

Mechanical Engineering

CODE :- 13



Time Allowed: Two Hours

Marks: 100

Name: _____

Roll No. _____

Read instructions given below before opening this booklet:

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO

1. Use only **BLUE Ball Point Pen**.
2. In case of any defect – Misprint, Missing Question/s Get the booklet changed. No complaint shall be entertained after the examination.
3. Before you mark the answer, read the instruction on the OMR Sheet (Answer Sheet) also before attempting the questions and fill the particulars in the **ANSWER SHEET** carefully and correctly.
4. There are **FOUR** options to each question. Darken only one to which you think is the right answer. There will be no Negative Marking.
5. Answer Sheets will be collected after the completion of examination and no candidate shall be allowed to leave the examination hall earlier.
6. The candidates are to ensure that the Answer Sheet is handed over to the room invigilator only.
7. Rough work, if any, can be done on space provided at the end of the Question Booklet itself. No extra sheet will be provided in any circumstances.
8. Write the **BOOKLET SERIES** in the space provided in the answer sheet, by darkening the corresponding circles.
9. Regarding incorrect questions or answers etc. Candidates kindly see **NOTE** at the last page of the Booklet.

SEAL

- Q1. An iron ball and a cotton ball of same mass are thrown from a height h in air. Then
 (A) the iron ball will reach the ground first
 (B) the cotton ball will reach the ground first
 (C) both balls reach the ground at the same time
 (D) None of these
- Q2. Acceleration due to gravity is
 (A) same at all places
 (B) more at the equator of the earth than at the poles
 (C) decreasing with altitude
 (D) All are correct
- Q3. A man moving in an accelerated train on horizontal tracks feels that his weight has/is
 (A) decreased (B) increased
 (C) zero (D) same
- Q4. The number of independent equations available from static equations of equilibrium for plane problems are
 (A) 3 (B) 6 (C) 12 (D) 9
- Q5. According to the law of equilibrium, two forces are said to be in equilibrium only if they are
 (A) equal in magnitude and opposite in direction (B) opposite in direction
 (C) collinear in action (D) Both (A) and (C)
- Q6. A block slides down a smooth inclined plane at 30° in time from the top. If an identical block is released from the same point, falling freely to the ground, then it will reach in time
 (A) $t/2$ (B) $t/3$ (C) $t/4$ (D) t
- Q7. A zero torque acting on a system results in conservation of
 (A) angular momentum (B) linear momentum
 (C) angular velocity (D) energy
- Q8. A railway train of 200m long passes over a bridge of 600m long. If the train is moving at 10m/s, the time taken to cross the bridge
 (A) 60s (B) 90s (C) 80s (D) 100s
- Q9. Two bodies of masses m_1 and m_2 are dropped from the same height. The ratio of their momentum at the ground is
 (A) m_1/m_2 (B) m_2/m_1
 (C) $(m_1/m_2)^{1/2}$ (D) $(m_2/m_1)^{1/2}$
- Q10. A body of weight W is placed on an inclined plane. The angle made by the inclined plane with horizontal, when the body is on the point of moving down is called
 (A) angle of inclination (B) angle of repose
 (C) angle of friction (D) angle of limiting friction

- Q11. The statement – “ if three forces acting at a point can be represented in magnitude and direction by the sides of a triangle taken in order, the forces are in equilibrium” – is known as
 (A) Lami’s theorem (B) Law of Polygon of forces
 (C) Law of triangle of forces (D) Newton’s law of forces
- Q12. If a body is moving in a straight line , the motion of the body is called
 (A) rectilinear (B) rotational
 (C) curvilinear (D) helical
- Q13. The expression $(mv^2/2)$, where m is the mass and v is the velocity ; denotes
 (A) centrifugal force (B) kinetic energy
 (C) potential energy (D) centripetal force
- Q14. Free body diagram of a body in a force system is
 (A) Completely isolated from the system (B) incompletely isolated from the system
 (C) completely attached to the system (D) incompletely attached to the system
- Q15. Centroid of a body is its:-
 (A) geometrical concentration (B) mass concentration
 (C) weight concentration (D) density concentration
- Q16. The apparent weight of a man in moving lift is less than his real weight when it is going down with
 (A) uniform speed (B) an acceleration
 (C) some linear acceleration (D) retardation
- Q17. When a body falls freely under gravity it possesses
 (A) maximum weight (B) minimum weight
 (C) no weight (D) a weight depending upon velocity
- Q18. When a body slides down an inclined surface, inclined at an angle β , the acceleration a of the body is given by
 (A) $a = g$ (B) $a = g \sin\beta$ (C) $a = g \cos\beta$ (D) $a = g \tan \beta$
- Q19. Strain energy is the
 (A) energy stored in a body when strained within elastic limits
 (B) energy stored in a body when strained upto the breaking of a specimen
 (C) maximum strain energy which can be stored in a body
 (D) proof resilience per unit volume of a material
- Q20. A vertical column has two moments of inertia (i.e. I_{xx} and I_{yy}). The column will tend to buckle in the direction of the
 (A) axis of load (B) perpendicular to the axis of load
 (C) maximum moment of inertia (D) minimum moment of inertia
- Q21. The neutral axis of the cross-section a beam is that axis at which the bending stress is
 (A) Zero (B) Minimum
 (C) Maximum (D) Infinity
- Q22. Euler's formula holds good only for
 (A) short columns (B) long columns
 (C) Both short and long columns (D) weak columns

- Q23. A steel bar of 5 mm is heated from 15° C to 40° C and it is free to expand. The bar will induce
- (A) no stress (B) shear stress
(C) tensile stress (D) compressive stress
- Q24. The stress induced in a body, when suddenly loaded, is _____ the stress induced when the same load is applied gradually.
- (A) equal to (B) one-half
(C) twice (D) four times
- Q25. If the slenderness ratio for a column is 100, then it is said to be a _____ column.
- (A) long (B) medium
(C) short (D) expanded
- Q26. The maximum diameter of the hole that can be punched from a plate of maximum shear stress $1/4^{\text{th}}$ of its maximum crushing stress of punch, is equal to (where t = thickness of the plate)
- (A) t (B) $2t$ (C) $4t$ (D) $8t$
- Q27. When a rectangular beam is loaded transversely, the maximum compressive stress is developed on the
- (A) top layer (B) bottom layer
(C) neutral axis (D) every cross-section
- Q28. The point of contra flexure is a point where
- (A) shear force changes sign (B) bending moment changes sign
(C) shear force is maximum (D) bending moment is maximum
- Q29. The maximum stress produced in a bar of tapering section is at
- (A) smaller end (B) larger end
(C) middle (D) anywhere
- Q30. In compression test, the fracture in cast iron specimen would occur along
- (A) the axis of load (B) an oblique plane
(C) at right angles to the axis of specimen (D) would not occur
- Q31. When shear force at a point is zero, then bending moment is _____ at that point.
- (A) Zero (B) Minimum
(C) Maximum (D) None of these
- Q32. In a kinematic pair, when the elements have surface contact while in motion, it is a
- (A) higher pair (B) closed pair
(C) unclosed pair (D) lower pair
- Q33. "Scotch Yoke" is an inversion of
- (A) slider crank mechanism (B) double slider crank mechanism
(C) 4-bar linkage (D) None of these

- Q34. Which type of gears has a constant pressure angle while meshing?
 (A) cycloidal gears (B) involute gears
 (C) Both a) and b) (D) None of these
- Q35. Which type of governor has controlling force diagram a straight line passing through the origin
 (A) proell governor (B) unstable governor
 (C) isochronous governor (D) porter governor
- Q36. The difference between the maximum and minimum kinetic energies of the flywheel is known as
 (A) coefficient of fluctuation of energy (B) maximum fluctuation of energy
 (C) maximum fluctuation of flywheel (D) None of these
- Q37. The conditions for static balancing and dynamic balancing in rotating masses are
 (A) $\sum mr^2 = 0$ and $\sum mr^2 l = 0$ respectively (B) $\sum mr^2 l = 0$ and $\sum mr^2 = 0$ respectively
 (C) $\sum mr = 0$ and $\sum mrl = 0$ respectively (D) $\sum mrl = 0$ and $\sum mr = 0$ respectively
- Q38. A helical spring, having N number of coils, has spring-constant 2000 N/m. If there is another helical spring of the same material and same wire diameter and having N/2 number of coils, its spring-constant will be
 (A) 4000 N/m (B) 2000 N/m
 (C) 1000 N/m (D) 500 N/m
- Q39. Choose the correct option for the given blank space“While using _____ method to find the natural frequency of free vibrations, it is assumed that kinetic energy at mean position is equal to the potential energy at the extreme positions.”
 (A) energy (B) equilibrium
 (C) kennedy’s (D) rayleigh’s
- Q40. Which of the following is a spring controlled governor
 (A) hartung governor (B) watt governor
 (C) porter governor (D) None of these
- Q41. If different masses are rotating about an axis in a single plane at different radii, then for their complete balance, it is sufficient to analyze the conditions of—
 (A) static and dynamic balancing both (B) static balancing only
 (C) dynamic balancing only (D) None of these
- Q42. Which one of the following types of gears can be used for speed reduction purpose only
 (A) spur gears (B) bevel gears
 (C) helical gears (D) worm and worm-wheel

- Q43. Initial contact between the driving and driven gear teeth occurs at a point where—
 (A) addendum circle of driven wheel interacts the line of action
 (B) dedendum circle of driven wheel interacts the line of action
 (C) dedendum circle of the driver wheel interacts the line of action
 (D) addendum circle of the driver wheel interacts the addendum circle of driven gear
- Q44. Oldhem's Coupling is used to connect two shafts which are
 (A) Intersecting (B) perpendicular
 (C) parallel (D) co-axial
- Q45. The portion of the cutting part enclosed between the face and the flank is called _____
 (A) wedge (B) shank
 (C) base (D) rake face
- Q46. Only two perpendicular components of cutting force act on the tool in case of ____ cutting.
 (A) oblique (B) orthogonal
 (C) 3D (D) inclined
- Q47. Operation of bending a partially cut hole on one side is called _____
 (A) nibbling (B) slitting
 (C) lancing (D) spiral
- Q48. On increasing the value of rake angle, the strength of the tool _____
 (A) increases (B) decreases
 (C) remains constant (D) is unpredictable
- Q49. Angle between portion of side flank immediately below major (side) cutting edge and a line perpendicular to the base of the tool is called _____ angle.
 (A) end relief (B) side rake
 (C) side relief (D) side clearance
- Q50. Which of the following is not a specification of lathe machine tool?
 (A) chuck size (B) swing over diameter
 (C) distance between centers (D) bed length
- Q51. In ____ milling process, feed direction and direction of rotation of cutter are in ____ direction.
 (A) up, opposite (B) up, same
 (C) down, opposite (D) down, reverse
- Q52. In shaper machine tool, workpiece _____ and tool _____.
 (A) reciprocates, rotates. (B) remains stationary, rotates.
 (C) remain stationary, reciprocates. (D) rotates, reciprocates.
- Q53. In oxidizing flame, the inner core attains a temperature of _____ °(C)
 (A) 2100 (B) 2800
 (C) 3150 (D) 3500

- Q54. Which of the following is not a function of flux that is added during casting of cast iron?
 (A) absorbs impurities (B) replenishes material loss
 (C) protects casting from oxidation (D) forms slag
- Q55. Arc blow occurs in _____ welding.
 (A) DC (B) AC
 (C) gas (D) resistance
- Q56. During welding when the weld reduces the cross-sectional thickness of the base metal it is called _____.
 (A) lack of penetration (B) spattering
 (C) undercutting (D) blow hole
- Q57. The connecting rods of IC engines are manufactured using the process of _____.
 (A) extrusion (B) drop forging
 (C) rolling (D) spinning
- Q58. Plastic bottles are manufactured using the process of:
 (A) blow molding (B) injection molding
 (C) atomizing (D) die casting
- Q59. The fraction defective chart that records the proportion defective items in a sample is _____ chart.
 (A) X bar (B) R
 (C) c (D) p
- Q60. Which of the following statement is not true for break-even analysis?
 (A) fixed cost does not vary with the total production.
 (B) total cost varies with the total production.
 (C) variable cost is dependent on total production.
 (D) break-even point is the point where fixed cost line and variable cost line intersect with each other on a volume cost graph.
- Q61. VED analysis of inventory management stands for
 (A) Vital – Essential– Desirable (B) Valuable – Easy–Difficult to obtain
 (C) Very Essentially Desired (D) Valuable –Effective –Difficult to obtain
- Q62. The symbol of rectangle shape represents the process of _____ in process analysis.
 (A) transportation (B) operation
 (C) inspection (D) delay
- Q63. Which of the following is not a type of flow process chart?
 (A) material (B) method
 (C) machine (D) man
- Q64. Which of the following is not the definition of Quality?
 (A) conformance to specification (B) fitness for use
 (C) spare part maintenance (D) customer delight

Q65. Which of the following method is used for recording path of movement during method study?

- (A) chronocyclographs (B) simo chart
(C) two handed process chart (D) therblig

Q66. In a _____ layout all machines or process of the same type are grouped together.

- (A) fixed position (B) factory
(C) process (D) product

Q67. Mass production is characterized by

- (A) low volume high variety (B) high volume low variety
(C) high volume high variety (D) low volume low variety

Q68. The Therblig symbol used for micro motion of 'release' is _____

- (A) R (B) RE
(C) RL (D) RS

Q69. _____ process chart is a graphic representation of the sequence of all the operations and inspections involved in a process or procedure.

- (A) operation (B) outline
(C) travel (D) flow process

Q70. Formula for calculating standard time (S) when observed time (O), rating factor (r) and PFD allowances are known is:

- (A) $S=(O/r) +PFD$ (B) $S= (O*r)-PFD$
(C) $S=(O/r)(PFD)$ (D) $S= O*r*(1+PFD)$

Q71. Formula for calculating EOQ in inventory management is:

- (A) $EOQ = (2*D*K/H)^{1/2}$ (B) $EOQ = (D*K/2H)^{1/2}$
(C) $EOQ = (2*K/D*H)^{1/2}$ (D) $EOQ = (K/2*D*H)^{1/2}$

Where D is annual demand quantity, K is fixed cost per order and H is Annual holding cost.

Q72. As per the principles of motion economy related to the sitting standing work place for males the thigh clearance should range between:

- (A) 10" to 12" (B) 8" to 10"
(C) 6" to 8" (D) 12" to 14"

Q73. A single fixed point temperature scale is based on

- (A) ice point (B) steam point
(C) triple point of water (D) critical point of water

Q74. Which one of the following correctly defines 1K, as per the internationally accepted definition of temperature scale?

- (A) $(1/100)^{th}$ of the difference between normal boiling point and normal freezing point
(B) $(1/273.15)^{th}$ of the normal freezing point of water
(C) 100 times the difference between the triple point of water and normal freezing point of water
(D) $(1/273.16)^{th}$ of triple point of water

Q75. Which thermometer is independent of the substance or material used in its construction?
 (A) mercury thermometer (B) alcohol thermometer
 (C) ideal gas thermometer (D) resistance thermometer

Q76. The following are the examples of some intensive and extensive properties
 1. pressure 2. temperature 3. volume 4. velocity
 5. electric charge 6. magnetization 7. viscosity 8. potential energy
 Which one of the following sets gives the correct combination of intensive and extensive properties?

	Intensive	Extensive
(A)	1,2,3,4	5,6,7,8
(B)	1,3,5,7	2,4,6,8
(C)	1,2,4,7	3,5,6,8
(D)	2,3,6,8	1,4,5,7

Q77. A system is capable of exchanging energy with its surroundings in the form of n-reversible work modes. The number of independent variables that completely specify the state of the system is

- (A) n-2 (B) n-1
 (C) n (D) n+1

Q78. If δQ is the heat transferred to the system and δW is the work done by the system, then which of the following is an exact differential

- (A) δQ (B) δW
 (C) $\delta Q + \delta W$ (D) $\delta Q - \delta W$

Q79. Air enters an adiabatic nozzle at 400 kPa and 900K with negligible velocity. If the flow is ideal and exit pressure is 100kPa, the exit temperature in K and exit velocity in m/s are respectively

- (A) 605.7, 768.7 (B) 225, 1164.8
 (C) 516.9, 877.5 (D) 129.2, 880.1

Q80. 170kJ of heat is supplied to a system at constant volume. Then the system rejects 180kJ of heat at constant pressure and 40kJ of work is done on it. The system is finally brought to its original state by an adiabatic process. If the initial value of internal energy is 100kJ, then which one of the following statements is correct?

- (A) the highest value of internal energy occurs at the end of the constant volume process
 (B) the highest value of internal energy occurs at the end of the constant pressure process
 (C) the highest value of internal energy occurs after adiabatic expansion
 (D) internal energy is equal at all the points

Q81. In a given process of an ideal gas, $\delta W=0$ and $\delta Q<0$. Then for the gas
 (A) the temperature will decrease (B) the volume will increase
 (C) the pressure will remain constant (D) the temperature will increase

Q82. According to the Clausius statement of second law of thermodynamics, the COP of a refrigerator is never

- (A) ∞ (B) 1
 (C) <1 (D) >1

- Q83. A process 'A' is irreversible and adiabatic (C) Process 'B' is reversible and adiabatic (C) The entropy change in process 'A' and process 'B', respectively are
 (A) zero and positive (B) zero and negative
 (C) negative and zero (D) positive and zero
- Q84. Which one of the following statements is FALSE?
 (A) a mixture of an ideal gas also behaves as an ideal gas
 (B) the enthalpy of an ideal gas is a function of temperature only
 (C) the entropy of an ideal gas is a function of temperature only
 (D) the temperature of an ideal gas always decreases during isentropic expansion
- Q85. For a refrigerant being used in a vapour compression refrigeration system, the Joule-Thomson coefficient should be
 (A) positive (B) negative
 (C) zero (D) infinity
- Q86. First law of thermodynamics is valid for
 (A) all processes
 (B) reversible processes only
 (C) cyclic processes only
 (D) only cyclic processes that are carried out reversibly
- Q87. A domestic refrigerator, set at 2°C , handles on an average a thermal load of 8000kJ per day. The ambient temperature is 30°C and the COP of the refrigerator is 0.15 times that of a Carnot refrigerator. The daily electricity consumption in kWh is approximately
 (A) 1.47 (B) 1.51
 (C) 3.28 (D) 2.86
- Q88. COP of a reversed Carnot cycle refrigerator working between higher temperature T_2 and lower temperature T_1
 (A) will increase with increase in T_1 keeping T_2 fixed
 (B) will decrease with increase in T_1 keeping T_2 fixed
 (C) will first increase with increase in T_1 and then decrease with increase in T_1 keeping T_2 fixed
 (D) none of the above
- Q89. A refrigerating machine working on reversed Carnot cycle takes out 2kW of heat from the cold body while working between the temperature limits of 300K and 200K. The COP and power consumed by the cycle will be respectively
 (A) 1 and 1kW (B) 1 and 2kW
 (C) 2 and 1 kW (D) 2 and 2 kW
- Q90. A 1 ton capacity water cooler cools water steadily from 35°C to 20°C (C) The specific heat of water is 4.18 kJ/kg-K. The water flow rate will be nearly
 (A) 13.33 liter/hr (B) 33.3 liter/hr
 (C) 200 liter/hr (D) 250 liter/hr

Q91. Consider the following statements:

- Dry compression in reciprocating compressor is preferred because it
1. prevents valve damage
 2. enables use of thermostatic expansion valve
 3. minimizes irreversibility in the compressor
 4. prevents washing out of the lubricating oil from cylinder walls

Which of these statements are correct?

- (A) 1 and 2
(B) 2 and 3
(C) 1 and 4
(D) 3 and 4

Q92. Sub-cooling heat exchanger is used in a refrigeration cycle. The enthalpies at condenser outlet and evaporator outlet are 78 kJ/kg and 182 kJ/kg respectively. The enthalpy at outlet of isentropic compressor is 230 kJ/kg and enthalpy of sub-cooled liquid is 68kJ/kg. The COP of the cycle is

- (A) 3.25
(B) 2.16
(C) 3.0
(D) 3.5

Q93. Waste heat can be effectively used in which one of the following refrigeration systems?

- (A) vapour compression refrigeration cycle
(B) air refrigeration cycle
(C) vapour absorption refrigeration cycle
(D) vortex refrigeration cycle

Q94. In a Vapour absorption refrigeration system, heat is rejected in

- (A) condenser only
(B) generator only
(C) absorber only
(D) condenser and absorber

Q95. An Electrolux refrigerator uses

- (A) one pump
(B) two pump
(C) no pump
(D) three pump

Q96. Which one of the following refrigerants has the highest critical temperature?

- (A) H₂O
(B) CO₂
(C) R-12
(D) NH₃

Q97. Dew point temperature is the temperature at which condensation begins when air is cooled at constant

- (A) volume
(B) entropy
(C) pressure
(D) enthalpy

Q98. The main process which takes place in a dessert cooler is

- (A) sensible cooling
(B) dehumidification
(C) adiabatic saturation
(D) cooling and dehumidification

Q99. Due to rotation of the impeller of a centrifugal pump in liquid surroundings

- (A) a momentum acts on the liquid
(B) a torque acts on the liquid in the direction of rotation
(C) a torque acts on the liquid in the direction opposite to the direction of impeller rotation
(D) just loss of energy alone takes place

Q100. Cavitation damage in a turbine runner occurs near

- (A) the inlet on the concave side of the blades
(B) the outlet on the convex side of the blades
(C) the inlet on the convex side of the blades
(D) the outlet on the concave side of the blades