Question Paper of

Civil Services Examination 2010

Mechanical Engineering

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

List-I	List-II
(Process)	(Heat transfer equal to)
A. Constant volume	1. Zero
B. Constant pressure	2. Change in internal energy
C. Constant temperature	3. Change in enthalpy
D. Constant entropy	4.. Work done

    Code:

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

2. For reversible adiabatic compression in a steady flow process, the work transfer per unit mass is

    (a) $\int P\,dV$ (b) $\int V\,dP$

    (c) $\int T\,dS$ (d) $\int S\,dT$

3. The expression can be used obtaining work of
    (a) Throttling process.
    (b) Steady flow reversible process.
    (c) Non-flow reversible process
    (d) Adiabatic irreversible process

4.. In a system which undergoes irreversible process, positive work done is 50 kJ and the heat added 45 kJ. What is the change in entropy?
    (a) Zero (b) Positive
    (c) Negative (d) Indeterminate

5. Consider the following processes in thermodynamic cycles?
    1. Constant pressure
    2. Constant volume
    3. Adiabatic
    4. Isothermal

Which of the above processes are involved in Stirling cycles?
(a) 1 and 2   (b) 2 and 4
(c) 2 and 3   (d) 3 and 4

6.   Which of the following processes is not a part of the dual cycle?
     (a) Adiabatic compression
     (b) Constant volume expansion
     (c) Isothermal expansion
     (d) Constant pressure expansion

7.   Consider the following statements:
     Comparing the thermal efficiency of air standard Otto and Diesel cycles, the Diesel
     cycle is more efficient for constant maximum pressure and constant:
     1.   Heat input
     2.   Output
     3.   Maximum temperature
     Which of the above statements is/are correct?
     (a) 1, 2 and 3   (b) 1 only
     (c) 1 and 2 only   (d) 2 and 3 only

8.   Why is the thermal efficiency of superheat (modified) Rankine cycle higher than
     that of simple Rankine cycle?
     (a) Enthalpy of steam is higher for superheat cycle.
     (b) Mean temperature of heat addition is higher.
     (c) Temperature of condenser is high.
     (d) Quality of steam in condenser is low.

9.   Consider the following statements in connection of ranking cycle with regenerative
     feed water heating:
     1.   It reduces boiler capacity for a given output.
     2.   It reduces the temperature stresses in the boiler.
     3.   It improves the cycle efficiency.
     4.   It provides a convenient means of deaerating the feed water.
     Which of the above statements are correct?
     (a) 1 and 2 only   (b) 2 and 3 only
     (c) 3 and 4 only   (d) 2, 3 and 4

10. Which is the most suitable thermodynamic cycle for high capacity refrigeration
   load of 1000 tons of refrigeration?
     (a) Vapor compression refrigeration cycle
     (b) Bell-Coleman cycle
     (c) Li-Br water absorption cycle
     (d) Aqua-ammonia absorption cycle

11. In a gas turbine, working on Bray ton cycle with regeneration, air exits from the
     compressor at 550 K and gas exits from the turbine at 800 K. If the effectiveness of
     the regenerator is 0.8, then what is the air temperature at the combustion
     chamber inlet?
     (a) 600 K   (b) 650 K
     (c) 700 K   (d) 750 K

12. **If the nozzle efficiency is reduced to half of its value, the nozzle velocity coefficient.**
    (a) Decreases by 2 times
    (b) Decreases by 1.414 times
    (c) Increases by 1.414 times
    (d) Increases by 2 times.

13. **A normal shock may occur when a flow is supersonic and the conditions downstream require it to be subsonic. Across a normal shock**
    (a) Pressure and temperature increase
    (b) There is no energy loss
    (c) Pressure and density decreased
    (d) Temperature and density decrease.

14. **Consider the following statements:**
    1. A device attached to the steam chest for preventing explosions due to excessive internal pressure is called fusible plug.
    2. A device used in a boiler to control the flow of steam from the boiler to the main pipe is known as blow-off cock.
    3. An air preheated enables low grade of fuel to be burnt in a boiler.
    Which of the above statements is/are correct?
    (a) 1, 2 and 3
    (b) 1 and 2 only
    (c) 3 only
    (d) 2 and 3 only

15. **Which of the following is a boiler accessory?**
    (a) Water level indicator
    (b) Steam injector
    (c) Feed check valve
    (d) Pressure gauge

16. **Consider the following:**
    1. Blow-off cock
    2. Steam stop valve
    3. Fusible plug
    4. Steam injector
    Which of these are boiler mountings?
    (a) 1, 2 and 4
    (b) 1, 3 and 4
    (c) 1, 2 and 3
    (d) 2, 3 and 4

17. **Consider the following statements:**
    1. Specific output increases
    2. Cycle efficiency increases
    3. Turbine speed decreases
    4. Blade erosion decreases.
    Which of these take place due to reheating of steam?
    (a) 1and 2 only
    (b) 2 and 4 only
    (c) 2, 3 and 4
    (d) 1, 2 and 4

18.

Discharge
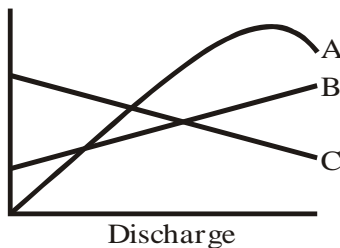
Curves A, B and C shown typical centrifugal pump characteristics. What are they?

(a) Efficiency, Power input and Delivery head

(b) Power input, Efficiency and Delivery head

(c) Efficiency, Delivery head and Power input

(d) Delivery head, Efficiency and Power input

19. What is the speed ratio of a Pelton turbine for a maximum hydraulic efficiency?

(a) $\dfrac{1}{2}$ (b) $\dfrac{1}{4}$

(c) $\dfrac{3}{4}$ (d) 1

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

List-I	List-II
A. Supersaturated flow	1. Turbo machines
B. Surging and choking phenomenon	2. Hydraulic pumps and turbines
C. Cavitations	3. Rotary compressors
D. Specific speed	4. Nozzles

Code:

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

21. The power required maintaining a certain flow rate in a tube of 10 m length and constant diameter is found to be 50 kW when the head loss is 5 m and the tube is horizontal. If the tube is now held vertical, the pumping power required for the same flow rate in the vertically upward direction is

(a) 150 kW   (b) 50 kW

(c) 300 kW   (d) 60 kW

22. Consider the following statements:

Orifice plate, venturimeter and mouthpiece are commonly used for discharge measurements for pipe flow. The three can be compared in terms of compactness and induced head loss.

1. All three result in large bead losses.

2. Venturimeter has low losses but is not compact

3. Orifice plate and mouthpiece are compact but are not loss-free

Which of the above statements is/are correct?

(a) 1 only   (b) 1 and 2

(c) 2 and 3   (d) 1 and 3

23. A Pitot-static tube when inserted into an air stream for measuring velocity at a point gives different pressure reading of 10 mm in an air-mercury manometer. Specific gravity of mercury is 13.6. Air density is 1.2 kg/m^3 and that of water is 1000 kg/m^3. Assuming acceleration due to gravity g = 10 m/s, what is the difference between stagnation and static pressure?

(a) 135.9 Pa

(b) 135988 Pa
(c) 13598.8 Pa
(d) 1359.88 Pa

24. **The gap between two parallel plates is filled with oil of viscosity μ. The gap h is small compared to the plate sizes. If one of the plates is moved with velocity U in its own plane (relative to the other), what is the force required to sustain this motion?**
(a) Proportional to U, inversely to μ and h
(b) Proportional to μ, U and inversely to h
(c) Inversely to μ, U and h
(d) Proportional to μ, U and h

25. **The parameters which determine the friction factor for turbulent flow in a rough pipe are**
(a) Froude number and relative roughness
(b) Froude number and Mach number
(c) Reynolds number and relative roughness
(d) Mach number and relative roughness

26. **Consider the following statements:**
If boundary-layer separates from a surface, one can expect the following:
1. Form drag will increase.
2. Vortex shedding will take place
3. Vortex shedding is suppressed.
4. Forces become time-dependent.
Which of the above statements is/are correct?
(a) 1 only   (b) 1, 2 and 4
(c) 2 and 3   (d) 3 and 4

Directions : Each of the next fourteen (14) items consist of two statements, one labeled as the 'Assertion (A)' and the other as 'Reason (R)'. You are to examine these two statements carefully and select the answers to these items using the code given below:

Code:
(a) Both A and R is individually true and R is the correct explanation of A
(b) Both A and R is 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

27. **Assertion (A):** When the shear force diagram in a loaded beam is s straight line parallel to the beam axis its bending moment diagram is a straight line inclined to its axis.
Reason (R): When the shear force at any section of a beam is either zero or changes sign, the bending moment at that section is maximum or minimum.

28. **Assertion (A):** A long column of square cross-section has greater buckling stability than that of a column of circular cross-section of same length, same material, same end condition and same area of cross-section.
Reason (R): A column of circular cross-section has smaller second moment of area than that of a square column of same cross-sectional area.

29. **Assertion (A):** In pendulum type centrifugal governor, the height of governor, the height of governor is inversely proportional to square of the speed.
    Reason (R): This governor is used at relatively low speeds.

30. **Assertion (A):** Soft automation lacks flexibility.
    Reason (R): Soft automation uses computer control for the machines and its various functions.

31. **Assertion (A):** In a two-high reversing mill the rolls rotate first in one direction and then in the other.
    Reason (R): So that the rolled metal may mass back and forth through the rolls several times.

32. **Assertion (A):** SIMO chart is a graphic representation of the separable steps of each pertinent body member of the worker.
    Reason (R): Tracing the movement of the worker can be used to reduce the fatigue of the worker.

33. **Assertion (A):** Technology park concept is used for locating I.T/software based ventures.
    Reason (R): Central air-conditioning is needed for long duration working when people are crowded together.

34. **Assertion (A):** Payback period is a good criteria for selection of mutually exclusive projects.
    Reason (R): While calculating payback period value of money is assumed to be same over different periods.

35. **Assertion (A):** The difference between production and job shop production is only the size of the batch used.
    Reason (R): Set-up time is different in job shop and mass production processing

36. **Assertion (A):** For batch production of quality components CNC machining centers are an excellent choice.
    Reason (R): Universal fixtures reduce set-up cost.

37. **Assertion (A):** The temperature of a system given by a mercury thermometer and an electric resistance thermometer would not be exactly the same except at their common fixed points.
    Reason (R): The empirical temperature scales are dependent on the nature of the thermometric substance used.

38. **Assertion (A):** When a given steam nozzle operates at critical pressure ratio, flow rate is maximum and remains constant.
    Reason (R): It is not possible to decrease the back pressure below the critical pressure.

39. **Assertion (A):** A vapour compression refrigerating cycle can never be reversible.
    Reason (R): The expansion of refrigerant through a valve causes throttling which is at constant internal energy.

40. **Assertion (A):** In a Lithium Bromide-water absorbent refrigeration system, water is the absorbent.
    Reason (R): It operates at lower pressures than ammonia system as the evaporation temperature at atmospheric pressure is 0°C.

41. Which one of the following is the correct relationship between the manipulated variable 'm' and the error signal 'e' of a proportional controller, if K_p is a constant ?
    (a) $m = Kp\ e$
    (b) $m = K_p \int e\ dt$
    (c) $m = K_p \dfrac{de}{dt}$
    (d) $m = -K_p \dfrac{de}{dt}$

42. While examining stability of a linear control system using Routh's criterion, if a zero appears in the left hand column of Routh's array and the sign of the term above this zero is the same as that below it, what information can be gathered about the roots ?
    (a) That a root lies in the right half plane of the imaginary axis
    (b) The roots contain a pair of zeros on the imaginary axis
    (c) Two roots lie in the left half plane of the imaginary axis
    (d) The roots contain a pair of zeros on a fixed axis

43. In an orthogonal cutting operation, the length of the cut is 76 mm, length of the chip measured is 61 mm and depth of cut is 0.2 mm. What is the thickness of the chip?
    (a) 0.01mm   (b) 0.8 mm
    (c) 0.2 mm   (d) 0.25 mm

44. Consider the following statements with respect to tool life:
    1. The presence of built up edge on the tool face during cutting sometimes decreases the tool life and sometimes increases it.
    2. For constant set of cutting conditions an optimum rake angle exists giving a maximum tool life.
    3. Tool life is defined as the cutting time required for failure of the tool.
    Which of the above statements is/are correct?
    (a) 1 only   (b) 1 and 2
    (c) 2 and 3   (d) 3 only

45. In orthogonal cutting, the component of the resultant force R along the shear plane is equal to which one of the following?
    (a) $R \cos (\phi + \beta - \alpha)$ (b) $R \sin (\phi + \beta - \alpha)$
    (c) $R \cos (\phi - [\beta - \alpha])$ (d) $R \sin (\phi - [\beta - \alpha])$
    where: ϕ = shear plane angle,
    β = friction angle,
    α = rake angle of the cutting tool.

46. The life of a single point cutting tool increases with which of the following?
    (a) Decrease in nose radius   (b) Decrease in rake angle
    (c) Increase in side cutting edge angle   (d) Increase in cutting speed

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

List-I   List-II
(Cutting tool material)   (Permissible cutting speed in m/min)
A. Cubic boron nitride (CBN)   1. 75 – 80
B. Ceramics   2. 150 – 170
C. Cemented carbides   3. 250 – 300
D. Cast non-ferrous alloy satellite4. Up to 1000
Code:

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

48. Which one of the following tool materials has the highest cutting speed?
(a) Carbide   (b) Carbon steel
(c) Tool steel   (d) High speed steel

49. Consider the following:
1. Tool life equation
2. Tool setting cost
3. Cost of operating the machine
On which of these, does optimum cutting speed for maximum production rate in turning depend?
(a) 1 only   (b) 1 and 2
(c) 2 and 3   (d) 3 only

50. Consider the following characteristics:
1. High pressures are required.
2. Used for making castings in aluminum
3. Melting unit is an integral part
Which of these characteristics of cold chamber die casting process are correct?
(a) 1, 2 and 3   (b) 1 and 2 only
(c) 1 and 3 only   (d) 2 and 3 only

51. Consider the following:
1. Chucking or mounting the work on mandrels is avoided.
2. Work having several diameters can be easily handled
3. The process is rapid and is adopted for production work.
4. Accuracy is easily controlled
Which of these advantages exist with centre less grinding?
(a) 1, 3 and 4   (b) 1, 2 and 3
(c) 2 and 3 only   (d) 2 and 4 only

52. Which of the following internal machining operations will produce the best surface finish?
(a) Reaming   (b) Boring
(c) Internal grinding   (d) Drilling

53. In sand casting moulds a sprue feeds metal to which one of the following?
    (a) Riser
    (b) Gate
    (c) Runner
    (d) Cavity

54. Which of the following is the important mechanical property for a material to be forged or rolled successfully?
    (a) Brittleness
    (b) Malleability
    (c) Ductility
    (d) Elasticity

55. In which of the following welding processes does the electrode *not* get consumed?
    (a) Submerged are welding
    (b) Electric welding
    (c) TIG welding
    (d) MIG welding

56. Rigid metal pieces to support big cores are called
    (a) Chaplets
    (b) Sprue
    (c) Riser
    (d) Ribs

57. Which one of the following moulding processes does *not* require use of core?
    (a) Sand moulding
    (b) Shell moulding
    (c) Lost foam
    (d) Plaster moulding

58. Which of the following casting methods utilizes wax pattern?
    (a) Die casting
    (b) Centrifugal casting
    (c) Investment casting
    (d) Semi-centrifugal casting

59. The products made by powder metallurgy process are very strong in
    (a) Bending
    (b) Compression
    (c) Tension
    (d) Shear

60. Thermosetting plastics can be formed by which of the following processes?
    (a) Injection moulding
    (b) Transfer moulding
    (c) Blow moulding
    (d) Extrusion

61. What will be the total number of torsionals vibration frequency of a shaft with N number of oscillating masses?
    (a) N
    (b) N + 1
    (c) $\dfrac{N}{2}$
    (d) N − 1

62. Which one of the following affects the critical speed of a shaft?
    (a) Span of the shaft
    (b) Diameter of the disc
    (c) Eccentricity
    (d) Span of the shaft, diameter of the disc and eccentricity

63. What type of balancing occurs when the bearing forces reduced to zero by balancing, but bending stresses over the entire length of the rotating shaft cannot be eliminated?
    (a) Static balancing
    (b) Dynamic balancing
    (c) Internal balancing
    (d) External balancing

64. Which one of the following is a correct statement regarding a flywheel?
    (a) A flywheel influences the mean speed of the prime mover.

(b) A flywheel influences the variation of load demand on the prime mover.
(c) A flywheel influences the cyclic variation of turning moment.
(d) A flywheel influences the mean torque developed by the prime mover.

65.
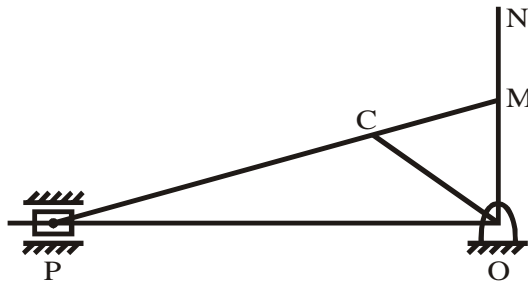
OCP is a slider-crank mechanism OC = 10 cm is the crank. CP is the connecting rod = 22 cm; OP = 30 cm. ON is perpendicular to OP.PC extended meets ON at M. OM = 7.5 cm, CM = 8.0 cm. Crank runs at 10 rod/s. Find the velocity of the piston in cm/s.
(a) 75   (b) 80
(c) 100   (d) 150

66. Which one of the following statements is appropriate for a governor of an engine of which the speed continuously fluctuates above and below the mean speed?
(a) It is stable   (b) It is hunting
(c) It is isochronous   (d) It is unstable

67. Which one of the following is a spring controlled centrifugal governor?
(a) Watt governor   (b) Proell governor
(c) Porter governor   (d) Pickering governor

68. The best choice of anti-friction bearing to support a shaft carrying a single helical gear is
(a) Self aligning ball bearing (b) Deep groove ball bearing
(c) Tapered roller bearing   (d) Thrust bearing

69. Which one of the following statements in connection with Sommerfeld number is true?
(a) It is directly proportional to load.
(b) It is inversely proportional to load.
(c) It is directly proportional to the square of load.
(d) It is inversely proportional to the square of load.

70. A factor which is a measure of the ability of the bearing material to accommodate the frictional energy generated in the bearing is called
(a) PV factor   (b) Wear factor
(c) Friction coefficient.   (d) Embed ability factor.

71. Which one of the following refers to a gear train of which the axes of the shafts ove which the gears are mounted move relative to a fixed axis?
(a) Compound gear train   (b) Epicyclic gear train
(c) Reverted gear train   (d) Simple gear train

72. **Cycloidal gear tooth profile consists of**
    (a) Only cycloid
    (b) Only hypocycloid.
    (c) Cycloid and epicycloids
    (d) Hypocycloid and epicycloids.

73. **A footstep bearing and a rotor of a vertical turbine forms an example of**
    (a) Incompletely constrained motion
    (b) Partially constrained motion
    (c) Completely constrained motion
    (d) Successfully constrained motion

74. **How many instantaneous centres are there in a mechanism with 8 binary links with one grounded link?**
    (a) 15
    (b) 21
    (c) 28
    (d) 36

75. **The ratio of equivalent length of the column to the minimum radius of gyration of the cross-sectional area of the column is called**
    (a) Bucking factor
    (b) Slenderness ratio
    (c) Column factor
    (d) Crippling factor

76. **A bar of cross-sectional area of 100 mm^2 is subjected to a tensile force of 1 kN. What is the maximum shear stress in the bar in MPa?**
    (a) Zero
    (b) 5
    (c) $5\sqrt{2}$
    (d) 10

77. **An elevator moves upwards with a velocity of 2 m/s. A man riding on the elevator throws up a ball of mass 1.0 kg with a speed of 4 m/s relative to the elevator. What is the work done by the man while throwing?**
    (a) 4 J
    (b) 8 J
    (c) 16 J
    (d) 36 J

78. **Principal strains at a point are $\varepsilon_1 = 200 \times 10^{-6}$ and $\varepsilon_2 = -400 \times 10^{-6}$. Modulus of rigidity of the material is 80 GPa. What is the magnitude of maximum shear stress at the point?**
    (a) 4.8 MPa
    (b) 48 MPa
    (c) 480 MPa
    (d) 4800 MPa

79. **Poisson's ratio of a material is 0.25. Its modulus of rigidity is 80 GPa. What is the value of its modulus of elasticity?**
    (a) 200 GPa
    (b) 150 GPa
    (c) 125 GPa
    (d) 100 GPa

80. **Consider the following statements:**
    1. The algebraic sum of the forces constituting couple is zero.
    2. The algebraic sum of the moment of the forces, constituting couple about any point in same plane is zero.
    3. A couple cannot be balanced by a single force.
    Which of the above statements is/are correct?
    (a) 1 only
    (b) 2 only
    (c) 1 and 3
    (d) 2 and 3

81. **The statement that the entropy of a pure substance in complete thermodynamic equilibrium becomes zero at the absolute zero of temperature is known as**
    (a) Law of entropy
    (b) First law of thermodynamics.

(c)   Second law of thermodynamics.   (d)   Third law of thermodynamics.

82. **For a gas that is allowed to expand reversibly and adiabatically, there is no change in**
   (a)   Internal energy   (b)   Temperature
   (c)   Entropy   (d)   Enthalpy

83. **The enthalpy change during reversible closed system, is given by**
   (a)   d H = –Sd T – Pd V
   (b)   d H = –Sd T + Vd P
   (c)   d H = Td s + Pd V
   (d)   d H = Tds + Vd p

84. **Which of the following is a heterogeneous system?**
   (a)   The cooling of a fluid in a radiator
   (b)   A mixture of ice, water and steam
   (c)   A mixture of hydrogen and oxygen
   (d)   Atmospheric air

85. **Which of the following relations is *not* valid for throttling process?**
   (a)   Mass before expansion = Mass after expansion
   (b)   Pressure before expansion = Pressure after expansion
   (c)   Enthalpy before expansion = Enthalpy after expansion
   (d)   External work done = Zero

86. **Scheduling defines**
   (a)   Sequence of operations to be performed.
   (b)   When and where operations are to be performed.
   (c)   Machine capacity plan.
   (d)   Sequence of machine performance.

87. **In process inventory will be maximum in case of a plant with**
   (a)   Process layout   (b)   Product layout
   (c)   Mixed Process and Product layout   (d)   Machine cell layout

88. **What is a useful aid in loading, scheduling, dispatching and progressing?**
   (a)   Master load chart   (b)   Gantt chart
   (c)   Flow process chart   (d)   PERT/CPM

89. **What is the act of authorizing the work-man actually to perform the work according to the method outlined using prescribed tools at a predetermined standard and schedule?**
   (a)   Dispatching   (b)   Loading
   (c)   Planning   (d)   Scheduling

90. **A purchasing assistant has calculated the annual carrying cost for an item to be Rs. 4/annum. EOQ worked out is 500 units. What is the annual ordering cost for the item?**
   (a)   Rs. 125   (b)   Rs. 500
   (c)   Rs. 1,000   (d)   Rs. 2,000

91. Consider the following statements:
    Work study of a task is carried out with a view
    1. To standardize the method of doing a task.
    2. To prepare a suitable incentive plan.
    3. To decide the processing parameters best suited.
    4. To promote good relations between supervisor and worker.
    Which of the above statements are correct?
    (a) 1, 2 and 3
    (b) 1 and 2 only
    (c) 2 and 4 only
    (d) 2, 3 and 4

92. Match List I with List II and select the correct answer using the code given below the lists:
    List-I
    (Material Handling Equipment)
    A. Fixed path
    B. Limited area
    C. Mobile
    D. Tools and Storage

    List-II
    (Example)
    1. Pallets
    2. Fork lift truck
    3. Gantry crane
    4. Containers
    5. Conveyors

    Code:

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

93. Consider the following statements with respect to limitations of a product layout:
    1. A breakdown of one machine may lead to complete stoppage of a line.
    2. Production, planning and control system are more involved.
    3. The pace of production is determined by the slowest machine.
    4. Total production time is usually longer.
    Which of the above statements are correct?
    (a) 1, 2, 3 and 4
    (b) 1 and 2 only
    (c) 1 and 3 only
    (d) 3 and 4 only

94. If the total investment is Rs. 5, 00,000 for a target production and the income for the current year is Rs. 3, 00,000 and the operating cost is Rs. 1, 00,000. What is the percentage economic yield?
    (a) 10%
    (b) 20%
    (c) 40%
    (d) 50%

95. Consider the following statements in respect of break-even point:
    1. Revenue is equal to total cost.
    2. Revenue is equal to variable cost.
    3. Profit/Loss is equal to zero.
    Which of the above statements are correct?
    (a) 1, 2 and 3
    (b) 1 and 2 only
    (c) 2 and 3 only
    (d) 1 and 3 only

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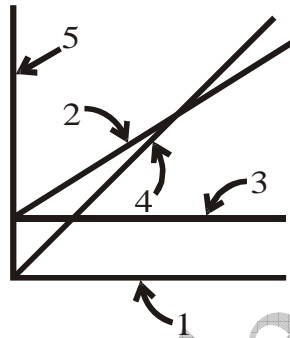
List-I

(Cost/Revenue parameter)

A. Facility cost

B. Total cost

C. Sales revenue

D. Production quantity

List-II

(Break-even chart's parameter)

Code:

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

97. The paths and movements followed by men, materials and equipments in executing the activities is indicated by which of the following?
(a) Flow diagram   (b) String diagram
(c) Travel charts   (d) Man-machine chart

98. In critically examining a method, the preferable sequence of questioning is given by
(a) Who, What, How, When, Where
(b) How, Who, What, Where, When
(c) What, Who, When, Where, How
(d) What, When, Where, Who, How

99. Which one of the following is *not* the purpose of method study?
(a) Save time   (b) Improve manpower planning
(c) Improve product design   (d) Reduce worker fatigue

100. Which one of the following is *not* the characteristic of machining of plastics?
(a) Poor surface finish after machining
(b) Intense dust formation
(c) Strong abrading action on cutting tools
(d) Good heat dissipation from the cutting zone

101. The stagnation and static pressures recorded by water meter during flow of water in a pipe are respectively 4 m and 2 m. If the coefficient of the water meter used is 0.98, then what is the velocity of flow?
(g is acceleration due to gravity)

(a) $1.50\sqrt{g}$
(b) $1.96\sqrt{g}$
(c) $2.00\sqrt{g}$
(d) $4.00\sqrt{g}$

102. The boundary layer separation occurs when

(a) $\left(\dfrac{\partial u}{\partial y}\right)_{Y=0} = 0$
(b) $\left(\dfrac{\partial u}{\partial y}\right)_{Y=0} < 0$
(c) $\left(\dfrac{\partial u}{\partial y}\right) < 0$
(d) $\left(\dfrac{\partial u}{\partial y}\right)_{Y=0} > 0$

103. The existence of velocity potential in fluid flow indicates that the
(a) Vorticity must be zero
(b) Vorticity must be non-zero
(c) Flow is rotational
(d) Flow should accelerate

104. The expansion valve in a vapour compression refrigeration system expands
(a) Refrigerant vapours adiabatically
(b) High pressure liquid isentropically
(c) High pressure liquid by throttling process
(d) High pressure liquid by free expansion process

105. Consider the following statements pertaining to comfort air-conditioning.
1. The temperature selected in comfort air-conditioning need not be that for optimum comfort.
2. For each 5°C drop in outside temperature 1°C should be reduced in effective temperature in design.
3. Heat insulated walls are not necessarily vapour barrier
Which of the above statements are correct?
(a) 1, 2 and 3
(b) 1 and 2 only
(c) 1 and 3 only
(d) 2 and 3 only

106. Which one of the following statements is correct for sum of sensible and latent heat transfer from a wetted surface to another surface with air temperature t, humidity ratio W, enthalpy h, saturated air temperature t_S, humidity ratio W_S and enthalpy h_S?
(a) Proportional to $(t - t_S)$
(b) Proportional to $(W - W_S)$
(c) Proportional to $(h - h_S)$
(d) Proportional to $(t - t_S) + 2500 (W - W_S)$

107. The mass of water vapour in one m^3 of dry air is defined as
(a) Specific humidity
(b) Humidity ratio
(c) Absolute humidity
(d) Relative humidity

108. The psychometric process the air undergoes while passing through a desert air cooler is
(a) Sensible cooling
(b) Evaporative cooling
(c) Humidification
(d) Dehumidification

109. Consider the following statements:
1. In a split type air-conditioning unit, the compressor alone is located outside the room.
2. In window type air-conditioning units, water comes out of the unit as a result of cooling the air below the freezing point of water.
3. Air may be cooled by blowing it over a wetted surface.
4. Air temperature increases when water vapour is separated by condensation.
Which of the above statements is/are correct?
(a) 1 only
(b) 1, 2 and 3
(c) 2, 3 and 4
(d) 3 and 4 only

110. In a vapour compression refrigerating system, it is desirable to have the refrigerant as
(a) Saturated liquid at the suction to the compression.
(b) Wet vapour at the suction to the compression
(c) Superheated vapour at the suction to the compression
(d) Supercooled liquid at the suction to the compression.

111. What is the commonly used refrigerant for domestic refrigerator?
(a) R 11
(b) R 22
(c) Ammonia
(d) Carbon dioxide

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

List-I	List-II
A. R – 1349	1. Propane
B. R – 152a	2. Isobutane
C. R – 290	3. Difluoroethane
D. R – 600a	4. Tetrafluoroethane

Code:

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

113. The maintenance cost of capillary tube is less than that for expansion valve. What is the reason?
(a) Absence of moisture
(b) Absence of air
(c) Absence of internal wall friction
(d) Absence of moving parts

114. Under-cooling of the refrigerant in a system
(a) Increases the power required
(b) Decreases the power required
(c) Decreases the COP.
(d) Increases the COP.

115. Consider the following statements:
1. The refrigerating capacity of a vapour compression refrigeration system can be varied by adjusting expansion valve opening.
2. During winter the pressure difference across the expansion valve increases and causes higher rate of flow.
3. In hermetically sealed motor, low suction pressure often causes burning of motor.

Which of the above statements is/are correct?
(a) 1 only   (b) 3 only
(c) 1 and 3   (d) 2 and 3

116. Consider the following statements pertaining to the absorbent refrigeration system:
1. In Ammonia water system, ammonia is refrigerant and water is absorbent.
2. The refrigerant vapour from the generator is mixed with water vapour.
3. The Ammonia-water absorption system works on reversible cycle.

Which of the above statements is/are correct?
(a) 1 only   (b) 1 and 2 only
(c) 2 and 3 only   (d) 1, 2 and 3

117. Consider the following statements:
1. The specific speed decreases if the degree of reaction is decreased.
2. The degree of reaction is zero for Pelton wheel.
3. The degree of reaction is between zero and one for Francis turbine
4. The degree of reaction is between 0.5 and one for Kaplan turbine.

Which of the above statements are correct?
(a) 2, 3 and 4   (b) 1 and 2 only
(c) 2 and 3 only   (d) 3 and 4 only

118. Which of the following materials is suitable for control rod of a nuclear reactor?
(a) Cadmium   (b) Copper
(c) Zinc   (d) Graphite

119. The risk of radioactive hazard is greatest in the turbine with the following reactor:
(a) Boiling water   (b) Pressurized water
(c) Gas cooled   (d) Liquid metal cooled

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

*Li*st-I	List- II
A. Pressurized heavy water reactor	1. No moderator
B. Gas cooled reactor	2. Magnetic pump
C. Fast breed reactor	3. Graphite
D. Sodium cooled reactor	4. Natural Uranium

Code:

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