# MECHANICAL ENGINEERING

PAPER-II

1. In the grain-size determination using standard charts, the relation between the given size number n and the average number of grains 'N' per square inch at a magnification of 100 X is
   a. $N = 2^n$
   b. $N = 2^{n-1}$
   c. $N = 2^{n+1}$
   d. $N = 2^n + 1$

2. Chemicals attack atoms within grain boundaries preferentially because they have
   a. Lower energy than those in the grains
   b. Higher energy than those in the grains
   c. Higher number of atoms than in the grains
   d. Lower number of atoms than in the grains

3. As per Gibb's phase rule, if number of components is equal to 2 then the number of phases will be
   a. ≤ 2
   b. ≤ 3
   c. ≤ 4
   d. ≤ 5

4. The rate of production of a powder metallurgy part depends on
   a. Flow rate of powder
   b. Green strength of compact
   c. Apparent density of compact
   d. Compressibility of powder

5. In a machining process, the percentage of heat carried away by the chips is typically
   a. 5%
   b. 25%
   c. 50%
   d. 75%

6. In economics of machining, which one of the following costs remains constant?
   a. Machining cost per piece
   b. Tool changing cost per piece
   c. Tool handling cost per piece
   d. Tool cost per piece

7. Which one of the following is the hardest cutting tool material next only to diamond?
   a. Cemented carbides
   b. Ceramics
   c. Silicon
   d. Cubic boron nitride

8. Crater wear on tools always starts at some distance from the tool tip because at that point
   a. Cutting fluid does not penetrate
   b. Normal stress on rake face is maximum
   c. Temperature is maximum
   d. Tool strength is minimum

9. A 31.8 mm H.S.S. drill is used to drill a hole in a cast iron block 100 mm thick at a cutting speed 20 m/min and feed 0.3 mm/rev. If te over travel of drill is 4 mm and approach 9 mm, the time required to drill the hole is
   a. 1 mm 40 s
   b. 1 mm 44 s
   c. 1 mm 49 s
   d. 1 mm 53 s

10. The value of surface roughness 'h' obtained during the tubing operating at a feed 'f' with a round nose tool having radius 'r' is given as
    a. $f/8r$
    b. $f^2/8r$
    c. $f^3/8r$
    d. $f^3/8r^2$

11. A side and face cutter 125mm diameter has 10 teeth. It operates at a cutting speed of 14 m/min with a table traverse 100 mm/min. The feed per tooth of the cutter is
    a. 10 mm
    b. 2.86 mm
    c. 0.286 mm

d. 0.8 mm

12. Which one is not a method of reducing cutting forces to prevent the overloading of press?
   a. Providing shear on die
   b. Providing shear on punch
   c. Increasing die clearance
   d. Stepping punches

13. In which one of the following welding techniques is vacuum environment required?
   a. Ultrasonic welding
   b. Laser beam welding
   c. Plasma arc welding
   d. Electron beam welding

14. In rolling a strip between two rolls, the position of the neutral point in the arc of contact does not depend on
   a. Amount of reduction
   b. Diameter of the rolls
   c. Coefficient of friction
   d. Material of the rolls

15. In a machine tool gear box, the smallest and largest spindles are 100 rpm and 1120 rpm respectively. If there, are 8 speed in all, the fourth speed will be
   a. 400 rpm
   b. 280 rpm
   c. 800 rpm
   d. 535 rpm

16. In a CNC machine tool, encoder is used to sense and control
   a. Table position
   b. Table velocity
   c. Spindle speed
   d. Coolant flow

17. In the tolerance specification 25 D 6, the letter D represents
   a. Grade of tolerance
   b. Upper deviation
   c. Lower deviation
   d. Type of fit

18. Repetitive fast speed activities can be effectively analyzed by taking photograph at
   a. Low speed and screening at low speed
   b. High speed and screening at high speed

   c. High speed and screening at low speed
   d. Low speed and screening at high speed

19. The reason or diversification is to
   a. Reduce production cost
   b. Balance low demand high capacity situation
   c. Satisfy more customers
   d. Improve capacity utilization

20. The proper sequence of activities for material requirement planning are
   a. Master production schedule, capacity planning, MRP and. Order release
   b. Order release, master production schedule, MRP arid capacity planning
   c. Master production schedule, order release , capacity planning and MRP
   d. Capacity planning, master production schedule, MRP and order release

21. Economic Order Quantity is the quantity at which the cost of carrying is
   a. Minimum
   b. Equal to the cost of ordering
   c. Less than the cost or ordering
   d. Cost of over stocking

22. A shop owner with an annual constant demand of 'A' units has ordering costs of Rs. 'P' per order and carrying costs Rs. '1' per unit per year. The economic order quantity for a purchasing model having no shortage may be determined from
   a. $\sqrt{24P/AI}$
   b. $\sqrt{24AP/I}$
   c. $\sqrt{2AP/I}$
   d. $\sqrt{2AI/P}$

23. Which one of the following is true in respect of production control for continuous or assembly line production?
   a. Control is achieved by PERT network
   b. Johnson algorithm is used for sequencing
   c. Control is on one work centre only
   d. Control is on flow of identical components through several operations

24. Which one of the following is the preferred logical sequence in the development of a flew product?
   a. Technical feasibility social acceptability and economic viability

b. Social acceptability, economic viability and technical feasibility

c. Economic viability, social acceptability and technical feasibility

d. Technical feasibility, economic viability and social acceptability

25. Which one of the following is assumed for timing the activities in PERT network?

    a. α distribution

    b. β distribution

    c. Binomial distribution

    d. Erlangian distribution

26. The three time estimates of a PERT activity are : optimistic time = 8 min, most likely time 10 min and pessimistic time = 14 mm. The expected time of the activity would be

    a. 10.00 min

    b. 10.33 min

    c. 10.66 min

    d. 11.00 min

27. For the network shown' in the figure, the variance along the critical path is 4.
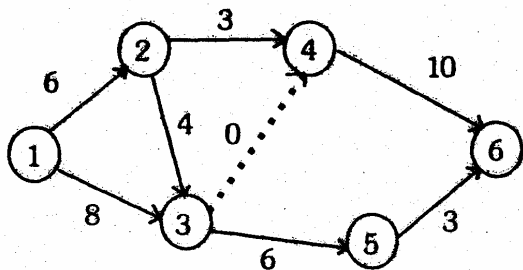
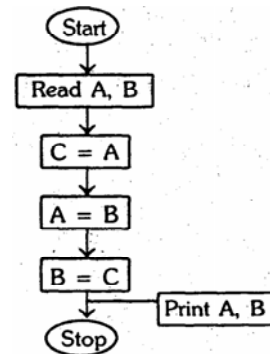The probability of completion of the project in 24 days is

    a. 68.2%

    b. 84.1%

    c. 95.4%

    d. 97.7%

28. The curve representing the level of achievement with reference to time is known as

    a. Performance curve

    b. Operating characteristic curve

    c. S-curve

    d. Learning curve

29. Which one of the following flow charts is correct for swapping values of A and B?

    a.
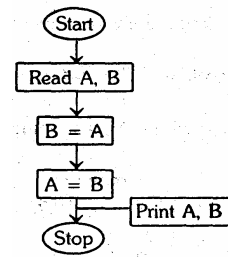
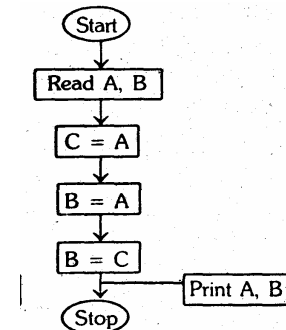b.
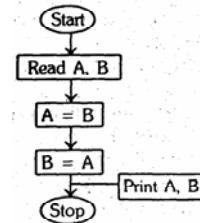
c.

d.

30. I = 1,3,4,2,6,5

K(I) = 100, 52, 300, 51, 600

Select the correct FORTRAN read statement from the following:

    a. READ(I, K(I),L = 1, 6)

    b. READ(L, K(I), I = 1, 6)

    c. READ(I, K(L), L = 1, 6)

    d. READ(L, K(L), L = 1, 6)

31. Match List I with list II and select the correct answer:

List I (Phase diagram)

A. Isomorphous system

B. Eutectic system

C. Peritectic system

D. Monotectic system

List II (Characteristic)

1. One liquid decomposes into another liquid and solid
2. One liquid and another solid combine to form a new solid
3. Two metals are completely soluble in liquid state and completely insoluble in solid state
4. Two metals, soluble in solid and liquid state

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

32. Match List I with List II and select the correct answer:

List I (Material)

A. Ceramics

B. Refractories

C. Stones

D. High silica glass

List II (Application)

1. Construction of chemical plants
2. Columns and pillars
3. lining of furnaces
4. Tiles

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

33. Match List I with List II and select the correct answer:

List I (Ingredients)

A. Silica

B. Potassium silicate

C. Ferro silicon

D. Cellulose

List II (Welding functions)

1. Arc stabilizer
2. De-oxidizer
3. Fluxing agent
4. Gas forming Material

	A	B	C	D

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

34. Match List I with List II and select the correct answer:

List I (Parts)

A. Seamless tubes

B. Accurate and smooth tubes

C. Surfaces having higher hardness and fatigue strength

List II (Machine tool parts)

1. Roll forming
2. Shot penning
3. Forging
4. Cold forming

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

35. Match List 1 with List II and select the correct answer:

List I (Machine tools)

A. Lathe

B. Milling machine

C. Shaper

D. Drilling machine

List II (Machine tool parts)

1. Lead strew
2. Rocker arm
3. Universal indexing
4. Flute

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

36. Match List I with List II and select the correct answer:

List I (Machine tool)

A. Lathe

B. Drilling machine

C. Shaper

D. Broaching machine

List II (Features)

1. Push or pull tool
2. Ratchet and pawl mechanism
3. Dividing head
4. Hollow tapered spindle
5. Face plate

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

37. Match List I with List II and select the correct answer:

List I (NC machine tool system)

A. NC system
B. CNC system
C. DNC system
D. Machining centre

List II Features)

1. It has an integrated automatic tool changing unit and a component indexing device
2. A number of machine tools are controlled by a computer. No tape reader, the part programme is transmitted directly to the machine tool from the computer memory
3. The controller consists of soft-wired computer and hard-wired logic system. Graphic display of tool path is also possible
4. The instructions on tape is prepared in binary decimal form and operated by a series of coded instructions

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

38. Match List I with List .11 and select the correct answer:

List I (Wage payment plans)

A. Time based
B. Price rate
C. Gain sharing
D. Indirect payments

List II (Method of payment)

1. Stock distribution
2. 100% bonus
3. Taylor differential piece rate
4. Straight salary

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

39. Match List I with List II and select the correct answer:

List I (Files in MRP)

A. Master production schedule
B. Bills of materials
C. Inventory records

List II (Inputs required)

1. Scheduled receipts
2. Units costs and discounts
3. Production capacity
4. Product structure

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

40. Match List I with List II and select the correct answer:

List I (Limits in normal distribution)

A. $\pm 3\sigma$
B. $\pm 2\sigma$
C. $\pm 1\sigma$

List II (Population covered)

1. 0.3413
2. 0.6826
3. 0.9973
4. 0.9545

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

41. Match List I with List II and select the correct answer:

List I (2-D Stress system loading)

A. Thin cylinder under internal pressure
B. Thin sphere under internal pressure
C. Shaft subjected to torsion

List II (Ratio of principal stresses)

1. 3.0
2. 1.0
3. -1.0
4. 2.0

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

42. Match List I (Persons with whom the models are associated) with List II (Models) and select the correct answer:

List I

A. J. Von Newmann
B. G. Dantzig
C. A.. K. Erlang
D. Richard Bellman

List II

1. Waiting lines
2. Simulation
3. Dynamic programming
4. Competitive strategies
5. Allocation by simplex method

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

43. Match List I with List II and select the correct answer:

List I (Computer language)

A. COBOL
B. FORTRAN
C. C
D. Assembler

List II (Application)

1. System software
2. System software and other common applications
3. Business application
4. Scientific application

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

44. **Assertion (A):** An in volute rack with 20° pressure angle meshes with a pinion of 14.5° pressure angle.

Reason (R): Such a matching is impossible.

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

45. **Assertion (A):** The precession of the axis of rotation of a shaft causes a gyroscopic reaction couple to act on the frame to which the bearings are fixed.

Reason (R): The reaction of the shaft on each bearing is equal and opposite to the action of the bearing on the shaft.

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

46. **Assertion (A):** A dynamically balanced system of multiple rotors on a shaft can rotate smoothly at the critical speeds of the system.

Reason (R): Dynamic balancing eliminates all the unbalanced forces and couples from the system.

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

47. **Assertion (A):** When a pair of spur gears of the same material is in mesh, the design is based on pinion.

Reason (R): For a pair of gears of the same material in mesh, the 'strength factor' of the pinion is less than that of the gear

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

48. **Assertion (A):** Tapered roller bearings are sensitive to the tightening between inner and outer races.

    Reason (R): Tapered roller bearings are always provided with adjusting nut for tightening.
    a. Both A & R are true & R is the correct explanation of A
    b. Both. A and R are 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

49. **Assertion (A):** Mohr's circle of stress can be related to Mohr's circle of strain by some constant of proportionality.

    Reason (R): The relationship is a function of yield stress of the material.
    a. Both A & R are true & R is the correct explanation of A
    b. Both A and R are 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

50. **Assertion (A):** If the bending moment diagram is a rectangle, it indicates that the beam is loaded by a uniformly distributed moment all along the length.

    Reason (R): The BMD is a representation of internal forces in the beam and not the moment applied on the beam.
    a. Both A & R are true & R is the correct explanation of A
    b. Both. A and R are 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

51. **Assertion (A):** The hardness test is a slow, expensive method of assessing the mechanical properties of materials.

    Reason (R): The hardness is a function of yield stress and the work hardening rate of material.
    a. Both A & R are true & R is the correct explanation of A
    b. Both A and R are 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

52. **Assertion (A):** Negative rake is usually provided on carbide tipped tools.

Reason (R): Carbide tools are weaker in compression.
    a. Both A & R are true & R is the correct explanation of A
    b. Both. A and R are 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

53. **Assertion (A):** Slender shafts are turned with tools having an approach angle of 90°.

    Reason (R): Small approach angle, however, results in increased radial component of force which tends to separate the from the tool thus promoting chatter.
    a. Both A & R are true & R is the correct explanation of A
    b. Both. A and R are 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

54. **Assertion (A):** Virtually all modern milling machines are capable of doing down-milling.

    Reason (R): In down-milling the cutter tends to push the work along and lift it upward from the table. This action tends to eliminate any effect in looseness in the feed screw and nut of the milling machine table and. results in smooth cut.
   a. Both A & R are true & R is the correct explanation of A
    b. Both. A and R are 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

55. **Assertion (A):** In ECM, the shape of the cavity is the mirror image of the tool, but unlike EDM, the tool wear in ECM is less.

    Reason (R): The tool in ECM is a cathode.
    a. Both A & R are true & R is the correct explanation of A
    b. Both. A and R are 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

56. **Assertion (A):** In CO_2 casting process, the moule or core attains maximum strength.

Reason (R): The optimum gassing time of CO_2 through the moule or core forms Silica Gel which imparts sufficient strength to the mould or core.

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

b. Both. A and R are 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

57. **Assertion (A):** Job enrichment increases the job satisfaction of the employee.

Reason (R): The jobs of wireman and lineman doing indoor and outdoor works respectively can be integrated for better results.

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

b. Both. A and R are 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

58. **Assertion (A):** The change in critical path required rescheduling in a PERT network.

Reason (R): Some of the activities cannot be completed in time due to unexpected breakdown of equipments or non-availability of raw materials.

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

b. Both. A and R are 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

59. **Assertion (A):** Function statements in a FORTRAN program is given in terms of parameters.

Reason (R): Function statements in a FORTRAN program can be shared by two subroutines in a program.

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

b. Both. A and R are 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

60. When will be the output values of A and B for the chart given?

a. $(A * B), X$

b. A, B

c. B,A
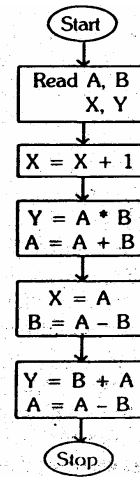
d. X,Y

61. Consider the following statements for completely balancing a single rotating mass:

1. Another rotating mass placed diametrically opposite in the same plane balances the unbalanced mass.

2. Another rotating mass placed diametrically opposite in a parallel plane balances the unbalanced mass.

3. Two masses placed in two different parallel planes balance the unbalanced mass.

Which of the above statements is/are correct?

a. 1 only

b. 1 and 2

c. 2 and 3

d. 1 and 3

62. Consider the following statements in case of reverted gear train:

1. The direction of rotation of the first and the last gear is the same.

2. The direction of rotation of the first and the last gear is opposite.

3. The first and the last gears are o the same shaft.

4. The first and the last gears are on separate but co-axial shafts.

Which of these statements is/are correct?

a. 1 and 3

b. 2 and 3

c. 2 and 4

d. 4 alone

63. The dynamic load on a gear is due to
1. Inaccuracies of tooth spacing
2. Irregularities in tooth profile
3. Deflection of the teeth under load
4. Type of service (i.e. Intermittent, one shift per day, continuous per day).
Which of the above statements are correct?
a. 1,2 and 3
b. 2,3 and 4
c. 1,3 and 4
d. 1,2 and 4

64. Consider the following statements:
A 200 stub tooth system is generally preferred in spur gears as it results in
1. Stronger teeth
2. Lesser number of teeth on the pinion
3. Lesser changes of surface fatigue failure
4. Reduction of interference
Which of the above statements are correct?
a. 1,2 and 4
b. 3 and 4
c. 1 and 3
d. 1, 2, 3 and 4

65. Consider the following statements:
Thermal stress is induced in a-component in general, when
1. A temperature gradient exists in the component
2. The component is free from any restraint
3. It is restrained to expand or contract freely
Which of the above statements are correct?
a. 1 and 2
b. 2 and 3
c. 3 alone
d. 2 alone

66. Consider the following statements in case of beams:
1. Rate of change of shear force is equal to the rate of loading at a particular section
2. Rate of change of bending moment is equal to the shear force at a particular section

3. Maximum shear force in a beam occurs at a point where bending moment is either zero or bending moment changes sign
Which of the above, statements are correct?
a. 1 alone
b. 2 alone
c. 1 and 2
d. 1,2 and 3

67. Which of the following are fabricated using engineering plastics?
1. Surface plate
2. Gears
3. Guide ways for machine tools
4. foundry patterns
Select the correct answer using the codes given below:
a. 1, 2 and 3
b. 1
c. 2, 3 and 4
d. 1, 2, 3 and 4

68. Consider the following statements:
Polytetrafluoroethene is
1. A thermoplastic material
2. Having high friction coefficient
3. A thermosetting material
4. Having low friction coefficient
5. An electric insulator
6. Non sticking to surfaces
Which of the above statements are correct?
a. 1,2 and 5
b. 2,3 and 6
c. 3, 4 and 5
d. 3, 2 and 5

69. Which of the following fibre materials are used for reinforcement in composite materials:
1. Glass
2. Boron carbide
3. Graphite
Select the correct answer using the codes given below:
a. 1and 2
b. 1 and 3
c. 2 and 3
d. 1, 2 and 3

70. Consider the following statements:

    The strength of a single point cutting tool depends upon

    1. Rake angle
    2. Clearance angle
    3. Lip angle

    Which of these statements are correct?

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

71. Which of the following materials are used in grinding wheels?

    1. Aluminium oxide
    2. Cubic boron nitride
    3. Silicon carbide

    Select the correct answer using the codes given below:

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

72. Consider the following statements related to piercing and blanking:

    1. Shear on the punch reduces the maximum cutting force
    2. Shear increases the capacity of the press. needed
    3. Shear increases the life of the punch
    4. The total energy needed to make the cut remains unaltered due to provision of shear

    Which of these statements are correct?

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

73. Consider the (following steps involved in hammer forging a connecting rod from bar stock:

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

    Which of the following is the correct sequence of operations?

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

74. The graph shows the results of various quality levels for a component
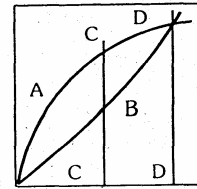
Level of quality

Consider the following statements:

    1. Curve A shows the variation of value of component
    2. Curve B shows the variation of cost of the component
    3. Graph is called as fish bone diagram
    4. The preferred level of quality is given by line CC
    5. The preferred level of quality is given by line DD

    Which of the above statements are correct?

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

75. The primal of a LP problem is maximization of objective function with 6 variables and 2 constraints.

    Which of the following correspond to the dual of the problem stated?

    1. It has 2 variables and 6 constraints.
    2. It has 6 variables and 2 constraints.
    3. Maximization of objective function.
    4. Minimization of objective function.

    Select the correct answer using the codes given below:

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

76. Consider the following statements regarding updating of the network:

    1. For short duration project, updating is done frequently

2. For large duration project, frequency of updating is decreased as the project is nearing completion
3. Updating is caused by overestimated or underestimated times of activities
4. The outbreak of natural calamity necessitates updating

Which of the above statements are correct?

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

77. Match List I with List II and select the correct answer:

List I (Kinematic pairs)

A. Sliding pair
B. Revolute pair
C. Rolling pair
D. Spherical pair

List II (Practical example)

1. A road roller rolling over the ground
2. Crank shaft in a journal bearing in an engine
3. Ball and socket joint
4. Piston and cylinder
5. Nut and screw

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

78. Match List I with List II and select the correct answer:

List I (Mechanism)

A. Hart mechanism
B. Pantograph
C. Whitworth mechanism
D. Scotch yoke

List II (Motion)

1. Quick return motion
2. Copying mechanism
3. Exact straight line motion
4. Simple harmonic motion
5. Approximate straight line motion

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

| c. | 5 | 2 | 1 | 3 |
| d. | 3 | 1 | 2 | 4 |

79. Match List I with List II and select the correct answer:

List I (Connecting shaft)

A. In perfect alignment
B. With angular misalignment of 10°
C. Shafts with parallel misalignment
D. Where one of the shafts may undergo more deflection with respect to the other

List II (Couplings)

1. Oldham coupling
2. Rigid coupling
3. Universal joint
4. Pin type flexible coupling

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

80. Match List I with List II and select the correct answer:

List I (Bearings)

A. Hydrodynamic Journal bearing
B. Rectangular Hydrostatic bearing
C. Taper Roller bearing
D. Angular contact ball bearing

List II (Load type)

1. High radial and thrust load combined
2. Radial load only
3. Thrust Load only
4. Medium to Low radial and thrust combined

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

81. Match List I with List II and select the correct answer:

List I (Loaded cylinder bar)

A. CI bar subject to tension
B. CI bar under torsion
C. MS bar under torsion
D. MS bar under tension

List II (Type of fracture)

1. Cup and Cone
2. Granular helicoidally
3. Granular plain perpendicular to axis
4. Smooth plain perpendicular to axis
5. Granular plain at 45° to axis

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

82. The instantaneous centre of rotation of a rigid thin disc rolling without slip on a plane rigid surface is located at
    a. The centre of the disc
    b. An infinite distance perpendicular to the plane surface
    c. The point of contact
    d. The point on the circumference situated vertically opposite to the contact point

83. The choice of displacement diagram during rise or return of a follower of a cam-follower mechanism is based on dynamic considerations. For high speed cam follower mechanism, the most suitable displacement for the follower is
    a. Cycloidal motion
    b. Simple harmonic motion
    c. Parabolic or uniform acceleration motion
    d. Uniform motion or constant velocity motion

84. A linkage is shown below in the figure in which links ABC and. DEF are ternary links whereas AF, BE and CD are binary links.
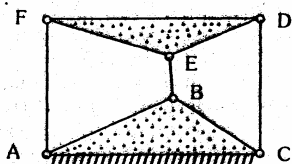
    The degrees of freedom of the linkage when link ABC is fixed are
    a. 0
    b. 1
    c. 2
    d. 3

85. The crank and slotted lever quick-return motion mechanism is shown in figure. The length of links $O_1 O_2$, O_1C and O_2A are 10 cm, 20 cm and 5 cm respectively.
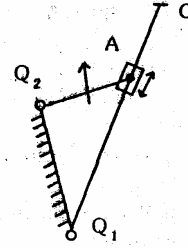

    The quick return ratio of the mechanism is
    a. 3.0
    b. 2.75
    c. 2.5
    d. 2.0

86. The radius of the friction circle in a journal bearing is dependent on coefficient of friction and the
    a. Angular velocity of the journal
    b. Radius of the journal
    c. Magnitudes of the forces on the journal.
    d. Journal and bearing clearance

87. In a collar thrust bearing, the number of collars have been doubled While maintaining to efficient of friction and axial thrust same. It will result in
    a. Same friction torque and same bearing pressure
    b. Double friction torque and half bearing pressure
    c. Double friction torque and same bearing pressure
    d. Same friction torque and half bearing pressure

88. If the rotating mass of a rim type fly wheel is distributed on another rim type fly wheel whose mean radius is half the mean radius of the former, then energy stored in the latter at the same speed will be
    a. Four times the first one
    b. Same as the first one
    c. One-fourth of the first one
    d. Two times the first one

89. The nature of the governors is shown by the graph between radius (r) of rotation and controlling force (F). Which of the following is an isochronous governor?
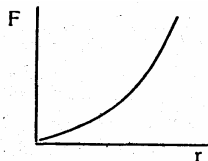   a.
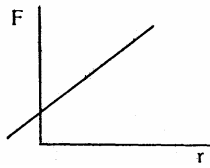
b.
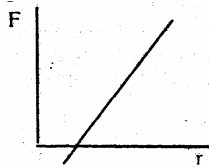
c.
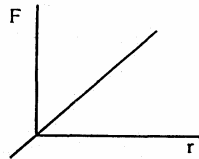
d.

90. In a Hartnell governor, the mass of each ball is 2.5 kg. Maximum and minimum speeds of rotation are 10 rod/s and 8 rad/s respectively. Maximum and minimum radii of rotation are 20 cm and 14 cm respectively. The lengths of horizontal and vertical arms of bell crank levers are 10 cm and 20 cm respectively. Neglecting obliquity and gravitational effects, the lift of the sleeve is
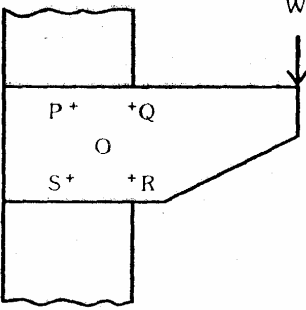
   a. 1.5 cm

   b. 3.0 cm

   c. 6.0 cm

   d. 12.0 cm

91. A. rod of uniform diameter is suspended from one of its ends in vertical plane. The mass of the rod is 'm' and length 'l' the natural frequency of this rod in Hz for small amplitude is

   a. $1/2\pi\sqrt{g/l}$

   b. $1/2\pi\sqrt{g/3l}$

   c. $1/2\pi\sqrt{2g/3l}$

   d. $1/2\pi\sqrt{3g/2l}$

92. The mass moment of inertia of the two rotors in a two rotor system are 100 kg m^2 and 10 kg m^2. The length of the shaft of uniform diameter between the rotors is 110

cm. The distance of node from the rotor of lower moment of inertia is

   a. 80cm

   b. 90cm

   c. 100 cm

   d. 110 cm

93. A shaft of 50 mm diameter and 1 m length carries a disc which has mass eccentricity equal to 190 microns. The displacement of the shaft at a speed which is 90% of critical speed in microns is

   a. 810

   b. 900

   c. 800

   d. 820

94. An epicyclic gear train has 3 shafts A, B and C. A is an input shaft running at 100 rpm clockwise. B is an output shaft running at 250 rpm clockwise. Torque on A is 50 kNm (clockwise). C is a fixed shaft. The torque to fix C

   a. Is 20 kNm anticlockwise

   b. Is 30 kNm anticlockwise

   c. Is 30 kNm clockwise

   d. Cannot be determined as the data is insufficient

95. Which of the following is a closed-loop control system?

   a. Traffic control on the roads by lights where the timing mechanism is present irrespective of the intensity of traffic

   b. Switching off the street lights of a tower at a predetermine time by a time-switch irrespective of the fact that the sun rises at a different time each day.

   c. Switching off an electric heater by a time-switch irrespective of whether the dish has been prepared or not

   d. Human body

96. A screw jack is said to be self-locking if its efficiency is

   a. Less than 50%

   b. Equal to 50%

   c. More than 50%

   d. 100%

97. If P is the pitch of a square thread, then the depth of thread d is given by

   a. 0.5 P

   b. P

c. 1.5 P

d. 2.0 P

98. The arm of a radial drilling machine is being raised at a speed of 3.9 m/min by single start square threads of 6 mm pitch and 30 mm diameter. The speed of the screw

a. Is 650 rpm

b. Is 180 rpm

c. Is 130 rpm

d. Cannot be determined as the data is insufficient

99. A cotter joint is used when no relative motion is permitted between the rods joined by the cotter. It is capable of transmitting

a. Twisting moment

b. An axial tensile as well as compressive load

c. The bending moment

d. Only compressive axial load

100. In a fillet welded joint, the weakest area of the wel is

a. Toe

b. Root

c. Throat

d. Face

101. The power transmitted by a belt is dependent on the centrifugal effect in the belt. The maximum power can be transmitted when the centrifugal tension is

a. 1/3 of tension (T_1) on the tight side

b. 1/3 of total tension (T_t) on the tight side

c. 1/3 of tension (T_2) on the slack side

d. 1/3 of sum of tensions T_1 and T_2 i.e. $1/3(T_1+T_2)$

102. The length of the belt in the case of a cross-belt drive is given in terms of centre distance between pulleys (C), diameters of the pulleys D and d as

a. $2C + \dfrac{\pi}{2}(D+d) + \dfrac{(D+d)^2}{4C}$

b. $2C + \dfrac{\pi}{2}(D-d) + \dfrac{(D+d)^2}{4C}$

c. $2C + \dfrac{\pi}{2}(D+d) + \dfrac{(D-d)^2}{4C}$

d. $2C + \dfrac{\pi}{2}(D-d) + \dfrac{(D-d)^2}{4C}$

103. A shaft can safely transmit 90 kW while rotating at a given speed. If this shaft is replaced by a shaft of diameter double of the previous one and rotated at half the speed of the previous, the power that can be transmitted by the new shaft is previous, the power that can be transmitted by the new shaft is

a. 90 kW

b. 180 kW

c. 360 kW

d. 720 kW

104. A cold roller steel shaft is designed on the basis of maximum shear stress theory. The principal stresses induced at its critical section are 60 MPa and -60 MPa respectively. If the yield stress for the shaft material is 360 MPa, the factor of safety of the design is

a. 2

b. 3

c. 4

d. 6

105. An eccentrically loaded riveted joint is shown with 4 rivets at P, Q, R and S.

Which of the rivets are the most loaded?

a. R and Q

b. Q and R

c. R and S

d. S and P

106. The bolts in a rigid flanged coupling connecting two shats transmitting power are subjected to

a. Shear force and bending moment

b. Axial force

c. Torsion and bending moment

d. Torsion

107. When a helical compression spring is cut into two equal halves, the stiffness of each of the resulting springs will be
    a. Unaltered
   b. Double
    c. One-half
    d. One-fourth

108. While calculating the stress induced in a closed coil helical spring, Wahl's factor must be considered to account for
    a. The curvature and stress concentration effect
    b. Shock loading
    c. Poor service conditions
    d. Fatigue loading

109. A straight bar is fixed at edges A and B. Its elastic modulus is E and cross-section is A. There is a load P = 120 N acting at C. Determine the reactions at the ends.
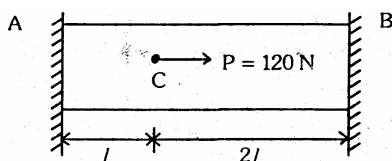
    a. 60 N at A, 60 N at B
    b. 30 N at A, 90 N at B
    c. 40 N at A, 80 N at B
    d. 80 N at A, 40 N at B

110. For a given material, the modulus of rigidity is 100 GPa and Poisson's ratio is 0.25. The value of modulus of elasticity in GPa is
    a. 12.5
    b. 15.0
    c. 20.0
    d. 25.0

111. A rigid beam of negligible weight is supported in a horizontal position by two rods of steel and aluminium, 2 m and 1 m long having values of cross - sectional areas 1 cm^2 and 2 cm^2 and E of 200 GPa and 100 GPa respectively. A load P is applied as shown in the figure
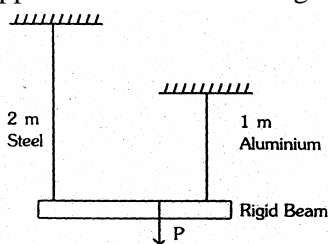
If the rigid beam is to remain horizontal then
    a. The forces on both sides should be equal
    b. The force on aluminium rod should be twice the force on steel
    c. The force on the steel rod should be twice the force on aluminium
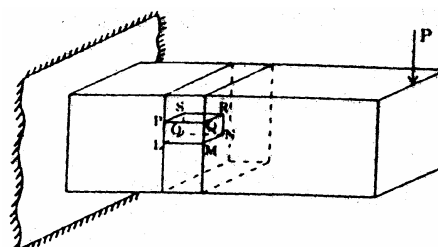   d. The force P must be applied at the centre of the beam

112. A shaft is subjected to torsion as shown.
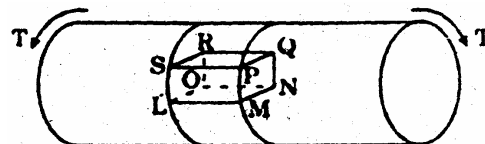
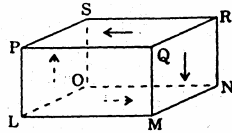Which of the following figures represents the shear stress on the element LMNOPQRS?
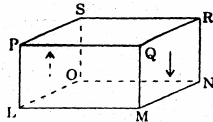
a.

b.

c.

d.

113.

A cantilever is loaded by a concentrated load P at the free end as shown. The shear stress in the element LMNOPQRS is under consideration. Which of the following figures represents the shear stress directions in the cantilever?
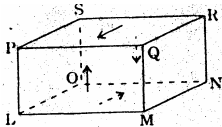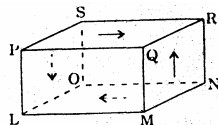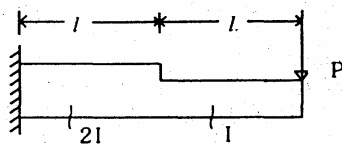
a.

b.

c.

d.

114. A thin cylinder of radius r and thickness t when subjected to an internal hydrostatic pressure P causes a radial displacement u, then the tangential strain caused is
   a. du/dr
   b. 1/r. du/dr
   c. u/r
   d. 2u/r

115.

   $I = 375 \times 10^{-6}$ m^4

   $l = 0.5$ m

   E = 200 GPa

   Determine the stiffness of the beam shown in the above figure
   a. 12×10^{10} N/m
   b. 10×10^{10} N/m
   c. 4×10^{10} N/m
   d. 8×10^{10} N/m

116. Strain energy stored in a body of volume V subjected to uniform stress s is

   a. sE / V
   b. sE^2 / V
   c. sV^2 / E
   d. $s^2V / 2E$

117. A thick open ended cylinder as shown in the figure, is made of a material with permissible normal and shear stresses 200 MPa and. 100 MI respectively. The ratio of permissible pressure based on the normal and shear stress is.
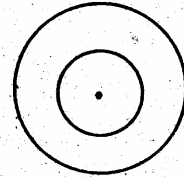
   $d_i = 10$ cm
   $d_0 = 20$ cm

   a. 9 / 5
   b. 8 / 5
   c. 7 / 5
   d. 4 / 5

118. T.T.T. diagram indicates time and temperature transformation of
   a. Cementite
   b. Pearlite
   c. Ferrite
   d. Austenite

119. The correct composition of austenitic stainless steel used for domestic utensils is
   a. 0.08% C, 18% Cr, 8% Ni, 2% Mn, 1% Si
   b. 0.08% C, 24% Cr, 12% Ni, 2% Mn, 1% Si
   c. 0.15% C, 12% Cr, 0.5% Ni, 1% Mn, 1% Si
   d. 0.30% C, 12% Cr, 0.4% Ni, 1% Mn, 1% Si

120. Which one of the following is true?
   a. Structure of metallic materials consists of atoms having valence of 5, 6 or 7
   b. Ceramic materials hove long range electron matrix bond
   c. Polymers are composed of long chain of repeating molecules
   d. Ceramics are weaker than metals because of weak electrostatic bond