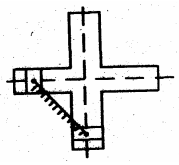
a. 68.5 mm
b. 70 mm
c. 70.5 mm
d. 72.5 mm

105. The double slider—crank chain is shown below in the diagram in its three possible inversions. The link shown hatched is the fixed link

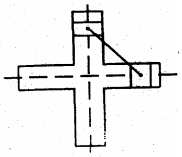
1.



2.



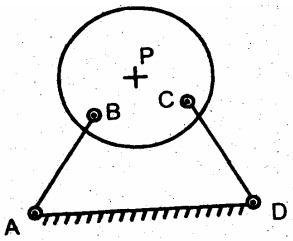
3.



4. Which one of the following statements is correct?

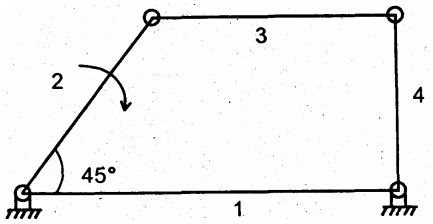
a. Inversion (1) is for ellipse trammel and inversion (2) is for Oldham coupling
b. Inversion (1) is for ellipse trammel and inversion(3) is for Oldham coupling
c. Inversion (2) is for ellipse trammel and inversion (3) is for Oldham coupling
d. Inversion (3) is for ellipse trammel and inversion (2) is for Oldham coupling

106. ABCD is a bar mechanism, in which AD is the fixed link, and link BC, is in the form of a circular disc with centre P In which one of the following cases P will be the instantaneous centre of the disc?



a. If it lies on the perpendicular bisector of line BC
b. If it lies on the intersection of the perpendicular bisectors of BC & AD
c. If it lies on the intersection of the perpendicular bisectors of AB & CD
d. If it lies on the intersection of the extensions of AB and CD

107. In the diagram given below, the magnitude of absolute angular velocity of link 2 is 10 radians per second while that of link 3 is 6 radians per second. What is the angular velocity of link 3 relative to 2?

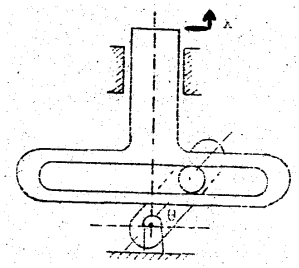


a. 6 radians per second
b. 16 radians per second
c. 4 radians per second
d. 14 radians per second

108. ABCD is a mechanism with link lengths AB = 200, BC = 300, CD = 400 and DA = 350. Which one of the following links should be fixed for the resulting mechanism to be a double crank mechanism? (All length are in mm)

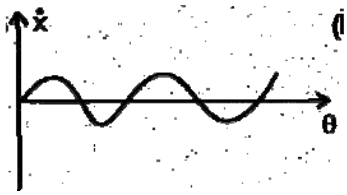
a. AB
b. BC
c. CD
d. DA

109. The crank of the mechanism shown below in the diagram rotates at a uniform angular velocity θ:

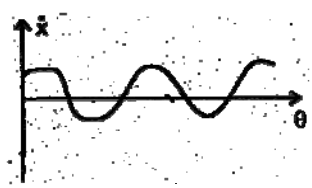


Which one of the following diagrams shows the velocity of slider $\dot{x}$ with respect to the crank angle?

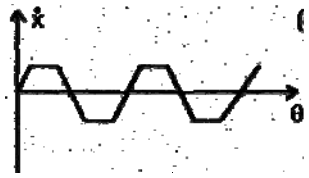
a.



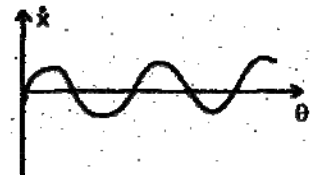
b.



c.



d.



110. In a plate cam mechanism with reciprocating roller follower, in which one of the following cases the follower has constant acceleration?

a. Cycloidal motion
b. Simple harmonic motion
c. Parabolic motion
d. 3 – 4 - 5 polynomial motion

111. Which one of the following statements is correct?

In a petrol engine mechanism the velocity of the piston is maximum when the crank is

a. at the dead centres
b. at right angles to the line of stroke
c. slightly less than 90° to line of stroke
d. slightly, above 90° to line of stroke

112. In a differential mechanism, two equal sized bevel wheels A and B are keyed to the two halves of the rear axle of a motor car. The car follows a curved path.

Which one of the following statements is correct?

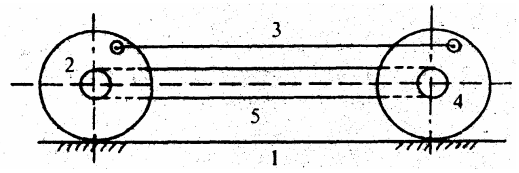
The wheels A and B will revole at different speeds and the casing will revolve at a speed which is equal to the

a. difference of speeds of A and B
b. arithmetic mean of speeds of A and B
c. geometric mean of speeds of A and B
d. harmonic mean of speeds of A and B

113. Which one of the following conversions is used by a lawn--sprinkler which is a four bar mechanisms?

a. Reciprocating motion to rotary motion
b. Reciprocating motion to oscillatory motion
c. Rotary motion to oscillatory motion
d. Oscillatory motion to rotary motion

114.



In the mechanism shown above, link 3 has

a. curvilinear translation and all points in it trace out identical cycloids
b. curvilinear translation and all points in it trace out identical involutes
c. linear translation & all points in it trace out identical helices
d. linear translation & all points in it trace out identical ellipses

115. Consider the following statements

1. C is an object - oriented programming like Java
2. C^{++} uses the same set of programming concepts as those of C

Which of the statements given above is/are correct?

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

116. Consider the following methods:

1. Trifiler suspension
2. Torsional oscillation
3. Fluctuation of energy of engine
4. Weight measurement & measurement of radius of flywheel Which of the above methods are used to determine the polar mass moment of inertia of an engine flywheel with arms?

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

117. A connecting rod has a mass of 0.5 kg. The radius of gyration through its centre of gravity is 5 cm and its acceleration is 2×10^4 rad/s^2. The equivalent two—mass system for the connecting rod has a radius of gyration 6 cm. What is the correction couple of the equivalent system?

a. 11 Nm
b. 9 Nm
c. 6 Nm
d. 2 Nm

118. Which one of the following statements is correct?

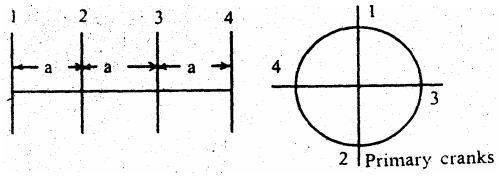
A governor will be stable if the radius ‘of rotation of the balls

a. increases as the equilibrium speed decreases
b. decreases as the equilibrium speed increases
c. increases as the equilibrium speed increases
d. remains unaltered with the change in equilibrium speed

119. Which one of the following statements in the context of balancing in engines is correct?

a. Magnitude of the primary unbalancing force is less than the secondary unbalancing force
b. The primary unbalancing force attains its maximum value twice. in one revolution of the crank
c. The hammer blow in the locomotive engines occurs due to unbalanced force along the line of stroke of the piston
d. The unbalanced force due to reciprocating masses varies in magnitude and direction

120. A four - cylinder in - line reciprocating engine is shown in the diagram given below. The cylinders are numbered 1 to 4 and the firing order is 1—4—2—3



Which one of the following statements is correct?

a. Both primary and secondary forces are balanced
b. Only primary force is balanced
c. Only secondary force is balanced
d. Both primary and secondary forces are unbalanced