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(Mechanical)
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Note: **(1)** Answer all questions.

(2) Each question carries 1 mark. There are no negative marks

(3) Answer to the questions must be entered only on OMR Answer Sheet provided separately by Completely shading with **Ball Point Pen (Black) only.**

(4) The OMR Answer Sheet will be invalidated if the circle is shaded using Pencil or if more than one circle is shaded against each question

Section A : Mechanical Engineering

1. Atomic packing factor of BCC structure is
(1) 1 (2) 2 (3) 3 (4) 4

2. The correct sequence of operations in powder metallurgy process is
(1) sintering - compacting - atomization (2) atomization - compacting - sintering
(3) sintering - atomization - compacting (4) compacting - atomization - sintering

3. The eutectic reaction in Iron-Carbon phase diagram refers to, when
(1) liquid metal changes to cementite and austenite
(2) ferrite changes to cementite and austenite
(3) austenite changes to ferrite and cementite
(4) cementite and ferrite combine to form austenite

4. Ageing is a term which is mostly associated with
(1) precipitation hardening (2) carbo-nitriding
(3) oil quenching (4) normalizing

5. A mechanism has 7 links with all binary pairs except one which is ternary. The number of instantaneous centers of reaction will be
(1) 13 (2) 14 (3) 21 (4) 28

5. Which one of the following is false for instantaneous center of rotation?
(1) At the instantaneous center of rotation, one rigid link rotates instantaneously relative to another for configuration of the mechanism concerned
(2) At the instantaneous center of rotation, the two rigid links have no linear velocities relative to each other
(3) both (1) and (2) are true
(4) both (1) and (2) are false

7 In a link AB, the part B moves relative to A. If ω is the angular velocity and α_{AB} is the angular acceleration, the total acceleration of B relative to A will be

(1) $\omega_{AB}^2 \times AB + \alpha \times AB$ (2) $\omega_{AB} \times AB + \alpha \times AB$

(3) $\sqrt{(\omega_{AB}^2 \times AB)} + \alpha \times AB$ (4) $\sqrt{\omega_{AB}^2 \times AB + \alpha \times AB}$

8 Power transmitted by an involute gear is given by
(F_T, F_R, v are Tangentrial force, Radial force and velocity respectively)

(1) $P = F_T \times v$ (2) $P = F_R \times v$

(3) $P = (F_T + F_R) \times v$ (4) $P = (F_T - F_R) \times v$

9 In a reverted gear train

(1) The axes of first and the last gear are parallel

(2) The axes of the first and last gear are co-axial

(3) One gear is always fixed

(4) Speed of last gear must be higher than speed of the first gear

10. In a reciprocating horizontal engine, the inertia forces due to reciprocating mass help the piston effort at

(1) $\theta = 30°$ (2) $\theta = 45°$

(3) $\theta = 120°$ (4) $\theta = 180°$

11. When the frequency of external exciting force is equal to the natural frequency of vibration of the system,

(1) the amplitude of vibration is zero

(2) the amplitude of vibration is insignificantly small

(3) the amplitude of vibration is very large

(4) the amplitude of vibration may be large or small depending upon the magnitude of frequency

12. A mass m attached to a shaft rotating at radius r from axis of a shaft is balanced by mass B at radius b from axis of the shaft in the same plane of rotation. The necessary condition of balancing is

(1) $m\omega r = Bwb$ (2) $mr = Bb$

(3) $\frac{m\omega^2}{r} = \frac{Bw^2}{b}$ (4) $\frac{m}{B} = \frac{r}{b}$

13. A cotter and key can be compared by which of the following statement
(1) Cotter is used to connect a rod which is subjected to axial loading, whereas keys are used in for twisting moment
(2) Cotter are used to connect shafts transmitting twisting moments whereas keys are used for axial loading
(3) Both cotters and keys are used for axial loading
(4) Both cotters and keys are used for twisting moment

14. Which one of the following holds true for coupling and clutch
(1) a coupling cannot be engaged / disengaged frequently
(2) a clutch can be engaged / disengaged frequently
(3) both (1) and (2) are true
(4) both (1) and (2) are false

15. Idler pulley in belt drives is used when
(1) high velocity ratio is desired at a long distance
(2) high velocity ratio is desired at a short distance
(3) when long life of the belt is desirable
(4) high forces are required to be transmitted

16. Velocity ratio of a flat belt drive with pulley radius R_1 and R_2, belt thickness is 't' and slip factor 's' will equal

(1) $VR = \frac{2R_2 + t}{2R_1 + t}(1 + s)$ (2) $VR = \frac{R_2 + t}{R_1 + t}(1 + s)$

(3) $VR = \frac{R_2 + 2t}{R_1 + 2t}(1 - s)$ (4) $VR = \frac{2R_2 + t}{2R_1 + t}(1 - s)$

17. The force required to move an object of F Newton downwards with the help of a power screw with ϕ angle of friction and α helix angle of the screw will be
(1) F tan $(\phi - \alpha)$ (2) F tan $(\phi + \alpha)$ (3) F tan $(\phi \times \alpha)$ (4) F tan (ϕ / α)

18. Net reaction of ground on wheels due to gyroscopic couple due to wheels and the dead weight and centrifugal force of a vehicle negotiating a curve
(1) increases on inner wheels and decreases on outer wheels
(2) decreases on inner wheels and increases on outer wheels
(3) decreases on all the wheels
(4) increases on all the wheels

P.T.O

19 In a flat pivot bearing, the total moment of friction force
(1) for uniform wear is greater than that for uniform pressure
(2) for uniform wear is lesser than that for uniform pressure
(3) for uniform wear is equal to that of uniform pressure
(4) for uniform wear may be more or less and cannot be predicted

20 First law of thermodynamics for steady flow
(1) accounts for all energy entering and leaving a control volume
(2) is an energy balance for a specified mass of fluid
(3) is primarily concerned with heat transfer
(4) is an expression of the conservation of linear momentum

21 The processes of a Carnot cycle are
(1) two adiabatic and two isothermals
(2) two isometric and two isothermals
(3) two isothermals and two isentropic
(4) two isobaric and two isothermals

22 Kelvin Plank's law deals with
(1) conversion of energy
(2) conversion of mass
(3) conversion of heat into work
(4) conversion of work into heat

23. What is the highest possible theoretical efficiency of a heat engine operating with a hot reservoir of furnace gases at 527°C, when the cooling water is available at 27°C
(1) 33% (2) 50% (3) 66% (4) 75%

24. Which of the following statements is correct
(1) Dew point temperature can be measured with the help of thermometer
(2) Dew point temperature is the saturation temperature corresponding to the partial pressure of water vapors in moist air
(3) Dew point temperature is the same as the thermodynamic wet bulb temperature
(4) For saturated air, dew point temperature is less than the wet bulb temperature

25. When the fuel is burned and water is released in the liquid phase, the heating value of fuel is called
(1) higher heating value
(2) lower heating value
(3) enthalpy of formation
(4) latent heat value

26. The clearance volume in reciprocating air compressors is provided to
(1) reduce the work done per kilogram of air delivered
(2) to increase the volumetric efficiency of the compressor
(3) to accommodate valves in the head of the compressor
(4) to create turbulence in the air to be delivered

27. Thermal efficiency of closed cycle gas turbine increases by
(1) reheating (2) intercooling (3) regenerator (4) all of the above

28. In a two stage gas turbine plant with intercooling and re-heating
(1) both work ratio and thermal efficiency improve
(2) work ratio improves but thermal efficiency decrease
(3) thermal efficiency improves but work ratio decreases
(4) both thermal efficiency and work ratio decreases

29. In a turbo-prop system, the expansion of gases takes place in the following manner
(1) 80% in turbine and 20% in nozzle (2) 70% in turbine and 30% in nozzle
(3) 60% in turbine and 40% in nozzle (4) 50% in turbine and 50% in nozzle

30. The value of reheat factor in steam turbines normally varied from
(1) 0.42 to 0.64 (2) 0.61 to 0.82 (3) 1.02 to 1.06 (4) 1.2 to 1.6

31. In Rankine cycle, the work output from the turbine is given by
(1) change of internal energy between inlet and outlet
(2) change of enthalpy between inlet and outlet
(3) change of entropy between inlet and outlet
(4) change of temperature between inlet and outlet

32. Fin effectiveness equals

(1) $\dfrac{\text{heat transfer rate from fin surface}}{\text{heat transfer rate from a standard fin but of the same size}}$

(2) $\dfrac{\text{heat transfer rate from fin surface}}{100}$

(3) $\dfrac{\text{heat transfer rate from fin surface}}{\text{heat transfer rate from an identical fin of infinite thermal conductivity}}$

(4) $\dfrac{\text{heat transfer rate from fin surface}}{\text{heat transfer rate from an identical fin made of copper}}$

33. Fundamental laws used in heat transfer are
(1) The laws of conservation of mass (2) Newton's laws of motion
(3) Laws of thermodynamics (4) All of the above

34. For incompressible flow, the pumping power is given by the expression
(1) (Pressure drop) × (volumetric flow rate)
(2) (Average pressure) × (volumetric flow rate)
(3) $\frac{1}{2}$ × (Average pressure) × (volumetric flow rate)
(4) $\frac{3}{4}$ × (pressure drop) × (volumetric flow rate)

35. In case of built-up edge in a machining process, which of the following statements is true
(1) It is an edge provided on the cutting tool by the tool manufacturer
(2) It consists of layers of material from the workpiece that are gradually deposited on the tool
(3) A thick built-up edge is desirable and improves cutting efficiency
(4) A thick built-up edge improves the surface finish of the machined surface

36. Select from the following ascending order of cutting tool materials hardness
(1) Ceramics - High carbon steel - High speed steel - Diamond
(2) Ceramics - High speed steel - High carbon steel - Diamond
(3) High speed steel - High carbon steel - Ceramics - Diamond
(4) High carbon steel - High speed steel - Ceramics - Diamond

37. Which one of the following is true in case of tool life
(1) It is directly proportional to the cutting speed
(2) It is inversely proportional to the cutting speed
(3) Does not depend on the cutting speed
(4) No equation is available that helps roughly calculate the cutting speed

38. Select the correct sequence of manufacturing processes in the ascending order of accuracy
(1) Reaming - Honing - Boring - Drilling
(2) Drilling - Boring - Honing - Reaming
(3) Drilling - Reaming - Boring - Honing
(4) Drilling - Honing - Boring - Reaming

39. Knurling process is used with a purpose to :
(1) Generate a rough surface for gripping
(2) To make tapered hole in a part
(3) To create stepped hole in a part
(4) It is another name of tapping operation

40. What is the meaning of the following NC code statement : N20 G91X 20Y 10
(1) Statement number 20 move the tool incrementally by X=20, Y=10 and Z=0
(2) Statement number 20 move the tool to X=20 and Y=10, Z=0 position
(3) Statement number 20 drill a hole with dia = 20 and depth = 10
(4) Statement number 20 drill a step hole with dia 20 and 10

41. 3-2-1 principle of locating the job in a fixture requires
(1) using 3, 2 and 1 pins on three sides of the job
(2) using 3 sides for the base, 2 on the top and 1 on the side
(3) using 3 pins for the base and 2 and 1 on sides of the job
(4) using 3 pins for the base, 1 on the top and 2 on the side

42. Read the following statements with respect to casting of parts and select the correct answer
a) Shrinkage allowance for a casting are independent of the casting material
b) Distortion allowance is provided to those castings which exhibit uniform cooling rates in their sections
c) Shaking or rapping allowance is a negative allowance
d) Draft allowance is provided to only those walls of the casting which are in the direction of disengagement of cope and drag
(1) Only statements (a) and (b) are true (2) Only statements (b) and (c) are true
(3) Only statements (c) and (d) are true (4) Only statements (a) and (d) are true

43. A riser compensates for the shrinkage that happens in the casting process during
(1) only molten stage (2) only solidification stage
(3) solid stage (4) both molten and solidification stage

44. In resistance welding
(1) voltage and current are high (2) voltage is high and current is low
(3) voltage and current are low (4) voltage is low and current is high

45. Thermit welding uses a mixture of the following
(1) iron oxide and sodium (2) iron oxide and aluminium
(3) iron oxide and alumina (4) iron, nickel and magnesium

46. Which of the following resistance welding processes essentially uses wheels as electrodes
(1) spot welding (2) projection welding
(3) seam welding (4) flash butt welding

47. Composition of most commonly used soldering alloy is
(1) Tin 60% and Lead 40% (2) Tin 50% and Lead 50%
(3) Tin 40% and Lead 60% (4) Tin 35% and Lead 65%

48. Which of the following statements is not a sheet metal working operation
(1) perforating (2) notching (3) slitting (4) upsetting

49. Which one of the following is most suitably applicable for a five axis CNC machine
(1) it has three rotational and two translation axis
(2) it has three translational and two rotational axis
(3) is a CNC machine where machining can be done 5/3 times faster than a 3 axis machine
(4) is useful only for complex geometry parts and normal 3D parts cannot be machined on it

50. Taguchi loss function is
(1) is a good method of production planning
(2) is commonly used in inventory control
(3) is a good method of production scheduling
(4) a concept used in tolerance design

51. Heat supplied (kJ kg^{-1}) to the cycle is
(1) 2372 (2) 2576 (3) 2863 (4) 3092

52. Consider an actual regenerative Rankine cycle with one open feed water heater. For each kg steam entering the turbine, if m kg steam with a specific enthalpy of h_1 is bled from the turbine, and the specific enthalpy of liquid water entering the heater is h_2, then the specific enthalpy of saturated liquid leaving the heater is equal to
(1) $mh_1 - (h_2 - h_1)$ (2) $h_1 - m(h_2 - h_1)$
(3) $h_2 - m(h_2 - h_1)$ (4) $mh_2 - (h_2 - h_1)$

53. What is the efficiency of an ideal regenerative Rankine cycle power plant using saturated steam at 327°C and pressure 135 bar at the inlet to the turbine and condensing temperature of 27°C (corresponding saturation pressure of 3.6 kPa)?
(1) 92% (2) 33% (3) 50% (4) 42%

54. Which one of the following is the correct statement?
The degree of reaction of an impulse turbine
(1) is less than zero
(2) is greater than zero
(3) is equal to zero
(4) increases with steam velocity at the inlet

55. In a two-row Curtis stage with symmetrical blading
(1) Work done by both rows of moving blades are equal
(2) Work done by the first row of moving blades is double of the work done by second row of moving blades
(3) Work done by the first row of moving blades is three times the work done by second row of moving blades
(4) Work done by the first row of moving blades is four times the work done by the second row of moving blades

56. In a three phase balanced delta connected system, the phase relation between line currents and their respective phase currents is given by
(1) line currents lag behind their respective phase currents by 30
(2) line currents lag behind their respective phase currents by 60
(3) line currents lead their respective phase currents by 30
(4) line currents lead their respective phase currents by 60

57. The pointer of an indicating instrument is generally made of
(1) copper (2) aluminium (3) silver (4) soft steel

58. The material used mostly in making standard resistor is
(1) constantium (2) maganin
(3) nicrome (4) gold chromium

59. If an alternator is operating at a lagging power factor, the voltage regulation will be
(1) always positive (2) always negative
(3) zero (4) independent of power factor

60. For lathes, pumps and other constant applications, the type of machine used is
(1) 3-phase induction motor (2) dc series motor
(3) dc compound motor (4) synchronous motor

61. A simply supported beam of 2 m length is applied with uniformly distributed load of 5 kN/m through-out. It is also applied with a point load of 1 kN at its center. The maximum bending moment in the beam will be
(1) 2 kNm (2) 3 kNm (3) 4 kNm (4) 5 kNm

62. A steel rod 20 m long is fixed between two ends. The stress induced in the rod when its temperature is increased by 100°C is
(1) 0.6 GPa (2) 0.8 GPa (3) 1.0 GPa (4) 1.2 GPa

63. A beam of rectangular cross-section of breadth 10 cm and depth 20 cm is subjected to a bending moment of 20 kNm. Stress developed at a distance of 10 cm from the top face of the beam is:
(1) Zero (2) 10 kPa (3) 20 kPa (4) 30 kPa

64. Compare a circular shaft of 10 cm diameter with a hollow shaft of 10 cm external and 5 cm internal diameter. The ratio of the maximum stresses developed in the solid and hollow shaft will be
(1) 1 : 4 (2) 1 : 8 (3) 1 : 16 (4) 1 : 32

65. Bulk modulus for a material is 200 GPa and its Poisson's ratio is 0.3. Young's modulus for that material will be
(1) 120 GPa (2) 160 GPa (3) 210 GPa (4) 240 GPa

66. The Euler's buckling load for an Aluminium bar 2 m long with cross-section of 10 mm × 12 mm, hinged at both the ends will equal
(1) $36\ \pi^2$ (2) $72\ \pi^2$ (3) $144\ \pi^2$ (4) $154\ \pi^2$

67. A load applied at center of the carriage spring to straighten its leaves is known as
(1) Yield load (2) Ultimate load (3) Proof load (4) Safe load

68. A piece of wood having a mass of 4 kg floats in a liquid of specific gravity 0.8 gm/cm^3. What will be the specific gravity of the wood piece if 75% of its volume is inside the liquid? (Assume g = 10 m/s^2)
(1) 0.4 gm/cm^3 (2) 0.6 gm/cm^3 (3) 0.8 gm/cm^3 (4) 1.0 gm/cm^3

69. A rectangular plate surface 2 m wide and 4 m deep lies in vertical plane in water. What will be the pressure and center of pressure when the upper edge is 2 m below the surface? (Assume g = 10 m/s^2)
(1) 80 kN (2) 120 kN (3) 160 kN (4) 320 kN

70. What will be volume of water displaced for buoyancy for a wooden block of width 2 m and depth 1 m. Density of wooden block is 700 kg/m^3 and its length is 4 m. (Assume g = 10 m/s^2)
(1) 2.8 m^3 (2) 5.6 m^3 (3) 11.2 m^3 (4) 22.4 m^3

71. The diameter of a pipe at two sections (section 1 and section 2) is 2 cm and 4 cm respectively. The velocity through the point at section 1 is 5 m/s, the velocity at section 2 will equal
(1) 1.0 m/s (2) 1.25 m/s (3) 2.5 m/s (4) 5.0 m/s

72. Water is flowing through a pipe of 5 cm diameter under a pressure of 0.5 MPa and mean velocity of 2.0 m/s. What is total head of water at a cross section, which is 4 m above the datum level? (Assume g = 10 m/s^2)
(1) 45.5 m (2) 47.2 m (3) 52.4 m (4) 55.2 m

73. The basic continuity equation for compressible fluid is. (Symbols used have usual meanings)
(1) $\frac{dV}{V}+\frac{dA}{A}+\frac{d\rho}{\rho}=1$ (2) $\frac{dV}{2V}+\frac{dA}{2A}+\frac{d\rho}{\rho}=0$
(3) $VdV+AdA+\rho d\rho=0$ (4) $\frac{dV}{V}+\frac{dA}{A}+\frac{d\rho}{\rho}=0$

74. The force exerted by a jet of water of 40 mm diameter on a flat stationary plate, when the jet strikes the plate normally with 20 m/s velocity
(1) 40 πN (2) 80 πN (3) 120 πN (4) 160 πN

75 Which one of the following is false
(1) Pelton wheel turbine is an axial flow turbine
(2) If at the inlet of the turbine, the energy available is only kinetic energy, the turbine is known as impulse turbine
(3) Radial flow turbines are those in which water flows in the radial direction
(4) In Francis turbine, the water leaves in the radial direction

76. The rotating part of the centrifugal pump is called
(1) Impeller (2) Rotor
(3) Compressor (4) Centrifuge

77. Heating the medium carbon steel to above recrystallization temperature and rapidly cooling by quenching causes
(1) hardening due to formation of troosite
(2) annealing of steel and relieving of stresses
(3) normalizing of steel and forming of fine grain structure
(4) hardening due to formation of martensite

78 Read the following statements and select the correct answer
a) Ferrite is α iron (BCC) which does not have more than 0.025% of carbon in solid form
b) Cementite is iron carbide (Fe_3C), which has 6.67% of carbon
c) Tempering is used for relieving the internal stresses
(1) Statements a and b are true and c is false
(2) Statements a and c are true and b is false
(3) Statements b and c are true and a is false
(4) Statements a, b and c are true

79. The carbon percentage in eutectoid steel is
(1) 0.5% (2) 0.8% (3) 1.2% (4) 2.14%

80. Which of the following heat treatment process is not a method of case-hardening
(1) nitriding (2) quenching
(3) cyaniding (4) induction hardening

N

Booklet Code : C

Section B : General Awareness and Numerical Ability

81. G.O. Number 610 is issued during the Chief Ministership of
(1) N. Sanjeeva Reddy (2) P.V. Narsimha Rao
(3) T. Anjaiah (4) N.T. Rama Rao

82. Who created the Emblem of Telangana state
(1) Ale Laxman (2) Andesree
(3) Venkanna (4) Gaddar

83. If $\sqrt{3} = 1.732$, then the value of $\frac{\sqrt{3}}{2} - \frac{7}{\sqrt{3}} + \sqrt{27}$ is equal to
(1) 4.330 (2) 2.009 (3) 1.224 (4) 3.585

84. The difference between a two-digit number and the number obtained by interchanging the digits is 54. What is the difference between the sum and the difference of the digits of the number if the ratio between the digits of the number is 1:3?
(1) 3 (2) 4 (3) 5 (4) 6

85. When a producer allows 34% commission on the retail price of this product he earns a profit of 10%. What would be his profit percent if the commission is reduced by 12%?
(1) 25 (2) 30 (3) 35 (4) 40

86. If 20 pumps can raise 5500 gallons of water in 12 days, working 6 hrs a day, in how many days will 12 pumps raise 2200 gallons of water, working 12 hrs a day?
(1) 4 (2) 5 (3) 6 (4) 7

87. Through which device the main components of the computer communicate with each other?
(1) System Bus (2) Keyboard (3) Monitor (4) Memory

88. Which of the following memory is non volatile?
(1) SRAM (2) DRAM (3) ROM (4) All the above

9. Microsoft Word is an example of
(1) An Operating System (2) Application Software
(3) Processing Device (4) System Software

90. Operating system is most common type of _____ Software
(1) Application (2) Communication
(3) System (4) Word processing type

91. One compound expression is incorrect. Which one?
(1) Court Martial (2) Chairman Deputy
(3) Poet Laureate (4) Secretary General

92. Find correct sequence of sentences:
Pollution has been defined
a) or form of energy to the environment at
b) accommodate its dispersion, breakdown, recycling or storage in some harmless form
c) a rate faster than the environment can
d) as the addition of any substance
(1) acdb (2) dacb (3) dcab (4) cadb

93. Why do you always _____ me when I try to ask a question?
(1) interpose (2) intercede (3) interfere (4) interrupt

94. There are several _____ that describe the state of being asleep.
(1) impressions (2) expressions (3) conditions (4) digressions

95. _____ has been appointed as President of Cricket Association of Bengal?
(1) Anil Kumble (2) Sachin Tendulkar
(3) Ajay Jadeja (4) Sourav Ganguly

96. _____ (known as Metro Man) has been appointed to United Nations High Level Advisory Group on Sustainable Transport by UN Secretary General Ban Ki-moon for three years?
(1) Upendra Tripathy (2) Sunil Arora
(3) Sanjay Singh (4) Elattuvalapil Sreedharan

97. _____ is the Engineer's Day in India. It marks Birthday of Bharat Ratna Mokshagundam Visvesvarayya?
(1) September 20 (2) January 17 (3) October 21 (4) September 15

98. Martin Winterkorn, CEO of _____ automobiles resigned?
(1) Skoda (2) Ford (3) FIAT (4) Volkswagen

99. Identify the first sovereign ruler of Kakatiya dynasty
(1) Rudradeva (2) Rudramadevi (3) Ganapathi deva (4) Mahadeva

100. Which Mughal emperor conquered the Golconda kingdom on 1687 A.D
(1) Babur (2) Akbar (3) Shahjahan (4) Aurangazeb