

(DO NOT OPEN THIS QUESTION BOOKLET BEFORE TIME OR UNTIL YOU
ARE ASKED TO DO SO)

A

SET-X

PHD-EE-2023-24

Mechanical Engineering

10017

Sr. No.

Time : 1¼ Hours

Max. Marks : 100

Total Questions : 100

Roll No. (in figures) _____ (in words) _____

Name _____ Date of Birth _____

Father's Name _____ Mother's Name _____

Date of Examination _____

(Signature of the Candidate)

(Signature of the Invigilator)

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PHD-EE-2023-24/(Mechanical Engg.)(SET-X)/(A)

SEAL

1. Type of spring used to absorb shocks and vibrations in vehicles is :
 - (1) Helical spring
 - (2) Spiral spring
 - (3) Multi-leaf spring
 - (4) Disk spring
2. According to first law of thermodynamics :
 - (1) Total internal energy of a system during a process remains constant
 - (2) Total energy of a system remains constant
 - (3) Work done by a system is equal to the heat transferred by the system
 - (4) None of these
3. For a given applied load, induced stress is a function of :
 - (1) Cross sectional area of the body
 - (2) Material of the body
 - (3) Both (1) and (2)
 - (4) None of these
4. Superheated vapor behaves :
 - (1) Exactly as gas
 - (2) As steam
 - (3) As ordinary vapor
 - (4) Approximately as a gas
5. The temperature distribution for a hollow cylinder for steady state heat flow and constant value of thermal conductivity is :
 - (1) Logarithmic
 - (2) Parabolic
 - (3) Hyperbolic
 - (4) Exponential
6. One ton of refrigeration is equal to :
 - (1) 210 kJ/min
 - (2) 3.5 kJ/min
 - (3) 105 kJ/min
 - (4) 250 kJ/min

7. The moment of inertia of a square section of size 1 unit about its diagonal is :
(1) $1/4$ (2) $1/8$ (3) $1/12$ (4) $1/24$
8. The unit of Bulk Modulus is :
(1) Nm (2) MPa (3) mm (4) N/m^3
9. A steel bar of $40 \text{ mm} \times 40 \text{ mm}$ square cross-section is subjected to an axial tensile load of 200 KN. If the length of bar is 2m and $E = 2 \times 10^5 \text{ MPa}$, the elongation of the bar will be :
(1) 1.50 mm (2) 1.25 mm (3) 0.75 mm (4) 0.50 mm
10. The unit of stiffness is :
(1) N/m^3 (2) N/m^2 (3) Nm^2 (4) N/m
11. If pressure angle is 20° , then minimum number of teeth is :
(1) 27 (2) 20 (3) 07 (4) None of these
12. Cavitation gives damage to turbine on :
(1) Outlet on the convex side of blades
(2) Inlet on the convex side of blades
(3) Both of these
(4) None of these
13. Maximum bending moment in a cantilever beam with uniformly distributed load (w/unit length) over whole length 'L' is :
(1) ωL^2 (2) $(\omega L^2)/2$ (3) $(\omega L^2)/4$ (4) $(\omega L^2)/8$
14. Bending stress at neutral axis is :
(1) Maximum (2) Zero
(3) Can't be zero (4) None of these

15. Which of the following is **not** a type of transmission shaft ?
- (1) Crankshaft (2) Line shaft
(3) Counter shaft (4) Transmission shaft
16. Lamé's theory is associated with :
- (1) Thin cylindrical shells (2) Thick cylindrical shells
(3) Direct and bending stresses (4) None of the above
17. The maximum principal strain theory is also known as :
- (1) Rankine's theory (2) Guest's theory
(3) Saint Venant's theory (4) Von-Mises theory
18. Two springs of stiffness k_1 and k_2 respectively are connected in series, what will be the stiffness of the composite spring ?
- (1) $k = \frac{k_1 \times k_2}{k_1 + k_2}$ (2) $k = \frac{k_1 + k_2}{k_1 \times k_2}$ (3) $k = k_1 \times k_2$ (4) $k = k_1 + k_2$
19. The point of contra-flexure occurs in :
- (1) Cantilever beams (2) Simply supported beams
(3) Overhanging beams (4) Fixed beams
20. The pair is known as a higher pair, when the relative motion between the elements of a pair is :
- (1) Turning only (2) Sliding only
(3) Rolling only (4) Partly turning and Partly sliding
21. Two shafts, one solid and the other hollow, are made of the same materials and are having same length and weight. The hollow shaft as compared to solid shaft is :
- (1) More strong (2) Less strong
(3) Have same strength (4) None of the above

22. A structural member subjected to an axial compressive force is called :
(1) Beam (2) Column (3) Frame (4) Strut
23. A downward vertical load of 10 kN acts at a distance of 40 cm from the left end on a 1 m long beam. This beam is simply supported at both ends. The vertical reaction at the left ends is :
(1) 4 (2) 5 (3) 0.25 (4) 6
24. Nusselt number in case of free convection is the function of :
(1) Reynolds number and Prandtl number
(2) Reynolds number only
(3) Grashoff number only
(4) Grashoff number and Prandtl number
25. For psychrometric charts :
(1) Constant relative humidity lines are uphill straight lines to the right.
(2) Constant wet bulb temperature lines are downhill straight lines to the right.
(3) Constant enthalpy lines are coincident with constant wet bulb temperature lines.
(4) None of these
26. The difference between the total head line and the hydraulic grade line represents :
(1) The velocity head (2) The piezoelectric head
(3) The pressure head (4) The elevation head
27. Which one of the following is a fire tube boiler ?
(1) Babcock - Wilcox boiler (2) Locomotive boiler
(3) Both of these (4) None of these

28. A refrigerator and a heat pump operate between the same temperature limits. If the COP of the refrigerator is 4, the COP of the heat pump would be :
- (1) 3 (2) 4 (3) 5 (4) 6
29. In axial flow turbine :
- (1) Inlet is axial and outlet is radial (2) Inlet is axial and outlet is axial
(3) Inlet is radial and outlet is axial (4) Inlet is radial and outlet is radial
30. If a material expands freely due to heating, it will develop :
- (1) Tensile stress (2) Compressive stress
(3) No stress (4) Thermal stress
31. Poisson's ratio is equal to :
- (1) Lateral Strain / Longitudinal Strain
(2) Lateral Strain \times Longitudinal Strain
(3) Longitudinal Strain / Lateral Strain
(4) None of these
32. The energy stored in a body when strained within elastic limit is known as :
- (1) Proof resilience (2) Impact energy
(3) Strain energy (4) Potential energy
33. The increase in hardness due to cold working is called :
- (1) Cold hardening (2) Work hardening
(3) Age hardening (4) None of these
34. For extrusion, important mechanical property of a material is :
- (1) Elasticity (2) Ductility (3) Plasticity (4) None of these

35. When steam flows through the fixed blades in reaction turbine :
- (1) Pressure increases
 - (2) Velocity increases
 - (3) Velocity increases and Pressure drops
 - (4) None of these
36. Reaming is a process used to :
- (1) Create a circular hole in metals
 - (2) Cut a slot on the existing hole surface
 - (3) Finish an existing hole surface
 - (4) Make non-circular holes in metals
37. The fixed cost and the variable cost of production of a product are Rs. 20,000 and Rs. 80 per unit, respectively. The demand for the item is 500 units. To break even, the unit price of the items in Rs. should be :
- (1) 150 (2) 120 (3) 130 (4) 100
38. The Young's modulus of elasticity of a material is 2.5 times its modulus of rigidity. The Poisson's ratio for the material will be :
- (1) 1.50 (2) 0.25 (3) 0.50 (4) 0.75
39. Acceptable Quality Level (AQL) is associated with :
- (1) Producer's risk
 - (2) Consumer's risk
 - (3) Lot tolerance percent defective
 - (4) Average outgoing quality limit
40. Self locking condition for a pair of square thread screw and nut having coefficient of friction = μ , lead of thread = L and pitch diameter of thread = d is given by :
- (1) $d > \pi\mu L$ (2) $d > \mu L$ (3) $\mu > Ld$ (4) None of these

41. The REL chart is used for :
- (1) Designing the layout of plants
 - (2) Estimating the valuation of stock
 - (3) Analyzing the movement of an item in a store
 - (4) Maintaining the issue and receipt record
42. Which one of the following is a heat treatment process for surface hardening ?
- (1) Normalizing
 - (2) Annealing
 - (3) Carburizing
 - (4) None of these
43. Resultant pressure of the liquid in case of an immersed body acts through which one of the following ?
- (1) Centre of gravity
 - (2) Centre of pressure
 - (3) Metacentre
 - (4) Centre of buoyancy
44. In a hollow cylindrical product manufactured by centrifugal casting, the density of the part is :
- (1) Maximum at the outer region
 - (2) Maximum at the inner region
 - (3) Maximum at the mid-point between outer and inner surfaces
 - (4) Uniform throughout
45. A typical Fe-C alloy containing greater than 0.8% C is known as :
- (1) Eutectoid steel
 - (2) Hypoeutectoid steel
 - (3) Mild steel
 - (4) Hypereutectoid steel
46. An autocollimator is used to :
- (1) Measure small angular displacements on flat surfaces
 - (2) Compare known and unknown dimensions
 - (3) Both of these
 - (4) None of these

A

53. A moving mandrel is used in :
(1) wire drawing (2) forging (3) bending (4) None of these
54. Brazing and Soldering are :
(1) Plastic joining methods
(2) Homogeneous joining methods
(3) Autogenous joining methods
(4) Heterogeneous joining methods
55. Bodies in flotation to be in stable equilibrium, the necessary and sufficient condition is that the centre of gravity is located below the :
(1) Metacentre (2) Centre of pressure
(3) Centre of gravity (4) Centre of buoyancy
56. A quantitative measure of maintainability is :
(1) Downtime (2) Mean Time to Repair
(3) Mean Time between Failure (4) System availability
57. Friction at the tool-chip interface can be reduced by :
(1) Decreasing the rake angle
(2) Increasing the cutting speed
(3) Decreasing the cutting speed
(4) None of these
58. Which one of the following is *not* a characteristic of JIT manufacturing system ?
(1) Reduction of lot sizes
(2) Efficient use of buffer inventory
(3) Small but frequent deliveries
(4) Higher productivity

59. Which one of the following methods can be used for producing metal powders ?
(1) Atomization (2) Machining and grinding
(3) Electrolysis (4) All of these
60. The Coriolis component of acceleration acts :
(1) Along the sliding surface
(2) Perpendicular to the sliding surface
(3) At 45 to the sliding surface
(4) Parallel to the sliding surface
61. The type of control chart used to monitor the amount of dispersion in a sample is :
(1) c-chart (2) p-chart (3) X bar-chart (4) R-chart
62. 'Production Planning' involves integration of :
scheduling, routing, estimating and dispatching activities. This statement is :
(1) Scheduling, routing, estimating and dispatching activities
(2) Scheduling, routing and selling activities
(3) Scheduling, routing and marketing activities
(4) None of these
63. Which of the following casting processes uses expendable pattern and expendable mould ?
(1) Shell mould casting (2) Investment casting
(3) Pressure die casting (4) Centrifugal casting
64. In resistance seam welding, the electrode is in the form of a :
(1) Cylinder (2) Flat plate (3) Circular disc (4) None of these
65. The binding material used in cemented carbide cutting tools is :
(1) Graphite (2) Tungsten (3) Nickel (4) Cobalt

66. In a homogeneous isotropic elastic material, the modulus of elasticity E in terms of G and K is equal to :
- (1) $\frac{9KG}{G+3K}$ (2) $\frac{9KG}{3G+K}$ (3) $\frac{3K+G}{3G+K}$ (4) $\frac{6KG}{K+3G}$
67. The number of defectives produced by a *six sigma* process (in parts per million) is :
- (1) 5.2 (2) 4.2 (3) 3.2 (4) 2.2
68. Which one of the following is **not** a method of calculating depreciation ?
- (1) Straight line method (2) Sum of year digits (SYD) method
(3) Declining balance method (4) All of these
69. Index jigs are used to :
- (1) Drill equidistant holes on a circular flange
(2) To manufacture components with awkward shape
(3) Drill components both with internal and external diameters
(4) Drill round parts like pipe flange
70. The rotary internal combustion engine is the inversion of :
- (1) Four bar link chain (2) Double slider crank chain
(3) Single slider crank mechanism (4) Rocker crank mechanism
71. In LPP, the condition to be satisfied is :
- (1) Constraints as well as objective function have to be linear
(2) Only objective function has to be linear
(3) Constraints can be non-linear
(4) None of the above

72. PERT and CPM are basically used in :

- | | |
|-----------------------|----------------------|
| (1) Decision making | (2) Layout designing |
| (3) Assessing quality | (4) Defect reduction |

73. Process layout is used for :

- | | |
|---------------------------------------|--------------------------------|
| (1) Batch production | (2) Continuous type of product |
| (3) Effective utilisation of machines | (4) None of the above |

74. PERT is :

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| (1) Target oriented | (2) Event oriented |
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75. Two beams, one having square cross section and another circular cross-section, are subjected to the same amount of bending moment. If the cross sectional area as well as the material of both the beams are the same then :

- (1) Maximum bending stress developed in both the beams is the same
- (2) Circular beam experiences more bending stress than the square one
- (3) Square beam experiences more bending stress than the circular one
- (4) As the material is same both the beams will experience same deformation

76. Two pipe systems in series are said to be equivalent when :

- (1) The average diameter in both systems is the same.
- (2) The discharge under the same head is same in both systems.
- (3) The average friction factor in both systems is the same.
- (4) Total length of the pipe is the same in both the systems.

77. Boundary layer separation is caused by :
- (1) Adverse pressure gradient
 - (2) Laminar flow changing to turbulent flow
 - (3) Reduction pressure to vapour pressure
 - (4) None of these
78. In which of the following resistance welding, a large number of welds can be carried out simultaneously ?
- (1) Spot welding
 - (2) Projection welding
 - (3) Seam welding
 - (4) Percussion welding
79. Which of the following welding processes results in the smallest heat affected zone ?
- (1) Shielded metal arc welding
 - (2) Gas welding
 - (3) Laser beam welding
 - (4) Thermit welding
80. The Klein's diagram is used when :
- (1) Crank has uniform angular velocity
 - (2) Crank has non-uniform angular velocity
 - (3) Crank has uniform angular acceleration
 - (4) Crank has non-uniform angular acceleration
81. In powder metallurgy, sintering of a component :
- (1) Improves strength and reduces hardness
 - (2) Reduces brittleness and improve strength
 - (3) Improves hardness and reduces toughness
 - (4) Reduces porosity and increases brittleness

82. One Time Measurement Unit (TMU) during Method Study is equal to :
- (1) 0.0001 minute (2) 0.0006 minute
(3) 0.006 minute (4) 0.001 minute
83. Motion study is carried out to :
- (1) Observe actions of an operator (2) Study layout
(3) Study safety arrangements (4) All of these
84. Percent idle time for men or machines is found by :
- (1) Work sampling (2) Method study
(3) Work study (4) ABC analysis
85. In projection welding, the depth of projection is about :
- (1) 40% of sheet thickness (2) 60% of sheet thickness
(3) 80% of sheet thickness (4) 20% of sheet thickness
86. In a quasi-equilibrium process, the pressure in a system :
- (1) Remains constant (2) Varies with temperature
(3) Is constant everywhere, at an instant (4) Increase if volume increases
87. Which of the following is a surface (two-dimensional) imperfection in the crystal structure of common metals ?
- (1) Vacancy (2) Dislocation (3) Inclusion (4) None of these
88. A steel bar of 40 mm × 40 mm square cross-section is subjected to an axial compressive load of 200 kN. If the length of the bar is 2 m and $E = 200$ GPa, the elongation of the bar will be :
- (1) 1.25 mm (2) 2.70 mm (3) 4.05 mm (4) 5.40 mm

89. Which one of the following non-dimensional numbers is used for transition from laminar to turbulent flow in free convection ?
- (1) Reynolds number (2) Grashof number
(3) Peclet number (4) Rayleigh number
90. During normalizing process of steel, the specimen is heated :
- (1) Between the upper and lower critical temperature and cooled in still air.
(2) Above the upper critical temperature and cooled in furnace.
(3) Above the upper critical temperature and cooled in still air.
(4) Between the upper and lower critical temperature and cooled in furnace.
91. For a ductile material, toughness is a measure of :
- (1) Resistance to scratching
(2) Ability to absorb energy till elastic limit
(3) Resistance to indentation
(4) None of these
92. In the 3-2-1 principle of fixture design, 3 refers to the number of :
- (1) Clamps required
(2) Degrees of freedom of the workpiece
(3) Operations carried out on the primary datum face
(4) None of these
93. A steel bar 200 mm in diameter is turned at a feed of 0.25 mm/rev with a depth of cut of 4 mm. The rotational speed of the work piece is 160 rpm. The material removal rate in mm^3/s is :
- (1) 160 (2) 167.6 (3) 1600 (4) 1675.5

94. The strain energy stored in a spring, when subjected to maximum load, without suffering permanent distortion, is known as :
- (1) Impact energy (2) Proof resilience
(3) Proof stress (4) Modulus of resilience
95. For same power output and same compression ratio, as compared to two -stroke engines, four- stroke engine have :
- (1) Higher fuel consumption (2) Lower thermal efficiency
(3) Higher exhaust temperatures (4) Higher thermal efficiency
96. Reciprocating compressors are usually preferred for :
- (1) High pressure and high discharge (2) High pressure and low discharge
(3) Low pressure and high discharge (4) Low pressure and low discharge
97. For a four-cylinder vertical engine, the commonly used firing order is :
- (1) 1-2-3-4 (2) 3-4-1-2 (3) 1-3-4-2 (4) 4-3-2-1
98. Two balls of equal mass and of perfectly elastic material are lying on the floor. One of the ball with velocity v is made to struck the second ball. Both the balls after impact will move with a velocity :
- (1) v (2) $v/2$ (3) $v/4$ (4) $v/8$
99. Bell Coleman cycle consists of :
- (1) Two isobars and two isentropic (2) Two isochores and two isentropic
(3) Two isotherms and two isochores (4) Two isotherms and two isentropic
100. Increase in entropy of a system represents :
- (1) Increase in availability of energy (2) Increase in temperature
(3) Decrease in pressure (4) Degradation of energy

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 - (3) Analyzing the movement of an item in a store
 - (4) Maintaining the issue and receipt record
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6. An autocollimator is used to :
 - (1) Measure small angular displacements on flat surfaces
 - (2) Compare known and unknown dimensions
 - (3) Both of these
 - (4) None of these

7. The ratio of total emissive power of body to the total emissive power of a black body at the same temperature is called :
- (1) Absorptivity (2) Transmissivity (3) Reflectivity (4) None of these
8. The angle of a twist drill that determines its rake angle is :
- (1) Lip relief angle (2) Chisel edge angle
(3) Helix angle (4) Point angle
9. Material Requirements Planning include :
- (1) bill of material (2) inventory level
(3) production schedule (4) All of these
10. In a flange coupling, the bolts are subjected to :
- (1) Tensile stress (2) Compressive stress
(3) Shear stress (4) None of these
11. In LPP, the condition to be satisfied is :
- (1) Constraints as well as objective function have to be linear
(2) Only objective function has to be linear
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12. PERT and CPM are basically used in :
- (1) Decision making (2) Layout designing
(3) Assessing quality (4) Defect reduction
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- (1) Batch production (2) Continuous type of product
(3) Effective utilisation of machines (4) None of the above

14. PERT is :

- | | |
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| (1) Target oriented | (2) Event oriented |
| (3) Activity oriented | (4) Cost oriented |

15. Two beams, one having square cross section and another circular cross-section, are subjected to the same amount of bending moment. If the cross sectional area as well as the material of both the beams are the same then :

- (1) Maximum bending stress developed in both the beams is the same
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16. Two pipe systems in series are said to be equivalent when :

- (1) The average diameter in both systems is the same.
- (2) The discharge under the same head is same in both systems.
- (3) The average friction factor in both systems is the same.
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- (3) Laser beam welding
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- (3) Crank has uniform angular acceleration
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- (1) Clamps required
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- (3) Operations carried out on the primary datum face
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23. A steel bar 200 mm in diameter is turned at a feed of 0.25 mm/rev with a depth of cut of 4 mm. The rotational speed of the work piece is 160 rpm. The material removal rate in mm^3/s is :

- (1) 160
- (2) 167.6
- (3) 1600
- (4) 1675.5

24. The strain energy stored in a spring, when subjected to maximum load, without suffering permanent distortion, is known as :
- (1) Impact energy
 - (2) Proof resilience
 - (3) Proof stress
 - (4) Modulus of resilience
25. For same power output and same compression ratio, as compared to two -stroke engines, four- stroke engine have :
- (1) Higher fuel consumption
 - (2) Lower thermal efficiency
 - (3) Higher exhaust temperatures
 - (4) Higher thermal efficiency
26. Reciprocating compressors are usually preferred for :
- (1) High pressure and high discharge
 - (2) High pressure and low discharge
 - (3) Low pressure and high discharge
 - (4) Low pressure and low discharge
27. For a four-cylinder vertical engine, the commonly used firing order is :
- (1) 1-2-3-4
 - (2) 3-4-1-2
 - (3) 1-3-4-2
 - (4) 4-3-2-1
28. Two balls of equal mass and of perfectly elastic material are lying on the floor. One of the ball with velocity v is made to struck the second ball. Both the balls after impact will move with a velocity :
- (1) v
 - (2) $v/2$
 - (3) $v/4$
 - (4) $v/8$
29. Bell Coleman cycle consists of :
- (1) Two isobars and two isentropic
 - (2) Two isochores and two isentropic
 - (3) Two isotherms and two isochores
 - (4) Two isotherms and two isentropic
30. Increase in entropy of a system represents :
- (1) Increase in availability of energy
 - (2) Increase in temperature
 - (3) Decrease in pressure
 - (4) Degradation of energy

31. Type of spring used to absorb shocks and vibrations in vehicles is :

- (1) Helical spring
- (2) Spiral spring
- (3) Multi-leaf spring
- (4) Disk spring

32. According to first law of thermodynamics :

- (1) Total internal energy of a system during a process remains constant
- (2) Total energy of a system remains constant
- (3) Work done by a system is equal to the heat transferred by the system
- (4) None of these

33. For a given applied load, induced stress is a function of :

- (1) Cross sectional area of the body
- (2) Material of the body
- (3) Both (1) and (2)
- (4) None of these

34. Superheated vapor behaves :

- (1) Exactly as gas
- (2) As steam
- (3) As ordinary vapor
- (4) Approximately as a gas

35. The temperature distribution for a hollow cylinder for steady state heat flow and constant value of thermal conductivity is :

- (1) Logarithmic
- (2) Parabolic
- (3) Hyperbolic
- (4) Exponential

36. One ton of refrigeration is equal to :

- (1) 210 kJ/min
- (2) 3.5 kJ/min
- (3) 105 kJ/min
- (4) 250 kJ/min

37. The moment of inertia of a square section of size 1 unit about its diagonal is :
(1) $1/4$ (2) $1/8$ (3) $1/12$ (4) $1/24$
38. The unit of Bulk Modulus is :
(1) Nm (2) MPa (3) mm (4) N/m^3
39. A steel bar of 40 mm \times 40 mm square cross-section is subjected to an axial tensile load of 200 KN. If the length of bar is 2m and $E = 2 \times 10^5$ MPa, the elongation of the bar will be :
(1) 1.50 mm (2) 1.25 mm (3) 0.75 mm (4) 0.50 mm
40. The unit of stiffness is :
(1) N/m^3 (2) N/m^2 (3) Nm^2 (4) N/m
41. Moving average method is used to :
(1) Manage supply chains
(2) Control inventory levels
(3) Calculate optimum production levels
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42. Ishikawa diagram is used to :
(1) Identify different types of quality defects
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43. A moving mandrel is used in :
(1) wire drawing (2) forging (3) bending (4) None of these

44. Brazing and Soldering are :
- (1) Plastic joining methods
 - (2) Homogeneous joining methods
 - (3) Autogenous joining methods
 - (4) Heterogeneous joining methods
45. Bodies in flotation to be in stable equilibrium, the necessary and sufficient condition is that the centre of gravity is located below the :
- (1) Metacentre
 - (2) Centre of pressure
 - (3) Centre of gravity
 - (4) Centre of buoyancy
46. A quantitative measure of maintainability is :
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 - (2) Mean Time to Repair
 - (3) Mean Time between Failure
 - (4) System availability
47. Friction at the tool-chip interface can be reduced by :
- (1) Decreasing the rake angle
 - (2) Increasing the cutting speed
 - (3) Decreasing the cutting speed
 - (4) None of these
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(3) Electrolysis (4) All of these
50. The Coriolis component of acceleration acts :
- (1) Along the sliding surface
(2) Perpendicular to the sliding surface
(3) At 45 to the sliding surface
(4) Parallel to the sliding surface
51. The type of control chart used to monitor the amount of dispersion in a sample is :
- (1) c-chart (2) p-chart (3) X bar-chart (4) R-chart
52. 'Production Planning' involves integration of :
scheduling, routing, estimating and dispatching activities. This statement is :
- (1) Scheduling, routing, estimating and dispatching activities
(2) Scheduling, routing and selling activities
(3) Scheduling, routing and marketing activities
(4) None of these
53. Which of the following casting processes uses expendable pattern and expendable mould ?
- (1) Shell mould casting (2) Investment casting
(3) Pressure die casting (4) Centrifugal casting
54. In resistance seam welding, the electrode is in the form of a :
- (1) Cylinder (2) Flat plate (3) Circular disc (4) None of these
55. The binding material used in cemented carbide cutting tools is :
- (1) Graphite (2) Tungsten (3) Nickel (4) Cobalt

56. In a homogeneous isotropic elastic material, the modulus of elasticity E in terms of G and K is equal to :
- (1) $\frac{9KG}{G+3K}$ (2) $\frac{9KG}{3G+K}$ (3) $\frac{3K+G}{3G+K}$ (4) $\frac{6KG}{K+3G}$
57. The number of defectives produced by a *six sigma* process (in parts per million) is :
- (1) 5.2 (2) 4.2 (3) 3.2 (4) 2.2
58. Which one of the following is **not** a method of calculating depreciation ?
- (1) Straight line method (2) Sum of year digits (SYD) method
(3) Declining balance method (4) All of these
59. Index jigs are used to :
- (1) Drill equidistant holes on a circular flange
(2) To manufacture components with awkward shape
(3) Drill components both with internal and external diameters
(4) Drill round parts like pipe flange
60. The rotary internal combustion engine is the inversion of :
- (1) Four bar link chain (2) Double slider crank chain
(3) Single slider crank mechanism (4) Rocker crank mechanism
61. Two shafts, one solid and the other hollow, are made of the same materials and are having same length and weight. The hollow shaft as compared to solid shaft is :
- (1) More strong (2) Less strong
(3) Have same strength (4) None of the above
62. A structural member subjected to an axial compressive force is called :
- (1) Beam (2) Column (3) Frame (4) Strut

63. A downward vertical load of 10 kN acts at a distance of 40 cm from the left end on a 1 m long beam. This beam is simply supported at both ends. The vertical reaction at the left ends is :
- (1) 4 (2) 5 (3) 0.25 (4) 6
64. Nusselt number in case of free convection is the function of :
- (1) Reynolds number and Prandtl number
(2) Reynolds number only
(3) Grashoff number only
(4) Grashoff number and Prandtl number
65. For psychrometric charts :
- (1) Constant relative humidity lines are uphill straight lines to the right.
(2) Constant wet bulb temperature lines are downhill straight lines to the right.
(3) Constant enthalpy lines are coincident with constant wet bulb temperature lines.
(4) None of these
66. The difference between the total head line and the hydraulic grade line represents :
- (1) The velocity head (2) The piezoelectric head
(3) The pressure head (4) The elevation head
67. Which one of the following is a fire tube boiler ?
- (1) Babcock - Wilcox boiler (2) Locomotive boiler
(3) Both of these (4) None of these
68. A refrigerator and a heat pump operate between the same temperature limits. If the COP of the refrigerator is 4, the COP of the heat pump would be :
- (1) 3 (2) 4 (3) 5 (4) 6

69. In axial flow turbine :

- | | |
|---|--|
| (1) Inlet is axial and outlet is radial | (2) Inlet is axial and outlet is axial |
| (3) Inlet is radial and outlet is axial | (4) Inlet is radial and outlet is radial |

70. If a material expands freely due to heating, it will develop :

- | | |
|--------------------|------------------------|
| (1) Tensile stress | (2) Compressive stress |
| (3) No stress | (4) Thermal stress |

71. If pressure angle is 20° , then minimum number of teeth is :

- | | | | |
|--------|--------|--------|-------------------|
| (1) 27 | (2) 20 | (3) 07 | (4) None of these |
|--------|--------|--------|-------------------|

72. Cavitation gives damage to turbine on :

- (1) Outlet on the convex side of blades
- (2) Inlet on the convex side of blades
- (3) Both of these
- (4) None of these

73. Maximum bending moment in a cantilever beam with uniformly distributed load (w /unit length) over whole length 'L' is :

- | | | | |
|------------------|----------------------|----------------------|----------------------|
| (1) ωL^2 | (2) $(\omega L^2)/2$ | (3) $(\omega L^2)/4$ | (4) $(\omega L^2)/8$ |
|------------------|----------------------|----------------------|----------------------|

74. Bending stress at neutral axis is :

- | | |
|-------------------|-------------------|
| (1) Maximum | (2) Zero |
| (3) Can't be zero | (4) None of these |

75. Which of the following is **not** a type of transmission shaft ?

- | | |
|-------------------|------------------------|
| (1) Crankshaft | (2) Line shaft |
| (3) Counter shaft | (4) Transmission shaft |

76. Lamé's theory is associated with :
- (1) Thin cylindrical shells
 - (2) Thick cylindrical shells
 - (3) Direct and bending stresses
 - (4) None of the above
77. The maximum principal strain theory is also known as :
- (1) Rankine's theory
 - (2) Guest's theory
 - (3) Saint Venant's theory
 - (4) Von-Mises theory
78. Two springs of stiffness k_1 and k_2 respectively are connected in series, what will be the stiffness of the composite spring ?
- (1) $k = \frac{k_1 \times k_2}{k_1 + k_2}$
 - (2) $k = \frac{k_1 + k_2}{k_1 \times k_2}$
 - (3) $k = k_1 \times k_2$
 - (4) $k = k_1 + k_2$
79. The point of contra-flexure occurs in :
- (1) Cantilever beams
 - (2) Simply supported beams
 - (3) Overhanging beams
 - (4) Fixed beams
80. The pair is known as a higher pair, when the relative motion between the elements of a pair is :
- (1) Turning only
 - (2) Sliding only
 - (3) Rolling only
 - (4) Partly turning and Partly sliding
81. In powder metallurgy, sintering of a component :
- (1) Improves strength and reduces hardness
 - (2) Reduces brittleness and improve strength
 - (3) Improves hardness and reduces toughness
 - (4) Reduces porosity and increases brittleness
82. One Time Measurement Unit (TMU) during Method Study is equal to :
- (1) 0.0001 minute
 - (2) 0.0006 minute
 - (3) 0.006 minute
 - (4) 0.001 minute

83. Motion study is carried out to :

- (1) Observe actions of an operator (2) Study layout
- (3) Study safety arrangements (4) All of these

84. Percent idle time for men or machines is found by :

- (1) Work sampling (2) Method study
- (3) Work study (4) ABC analysis

85. In projection welding, the depth of projection is about :

- (1) 40% of sheet thickness (2) 60% of sheet thickness
- (3) 80% of sheet thickness (4) 20% of sheet thickness

86. In a quasi-equilibrium process, the pressure in a system :

- (1) Remains constant (2) Varies with temperature
- (3) Is constant everywhere, at an instant (4) Increase if volume increases

87. Which of the following is a surface (two-dimensional) imperfection in the crystal structure of common metals ?

- (1) Vacancy (2) Dislocation (3) Inclusion (4) None of these

88. A steel bar of 40 mm × 40 mm square cross-section is subjected to an axial compressive load of 200 kN. If the length of the bar is 2 m and $E = 200$ GPa, the elongation of the bar will be :

- (1) 1.25 mm (2) 2.70 mm (3) 4.05 mm (4) 5.40 mm

89. Which one of the following non-dimensional numbers is used for transition from laminar to turbulent flow in free convection ?

- (1) Reynolds number (2) Grashof number
- (3) Peclet number (4) Rayleigh number

90. During normalizing process of steel, the specimen is heated :
- (1) Between the upper and lower critical temperature and cooled in still air.
 - (2) Above the upper critical temperature and cooled in furnace.
 - (3) Above the upper critical temperature and cooled in still air.
 - (4) Between the upper and lower critical temperature and cooled in furnace.
91. Poisson's ratio is equal to :
- (1) Lateral Strain / Longitudinal Strain
 - (2) Lateral Strain \times Longitudinal Strain
 - (3) Longitudinal Strain / Lateral Strain
 - (4) None of these
92. The energy stored in a body when strained within elastic limit is known as :
- (1) Proof resilience
 - (2) Impact energy
 - (3) Strain energy
 - (4) Potential energy
93. The increase in hardness due to cold working is called :
- (1) Cold hardening
 - (2) Work hardening
 - (3) Age hardening
 - (4) None of these
94. For extrusion, important mechanical property of a material is :
- (1) Elasticity
 - (2) Ductility
 - (3) Plasticity
 - (4) None of these
95. When steam flows through the fixed blades in reaction turbine :
- (1) Pressure increases
 - (2) Velocity increases
 - (3) Velocity increases and Pressure drops
 - (4) None of these

96. Reaming is a process used to :
- (1) Create a circular hole in metals
 - (2) Cut a slot on the existing hole surface
 - (3) Finish an existing hole surface
 - (4) Make non-circular holes in metals
97. The fixed cost and the variable cost of production of a product are Rs. 20,000 and Rs. 80 per unit, respectively. The demand for the item is 500 units. To break even, the unit price of the items in Rs. should be :
- (1) 150 (2) 120 (3) 130 (4) 100
98. The Young's modulus of elasticity of a material is 2.5 times its modulus of rigidity. The Poisson's ratio for the material will be :
- (1) 1.50 (2) 0.25 (3) 0.50 (4) 0.75
99. Acceptable Quality Level (AQL) is associated with :
- (1) Producer's risk
 - (2) Consumer's risk
 - (3) Lot tolerance percent defective
 - (4) Average outgoing quality limit
100. Self locking condition for a pair of square thread screw and nut having coefficient of friction = μ , lead of thread = L and pitch diameter of thread = d is given by :
- (1) $d > \pi\mu L$ (2) $d > \mu L$ (3) $\mu > Ld$ (4) None of these

Total No. of Printed Pages : 17

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ARE ASKED TO DO SO)

C

PHD-EE-2023-24

SET-X

Mechanical Engineering

10011

Sr. No.

Time : 1¼ Hours

Max. Marks : 100

Total Questions : 100

Roll No. (in figures) _____ (in words) _____

Name _____ Date of Birth _____

Father's Name _____ Mother's Name _____

Date of Examination _____

(Signature of the Candidate)

(Signature of the Invigilator)

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STARTING THE QUESTION PAPER.**

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2. The candidates **must return** the question booklet as well as OMR Answer-Sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfair-means / mis-behaviour will be registered against him / her, in addition to lodging of an FIR with the police. Further the answer-sheet of such a candidate will not be evaluated.
3. Keeping in view the transparency of the examination system, carbonless OMR Sheet is provided to the candidate so that a copy of OMR Sheet may be kept by the candidate.
4. Question Booklet along with answer key of all the A, B, C & D code shall be got uploaded on the University Website immediately after the conduct of Entrance Examination. Candidates may raise valid objection/complaint if any, with regard to discrepancy in the question booklet/answer key within 24 hours of uploading the same on the University Website. The complaint be sent by the students to the Controller of Examinations by hand or through email. Thereafter, no complaint in any case, will be considered.
5. The candidate **must not** do any rough work or writing in the OMR Answer-Sheet. Rough work, if any, may be done in the question booklet itself. Answers **must not** be ticked in the question booklet.
6. **There will be no negative marking. Each correct answer will be awarded one full mark. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.**
7. Use only **Black or Blue Ball Point Pen** of good quality in the OMR Answer-Sheet.
8. **Before answering the questions, the candidates should ensure that they have been supplied correct and complete booklet. Complaints, if any, regarding misprinting etc. will not be entertained 30 minutes after starting of the examination.**

PHD-EE-2023-24/(Mechanical Engg.)(SET-X)/(C)

SEAL

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(2) Above the upper critical temperature and cooled in furnace.
(3) Above the upper critical temperature and cooled in still air.
(4) Between the upper and lower critical temperature and cooled in furnace.

31. In LPP, the condition to be satisfied is :
- (1) Constraints as well as objective function have to be linear
 - (2) Only objective function has to be linear
 - (3) Constraints can be non-linear
 - (4) None of the above
32. PERT and CPM are basically used in :
- (1) Decision making
 - (2) Layout designing
 - (3) Assessing quality
 - (4) Defect reduction
33. Process layout is used for :
- (1) Batch production
 - (2) Continuous type of product
 - (3) Effective utilisation of machines
 - (4) None of the above
34. PERT is :
- (1) Target oriented
 - (2) Event oriented
 - (3) Activity oriented
 - (4) Cost oriented
35. Two beams, one having square cross section and another circular cross-section, are subjected to the same amount of bending moment. If the cross sectional area as well as the material of both the beams are the same then :
- (1) Maximum bending stress developed in both the beams is the same
 - (2) Circular beam experiences more bending stress than the square one
 - (3) Square beam experiences more bending stress than the circular one
 - (4) As the material is same both the beams will experience same deformation

36. Two pipe systems in series are said to be equivalent when :
- (1) The average diameter in both systems is the same.
 - (2) The discharge under the same head is same in both systems.
 - (3) The average friction factor in both systems is the same.
 - (4) Total length of the pipe is the same in both the systems.
37. Boundary layer separation is caused by :
- (1) Adverse pressure gradient
 - (2) Laminar flow changing to turbulent flow
 - (3) Reduction pressure to vapour pressure
 - (4) None of these
38. In which of the following resistance welding, a large number of welds can be carried out simultaneously ?
- (1) Spot welding
 - (2) Projection welding
 - (3) Seam welding
 - (4) Percussion welding
39. Which of the following welding processes results in the smallest heat affected zone ?
- (1) Shielded metal arc welding
 - (2) Gas welding
 - (3) Laser beam welding
 - (4) Thermit welding
40. The Klein's diagram is used when :
- (1) Crank has uniform angular velocity
 - (2) Crank has non-uniform angular velocity
 - (3) Crank has uniform angular acceleration
 - (4) Crank has non-uniform angular acceleration

41. If pressure angle is 20° , then minimum number of teeth is :
(1) 27 (2) 20 (3) 07 (4) None of these
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(1) ωL^2 (2) $(\omega L^2)/2$ (3) $(\omega L^2)/4$ (4) $(\omega L^2)/8$
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(3) Can't be zero (4) None of these
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(3) Overhanging beams (4) Fixed beams
50. The pair is known as a higher pair, when the relative motion between the elements of a pair is :
- (1) Turning only (2) Sliding only
(3) Rolling only (4) Partly turning and Partly sliding
51. Poisson's ratio is equal to :
- (1) Lateral Strain / Longitudinal Strain
(2) Lateral Strain \times Longitudinal Strain
(3) Longitudinal Strain / Lateral Strain
(4) None of these
52. The energy stored in a body when strained within elastic limit is known as :
- (1) Proof resilience (2) Impact energy
(3) Strain energy (4) Potential energy
53. The increase in hardness due to cold working is called :
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- (1) Elasticity (2) Ductility (3) Plasticity (4) None of these

55. When steam flows through the fixed blades in reaction turbine :
- (1) Pressure increases
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- (1) 150 (2) 120 (3) 130 (4) 100
58. The Young's modulus of elasticity of a material is 2.5 times its modulus of rigidity. The Poisson's ratio for the material will be :
- (1) 1.50 (2) 0.25 (3) 0.50 (4) 0.75
59. Acceptable Quality Level (AQL) is associated with :
- (1) Producer's risk
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 - (3) Lot tolerance percent defective
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60. Self locking condition for a pair of square thread screw and nut having coefficient of friction = μ , lead of thread = L and pitch diameter of thread = d is given by :
- (1) $d > \pi\mu L$ (2) $d > \mu L$ (3) $\mu > Ld$ (4) None of these

61. Type of spring used to absorb shocks and vibrations in vehicles is :
(1) Helical spring (2) Spiral spring
(3) Multi-leaf spring (4) Disk spring
62. According to first law of thermodynamics :
(1) Total internal energy of a system during a process remains constant
(2) Total energy of a system remains constant
(3) Work done by a system is equal to the heat transferred by the system
(4) None of these
63. For a given applied load, induced stress is a function of :
(1) Cross sectional area of the body
(2) Material of the body
(3) Both (1) and (2)
(4) None of these
64. Superheated vapor behaves :
(1) Exactly as gas (2) As steam
(3) As ordinary vapor (4) Approximately as a gas
65. The temperature distribution for a hollow cylinder for steady state heat flow and constant value of thermal conductivity is :
(1) Logarithmic (2) Parabolic (3) Hyperbolic (4) Exponential
66. One ton of refrigeration is equal to :
(1) 210 kJ/min (2) 3.5 kJ/min (3) 105 kJ/min (4) 250 kJ/min
67. The moment of inertia of a square section of size 1 unit about its diagonal is :
(1) $1/4$ (2) $1/8$ (3) $1/12$ (4) $1/24$

68. The unit of Bulk Modulus is :
(1) Nm (2) MPa (3) mm (4) N/m^3
69. A steel bar of 40 mm \times 40 mm square cross-section is subjected to an axial tensile load of 200 KN. If the length of bar is 2m and $E = 2 \times 10^5$ MPa, the elongation of the bar will be :
(1) 1.50 mm (2) 1.25 mm (3) 0.75 mm (4) 0.50 mm
70. The unit of stiffness is :
(1) N/m^3 (2) N/m^2 (3) Nm^2 (4) N/m
71. The REL chart is used for :
(1) Designing the layout of plants
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(1) Measure small angular displacements on flat surfaces
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83. A steel bar 200 mm in diameter is turned at a feed of 0.25 mm/rev with a depth of cut of 4 mm. The rotational speed of the work piece is 160 rpm. The material removal rate in mm^3/s is :
(1) 160 (2) 167.6 (3) 1600 (4) 1675.5
84. The strain energy stored in a spring, when subjected to maximum load, without suffering permanent distortion, is known as :
(1) Impact energy (2) Proof resilience
(3) Proof stress (4) Modulus of resilience
85. For same power output and same compression ratio, as compared to two -stroke engines, four- stroke engine have :
(1) Higher fuel consumption (2) Lower thermal efficiency
(3) Higher exhaust temperatures (4) Higher thermal efficiency
86. Reciprocating compressors are usually preferred for :
(1) High pressure and high discharge (2) High pressure and low discharge
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87. For a four-cylinder vertical engine, the commonly used firing order is :
(1) 1-2-3-4 (2) 3-4-1-2 (3) 1-3-4-2 (4) 4-3-2-1
88. Two balls of equal mass and of perfectly elastic material are lying on the floor. One of the ball with velocity v is made to struck the second ball. Both the balls after impact will move with a velocity :
(1) v (2) $v/2$ (3) $v/4$ (4) $v/8$

89. Bell Coleman cycle consists of :
- (1) Two isobars and two isentropic
 - (2) Two isochores and two isentropic
 - (3) Two isotherms and two isochores
 - (4) Two isotherms and two isentropic
90. Increase in entropy of a system represents :
- (1) Increase in availability of energy
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 - (3) Decrease in pressure
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91. The type of control chart used to monitor the amount of dispersion in a sample is :
- (1) c-chart
 - (2) p-chart
 - (3) X bar-chart
 - (4) R-chart
92. 'Production Planning' involves integration of :
scheduling, routing, estimating and dispatching activities. This statement is :
- (1) Scheduling, routing, estimating and dispatching activities
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- (1) $\frac{9KG}{G+3K}$ (2) $\frac{9KG}{3G+K}$ (3) $\frac{3K+G}{3G+K}$ (4) $\frac{6KG}{K+3G}$
97. The number of defectives produced by a *six sigma* process (in parts per million) is :
- (1) 5.2 (2) 4.2 (3) 3.2 (4) 2.2
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- (1) Straight line method (2) Sum of year digits (SYD) method
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(DO NOT OPEN THIS QUESTION BOOKLET BEFORE TIME OR UNTIL YOU
ARE ASKED TO DO SO)

D

PHD-EE-2023-24

SET-X

Mechanical Engineering

10004

Sr. No. _____

Time : 1¼ Hours

Max. Marks : 100

Total Questions : 100

Roll No. (in figures) _____ (in words) _____

Name _____ Date of Birth _____

Father's Name _____ Mother's Name _____

Date of Examination _____

(Signature of the Candidate)

(Signature of the Invigilator)

**CANDIDATES MUST READ THE FOLLOWING INFORMATION/INSTRUCTIONS BEFORE
STARTING THE QUESTION PAPER.**

1. **All questions are compulsory.**
2. The candidates **must return** the question booklet as well as OMR Answer-Sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfair-means / mis-behaviour will be registered against him / her, in addition to lodging of an FIR with the police. Further the answer-sheet of such a candidate will not be evaluated.
3. Keeping in view the transparency of the examination system, carbonless OMR Sheet is provided to the candidate so that a copy of OMR Sheet may be kept by the candidate.
4. Question Booklet along with answer key of all the A, B, C & D code shall be got uploaded on the University Website immediately after the conduct of Entrance Examination. Candidates may raise valid objection/complaint if any, with regard to discrepancy in the question booklet/answer key within 24 hours of uploading the same on the University Website. The complaint be sent by the students to the Controller of Examinations by hand or through email. Thereafter, no complaint in any case, will be considered.
5. The candidate **must not** do any rough work or writing in the OMR Answer-Sheet. Rough work, if any, may be done in the question booklet itself. Answers **must not** be ticked in the question booklet.
6. **There will be no negative marking. Each correct answer will be awarded one full mark. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.**
7. Use only **Black or Blue Ball Point Pen** of good quality in the OMR Answer-Sheet.
8. **Before answering the questions, the candidates should ensure that they have been supplied correct and complete booklet. Complaints, if any, regarding misprinting etc. will not be entertained 30 minutes after starting of the examination.**

PHD-EE-2023-24/(Mechanical Engg.)(SET-X)/(D)

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- (1) $d > \pi\mu L$ (2) $d > \mu L$ (3) $\mu > Ld$ (4) None of these
21. In LPP, the condition to be satisfied is :
- (1) Constraints as well as objective function have to be linear
(2) Only objective function has to be linear
(3) Constraints can be non-linear
(4) None of the above
22. PERT and CPM are basically used in :
- (1) Decision making (2) Layout designing
(3) Assessing quality (4) Defect reduction
23. Process layout is used for :
- (1) Batch production (2) Continuous type of product
(3) Effective utilisation of machines (4) None of the above
24. PERT is :
- (1) Target oriented (2) Event oriented
(3) Activity oriented (4) Cost oriented
25. Two beams, one having square cross section and another circular cross-section, are subjected to the same amount of bending moment. If the cross sectional area as well as the material of both the beams are the same then :
- (1) Maximum bending stress developed in both the beams is the same
(2) Circular beam experiences more bending stress than the square one
(3) Square beam experiences more bending stress than the circular one
(4) As the material is same both the beams will experience same deformation

26. Two pipe systems in series are said to be equivalent when :
- (1) The average diameter in both systems is the same.
 - (2) The discharge under the same head is same in both systems.
 - (3) The average friction factor in both systems is the same.
 - (4) Total length of the pipe is the same in both the systems.
27. Boundary layer separation is caused by :
- (1) Adverse pressure gradient
 - (2) Laminar flow changing to turbulent flow
 - (3) Reduction pressure to vapour pressure
 - (4) None of these
28. In which of the following resistance welding, a large number of welds can be carried out simultaneously ?
- | | |
|------------------|------------------------|
| (1) Spot welding | (2) Projection welding |
| (3) Seam welding | (4) Percussion welding |
29. Which of the following welding processes results in the smallest heat affected zone ?
- | | |
|--------------------------------|---------------------|
| (1) Shielded metal arc welding | (2) Gas welding |
| (3) Laser beam welding | (4) Thermit welding |
30. The Klein's diagram is used when :
- (1) Crank has uniform angular velocity
 - (2) Crank has non-uniform angular velocity
 - (3) Crank has uniform angular acceleration
 - (4) Crank has non-uniform angular acceleration

D

37. Which one of the following is a fire tube boiler ?
 (1) Babcock - Wilcox boiler (2) Locomotive boiler
 (3) Both of these (4) None of these
38. A refrigerator and a heat pump operate between the same temperature limits. If the COP of the refrigerator is 4, the COP of the heat pump would be :
 (1) 3 (2) 4 (3) 5 (4) 6
39. In axial flow turbine :
 (1) Inlet is axial and outlet is radial (2) Inlet is axial and outlet is axial
 (3) Inlet is radial and outlet is axial (4) Inlet is radial and outlet is radial
40. If a material expands freely due to heating, it will develop :
 (1) Tensile stress (2) Compressive stress
 (3) No stress (4) Thermal stress
41. The type of control chart used to monitor the amount of dispersion in a sample is :
 (1) c-chart (2) p-chart (3) X bar-chart (4) R-chart
42. 'Production Planning' involves integration of :
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51. In powder metallurgy, sintering of a component :
- (1) Improves strength and reduces hardness
 - (2) Reduces brittleness and improve strength
 - (3) Improves hardness and reduces toughness
 - (4) Reduces porosity and increases brittleness
52. One Time Measurement Unit (TMU) during Method Study is equal to :
- (1) 0.0001 minute
 - (2) 0.0006 minute
 - (3) 0.006 minute
 - (4) 0.001 minute
53. Motion study is carried out to :
- (1) Observe actions of an operator
 - (2) Study layout
 - (3) Study safety arrangements
 - (4) All of these
54. Percent idle time for men or machines is found by :
- (1) Work sampling
 - (2) Method study
 - (3) Work study
 - (4) ABC analysis
55. In projection welding, the depth of projection is about :
- (1) 40% of sheet thickness
 - (2) 60% of sheet thickness
 - (3) 80% of sheet thickness
 - (4) 20% of sheet thickness
56. In a quasi-equilibrium process, the pressure in a system :
- (1) Remains constant
 - (2) Varies with temperature
 - (3) Is constant everywhere, at an instant
 - (4) Increase if volume increases

57. Which of the following is a surface (two-dimensional) imperfection in the crystal structure of common metals ?
(1) Vacancy (2) Dislocation (3) Inclusion (4) None of these
58. A steel bar of 40 mm × 40 mm square cross-section is subjected to an axial compressive load of 200 kN. If the length of the bar is 2 m and $E = 200$ GPa, the elongation of the bar will be :
(1) 1.25 mm (2) 2.70 mm (3) 4.05 mm (4) 5.40 mm
59. Which one of the following non-dimensional numbers is used for transition from laminar to turbulent flow in free convection ?
(1) Reynolds number (2) Grashof number
(3) Peclet number (4) Rayleigh number
60. During normalizing process of steel, the specimen is heated :
(1) Between the upper and lower critical temperature and cooled in still air.
(2) Above the upper critical temperature and cooled in furnace.
(3) Above the upper critical temperature and cooled in still air.
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71. Moving average method is used to :

- (1) Manage supply chains
- (2) Control inventory levels
- (3) Calculate optimum production levels
- (4) Make sales forecast

72. Ishikawa diagram is used to :

- (1) Identify different types of quality defects
- (2) Find quantitative relation between a defect and a process parameter
- (3) Find relation between defects and their causes
- (4) Prioritized quality defects

73. A moving mandrel is used in :

- | | | | |
|------------------|-------------|-------------|-------------------|
| (1) wire drawing | (2) forging | (3) bending | (4) None of these |
|------------------|-------------|-------------|-------------------|

74. Brazing and Soldering are :

- (1) Plastic joining methods
- (2) Homogeneous joining methods
- (3) Autogenous joining methods
- (4) Heterogeneous joining methods

75. Bodies in flotation to be in stable equilibrium, the necessary and sufficient condition is that the centre of gravity is located below the :
- (1) Metacentre
 - (2) Centre of pressure
 - (3) Centre of gravity
 - (4) Centre of buoyancy
76. A quantitative measure of maintainability is :
- (1) Downtime
 - (2) Mean Time to Repair
 - (3) Mean Time between Failure
 - (4) System availability
77. Friction at the tool-chip interface can be reduced by :
- (1) Decreasing the rake angle
 - (2) Increasing the cutting speed
 - (3) Decreasing the cutting speed
 - (4) None of these
78. Which one of the following is *not* a characteristic of JIT manufacturing system ?
- (1) Reduction of lot sizes
 - (2) Efficient use of buffer inventory
 - (3) Small but frequent deliveries
 - (4) Higher productivity
79. Which one of the following methods can be used for producing metal powders ?
- (1) Atomization
 - (2) Machining and grinding
 - (3) Electrolysis
 - (4) All of these
80. The Coriolis component of acceleration acts :
- (1) Along the sliding surface
 - (2) Perpendicular to the sliding surface
 - (3) At 45 to the sliding surface
 - (4) Parallel to the sliding surface

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- (1) Cross sectional area of the body
- (2) Material of the body
- (3) Both (1) and (2)
- (4) None of these

84. Superheated vapor behaves :

- (1) Exactly as gas
- (2) As steam
- (3) As ordinary vapor
- (4) Approximately as a gas

85. The temperature distribution for a hollow cylinder for steady state heat flow and constant value of thermal conductivity is :

- (1) Logarithmic
- (2) Parabolic
- (3) Hyperbolic
- (4) Exponential

86. One ton of refrigeration is equal to :

- (1) 210 kJ/min
- (2) 3.5 kJ/min
- (3) 105 kJ/min
- (4) 250 kJ/min

87. The moment of inertia of a square section of size 1 unit about its diagonal is :
- (1) $1/4$ (2) $1/8$ (3) $1/12$ (4) $1/24$
88. The unit of Bulk Modulus is :
- (1) Nm (2) MPa (3) mm (4) N/m^3
89. A steel bar of $40 \text{ mm} \times 40 \text{ mm}$ square cross-section is subjected to an axial tensile load of 200 KN. If the length of bar is 2m and $E = 2 \times 10^5 \text{ MPa}$, the elongation of the bar will be :
- (1) 1.50 mm (2) 1.25 mm (3) 0.75 mm (4) 0.50 mm
90. The unit of stiffness is :
- (1) N/m^3 (2) N/m^2 (3) Nm^2 (4) N/m
91. If pressure angle is 20° , then minimum number of teeth is :
- (1) 27 (2) 20 (3) 07 (4) None of these
92. Cavitation gives damage to turbine on :
- (1) Outlet on the convex side of blades
- (2) Inlet on the convex side of blades
- (3) Both of these
- (4) None of these
93. Maximum bending moment in a cantilever beam with uniformly distributed load ($w/\text{unit length}$) over whole length 'L' is :
- (1) ωL^2 (2) $(\omega L^2)/2$ (3) $(\omega L^2)/4$ (4) $(\omega L^2)/8$
94. Bending stress at neutral axis is :
- (1) Maximum (2) Zero
- (3) Can't be zero (4) None of these

95. Which of the following is **not** a type of transmission shaft ?
- (1) Crankshaft (2) Line shaft
(3) Counter shaft (4) Transmission shaft
96. Lamé's theory is associated with :
- (1) Thin cylindrical shells (2) Thick cylindrical shells
(3) Direct and bending stresses (4) None of the above
97. The maximum principal strain theory is also known as :
- (1) Rankine's theory (2) Guest's theory
(3) Saint Venant's theory (4) Von-Mises theory
98. Two springs of stiffness k_1 and k_2 respectively are connected in series, what will be the stiffness of the composite spring ?
- (1) $k = \frac{k_1 \times k_2}{k_1 + k_2}$ (2) $k = \frac{k_1 + k_2}{k_1 \times k_2}$ (3) $k = k_1 \times k_2$ (4) $k = k_1 + k_2$
99. The point of contra-flexure occurs in :
- (1) Cantilever beams (2) Simply supported beams
(3) Overhanging beams (4) Fixed beams
100. The pair is known as a higher pair, when the relative motion between the elements of a pair is :
- (1) Turning only (2) Sliding only
(3) Rolling only (4) Partly turning and Partly sliding

Answer keys of PHD-EE-2023-24 (MECHANICAL ENGG.) entrance exam dated 22.03.2024

Q. NO.	A	B	C	D
1	3	1	1	4
2	2	3	4	4
3	1	2	4	4
4	4	1	4	2
5	1	4	2	4
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7	3	4	2	3
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49	4	4	3	1
50	3	2	4	3

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Answer keys of PHD-EE-2023-24 (MECHANICAL ENGG.) entrance exam dated 22.03.2024

Q. NO.	A	B	C	D
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99	1	3	1	3
100	4	4	3	4

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