## Total No. of Printed Pages : 17 (DO NOT OPEN THIS QUESTION BOOKLET BEFORE TIME OR UNTIL YOU ARE ASKED TO DO SO) PHD-EE-2023-24 Mechanical Engineering 10017 St. 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		

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

- Α
- 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

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7.	The moment of iner	rtia of a square sectio	n of size 1 unit about	tits diagonal is :	
	(1) 1/4	(2) 1/8	(3) 1/12	(4) 1/24	
8.	The unit of Bulk M	odulus is :			
	(1) Nm	(2) MPa	(3) mm	(4) $N/m^3$	
9.	3. A steel bar of 40 mm × 40 mm square cross-section is subjected to an axial tensile lo of 200 KN. If the length of bar is 2m and $E = 2 \times 10^5$ MPa, the elongation of the t will be :				ad ar
	(1) 1.50 mm	(2) 1.25 mm	(3) 0.75 mm	(4) 0.50 mm	
10.	The unit of stiffnes	s 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
- Maximum bending moment in a cantilever beam with uniformly distributed load 13. (w/unit length) over whole length 'L' is :
  - (1)  $\omega L^2$ (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

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15	5. Which of the following is <i>not</i> a type of transmission shaft?		
	(1) Crankshaft	(2) Line shaft	
	(3) Counter shaft	(4) Transmission shaft	
16.	Lame's theory is associated with :	ν <u>1</u> .	
	(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 $k_2$ rest the stiffness of the composite spring ?	pectively are connected in series, what will be	
	(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, whe pair is :	n the relative motion between the elements of a	
	(1) Turning only	(2) Sliding only	
	(3) Rolling only	(4) Partly turning and Partly sliding	
1.	Two shafts, one solid and the other ho having same length and weight. The hol	blow, are made of the same materials and are low shaft as compared to solid shaft is :	
	(1) More strong	(2) Less strong	

(4) None of the above (3) Have same strength

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P. T. O.

- 4
- 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 : (4) 6 (1) 3 (2) 4 (3) 5 In axial flow turbine : 29. (2) Inlet is axial and outlet is axial (1) Inlet is axial and outlet is radial (4) Inlet is radial and outlet is radial (3) Inlet is radial and outlet is axial 30. If a material expands freely due to heating, it will develop : (1) Tensile stress (2) Compressive stress (4) Thermal stress (3) No stress **31.** Poisson's ratio is equal to : (1) Lateral Strain / Longitudinal Strain (2) Lateral Strain × Longitudinal Strain (3) Longitudinal Strain / Lateral Strain (4) None of these The energy stored in a body when strained within elastic limit is known as : 32. (2) Impact energy (1) Proof resilience (4) Potnetial energy (3) Strain energy The increase in hardness due to cold working is called : 33. (2) Work hardening (1) Cold hardening (4) None of these (3) Age hardening **34.** For extrusion, important mechanical property of a material is : (4) None of these (3) Plasticity

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(1) Elasticity

(2) Ductility

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- **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 =  $\mu$ , 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

- A
- 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

47. The ratio of total emissive power of body to the total emissive power of a black body at the same temperature is called : (4) None of these (1) Absorptivity (2) Transmissivity (3) Reflectivity **48.** The angle of a twist drill that determines its rake angle is : (2) Chisel edge angle (1) Lip relief angle (4) Point angle (3) Helix angle 49. Material Requirements Planning include : (2) inventory level (1) bill of material (4) All of these (3) production schedule 50. In a flange coupling, the bolts arc subjected to : (2) Compressive stress (1) Tensile stress (4) None of these (3) Shear stress 51. Moving average method is used to : (1) Manage supply chains (2) Control inventory levels (3) Calculate optimum production levels (4) Make sales forecast 52. Ishikawa diagram is used to : (1) Identify different types of quality defects (2) Find quantitative relation between a defect and a process parameter

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- (3) Find relation between defects and their causes
- (4) Prioritized quality defects

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- Α
- 53. A moving mandrel is used in :
  - (1) wire drawing (2) forging
- 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

(4) None or these

P. T. O.

59.

- (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

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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 :

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- (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 tunction have to be linear
  - (2) Only objective function has to be linear
  - (3) Constraints can be non-linear
  - (4) None of the above

- 12
  - 72. PERT and CPM are basically used in :
    - (1) Decision making
    - (3) Assessing quality
  - 73. Process layout is used for :
    - (2) Continuous type of product (1) Batch production
    - (3) Effective utilisation of machines
  - 74. PERT is :
    - (2) Event oriented (1) Target oriented
    - (4) Cost oriented (3) Activity oriented
  - Two beams, one having square cross section and another circular cross-section, are 75. 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.

- (2) Layout designing
- (4) Defect reduction
- (4) None of the above

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- 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
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82.	One Time Measurement Unit (TMU) du	ring 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 proje	ection 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 press	sure in a system :
	(1) Remains constant	(2) Varies with temperature
	(3) Is constant everywhere, at an instan	t (4) Increase if volume increases
87.	Which of the following is a surface structure of common metals?	(two-dimensional) imperfection in the crystal
	(1) Vacancy (2) Dislocation	(3) Inclusion (4) None of these
88.	A steel bar of 40 mm $\times$ 40 mm s compressive load of 200 kN. If the le elongation of the bar will be :	equare cross-section is subjected to an axial ngth of the bar is 2 m and $E = 200$ GPa, the

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

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

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**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<sup>3</sup>/s is :
  - (1) 160 (2) 167.6 (3) 1600 (4) 1675.5

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P. T. O.

94.	The strain energy stored in a spring, suffering permanent distortion, is known	, when subjected to maximum load, without n as :
	(1) Impact energy	(2) Proof resilience
	(3) Proof stress	(4) Modulus of resilience
95.	For same power output and same co engines, four-stroke engine have :	mpression ratio, as compared to two -stroke
	(1) Higher fuel consumption	(2) Lower thermal efficiency
	(3) Higher exhaust temperatures	(4) Higher thermal efficiency
96.	Reciprocating compressors are usually p	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 c	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 the ball with velocity v is made to stru- will move with a velocity :	y elastic material are lying on the floor. One of ck the second ball. Both the balls after impact
	(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
	(3) Two isotherms and two isochores	<ul><li>(4) Two isotherms and two isentropic</li></ul>
100.	Increase in entropy of a system represen	ts :
	(1) Increase in availability of energy	(2) Increase in the
	(3) Decrease in pressure	(4) Degradation of energy

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<b>D</b>   PHD-EE-2023	3-24 SET-X
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- B
- 1. The REL chart is used for :
  - (1) Designing the layout of plants
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  - (2) Compare known and unknown dimensions
  - (3) Both of these
  - (4) None of these

2

7.	The ratio of total emissive power of body the same temperature is called :	to the total emissive power of a black body at
	(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 arc subjec	ted 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 tunc	tion have to be linear
	(2) Only objective function has to be lim	ear
	(3) Constraints can be non-linear	
	(4) None of the above	
12.	PERT and CPM are basically used in :	
	(1) Decision making	(2) Layout designing
	(3) Assessing quality	(4) Defect reduction
13.	Process layout is used for :	
	(1) Batch production	(2) Continuous type of product
	(3) Effective utilisation of machines	(4) None of the above

15.

16.

17.

18.

14.	PERT is :	
	(1) Target oriented	(2) Event oriented
	(3) Activity oriented	(4) Cost oriented
15.	Two beams, one having square cross subjected to the same amount of bendin the material of both the beams are the sa	section and another circular cross-section, are ag moment. If the cross sectional area as well as ame then :
	(1) Maximum bending stress developed	l in both the beams is the same
	(2) Circular beam experiences more be	nding stress than the square one
	(3) Square beam experiences more bene	ding stress than the circular one
	(4) As the material is same both the bea	ms will experience same deformation
16.	Two pipe systems in series are said to be	e equivalent when :
	(1) The average diameter in both system	ns is the same.
	(2) The discharge under the same head	is same in both systems.
	(3) The average friction factor in both s	ystems is the same.
	(4) Total length of the pipe is the same	in both the systems.
7.	Boundary layer separation is caused by :	
	(1) Adverse pressure gradient	
	(2) Laminar flow changing to turbulent	flow
	(3) Reduction pressure to vapour pressu	re
	(4) None of these	
8.	In which of the following resistance we out simultaneously ?	elding, a large number of welds can be carried
	(1) Spot welding	(2) Projection welding

(3) Seam welding (4) Percussion welding

## PHD-EE-2023-24/(Mech. Engg.)(SET-X)/(B)

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P. T. O.

10	Which o	f the following welding processe	s results in the smallest heat affected zona o
	(1) Shie	lded metal arc welding	(2) Gas welding
	(3) Lase	r beam welding	(4) Thermit welding
20	The Klei	n's diagram is used when :	
	(1) Cran	k has uniform angular velocity	
	(2) Cran	k has non-uniform angular veloc	ity
	(3) Cran	k has uniform angular accelerati	On
	(4) Cran	k has non-uniform angular accel	eration
21.	For a duc	tile material, toughness is a mea	sure of :
	(1) Resis	tance to scratching	
	(2) Abili	ly to absorb energy till elastic lin	nit
	(3) Resis	tance to indentation	
	(4) None	of these	
22.	In the 3-2	-1 principle of fixture design, 31	efers to the number of .
	(1) Clam	os required	
	(2) Degre	es of freedom of the workpiece	
	(3) Opera	tions carried out on the primary	datum face
	(4) None	of these	
23.	A steel ba of 4 mm. <sup>7</sup> in mm <sup>3</sup> /s i	r 200 mm in diameter is turned The rotational speed of the work s :	at a feed of 0.25 mm/rev with a depth of cut t piece is 160 rpm. The material removal rate
	(1) 160	(2) 167.6 ()	3) 1600 (4) 1675.5
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The strain energy stored in a spring, when subjected to maximum load, without suffering permanent distortion, is known as : 24.

ngh Nie (2) Proof resilience

- (1) Impact energy
- (4) Modulus of resilience (3) Proof stress
- For same power output and same compression ratio, as compared to two -stroke engines, four- stroke engine have : 25.
- (2) Lower thermal efficiency (1) Higher fuel consumption
- (4) Higher thermal efficiency (3) Higher exhaust temperatures
- Reciprocating compressors are usually preferred for : 26.
- (2) High pressure and low discharge (1) High pressure and high discharge
- (4) Low pressure and low discharge (3) Low pressure and high discharge
- For a four-cylinder vertical engine, the commonly used firing order is : 27.
- (4) 4-3-2-1 (3) 1-3-4-2 (2) 3-4-1-2 (1) 1-2-3-4
- 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 : 28.
- (4) v/8 (3) v/4 (2) v/2 (1) v
- 29. Bell Coleman cycle consists of :
- (4) Two isotherms and two isentropic (2) Two isochores and two isentropic (3) Two isotherms and two isochores (1) Two isobars and two isentropic
- **30.** Increase in entropy of a system represents :
- (2) Increase in temperature (1) Increase in availability of energy
- (3) Decrease in pressure
- (4) Degradation of energy

(1) Defineration of one

**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 the	tia of a square section	on of size 1 unit about	t its diagonal is :
	(1) 1/4	(2) 1/8	(3) 1/12	(4) 1/24
38.	The unit of Bulk M	odulus is :		
	(1) Nm	(2) MPa	(3) mm	(4) $N/m^3$
39.	A steel bar of 40 million of 200 KN. If the like will be :	$m \times 40 mm$ square c ength of bar is 2m a	ross-section is subject nd E = $2 \times 10^5$ MPa	eted to an axial tensile load a, the elongation of the bar
	(1) 1.50 mm	(2) 1.25 mm	(3) 0.75 mm	(4) 0.50 mm
40.	The unit of stiffness	s is :		
	(1) $N/m^3$	(2) $N/m^2$	(3) $Nm^2$	(4) N/m
41.	Moving average me	ethod is used to :		
	(1) Manage supply	chains		
	(2) Control invento	ory levels		
	(3) Calculate optim	um production level	S	
	(4) Make sales fore	cast		
42.	Ishikawa diagram is	s used to :		
	(1) Identify differen	nt types of quality de	fects	
	(2) Find quantitativ	e relation between a	defect and a process	parameter
	(3) Find relation be	tween defects and th	eir causes	
	(4) Prioritized qual	ity defects		

**43.** A moving mandrel is used in :

(1) wire drawing (2) forging (3) bending (4) None or these

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- 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 :
  - (1) Downtime (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

**48.** 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

### PHD-EE-2023-24/(Mech. Engg.)(SET-X)/(B)

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49.

(1) Atomization
(2) Machining and grinding
(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 :

Which one of the following methods can be used for producing metal powders?

(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

#### PHD-EE-2023-24/(Mech. Engg.)(SET-X)/(B)

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

- B
- **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 turbin	e :			
	(1) Inlet is axial an	d outlet is radial	(2)	Inlet is axial an	d outlet is axial
	(3) Inlet is radial as	nd outlet is axial	(4)	Inlet is radial an	nd outlet is radial
70.	If a material expand	is freely due to heating	ng, it	will develop :	
	(1) Tensile stress		(2)	Compressive st	ress
	(3) No stress		(4)	Thermal stress	
71.	If pressure angle is	20°, then minimum	numt	per of teeth is :	
	(1) 27	(2) 20	(3)	07	(4) None of these
72.	Cavitation gives da	mage to turbine on :			
	(1) Outlet on the co	onvex side of blades			
	(2) Inlet on the cor	nvex side of blades			
	(3) Both of these				
	(4) None of these				
73.	Maximum bending (w/unit length) over	g moment in a can r whole length 'L' is :	tilevo	er beam with u	niformly distributed load
	(1) $\omega L^2$	(2) $(\omega L^2)/2$	(3)	$(\omega L^2)/4$	(4) $(\omega L^2)/8$
74.	Bending stress at ne	eutral axis is :			
	(1) Maximum		(2)	Zero	
	(3) Can't be zero		(4)	None of these	
75.	Which of the follow	ving is <i>not</i> a type of t	rans	mission shaft?	
	(1) Crankshaft		(2)	Line shaft	
	(3) Counter shaft		(4)	Transmission sl	haft

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- 76. Lame'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 proje	ction 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 press	ure 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 structure of common metals?	(two-dimensional) imperfection in the crystal
	(1) Vacancy (2) Dislocation	(3) Inclusion (4) None of these
88.	A steel bar of 40 mm $\times$ 40 mm so compressive load of 200 kN. If the left elongation of the bar will be :	quare cross-section is subjected to an axial ngth of the bar is 2 m and $E = 200$ GPa, the
	(1) 1.25 mm (2) 2.70 mm	(3) 4.05 mm (4) 5.40 mm
89.	Which one of the following non-dime laminar to turbulent flow in free convect	ensional numbers is used for transition from tion?
	(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 × 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) Potnetial 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 =  $\mu$ , 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

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	THIS QUESTION BOOKLET BEFORE T ARE ASKED TO DO SO) PHD-EE-2023-24 Mechanical Engineering	IME OR UNTIL YOU SET-X 10011
Time : <b>1¼ Hours</b> Roll No. (in figures)	Max. Marks : 100 (in words)	Total Questions : 100
Name	Date of Birth	

Father's Name \_\_\_\_\_ Mother's Name \_\_\_\_\_

Date of Examination\_\_\_\_\_

(Signature of the Candidate)

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- 7. Use only Black or Blue Ball Point Pen of good quality in the OMR Answer-Sheet.
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1.	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	a(≤) ( <b>≤</b> ) (2	2) Less strong	aparto in shorth (E)		
11 11	(3) Have same strength	moniad on (4	) None of the abo	ve Martine A B		
2.	A structural member subjected to an axial compressive force is called :					
	(1) Beam (2) Colu	umn (3	b) Frame	(4) Strut		
3.	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 :					
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	(4) Grashoff number and Pr	andtl number	at a dia to	(2) Control III - I		
5	5. For psychrometric charts :		A noncolorid and	<ul> <li>Following the star optimized</li> </ul>		
	(1) Constant relative humid	ity lines are up	hill straight lines to	o the right.		
	(2) Constant wet bulb temp	erature lines ar	e downhill straight	lines to the right.		
	(3) Constant enthalpy lines	are coincident	with constant wet	bulb temperature lines.		
	(4) None of these		st her ple server me	(1) felse fy dama		
e	6. The difference between the	total head line	and the hydraulic g	grade line represents :		
	(1) The velocity head		2) The piezoelectr	ic head		
	(3) The pressure head	(	4) The elevation h	ead become in the		
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7.	Which one of the following is a fire tube boiler ? In the bries show which ow T	
	(1) Babcock - Wilcox boiler (2) Locomotive boiler	
	(3) Both of these (4) None of these (1)	
8.	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	
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1113	(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	
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16.	A quantitative measure of maintainability is :
	(1) Downtime (2) Mean Time to Repair
	(3) Mean Time between Failure zame (4) System availability group (1) (4)
17.	Friction at the tool-chip interface can be reduced by : [] as a subset of the set of the
	(1) Decreasing the rake angle $(0,0,0)$
	(2) Increasing the cutting speed
	(3) Decreasing the cutting speed
	(4) None of these in the second
18.	Which one of the following is not a characteristic of JIT manufacturing system ?
	(1) Reduction of lot sizes in to lise which a second group yields that? (i)
	(2) Efficient use of buffer inventory
	(3) Small but frequent deliveries
·	(4) Higher productivity (1) (4)

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19.	Which one of the following methods can	n be used for producing metal powders?
	(1) Atomization	(2) Machining and grinding
	(3) Electrolysis	(4) All of these doubled bus growers [4]
20.	The Coriolis component of acceleration	acts: Acation gaining pitc. 19 (1)
	(1) Along the sliding surface	(2) Hometer would provide methods
	(2) Perpendicular to the sliding surface	(3) Antegenous maing methods
	(3) At 45 to the sliding surface	(a) Heterageneous juming mitheds
	(4) Parallel to the sliding surface	a Redies in Golation to be in stable could
21.	In powder metallurgy, sintering of a com	that the centre of gravity is located being
	(1) Improves strength and reduces hardr	- (i) Metacentre
	(2) Reduces heitel	(3) Centee of gravity
	(2) Reduces brittleness and improve stre	ngth Triblin Statute to Statuse in Presidentian Action
	(3) Improves hardness and reduces toug	hness
	(4) Reduces porosity and increases brittl	eness Station has a contract much from
22.	One Time Measurement Unit (TMU) dur	ing Method Spudaria
	(1) 0.0001 minute	ing method Study is equal to : would hele if
	(2)  0  0  0  (2)	(2) 0.0006 minute
	(3) 0.006 minute	(4) 0.001 minute
23.	Motion study is carried out to :	(3) Decrements of energy (5)
	(1) Observe actions of an operator	(a) Moneral (Rese
	(3) Study safety arrangements	(2) Study layout
24	Demonst i li sti se s	(4) All of these work is another best of the
24.	(1) Work compliant	ound by : " - that to see a monolible (See
	(1) Work sampling (3) Work study	(2) Method study
DIT	( ) ··· our study	(4) ABC analysis bathering principle (a)
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40% of sheet thickness(2) 60% of sheet thickness80% of sheet thickness(4) 20% of sheet thicknessquasi-equilibrium process, the pressure in a system :Remains constant(2) Varies with temperatureIs constant everywhere, at an instant (4) Increase if volume increasesich of the following is a surface (two-dimensional) imperfection in the crystalcture of common metals ?Vacancy(2) Dislocation(3) Inclusion(4) None of these			
80% of sheet thickness       (4) 20% of sheet thickness         quasi-equilibrium process, the pressure in a system :         Remains constant       (2) Varies with temperature         Is constant everywhere, at an instant (4) Increase if volume increases         ich of the following is a surface (two-dimensional) imperfection in the crystal cture of common metals ?         Vacancy       (2) Dislocation         (3) Inclusion       (4) None of these			
quasi-equilibrium process, the pressure in a system :Remains constant(2) Varies with temperatureIs constant everywhere, at an instant (4) Increase if volume increasesich of the following is a surface (two-dimensional) imperfection in the crystalcture of common metals ?Vacancy(2) Dislocation(3) Inclusion(4) None of thesesteel bar of 40 mm × 40 mm aguare error section is rubicated to an arried			
Remains constant(2) Varies with temperatureIs constant everywhere, at an instant (4) Increase if volume increasesich of the following is a surface (two-dimensional) imperfection in the crystal cture of common metals ?Vacancy(2) Dislocation(3) Inclusion(4) None of thesesteel bar of 40 mm × 40 mm assure error section is subjected to an axial			
Is constant everywhere, at an instant (4) Increase if volume increases ich of the following is a surface (two-dimensional) imperfection in the crystal cture of common metals ? Vacancy (2) Dislocation (3) Inclusion (4) None of these			
ich of the following is a surface (two-dimensional) imperfection in the crystal cture of common metals ? Vacancy (2) Dislocation (3) Inclusion (4) None of these			
Vacancy (2) Dislocation (3) Inclusion (4) None of these			
3. A steel bar of 40 mm $\times$ 40 mm square cross-section is subjected to an axia			
A steel bar of 40 mm $\times$ 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 :			
1.25 mm (2) 2.70 mm (3) 4.05 mm (4) 5.40 mm			
1 AL 1 AL 1 AL 1 AL 1 AL			
nich one of the following non-dimensional numbers is used for transition from ninar to turbulent flow in free convection ?			
nich one of the following non-dimensional numbers is used for transition from ninar to turbulent flow in free convection ? Reynolds number (2) Grashof number			
nich one of the following non-dimensional numbers is used for transition from ninar to turbulent flow in free convection ?Reynolds number(2) Grashof numberPeclet number(4) Rayleigh number			
nich one of the following non-dimensional numbers is used for transition from         ninar to turbulent flow in free convection ?         Reynolds number       (2) Grashof number         Peclet number       (4) Rayleigh number         ring normalizing process of steel, the specimen is heated :			
hich one of the following non-dimensional numbers is used for transition from ninar to turbulent flow in free convection ?         Reynolds number       (2) Grashof number         Peclet number       (4) Rayleigh number         ring normalizing process of steel, the specimen is heated :         Between the upper and lower critical temperature and cooled in still air.			
aich one of the following non-dimensional numbers is used for transition from ninar to turbulent flow in free convection ?         Reynolds number       (2) Grashof number         Peclet number       (4) Rayleigh number         aring normalizing process of steel, the specimen is heated :         Between the upper and lower critical temperature and cooled in still air.         Above the upper critical temperature and cooled in furnace.			
Anich one of the following non-dimensional numbers is used for transition from         Initial flow in free convection ?         Reynolds number       (2) Grashof number         Peclet number       (4) Rayleigh number         Iring normalizing process of steel, the specimen is heated :         Between the upper and lower critical temperature and cooled in still air.         Above the upper critical temperature and cooled in furnace.         Above the upper critical temperature and cooled in still air.			
ngation of the bar will be :			

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31.	In LPP, the condition to be satisfied is : your complete it gathless pointsigneen	25.
	(1) Constraints as well as objective function have to be linear mathematical to the	
	(2) Only objective function has to be linear	
	(3) Constraints can be non-linear and any order approximate presentation and	.85
	(4) None of the above this genuid (3) in the post output (3)	
32,	PERT and CPM are basically used in : Include as a study of the anos of (2)	
	(1) Decision making (2) Layout designing	27
	(3) Assessing quality (4) Defect reduction were to a marked	
33.	Process layout is used for :	
	(1) Batch production (2) Continuous type of product	88
	(3) Effective utilisation of machines (4) None of the above	
34.	PERT is :	
	(1) Target oriented (2) Event oriented	29
	(3) Activity oriented (4) Cost oriented	
35.	Two beams, one having square cross section and another circular cross-section subjected to the same amount of bending moment. If the cross sectional area as we the material of both the beams are the same then :	, are ell as
	(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

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36.	Two pipe systems in series are said to be equivalent when : Series and the area of the second s
	(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 of rlight and five a to establish the story
	(4) None of these (4) (4) (4) (4) (4) (4) (4) (4) (4) (4)
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 and the second manipulation of the second manipulation of the second se
	(3) Crank has uniform angular acceleration
	(4) Crank has non-uniform angular acceleration

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41.	If pressure angle is 20°, then minin	num number of teeth is : a constant of a ow 1	2
	(1) 27 (2) 20	(3) 07 (4) None of these	
42.	Cavitation gives damage to turbine	on : haad anna all rabro ann Cabrall (C)	
	(1) Outlet on the convex side of bl	ades dior or man and a dage of the Self (5)	
	(2) Inlet on the convex side of blac	des au annes anti-company and to attache a static com	
	(3) Both of these	set basses erunden gillere köllensbernöllig. 58	
	(4) None of these	Including the and att MoV of a	
43.	Maximum bending moment in a (w/unit length) over whole length 'I	cantilever beam with uniformly distributed lo	ad
	(1) $\omega L^2$ (2) $(\omega L^2)/2$	(3) $(\omega L^2)/4$ (4) $(\omega L^2)/8$	
44.	Bending stress at neutral axis is :	38. In which of the following rest have vidin	
	(1) Maximum	(2) Zero	
	(3) Can't be zero	(5) (4) None of these	
45.	Which of the following is <i>not</i> a type	e of transmission shaft ?	
	(1) Crankshaft	(2) Line shaft	
	(3) Counter shaft	(4) Transmission shaft	
46.	Lame's theory is associated with :	<ul> <li>(3) Laster Ready Washing</li> </ul>	
	(1) Thin cylindrical shells	(2) Thick cylindrical shells	
	(3) Direct and bending stresses	(4) None of the above and show (1)	
47.	The maximum principal strain theor	y is also known as : fine mode and the control (S)	
	(1) Rankine's theory	don (2) Guest's theory dime and sheet ) (C)	
	(3) Saint Venant's theory	(4) Von-Mises theory	

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48.	Two springs of stiffness $k_1$ and $k_2$ respectively are connected in series, what will be			
	the stiffness of the composite spring?	5. 1010-11 2002 57 <sup>0</sup> (1)		
	(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) $k = k_1 + k_2$		
49.	The point of contra-flexure occurs in :			
	(1) Cantilever beams	(2) Simply supported beams provide the		
	(3) Overhanging beams	(4) Fixed beams		
50.	The pair is known as a higher pair, when pair is :	n the relative motion between the elements of a		
	(1) Turning only	<ul> <li>(2) Sliding only</li> </ul>		
oe Ry. A line	(3) Rolling only	(4) Partly turning and Partly sliding		
51.	Poisson's ratio is equal to :	price of the iteras is Rs. should be :		
	(1) Lateral Strain / Longitudinal Strain	** 150 (2) 120		
	(2) Lateral Strain × Longitudinal Strain	s to guarants to subtration signing " of a		
	(3) Longitudinal Strain / Lateral Strain	<sup>2</sup> of some static number material wolf be .		
	(4) None of these $(1^2 \cup 1^2)$	(2) 0.23		
52.	The energy stored in a body when straine	ed within elastic limit is known as :		
	(1) Proof resilience	(2) Impact energy declarates bond (1)		
	(3) Strain energy	(4) Potnetial energy a sub-action (1)		
53.	The increase in hardness due to cold wor	king is called : 100000 summalise to Jorda		
	(1) Cold hardening	(2) Work hardening a provident of		
	(3) Age hardening	(4) None of these		
54.	For extrusion, important mechanical proj	perty of a material is : 000 0 = material		
	(1) Elasticity (2) Ductility	(3) Plasticity (4) None of these		
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55.	When steam flows	through the fixed bla	des in reaction turb	oine: to square part	.81
	(1) Pressure increa	ses	e als above the	o minine can the offi	
	(2) Velocity increa	ISCS			
	(3) Velocity increa	ses and Pressure dro	pps		
	(4) None of these			Second of conself.	.en
56.	Reaming is a proce	ss used to :			
	(1) Create a circula	ar hole in metals			
	(2) Cut a slot on th	e existing hole surfa	ce	and the sector of the	.06
	(3) Finish an existi	ng hole surface			
	(4) Make non-circ	ular holes in metals		atm is is with the	
57.	The fixed cost and 80 per unit, respect price of the items in	the variable cost of lively. The demand f n Rs. should be :	production of a pro or the item is 500 u	duct are Rs. 20,000 ar nits. To break even, th	ıd Rs. e unit
	(1) 150	(2) 120	(3) 130	(4) 100	
58.	The Young's modu Poisson's ratio for t (1) 1.50	lus of elasticity of a r he material will be : (2) 0.25	naterial is 2.5 times (3) 0.50	its modulus of rigidity (4) 0.75	7. The
59.	Acceptable Ouality	Level (AOL) is asso	ciated with :		
	(1) Producer's risk		anna an an Grad an	a bendik Zenako di K	
	(2) Consumer's ris	k mahala ata da		A Press to metally	
	(3) Lot tolerance n	ercent defective			
	(4) Average outgo	ing quality limit	a 8 2002 an 909 2208	Press the associated with Pro-	56
60				naio de la coloria.	
ου.	friction = $\mu$ , lead of	fion for a pair of squ f thread = L and pitch	are thread screw and diameter of thread	nd nut having coefficient = d is given by :	ent of
	(1) $d > \pi \mu L$	(2) $d > \mu L$	(3) μ > Ld	(4) None of these	

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61.	Type of spring used to absorb shocks and v	ibrations in vehicles	is floring off58	
	(1) Helical spring (2	2) Spiral spring		
hae ndd 10 f odd	(3) Multi-leaf spring (4	4) Disk spring	188. A street have en All An 11 (Poll 100) To	
62.	According to first law of thermodynamics	:		
	(1) Total internal energy of a system durin	g a process remains	constant	
	(2) Total energy of a system remains cons	tant	10. Presson al autilit 711 Non <sup>1</sup>	
	(3) Work done by a system is equal to the	heat transferred by t	he system	
	(4) None of these	use of the second	and and the	
63.	For a given applied load induced stress is	a function of		
	<ol> <li>Cross sectional area of the body</li> </ol>	a renetion of .		
	(2) Material of the body		(4) Mantalaure	
	(2) Both (1) and (2)			
	(4) None of these			
line an				
64.	Superheated vapor behaves :	and the second	and the part of the second s	
	(1) Exactly as gas	2) As steam		
	(3) As ordinary vapor	4) Approximately a	s a gas	
<b>65.</b>	The temperature distribution for a hollo constant value of thermal conductivity is :	ow cylinder for ste	ady state heat flow	and 5
	(1) Logarithmic (2) Parabolic	(3) Hyperbolic	(4) Exponential	
66.	One ton of refrigeration is equal to :	in the total add	Er Manutar all	
	(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	
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68.	The unit of Bulk N	fodulus is to control	(2) mm	(4) $N/m^3$
	(1) Nm	(2) MPa	(3) 11111	(-)
69.	A steel bar of 40 m of 200 KN. If the will be :	$100 \times 40 \text{ mm squar}$ length of bar is 2r	e cross-section is sub m and $E = 2 \times 10^5 $ M	ojected to an axial tensile load IPa, the elongation of the bar
	(1) 1.50 mm	(2) 1.25 mm	(3) 0.75 mm	(4) 0.50 mm
70.	The unit of stiffnes	s is :		
	(1) $N/m^3$	(2) N/m <sup>2</sup>	(3) $\mathrm{N}\mathrm{m}^2$	(4) N/m
71.	The REL chart is u	sed for :	Surer is even to the	201178 - HOHE MILE (4. 14.)
	(1) Designing the l	ayout of plants		
	(2) Estimating the	valuation of stock		( be Republic
	(3) Analyzing the	movement of an ite	em in a store	
	(4) Maintaining the	e issue and receipt	record	
72.	Which one of the fo	ollowing is a heat t	reatment process for	surface hardening?
	(1) Normalizing	(2) Annealing	(3) Carburizing	(4) None of these
73.	Resultant pressure	of the liquid in case	e of an immersed boo	ly acts through which one of
	the following ?	nisuk Michie		
	(1) Centre of gravit	Coartenis relation (c) R	(2) Centre of pres	ssure
tean a	(3) Metacentre	2 101 1 100 C VO	(4) Centre of buo	yancy
74.	In a hollow cylindr	ical product manuf	factured by centrifug	al casting, the density of the
	(1) Maximum at the	e outer region		$dim (t_{i}, t_{i}) \in \{1, 1\}$
	(2) Maximum at the	e inner region	nu bratis kontr	66. () here a constant
	(3) Maximum at the	e mid-point betwee	en outer and inner sur	faces
	(4) Uniform through	hout		1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1
	(* 172-s			131 [)
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75.	A typical Fe-C alloy containing greater the	nan 0.8%, C is know	wn as 🕄 🔤 Easteral	82.
	(1) Eutectoid steel	(2) Hypoeutectoid	steel and the set	
	(3) Mild steel	(4) Hypereutectoi	d steel	
76.	An autocollimator is used to :	antid all no mo pro	ch. Operations area	
	(1) Measure small angular displacement	s on flat surfaces	peak to make the	
to to i	(2) Compare known and unknown dimer	isions approaches	nes 201, and Print F	
tist I.	(3) Both of these	and to Longs have	or 4 area. The matti	
	(4) None of these		in iam /s	
77	The ratio of total emissive name	(2) 167 6		
	the same temperature is called :	y to the total emissi	ve power of a black b	ody at
	(1) Absorptivity (2) Transmissivity	(3) Reflectivity	(4) None of these	
78.	The angle of a twist drill that determines	its rake angle is :	(3) Proof terror	
	(1) Lip relief angle	(2) Chisel edge ar	igle	20
	(3) Helix angle	(4) Point angle	engines, loar- trok	
79.	Material Requirements Planning include	sumption	(1) Higher tiel con-	
	(1) bill of material	(2) inventory leve	Routze redgill (1)	
	(3) production schedule and harder	(4) All of these	Rearrant comp	.86
80.	In a flange coupling, the bolts arc subjec	ted to the share by	(1) High pressure m	
	(1) Tensile stress	(2) Compressive s	stress word (E)	
	(3) Shear stress a matrix boost algorithm	(4) None of these	For a four-relieder	57
81	For a ductile material toughness is a me	asure of .	and a first a present	
01.	(1) Peristence to contabing	asure or .		
	(1) Ability to absorb energy till elastic 1	imit i slove	Two balls of equals	88
	(3) Resistance to indentation	анна стана и тип. Стана и така	and a stranger for and	
	(4) None of these	21.40		

82.	In the 3-2-1 princ	eiple of fixture des	sign, 3 refers to the	number of : 1-sid lusing 1 A 20
	(1) Clamps requi	red and to constit		$t_{1}$ is including $\{0\}$ is
	(2) Degrees of fr	cedom of the wor	kpiece	LUDE CLIM ARY
	(3) Operations ca	arried out on the p	orimary datum face	and a stand of the second second
	(4) None of these	e		
83	A steel bar 200 m	and in diameter is	turned at a feed of	0.25 mm/rev with a depth of cut
	of 4 mm. The rot in $mm^3/s$ is :	ational speed of th	he work piece is 16	0 rpm. The material removal rate
	(1) 160	(2) 167.6	(3) 1600	(4) 1675.5
84.	The strain energ suffering perman	gy stored in a sp ent distortion, is k	oring, when subjec nown as :	ted to maximum load, without
	(1) Impact energ	y diama and	(2) Proof res	llience
	(3) Proof stress	$(3.5)_{\pm}(1.5)_{\pm}(1.5)_{\pm}$	(4) Modulus	of resilience
85.	For same power engines, four- stre	output and sam oke engine have :	e compression ratio	o, as compared to two -stroke
	(1) Higher fuel c	onsumption	(2) Lower the	rmal efficiency
	(3) Higher exhau	ist temperatures	(4) Higher the	ermal efficiency
86.	Reciprocating con	mpressors are usua	ally preferred for :	the transmitter of the
	(1) High pressure	e and high dischar	ge (2) High pres	sure and low discharge
	(3) Low pressure	and high discharg	ge (4) Low press	ure and low discharge
87.	For a four-cylinde	er 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 equations the ball with velocity will move with a second se	al mass and of per ocity v is made to velocity :	fectly elastic materia struck the second b	al are lying on the floor. One of ball. Both the balls after impact
	(1) v	(2) v/2	(3) v/4	(4) v/8
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<ul> <li>(1) Two isobars and two isentropic</li> <li>(2) Two isochores and two isentropic</li> <li>(3) Two isotherms and two isochores</li> <li>(4) Two isotherms and two isentropic</li> <li>(9) Increase in entropy of a system represents : <ul> <li>(1) Increase in availability of energy</li> <li>(2) Increase in temperature</li> <li>(3) Decrease in pressure</li> <li>(4) Degradation of energy</li> </ul> </li> <li>(1) Increase in availability of energy</li> <li>(2) Increase in temperature</li> <li>(3) Decrease in pressure</li> <li>(4) Degradation of energy</li> <li>(1) Increase in availability of energy</li> <li>(2) Increase in temperature</li> <li>(3) Decrease in pressure</li> <li>(4) Degradation of energy</li> <li>(2) Increase in a sample is : <ul> <li>(1) c-chart</li> <li>(2) p-chart</li> <li>(3) X bar-chart</li> <li>(4) R-chart</li> </ul> </li> <li>(2) Production Planning' involves integration of : <ul> <li>scheduling, routing, estimating and dispatching activities</li> <li>(2) Scheduling, routing and selling activities</li> <li>(3) Scheduling, routing and selling activities</li> <li>(4) None of these</li> </ul> </li> <li>(3) Which of the following casting processes uses expendable pattern and expenda mould ? <ul> <li>(1) Shell mould casting</li> <li>(2) Investment casting</li> <li>(3) Pressure die casting</li> <li>(4) Centrifugal casting</li> </ul> </li> <li>(4) None of these</li> <li>(5) The binding material used in cemented carbide cutting tools is :</li> </ul>	89.	Bell Coleman cycle consists of :	
<ul> <li>90. Increase in entropy of a system represents : <ul> <li>(1) Increase in availability of energy</li> <li>(2) Increase in temperature</li> <li>(3) Decrease in pressure</li> <li>(4) Degradation of energy</li> </ul> </li> <li>91. The type of control chart used to monitor the amount of dispersion in a sample is : <ul> <li>(1) c-chart</li> <li>(2) p-chart</li> <li>(3) X bar-chart</li> <li>(4) R-chart</li> </ul> </li> <li>92. Production Planning' involves integration of : <ul> <li>scheduling, routing, estimating and dispatching activities. This statement is :</li> <li>(1) Scheduling, routing and selling activities</li> <li>(2) Scheduling, routing and selling activities</li> <li>(3) Scheduling, routing and marketing activities</li> <li>(4) None of these</li> </ul> </li> <li>93. Which of the following casting processes uses expendable pattern and expendation and anould ? <ul> <li>(1) Shell mould casting</li> <li>(2) Investment casting</li> <li>(3) Pressure die casting</li> <li>(4) Centrifugal casting</li> </ul> </li> <li>94. In resistance seam welding, the electrode is in the form of a : <ul> <li>(1) Cylinder</li> <li>(2) Flat plate</li> <li>(3) Circular disc</li> <li>(4) None of these</li> </ul> </li> </ul>		<ol> <li>(1) Two isobars and two isentropic</li> <li>(3) Two isotherms and two isochores</li> </ol>	<ul><li>(2) Two isochores and two isentropic</li><li>(4) Two isotherms and two isentropic</li></ul>
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In a homogeneous isotropic elastic material, the modulus of elasticity E in terms of G96. and K is equal to : (1)  $\frac{9KG}{G+3K}$  (2)  $\frac{9KG}{3G+K}$  (3)  $\frac{3K+G}{3G+K}$  (4)  $\frac{6KG}{K+3G}$ The number of defectives produced by a six sigma process (in parts per million) is : 97. (4) 2.2 (3) 3.2 (2) 4.2 (1) 5.2Which one of the following is *not* a method of calculating depreciation ? 98. (2) Sum of year digits (SYD) method (1) Straight line method (4) All of these (3) Declining balance method 99. 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 The rotary internal combustion engine is the inversion of : 100. Bern William (1) Four bar link chain (2) Double slider crank chain (3) Single slider crank mechanism (4) Rocker crank mechanism WERE BUILDER STORE In real said of a shortest die classifier in the class with the main

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## Total No. of Printed Pages : 17 (DO NOT OPEN THIS QUESTION BOOKLET BEFORE TIME OR UNTIL YOU ARE ASKED TO DO SO) PHD-EE-2023-24

# **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)

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#### 1. All questions are compulsory.

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

- D
- 1. 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
- 2. 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
- **3.** 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<sup>3</sup>/s is :
  - (1) 160 (2) 167.6 (3) 1600 (4) 1675.5
- 4. 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
- 5. 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
- 6. 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

P. T. O.

- 7. For a four-cylinder vertical engine, the commonly used firing order is :
  - (4) 4-3-2-1 (3) 1-3-4-2 (1) 1-2-3-4 (2) 3-4-1-2
- Two balls of equal mass and of perfectly elastic material are lying on the floor. One of 8. the ball with velocity v is made to struck the second ball. Both the balls after impact will move with a velocity :
  - (3) v/4 (4) v/8(1) v (2) v/2
- 9. Bell Coleman cycle consists of :
  - (1) Two isobars and two isentropic
- **10.** Increase in entropy of a system represents :

(3) Two isotherms and two isochores

- (1) Increase in availability of energy
- (4) Degradation of energy (3) Decrease in pressure
- **11.** Poisson's ratio is equal to :
  - (1) Lateral Strain / Longitudinal Strain
  - (2) Lateral Strain × Longitudinal Strain
  - (3) Longitudinal Strain / Lateral Strain
  - (4) None of these

The energy stored in a body when strained within elastic limit is known as : 12.

- (2) Impact energy (1) Proof resilience
- (4) Potnetial energy (3) Strain energy
- The increase in hardness due to cold working is called : 13.
  - (2) Work hardening (1) Cold hardening
  - (4) None of these (3) Age hardening
- PHD-EE-2023-24/(Mech. Engg.)(SET-X)/(D)

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D

- (2) Two isochores and two isentropic
- (4) Two isotherms and two isentropic
- (2) Increase in temperature

14. For extrusion, important mechanical property of a material is : (1) Elasticity (2) Ductility (3) Plasticity (4) None of these When steam flows through the fixed blades in reaction turbine : 15. (1) Pressure increases (2) Velocity increases (3) Velocity increases and Pressure drops (4) None of these 16. 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 17. 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 18. 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 19. Acceptable Quality Level (AQL) is associated with : (1) Producer's risk (2) Consumer's risk

(3) Lot tolerance percent defective

D

(4) Average outgoing quality limit

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**P.** T. O.

- Self locking condition for a pair of square thread screw and nut having coefficient of friction =  $\mu$ , lead of thread = L and pitch diameter of thread = d is given by : 20.
  - (4) None of these (3)  $\mu > Ld$ (2)  $d > \mu L$ (1)  $d > \pi \mu L$
- **21.** In LPP, the condition to be satisfied is :
  - (1) Constraints as well as objective tunction 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
  - (3) Assessing quality
- Process layout is used for : 23.
  - (1) Batch production
  - (3) Effective utilisation of machines
- PERT is : 24.
  - (1) Target oriented
  - (4) Cost oriented (3) Activity oriented
- Two beams, one having square cross section and another circular cross-section, are 25. 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

D

- (2) Layout designing
- (4) Defect reduction
- (2) Continuous type of product
- (4) None of the above
- (2) Event oriented

- D
  - 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

- **31.** 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
- 32. A structural member subjected to an axial compressive force is called :
  - (1) Beam (2) Column (3) Frame (4) Strut
- **33.** 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
- 34. 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
- **35.** 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
- **36.** 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

- **37.** Which one of the following is a fire tube boiler ? (2) Locomotive boiler (1) Babcock - Wilcox boiler (4) None of these (3) Both of these A refrigerator and a heat pump operate between the same temperature limits. If the 38. COP of the refrigerator is 4, the COP of the heat pump would be : (4) 6(3) 5 (1) 3 (2) 4 In axial flow turbine : 39. (2) Inlet is axial and outlet is axial (1) Inlet is axial and outlet is radial (4) Inlet is radial and outlet is radial (3) Inlet is radial and outlet is axial If a material expands freely due to heating, it will develop : 40. (2) Compressive stress (1) Tensile stress (4) Thermal stress (3) No stress The type of control chart used to monitor the amount of dispersion in a sample is : 41. (4) R-chart (3) X bar-chart (2) p-chart (1) c-chart 'Production Planning' involves integration of : 42. 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 Which of the following casting processes uses expendable pattern and expendable 43. mould? (2) Investment casting (1) Shell mould casting
  - (3) Pressure die casting (4) Centrifugal casting

D

P. T. O.

44. In resistance seam welding, the electrode is in the form of a : (1) Cylinder (2) Flat plate (3) Circular disc (4) None of these 45. The binding material used in cemented carbide cutting tools is : (1) Graphite (2) Tungsten (3) Nickel (4) Cobalt In a homogeneous isotropic elastic material, the modulus of elasticity E in terms of G46. and K is equal to : (1)  $\frac{9KG}{G+3K}$  (2)  $\frac{9KG}{3G+K}$  (3)  $\frac{3K+G}{3G+K}$  (4)  $\frac{6KG}{K+3G}$ The number of defectives produced by a six sigma process (in parts per million) is : 47. (1) 5.2(2) 4.2 (3) 3.2 (4) 2.2 Which one of the following is not a method of calculating depreciation ? 48. (1) Straight line method (2) Sum of year digits (SYD) method (3) Declining balance method (4) All of these 49. 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
- 50. 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

- D
  - **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

P. T. O.

- **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  $\times$  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.
- (4) Between the upper and lower critical temperature and cooled in furnace.
- 61. 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
- 62. Which one of the following is a heat treatment process for surface hardening?
  - (1) Normalizing (2) Annealing (3) Carburizing (4) None of these

- **63.** 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

**64.** 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
- 65. 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
- 66. 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
- **67.** 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
- 68. 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

69.	Material Requirements Planning include	:
	(1) bill of material	(2) inventory level
	(3) production schedule	(4) All of these
70.	In a flange coupling, the bolts arc subject	ted to :
	(1) Tensile stress	(2) Compressive stress
	(3) Shear stress	(4) None of these
71.	Moving average method is used to :	
	(1) Manage supply chains	
	(2) Control inventory levels	
	(3) Calculate optimum production level	S
	(4) Make sales forecast	
72.	Ishikawa diagram is used to :	
	(1) Identify different types of quality de	efects
	(2) Find quantitative relation between a	defect and a process parameter
	(3) Find relation between defects and the	neir causes
	(4) Prioritized quality defects	
73.	A moving mandrel is used in :	
	(1) wire drawing (2) forging	(3) bending (4) None
74.	Brazing and Soldering are :	
	(1) Plastic joining methods	
	(2) Homogeneous joining methods	
	(3) Autogenous joining methods	

(4) Heterogeneous joining methods

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or these

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75.

(1) Metacentre

(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 (4) All of these (3) Electrolysis

Bodies in flotation to be in stable equilibrium, the necessary and sufficient condition is

(2) Centre of pressure

that the centre of gravity is located below the :

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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81. 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
- 82. 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
- 83. 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
- 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 in	ertia of a square sec	tion of size 1 unit ab	out 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 r of 200 KN. If the will be :	mm $\times$ 40 mm square length of bar is 2n	e cross-section is sub n and $E = 2 \times 10^5 M$	jected to an axial tensile load Pa, the elongation of the bar
	(1) 1.50 mm	(2) 1.25 mm	(3) 0.75 mm	(4) 0.50 mm
90.	The unit of stiffne	ss is :		
	(1) $N/m^3$	(2) $N/m^2$	(3) $Nm^2$	(4) N/m
91.	If pressure angle is	s 20°, then minimur	n number of teeth is	:
	(1) 27	(2) 20	(3) 07	(4) None of these
92.	Cavitation gives da	amage to turbine on	:	
	(1) Outlet on the c	convex side of blade	es	
	(2) Inlet on the co	nvex side of blades		
	(3) Both of these			
	(4) None of these			
93.	Maximum bending (w/unit length) ove	g moment in a ca er whole length 'L' i	antilever beam with s :	uniformly distributed load
	(1) $\omega L^2$	(2) $(\omega L^2)/2$	(3) $(\omega L^2)/4$	(4) $(\omega L^2)/8$
94.	Bending stress at n	eutral axis is :		
	(1) Maximum		(2) Zero	
	(3) Can't be zero		(4) None of these	e

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(2) Line shaft (1) Crankshaft (4) Transmission shaft (3) Counter shaft (2) Thick cylindrical shells (1) Thin cylindrical shells (4) None of the above (3) Direct and bending stresses (2) Guest's theory (1) Rankine's theory (3) Saint Venant's theory (4) Von-Mises theory 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)  $k = k_1 + k_2$ The point of contra-flexure occurs in : (1) Cantilever beams (2) Simply supported beams (3) Overhanging beams (4) Fixed beams The pair is known as a higher pair, when the relative motion between the elements of a (1) Turning only (2) Sliding only

- 95. Which of the following is *not* a type of transmission shaft?
- 96. Lame's theory is associated with :

97. The maximum principal strain theory is also known as :

- 98. Two springs of stiffness  $k_1$  and  $k_2$  respectively are connected in series, what will be
- 99.
- 100.
  - (3) Rolling only

(4) Partly turning and Partly sliding

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Answer ker	ys of PHD-EE-2023-24	(MECHANICAL ENGG.)	entrance exam dated	22.03.2024
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5	1	4	2	4
6	1	1	1	2
7	3	4	2	3
8	2	3	3	2
9	2	4	2	1
10	4	3	3	4
11	4	1	4	1
12	1	1	3	3
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58	2	J	2	4
50	Z	1	2	1
59	4	1	5	4
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95	4	3	4	1
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97	3	2	3	3
98	2	2	4	1
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