Booklet Sr. No.

Candidate's Name _____

Father's Name _____

Date of Birth : ☐☐ ☐☐ ☐☐☐☐
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OMR Response Sheet No. _____ **Roll No.** _____

Candidate's Signature :
(Please sign in the box)

Total Questions : **120**]
Time Allowed : **2** Hours]

INSTRUCTIONS

1. The candidate shall NOT open this booklet till the time he/she is told to do so by the Invigilation Staff. However, in the meantime, the candidate can read these instructions carefully and subsequently fill the appropriate columns given above in CAPITAL letters. The candidate may also fill the relevant boxes out of 1 to 9 of the Optical Mark Reader (OMR) response sheet, supplied separately.

2. Use only blue or black ball point pen to fill the relevant columns on this page as well as in the OMR sheet. Use of ink pen or any other pen is not allowed.

3. The candidate shall be liable for any adverse effect if the information given above is wrong or illegible or incomplete.

4. Each candidate is required to attempt 120 questions in 120 minutes, except for orthopedically/visually impaired candidates, who would be given 40 extra minutes, by marking correct responses on the OMR sheet.

5. The candidates, when allowed to open the question paper booklet, must first check the entire booklet to confirm that the booklet has complete number of pages, the pages printed correctly and there are no blank pages. In case there is any such error in the question paper booklet then the candidate should IMMEDIATELY bring this fact to the notice of the Invigilation Staff and obtain a new booklet of the same series as given earlier.

6. The serial number of the new Question booklet if issued for some reason should be entered in the relevant column of the OMR. The Invigilation Staff must make necessary corrections in their record regarding the change in the serial no. of Question booklet.

7. The question paper booklet has **20** pages.

8. The paper consists of total 300 marks. Each question shall carry 2·5 marks. There are four options for each question and the candidate has to mark the MOST APPROPRIATE answer on the OMR response sheet.

9. There is negative marking (0·5 marks for each question) for questions wrongly answered by the candidate.

10. The candidate **MUST READ INSTRUCTIONS BEHIND THE OMR SHEET** before they start answering the questions and check that two carbon copies attached to the OMR sheet are intact.

SECTION A

1. According to Kelvin-Planck's statement of second law of thermodynamics,

   (a) it is impossible to construct an engine working on a cyclic process, whose sole purpose is to convert heat energy into work.

   (b) it is possible to construct an engine working on a cyclic process, whose sole purpose is to convert heat energy into work.

   (c) it is impossible to construct a device which operates in a cyclic process and produces no effect other than the transfer of heat from a cold body to a hot body.

   (d) None of the above

2. A mixture of gas expands from $0{\cdot}03$ m^3 to $0{\cdot}06$ m^3 at a constant pressure of 1 MPa and absorbs 84 kJ of heat during the process. The change in internal energy of the mixture is

   (a) 30 kJ

   (b) 54 kJ

   (c) 84 kJ

   (d) 11 kJ

3. A spherical steel ball of 12 mm diameter is initially at 1000 K. It is slowly cooled in a surrounding of 300 K. The heat transfer coefficient between the steel ball and the surrounding is 5 W/m^2 K. The thermal conductivity of steel is 20 W/mK. The temperature difference between the centre and the surface of the steel ball is

   (a) large because conduction resistance is far higher than the convective resistance.

   (b) large because conduction resistance is far less than the convective resistance.

   (c) small because conduction resistance is far higher than the convective resistance.

   (d) small because conduction resistance is far less than the convective resistance.

4. The triple point temperature for water is

   (a) 0°K

   (b) 0°C

   (c) 0·01°C

   (d) 0·1°C

5. During sensible heating of moist air, enthalpy

(a) increases.

(b) decreases.

(c) remains constant.

(d) None of the above

6. Babbit metal is an alloy of

(a) Sn, Cu, Sb and Pb

(b) Sn, Cu, Zn and Pb

(c) Sn, Cu, Al and Pb

(d) Sn, Cu, Mn and Sb

7. The chip thickness along shear plane is

(a) equal to uncut thickness.

(b) equal to cut chip thickness.

(c) greater than uncut thickness and cut chip thickness.

(d) not related to chip thickness before or after cut.

8. A casting process which can produce hollow cylinder without use of core is

(a) Permanent mould casting.

(b) Semi-permanent mould casting.

(c) Pressed casting.

(d) Slush casting.

9. Shrinkage allowance is a _____ while draft allowance is a _____ type of allowance in respect of pattern allowances.

(a) negative, positive

(b) positive, negative

(c) negative, neutral

(d) None of the above

10. Typical hot working temperature of aluminium alloys is

(a) 200 to 300°C

(b) 350 to 485°C

(c) 500 to 700°C

(d) 700 to 1000°C

11. For cold rolling of sheets and strips, the value of bite angle varies from

(a) 2 – 10 degrees

(b) 15 – 20 degrees

(c) 20 – 30 degrees

(d) 30 – 40 degrees

12. In powder metallurgy process the sequence of operations is given by

(a) atomization, mixing, sintering, pressing.

(b) atomization, sintering, mixing, pressing.

(c) atomization, pressing, mixing, sintering.

(d) atomization, mixing, pressing, sintering.

13. Jigs are used for

(a) holding the workpiece only.

(b) holding the workpiece and guiding the tool.

(c) guiding the tool only.

(d) positioning the workpiece on machine.

14. Brazing is a metal joining process whereby

(a) a filler metal is heated above melting point and distributed between two or more close fitting parts by capillary action.

(b) a filler metal is heated below melting point and distributed between two or more close fitting parts by capillary action.

(c) a filler metal is heated at melting point and distributed between two or more close fitting parts by capillary action.

(d) None of the above

15. In Tungsten Inert Gas welding process,

(a) Argon or helium gas is used with a consumable electrode.

(b) Argon or helium gas is used with a non-consumable electrode.

(c) Nitrogen gas is used with a consumable electrode.

(d) Oxygen gas is used with a consumable electrode.

16. With reference to single point cutting tool, the angle between the end cutting edge and a line perpendicular to the shank of tool is called

(a) End cutting edge angle.

(b) Side cutting edge angle.

(c) End relief angle.

(d) Side relief angle.

17. Tool life in turning will decrease by maximum extent if we double the

(a) depth of cut.

(b) feed.

(c) cutting velocity.

(d) tool rake angle.

18. The basic rapid prototyping process is

(a) EDM

(b) ECM

(c) Stereo lithography

(d) AJM

19. A sine bar is generally used with

(a) Slip gauges.

(b) Dial gauge.

(c) Surface plate.

(d) All of the above

20. In 3-D wireframe modelling, the curved surfaces are represented by

(a) suitably under spaced generators.

(b) suitably spaced generators.

(c) randomly spaced generators.

(d) suitably over spaced generators.

21. The Coriolis component of acceleration is present in

(a) 4-bar mechanisms with 4 turning pairs.

(b) Whitworth quick return mechanism.

(c) Slider-crank mechanism.

(d) Scotch Yoke mechanism.

22. If l_1 is the effort arm and l_2 is the load arm of the lever, the *'leverage'* is defined as

(a) $\dfrac{l_2}{l_1}$

(b) $\dfrac{l_1}{l_2}$

(c) $\dfrac{l_1^2}{l_2^2}$

(d) $\sqrt{\dfrac{l_1}{l_2}}$

23. A ball is projected vertically upward with a certain velocity. It takes 40 s for its upward journey. The time (in seconds) taken for its downward journey is

(a) 10

(b) 20

(c) 30

(d) 40

24. Maximum shear stress developed on the surface of a solid circular shaft under pure torsion is 240 MPa. If the shaft diameter is doubled, then the maximum shear stress developed corresponding to the same torque will be

(a) 120 MPa

(b) 60 MPa

(c) 30 MPa

(d) 15 MPa

25. In terms of Poisson's ratio (v), the ratio of Young's modulus (E) to shear modulus (G) of elastic materials is

(a) $2(1 + v)$

(b) $2(1 - v)$

(c) $\dfrac{(1 + v)}{2}$

(d) $\dfrac{(1 - v)}{2}$

26. For a plane stress case, $\sigma_1 = 50$ MPa, $\sigma_2 = -100$ MPa, $\tau_{12} = 40$ MPa, the maximum and minimum principal stresses are, respectively,

(a) 60 MPa, -110 MPa

(b) 50 MPa, 110 MPa

(c) 40 MPa, -120 MPa

(d) 70 MPa, 130 MPa

27. Mobility of a statically indeterminate structure is

(a) ≤ -1

(b) 0

(c) 1

(d) ≥ 2

28. Gears used in drive to the differential of an automobile are

(a) straight bevel gears.

(b) spiral bevel gears.

(c) zero bevel gears.

(d) All of the above

29. During adiabatic saturation process of unsaturated air, _____ remains constant.

(a) dew point temperature

(b) relative humidity

(c) dry bulb temperature

(d) wet bulb temperature

30. The subcooling in a refrigeration cycle

  (a) decreases COP.

  (b) increases COP.

  (c) does not alter COP.

  (d) None of the above

31. The by-pass factor for a cooling coil

  (a) decreases with increase in velocity of air passing through it.

  (b) increases with increase in velocity of air passing through it.

  (c) remains unchanged with increase in velocity of air passing through it.

  (d) may increase or decrease with increase in velocity of air passing through it depending upon the condition of air entering.

32. The primary reason for formation of NO_x is

  (a) high temperature and low pressure.

  (b) low temperature and low pressure.

  (c) high temperature and availability of O_2.

  (d) low temperature and availability of O_2.

33. When an engine is idling, it requires

  (a) rich fuel air mixture.

  (b) lean fuel air mixture.

  (c) no fuel in the air.

  (d) stoichiometric mixture.

34. In a petrol engine, the pressures in the cylinder at 30% and 70% of the compression stroke are 1·33 bar and 2·66 bar respectively. The compression ratio is (n = 1·33)

  (a) 3·5

  (b) 4·5

  (c) 5·5

  (d) 6·5

35. By higher Octane number of S.I. fuel, it is meant that fuel has

  (a) higher flash point.

  (b) higher heating value.

  (c) lower volatility.

  (d) longer ignition delay.

36. Knock in a spark ignition engine

  (a) is suppressed by advancing the spark timing.

  (b) increases heat loss to the coolant.

  (c) increases the work done during expansion.

  (d) occurs during early part of combustion.

37. The values of principal cutting edge angle, ϕ of the turning tool whose geometry is designated as : 10°, – 10°, 8°, 6°, 15°, 30°, 0 (inch).

  (a) 6°

  (b) 15°

  (c) 30°

  (d) 60°

38. The maximum height of surface roughness H_{max} produced by a single point turning tool having feed, f mm/rev and nose radius, R mm is

(a) $\dfrac{f^2}{8R}$

(b) $\dfrac{f}{8R}$

(c) $\dfrac{f^2}{2R}$

(d) $\dfrac{f}{2R}$

39. While orthogonal turning at a cutting speed of 100 m/min, the tool life is 10 minutes, while the tool life increases to 40 minutes if the cutting speed is reduced to 50 m/min. The value of index (n) in the Taylor's tool life equation is

(a) 2

(b) 0·5

(c) 5

(d) 0·2

40. Cold shuts are casting defects

(a) which occur due to some sand shearing from the cope.

(b) which take the form of internal voids or surface depression due to excessive gaseous material not being able to escape.

(c) caused by two streams of metals that are too cold to fuse.

(d) which occur due to discontinuity in metal casting resulting from hindered contraction.

41. Property of sand mould which ensures that sand mould will not resist the contraction of metal during casting :

(a) Collapsibility

(b) Flowability

(c) Refractoriness

(d) Permeability

42. Residual stress in welding causes

(a) enhanced dimensional stability.

(b) welding cracking.

(c) reduction in creep strength.

(d) both (b) and (c)

43. The acetylene cylinder is filled with a material saturated with

(a) Calcium carbide

(b) Acetylene

(c) Calcium oxide

(d) Acetone

44. TIG welding is best suited for welding

(a) Mild steel

(b) Stainless steel

(c) Carbon steel

(d) Aluminium

45. In single pass rolling operation using a 600 mm diameter roller at a rotational speed of 100 rpm, a plate of 19 mm thickness and 100 mm width is reduced to 16 mm thickness. The roll strip contact length will be

(a) 42·4 mm

(b) 30 mm

(c) 40 mm

(d) 20 mm

46. Cold working of metals results in

(a) increased strength and hardness but reduced dislocation density.

(b) increased strength and hardness as well as increased dislocation density.

(c) decreased strength and hardness as well as reduced dislocation density.

(d) decreased strength and hardness but increased dislocation density.

47. Effective Diameter of screw thread can be measured using

(a) Bench micrometer

(b) Two-wire methods

(c) Floating carriage micrometer

(d) Vernier caliper

48. A 100 mm long workpiece is to be machined on an NC lathe at 500 rpm and feed rate of 0·1 mm/rev. A stepper motor having a step of 1·8° is used to provide the feed motion through a lead screw having a pitch of 5 mm. Pulses required to machine the workpiece :

(a) 4000

(b) 3000

(c) 3500

(d) 4500

49. In simple exponential smoothing forecasting, the value of smoothening coefficient should be kept close to _____ in order to give lower weightage to past demand.

(a) 1·0

(b) 0

(c) – 1

(d) 0·5

50. In which manufacturing system, 5Ss (seiri, seiton, seisō, seiketsu, and shitsuke) is used as a workplace management technique ?

(a) Toyota Production System

(b) Flexible Manufacturing System

(c) Agile Manufacturing System

(d) Cellular Manufacturing System

51. For a production system, annual consumption is 21,000 units and cost of one unit is ₹ 4. The ordering cost and holding cost is ₹ 60 per order and holding cost is ₹ 0·6 per unit per year. Past lead times are 19, 20, 18, 16, 22 and 25 days. If there are 300 working days in a year, the reorder level (units) is

(a) 350

(b) 1450

(c) 1750

(d) 1540

52. Which of the following methods can be used to find basic feasible solution of a transportation problem ?

(a) Big-M method

(b) Stepping Stone method

(c) Two Phase method

(d) Vogel's Approximation method

53. Two identical trusses supported a load of 100 N as shown in the figure. The length of each truss is 0·1 m; cross-sectional area is 200 mm^2, Young's modulus E = 200 GPa. The force in the truss AC (in N) is
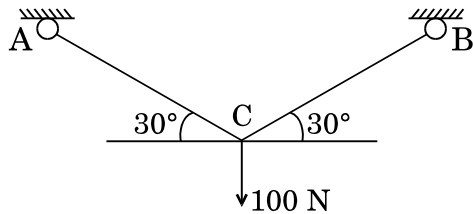

(a) 100 N

(b) 200 N

(c) 50 N

(d) 150 N

54. A cantilever OP is connected to another beam PQ with a pin joint as shown in the figure. A load of 10 kN is applied at the mid-point of PQ. The magnitude of bending moment (in kNm) at fixed end O is
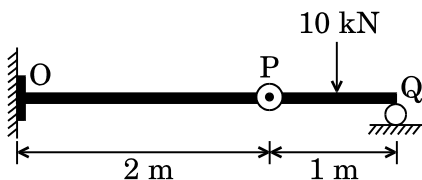
(a) 2·5

(b) 5

(c) 10

(d) 25

55. A machine element XY, fixed at end X, is subjected to an axial load P, transverse load F, and a twisting moment T at its free end Y. The most critical point from the strength point of view is a
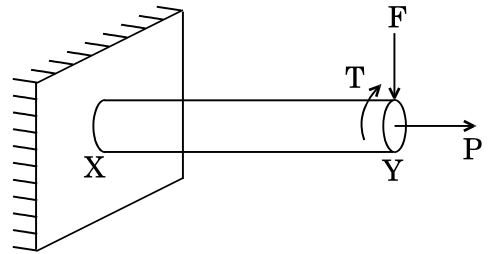
(a) point on the circumference at location Y.

(b) point at the centre at location Y.

(c) point on the circumference at location X.

(d) point at the centre at location X.

56. If σ_1 and σ_3 are the algebraically largest and smallest principal stresses respectively, the value of the maximum shear stress is

(a) $\dfrac{\sigma_1 + \sigma_3}{2}$

(b) $\dfrac{\sigma_1 - \sigma_3}{2}$

(c) $\sqrt{\dfrac{\sigma_1 + \sigma_3}{2}}$

(d) $\sqrt{\dfrac{\sigma_1 - \sigma_3}{2}}$

57. A rope brake dynamometer attached to the crank shaft of an IC engine measures a brake power of 10 kW when the speed of rotation of the shaft is 400 rad/s. The shaft torque (in N-m) sensed by the dynamometer is

(a) 25 Nm

(b) 20 Nm

(c) 10 Nm

(d) 15 Nm

58. Which of the bearings given below should *not* be subjected to a thrust load ?

(a) Deep groove ball bearing.

(b) Angular contact ball bearing.

(c) Cylindrical (straight) roller bearing.

(d) Single row tapered roller bearing.

59. Pre-tensioning of a bolted joint is used to

(a) strain harden the bolt head.

(b) decrease stiffness of the bolted joint.

(c) increase stiffness of the bolted joint.

(d) prevent yielding of the thread root.

60. Water (density 1000 kg/m³) at ambient temperature flows through a horizontal pipe of uniform cross-section at the rate of 1 kg/s. If the pressure drop across the pipe is 100 KPa, the minimum power required to pump the water across the pipe, in watts, is

(a) 10 W

(b) 100 W

(c) 200 W

(d) 20 W

61. Which one of the following statements is true ?

(a) Both Pelton and Francis turbines are impulse turbines.

(b) Francis turbine is a reaction turbine but Kaplan turbine is an impulse turbine.

(c) Francis turbine is an axial-flow reaction turbine.

(d) Kaplan turbine is an axial-flow reaction turbine.

62. For the stability of a floating body, the

(a) centre of buoyancy must coincide with the centre of gravity.

(b) centre of buoyancy must be above the centre of gravity.

(c) centre of gravity must be above the centre of buoyancy.

(d) metacentre must be above the centre of gravity.

63. Two pipe lines of equal lengths are connected in series. The diameter of the second pipe is two times that of the first pipe. The ratio of frictional head losses between the first pipe and the second pipe is

(a) 1 : 32

(b) 1 : 16

(c) 1 : 8

(d) 1 : 4

64. The ratio of momentum diffusivity (v) to thermal diffusivity (α), is called

(a) Prandtl number

(b) Nusselt number

(c) Biot number

(d) Lewis number

65. For flow of fluid over a heated plate, the following fluid properties are known :

Viscosity = 0·001 Pa.s

Specific heat at constant pressure, $c_p = 1$ kJ/kg K

Thermal conductivity, k = 1 W/mK

The hydrodynamic boundary layer thickness at a specified location on the plate is 1 mm.

The thermal boundary layer thickness at the same location is

(a) 0·0001 mm

(b) 0·01 mm

(c) 1 mm

(d) 1000 mm

66. The heat loss from a fin is 6 W. The effectiveness and efficiency of the fin are 3 and 0·75, respectively. The heat loss (in W) from the fin, keeping the entire fin surface at base temperature, is

(a) 2 W

(b) 3 W

(c) 4 W

(d) 8 W

67. The emissive power of a blackbody is P. If its absolute temperature is doubled, the emissive power becomes

(a) 2P

(b) 4P

(c) 8P

(d) 16P

68. Lumped system analysis of transient heat conduction situation is valid when the Biot number is

(a) very small.

(b) very large.

(c) approximately one.

(d) cannot say unless the Fourier number is also known.

69. For an ideal gas with constant values of specific heats, for calculation of the specific enthalpy,

(a) it is sufficient to know only the temperature.

(b) both temperature and pressure are required to be known.

(c) both temperature and volume are required to be known.

(d) both temperature and mass are required to be known.

70. The internal energy of an ideal gas is a function of

(a) temperature and pressure.

(b) volume and pressure.

(c) entropy and pressure.

(d) temperature only.

71. An air standard Otto cycle has the following shape on a thermodynamic property plane.
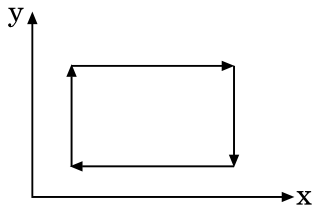
The x and y coordinates, respectively are

(a) V and P

(b) S and V

(c) V and T

(d) S and P

72. For an ideal gas as a working fluid for a given heat input Q, the process that gives the maximum work among the following four processes is

(a) Isothermal

(b) Constant volume

(c) Constant pressure

(d) Isentropic

73. The coefficient of performance (COP) of a Carnot refrigerator is 5. If the refrigerator, operating between the same two thermal reservoirs, is used as a Carnot heat pump, the COP of the heat pump will be

(a) 4

(b) 5

(c) 6

(d) 8

74. The welding process which uses a blanket of fusible granular flux is

(a) Tungsten inert gas welding.

(b) Submerged arc welding.

(c) Electroslag welding.

(d) Thermit welding.

75. The number of atoms per unit cell and the number of slip systems, respectively, for a face-centred cubic (FCC) crystal are

(a) 3, 3

(b) 3, 12

(c) 4, 12

(d) 4, 48

76. During solidification of a pure molten metal, the grains in the casting near the mould wall are

(a) coarse and randomly oriented.

(b) fine and randomly oriented.

(c) fine and ordered.

(d) coarse and ordered.

77. Match the following products with the suitable manufacturing process :

	Product		Manufacturing Process
P.	Toothpaste tube	1.	Centrifugal casting
Q.	Metallic pipes	2.	Blow moulding
R.	Plastic bottles	3.	Rolling
S.	Threaded bolts	4.	Impact extrusion

(a) P-4, Q-3, R-1, S-2

(b) P-2, Q-1, R-3, S-4

(c) P-4, Q-1, R-2, S-3

(d) P-1, Q-3, R-4, S-2

78. Which of the following welding methods provides the highest heat flux (W/mm^2) ?

(a) Oxy-acetylene gas welding

(b) Tungsten inert gas welding

(c) Plasma arc welding

(d) Laser beam welding

79. The fluidity of molten metal of cast alloys (without any addition of fluxes) increases with increase in

(a) Viscosity

(b) Surface tension

(c) Freezing range

(d) Degree of super heat

80. Consider the following quenching media :

1. Oil

2. Water

3. Water + NaOH

4. Brine

The correct sequence of these media in order of increasing hardness of steel undergoing heat treatment is

(a) $1 < 3 < 2 < 4$

(b) $2 < 1 < 3 < 4$

(c) $1 < 2 < 3 < 4$

(d) $4 < 3 < 2 < 1$

81. A 50 mm diameter disc is to be punched out from a carbon steel sheet 1·0 mm thick. The diameter of the punch should be

(a) 49·925 mm

(b) 50·00 mm

(c) 50·075 mm

(d) None of the above

82. Hole of diameter $25^{+0·040}_{+0·020}$ mm are assembled interchangeably with the pins of diameter $25^{+0·005}_{-0·008}$ mm. The minimum clearance in the assembly will be

(a) 0·048 mm

(b) 0·015 mm

(c) 0·005 mm

(d) 0·008 mm

83. In an ultrasonic machining (USM) process, the material removal rate (MRR) is plotted as a function of the feed force of the USM tool. With increasing feed force, the MRR exhibits the following behaviour :

(a) Increases linearly

(b) Decreases linearly

(c) Does not change

(d) First increases and then decreases

84. Internal gears are manufactured by

(a) Hobbing.

(b) Shaping with pinion cutter.

(c) Shaping with rack cutter.

(d) Milling.

85. Metal removal in electric discharge machining takes place through

(a) Ion displacement.

(b) Melting and vaporization.

(c) Corrosive reaction.

(d) Plastic shear.

86. In Taylor's tool life equation $VT^n = C$, the constants n and C depend upon

1. Work piece material

2. Tool material

3. Coolant

(a) 1, 2 and 3

(b) 1 and 2 only

(c) 2 and 3 only

(d) 1 and 3 only

87. Clearance in a fit is the difference between

(a) Maximum hole size and Minimum shaft size.

(b) Minimum hole size and Maximum shaft size.

(c) Maximum hole size and Maximum shaft size.

(d) None of the above

88. In metal cutting operation, the approximate ratio of heat distributed among chip, tool and work, in that order is

(a) 80 : 10 : 10

(b) 33 : 33 : 33

(c) 20 : 60 : 10

(d) 10 : 10 : 80

89. Two points on a link are moving with velocities of 5x and 2x perpendicular to the link in the same direction, separated by a distance d. What is the angular velocity of the link ?

(a) 7x/d

(b) 10x/d

(c) 3x/d

(d) 2·5x/d

90. If the outer diameter of a cylinder is D and thickness is t, then for this cylinder to be a thin cylinder, the ratio D/t will be approximately

(a) 10

(b) 12

(c) 15

(d) 8

91. In case of simply supported beam, if the position of point of application of bending moment is changed towards left, over the length of the beam, the value of the reactive force at the left end of the beam will

(a) remain unchanged.

(b) increase.

(c) decrease.

(d) be doubled of the previous value.

92. In case of a bar under torsion if the force is applied at the outer surface of the bar and longitudinally, the shear stress is maximum at

(a) the centre of the bar.

(b) just before the outer surface.

(c) the outer surface.

(d) the mid-point of radius of the bar.

93. In Brinell hardness test, a _____ ball is used for a standard time usually for _____ .

(a) Steel, 10 seconds

(b) Tungsten Carbide, 10 seconds

(c) Steel ball, 30 seconds

(d) Tungsten Carbide, 30 seconds

94. Which of the following statements is/are *false* for active gyroscopic couple ?

(a) Reactive gyroscopic couple and active gyroscopic couple are opposite in direction.

(b) In right hand rule, curled fingers denote direction of precession.

(c) In active gyroscopic couple spin vector and precession vector are parallel to each other.

(d) All the above statements are false.

95. A light cantilever of rectangular section (5 cm deep and 2·5 cm wide) has a mass fixed at its free end. The ratio of frequency of free lateral vibrations in vertical plane to that in the horizontal plane will be

(a) 3 : 1

(b) 1 : 3

(c) 2 : 1

(d) 1 : 2

96. The unit of a physical quantity which does not depend on the unit of any other physical quantity is called

(a) independent dimension.

(b) fundamental dimension.

(c) core dimension.

(d) All of the above

97. Zeroth Law of thermodynamics provides a basis for the measurement of

(a) Temperature

(b) Pressure

(c) Volume

(d) Heat

98. An adiabatic system is a thermally insulated system with its surroundings and

(a) does not exchange work with its surroundings.

(b) exchanges work with surroundings.

(c) Both (a) and (b)

(d) None of the above

99. In an internal combustion engine, if during compression, the heat rejected is 60 kJ/kg and work input is 120 kJ/kg, then what will be the change in internal energy of the working fluid ?

(a) Loss of internal energy is 60 kJ/kg

(b) Gain of internal energy is 60 kJ/kg

(c) Loss of internal energy is 120 kJ/kg

(d) Gain of internal energy is 120 kJ/kg

100. Which of the following represents Otto cycle on temperature – entropy diagram ?

(a)

(b)

(c)

(d)
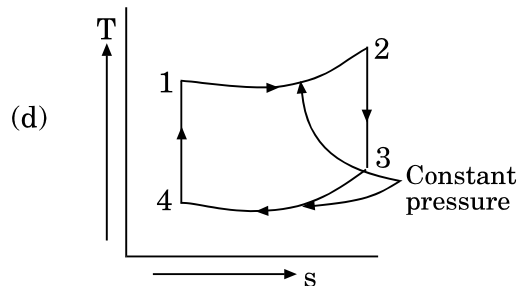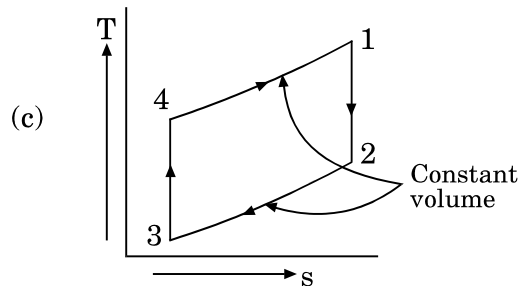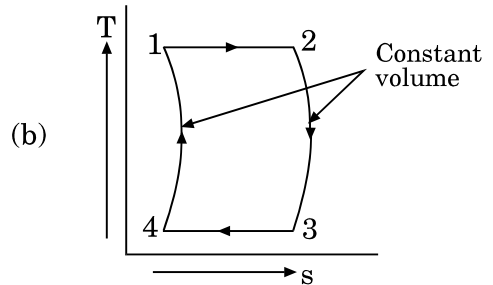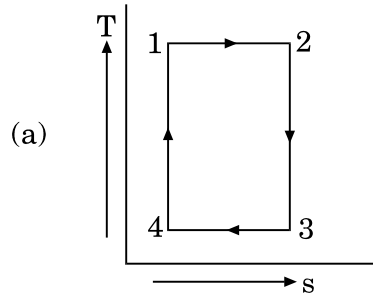
SECTION B

101. Who is the current Chairman of the Prime Minister's Economic Advisory Council ?
  (a) Nilesh Shah
  (b) Neelkanth Mishra
  (c) Bibek Debroy
  (d) Ratan Watal

102. Which among the following are the IUCN biodiversity hotspots in India ?
  1. The Himalayas
  2. The Western Ghats
  3. The Indo-Burma region
  4. The Sundaland (near Nicobar group of islands)

  Choose the correct answer using the following codes given below :
  (a) 1, 2 and 4
  (b) 2 and 3
  (c) 2, 3 and 4
  (d) All of the above

103. Which crop has Nitrogen fixing bacteria through combination with cells in their roots ?
  (a) Pulses
  (b) Wheat
  (c) Rice
  (d) Banana

104. Who among the following wrote 'Why I Am an Atheist' ?
  (a) Udham Singh
  (b) Bhagat Singh
  (c) Dadabhai Naoroji
  (d) Mahatma Gandhi

105. The sun is directly overhead at noon on 22nd December at the
  (a) Equator
  (b) Tropic of Cancer
  (c) Tropic of Capricorn
  (d) Antarctic Circle

Directions (Question no. 106) : In the following question, there is a certain relationship between two given words on one side of : : and one word is given on the other side of : : while another word is to be found from the given alternatives, having the same relation with this word as the words of the given pair bear. Choose the correct alternative.

106. Lion : Den : : Rabbit : ?
  (a) Trench
  (b) Hole
  (c) Pit
  (d) Burrow

107. X introduces Y saying, "He is the husband of the granddaughter of the father of my father." How is Y related to X ?
  (a) Brother
  (b) Son
  (c) Brother-in-law
  (d) Nephew

Directions (Questions no. 108 – 110) : Read the following information and answer the questions given below it :

Six students A, B, C, D, E and F are sitting in the field. A and B are from Nehru House while the rest belong to Gandhi House. D and F are tall while the others are short. A, C and D are wearing glasses while the others are not.

108. Which two students, who are not wearing glasses, are short ?
  (a) A and F
  (b) C and E
  (c) B and E
  (d) E and F

109. Which short student of Gandhi House is not wearing glasses ?
  (a) F
  (b) E
  (c) B
  (d) A

110. Which tall student of Gandhi House is not wearing glasses ?
- (a) B
- (b) C
- (c) E
- (d) F

Directions (Questions no. 111 – 115) :
Read the following information carefully and answer the questions given below it :
Sumeet, Philips, Wasim, Bishan and Chetan are five players of the College Cricket Team and their home towns are Surat, Pune, Warangal, Bangalore and Chandigarh, but not in that order. The five specialist slots of spinner, pace bowler, wicket-keeper, batsman and captain are held by them, again not in the order of their names stated above.

- I. Their names, home towns and specialities do not start with the same letter.
- II. Neither Philips nor Wasim is the captain and they do not belong to either Surat or Bangalore.
- III. Sumeet is neither a wicket-keeper nor a batsman.
- IV. Pune is not Bishan's home town.
- V. The player who hails from Bangalore is a wicket-keeper.
- VI. The captain's home town is Pune while the batsman does not hail from Warangal.

111. The spinner's home town is
- (a) Chandigarh
- (b) Bangalore
- (c) Warangal
- (d) Pune

112. Chandigarh is the home town of
- (a) Sumeet
- (b) Bishan
- (c) Wasim
- (d) Philips

113. Who is the pace bowler ?
- (a) Chetan
- (b) Wasim
- (c) Sumeet
- (d) Bishan

114. Who is the spinner ?
- (a) Philips
- (b) Chetan
- (c) Bishan
- (d) Wasim

115. Chetan's home town is
- (a) Pune
- (b) Surat
- (c) Warangal
- (d) Bangalore

116. Which of the following is a constituent organization of the World Bank ?
- (a) Goldman Sachs
- (b) New Development Bank
- (c) International Development Association (IDA)
- (d) Bank of America

117. Which of the following countries have dispute over Katchatheevu island ?
- (a) Philippines and China
- (b) Vietnam and China
- (c) India and Sri Lanka
- (d) Japan and China

118. International Court of Justice has its permanent seat at
- (a) The Hague
- (b) Geneva
- (c) Paris
- (d) New York

119. Free and fair elections to the Panchayats are to be conducted by which of the following institutions ?
- (a) Election Commission of India
- (b) Chief Minister of the State
- (c) Panchayat Election Commission
- (d) State Election Commission

120. Who sets up the Finance Commission in India ?
- (a) The Prime Minister
- (b) The Parliament
- (c) The Finance Minister
- (d) The President

SPACE FOR ROUGH WORK

SPACE FOR ROUGH WORK