

ENTRANCE EXAMINATION FOR ADMISSION, MAY 2012.

Ph.D. (MECHANICAL ENGINEERING)

COURSE CODE : 139

Register Number :

*Signature of the Invigilator
(with date)*

COURSE CODE : 139

Time : 2 Hours

Max : 400 Marks

Instructions to Candidates :

1. Write your Register Number within the box provided on the top of this page and fill in the page 1 of the answer sheet using pen.
2. Do not write your name anywhere in this booklet or answer sheet. Violation of this entails disqualification.
3. Read each of the question carefully and shade the relevant answer (A) or (B) or (C) or (D) in the relevant box of the ANSWER SHEET using HB pencil.
4. Avoid blind guessing. A wrong answer will fetch you -1 mark and the correct answer will fetch 4 marks.
5. Do not write anything in the question paper. Use the white sheets attached at the end for rough works.
6. Do not open the question paper until the start signal is given.
7. Do not attempt to answer after stop signal is given. Any such attempt will disqualify your candidature.
8. On stop signal, keep the question paper and the answer sheet on your table and wait for the invigilator to collect them.
9. Use of Calculators, Tables, etc. are prohibited.

1. Chip breakers are used while machining

(A) Ductile materials	(B) Brittle materials
(C) Both (A) and (B) above	(D) None of the above

2. Hardest tool material is

(A) Cast Steel	(B) High Speed Steel
(C) Diamond	(D) UCON

3. Abrasive for grinding materials with high tensile strength is

(A) Silicon carbide	(B) Aluminum Oxide
(C) Diamond	(D) Corundum

4. Which one of the following is a thermal process?

(A) Ultrasonic machining	(B) Water Jet machining
(C) Abrasive Jet machining	(D) Laser Beam machining

5. The isothermal law is given by

(A) $p/v = \text{constant}$	(B) $p v = \text{constant}$
(C) $v/T = \text{constant}$	(D) $p/T = \text{constant}$

6. Heat can not be transferred from lower temperature body to higher temperature body without any external force

(A) Carnot theorem	(B) Kelvin-Plank statement
(C) Clausius statement	(D) Clausius inequality

7. Which one of the following is considered as a pure substance?

(A) Ammonia	(B) Steam
(C) Air-Fuel mixture	(D) Atmospheric Air

8. Dry air is the mixture of

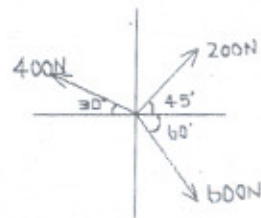
(A) O_2 & N_2	(B) CO_2 & O_2
(C) He & O_2	(D) O_2 , N_2 , Ar, CO_2

9. Two forces of 7 kg and 8 kg respectively act simultaneously at a point. The resultant of two forces if the angle between the two forces is 60 degrees, will be

(A) 13 kg	(B) 30 kg
(C) 169 kg	(D) None of the above

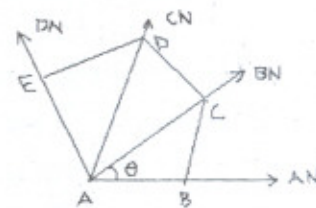
10. Direction of resultant forces

- (A) 61.93
- (B) 60.93
- (C) -61.93
- (D) -60.93



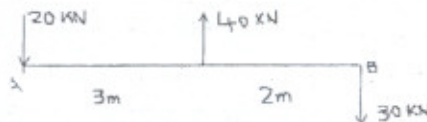
11. The sum of the interior angles of any regular polygon is

- (A) $(2n - 4) 180$
- (B) $(2n + 4) 180$
- (C) $(2n - 4) 90$
- (D) $(2n + 4) 90$



12. Magnitude of resultant force _____

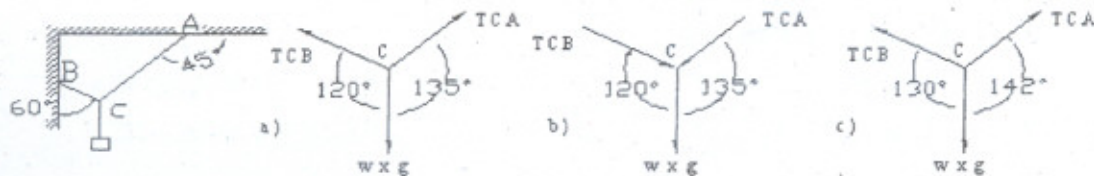
- (A) 10 KN
- (B) 30 KN
- (C) -10 KN
- (D) 20 KN



13. P is:

- (A) Resultant
- (B) Resultant and equivalent
- (C) Equilibrant
- (D) Nominal force

14. Convert the body under equilibrium to FB diagram



- (A) a
- (B) b
- (C) c
- (D) None of the above

15. A block of weight 500 N is placed on a horizontal plane. When a horizontal force of 180 N is applied; the block is just on the point of motion, the angle of friction will be
 (A) $17^\circ 48'$ (B) $18^\circ 47'$ (C) $19^\circ 48'$ (D) $20^\circ 48'$
16. Name the rule which determines solid solubility
 (A) Gibbs rule (B) Hall-Petch effect
 (C) Hume-Rothery rule (D) Both (A) and (B)
17. Gibbs phase rule is given by the equation
 (A) $P + F = C + 1$ (B) $P + F = C$ (C) $F = P - C + 2$ (D) $P + F = C + 3$
18. Hast alloy consists of
 (A) Copper and nickel (B) Copper and aluminum
 (C) Molybdenum and nickel (D) Nickel and aluminum
19. The second order partial differential equation is said to be elliptic, if
 (A) $B^2 - 4 AC = 0$ (B) $B^2 - 4 AC > 0$
 (C) $B^2 - 4 AC < 0$ (D) $B^2 = -4 AC$
20. One dimensional heat equation $U_t = \alpha^2 U_{xx}$ is
 (A) Elliptic
 (B) Parabolic
 (C) Hyperbolic
 (D) Elliptic if $\alpha > 0$ and Hyperbolic if $\alpha < 0$
21. Vander Walls equation of state is
 (A) $(P+a/V^2)(V_m-a) = RT$ (B) $(P+a/V^2)(V_m-c) = RT$
 (C) $(P+a/V^2)(V_m-d) = RT$ (D) $(P+a/V^2)(V_m-b) = RT$
22. Otto cycle consists of
 (A) Two adiabatic and one constant volume & one constant pressure process
 (B) Two adiabatic and two constant volume processes
 (C) Two constant pressure and two reversible adiabatic processes
 (D) One constant volume, one constant pressure and two reversible adiabatic processes

23. In a single stage, single acting reciprocating air compressor without clearance volume, the work done is minimum during
- (A) Isothermal compression (B) Isentropic compression
(C) Polytrophic compression (D) None of these
24. It is the temperature of air recorded by a thermometer when the moisture present in it begins to condense
- (A) Dew point temperature (B) Dew point depression
(C) Dry bulb temperature (D) Wet bulb temperature
25. Bending moment at supports in case of simply supported beam is always
- (A) More than unity (B) Less than unity
(C) Zero (D) Infinity
26. Moment of inertia for a circle
- (A) $\pi d^4/64$ (B) $\pi d^4/48$
(C) $\pi d^4/12$ (D) $\pi d^4/128$
27. The ratio of lateral strain to the linear strain is called
- (A) Modulus of elasticity (B) Modulus of rigidity
(C) Bulk modulus (D) Poison's ratio
28. The ratio of the torques transmitted by a hollow and a solid shaft, both made of same material, length and weight is
- (A) $(n^2 + 1)/n \times \text{square root of } n^2 + 1$ (B) $(n^2 + 1)/n \times \text{square root of } n^2 - 1$
(C) $(n^2 + 1)/n \times \text{square root of } n + 1$ (D) $(n^2 + 1)/n + \text{square root of } n^2 + 1$
29. The acceleration of the practical moving with simple harmonic motion, at any instant is given by
- (A) ωx (B) ω^2 (C) $\omega^2/2$ (D) $\omega^3/3$
30. When a point moves along a straight line its acceleration will have
- (A) Radial component only
(B) Tangential component only
(C) Coriolis component only
(D) Radial & tangential component only

47. Which is not the property of the stiffness matrix?
- (A) Symmetric matrix
 - (B) Sum of elements in any column is equal to zero
 - (C) Stable element
 - (D) Determinant value is equal to zero
48. The size of the global stiffness matrix
- (A) Number of points * degree of freedom per point
 - (B) Number of node * degree of freedom per point
 - (C) Number of node * degree of freedom per node.
 - (D) None of the above
49. In a one dimensional finite element, the physical displacement variable v and its derivative with respect to x , v' , are the nodal variables. Given that at the first node ($x=0$), $v=v'=0$, and at the second node ($x=1$), $v=1m$ and $v'=3$, the displacement variable at ($x=0.5$) is
- (A) $1/8$
 - (B) $1/4$
 - (C) $1/2$
 - (D) 1
50. Electro Magnetic flow meter is used for
- (A) electrically conductive fluids
 - (B) electrically non-conductive fluids
 - (C) magnetically conductive fluids
 - (D) magnetically non-conductive fluids
51. In PLC for input channel protection _____ is used.
- (A) Auto coupler
 - (B) Diode
 - (C) Transistor
 - (D) All of the above
52. The robot gripper movement is achieved by
- (A) Mechanical power transmission systems
 - (B) Pneumatic cylinder
 - (C) Hydraulic cylinder
 - (D) Electrical motors
53. PUMA Stands for _____
- (A) Plan using Man Assistance
 - (B) Programmable Universal machine for Assembly
 - (C) Programmable Unmanned Machine for Assembly
 - (D) Planning Unmanned Machine For assembly

54. The following is used as a basic underlying assumption in formulating the Linear Programming Problem (LPP), which deals with the optimization of a function of decision variables
- (A) proportionality (B) additivity
(C) multi objective (D) linearity
55. In simplex method,
- (I) The new basic variable to be included is called "entering variable"
(II) The variable which is to be removed from the basis is called "leaving variable"
- (A) Both I & II are true (B) Both I & II are false
(C) I-true & II-false (D) II-true & I-false
56. A feasible solution to a $m \times n$ Transportation problem that contains more than $(m+n-1)$ non-negative allocations is called_____
- (A) Feasible solution (B) Non-feasible solution
(C) Initial basic feasible solution (D) None
57. A initial basic feasible solution to a $m \times n$ Transportation problem is said to be non-degenerate basic feasible solution if it contains _____ non-negative allocations in independent positions.
- (A) $m + n - 1$ (B) $m + n + 1$
(C) $m - n - 1$ (D) None
58. In CPM network model, the difference between late start of the job and the early start of the job is called
- (A) Free slack (B) Total slack
(C) (A) and (B) (D) None
59. The PERT network model is
- (A) Deterministic (B) Probabilistic (C) (A) and (B) (D) None
60. S1. Cetane number is the same as octane rating.
S2. Cetane number is the opposite of octane rating.
- (A) S1 is right (B) S2 is right
(C) S1 & S2 are right (D) S1 & S2 are wrong
61. Multi plate clutches are used for transfer of high horse power mechanism
- (A) True (B) False
(C) Either true or false (D) Not known

62. A front stabilizer bar is used to
- (A) Increase load carrying capacity
 - (B) Provide a softer ride
 - (C) Stiffen the suspension to control the body roll
 - (D) Prevent the sideward movement of the axle housing
63. When the front wheels are not parallel to each other and moved further away at the top, it is termed as
- (A) Positive camber
 - (B) Negative camber
 - (C) Roll out
 - (D) None
64. The major content of biogas are
- (A) Methane and CO_2
 - (B) Ammonia and oxygen
 - (C) Hydrogen and methane
 - (D) None of the above
65. In Meyer's expansion valve, the expansion valve is driven by an eccentric having an angle of advance from
- (A) $50^\circ - 60^\circ$
 - (B) $60^\circ - 70^\circ$
 - (C) $70^\circ - 80^\circ$
 - (D) $80^\circ - 90^\circ$
66. The tractive force in maximum or minimum when the angle of inclination of the crank to the line of stroke is equal to
- (A) 90° and 225°
 - (B) 135° and 180°
 - (C) 180° and 225°
 - (D) 135° and 315°
67. In free vibrations, the velocity vector leads the displacement vector by
- (A) π
 - (B) $\pi/2$
 - (C) $\pi/3$
 - (D) $2\pi/3$
68. Sensitiveness of the governor is defined as the ratio of the
- (A) Mean speed to the maximum equilibrium speed
 - (B) Mean speed to the minimum equilibrium speed
 - (C) Difference of the max. and min. equilibrium speed to the mean speed
 - (D) Sum of the max. and min. equilibrium speed to the mean speed
69. When a material is subjected to fatigue loading, the ratio of the endurance limit to the ultimate tensile strength is
- (A) 0.20
 - (B) 0.35
 - (C) 0.50
 - (D) 0.65

70. A metal pipe of 1 m diameter contains fluid having a pressure of 1 N/mm^2 . If the permissible tensile stress in the metal is 20 N/mm^2 , then the thickness of metal required for making the pipe will be
- (A) 5 mm (B) 10 mm
(C) 15 mm (D) 25 mm
71. Two shafts of same length and material are joined in series. If the ratio of the diameters is 2, then the ratio of their angle of twist is
- (A) 2 (B) 4 (C) 8 (D) 16
72. The bending moment M and a torque T is applied on a solid circular shaft. If the max. bending stress equals to maximum shear stress developed, then M is equal to
- (A) $T/2$ (B) T (C) $2 \times T$ (D) $4 \times T$
73. While designing a screw in a screw jack against buckling failure, the end conditions for the screw are taken as
- (A) Both the ends fixed
(B) Both the ends hinged
(C) One end fixed and the other end hinged
(D) One end fixed and the other end free
74. In electric resistance welding, pressure applied varies from
- (A) 1 to 5 MPa (B) 5 to 10 MPa
(C) 10 to 25 MPa (D) 25 to 55 MPa
75. Which of the following spring is used in a mechanical wrist watch?
- (A) Helical compression spring (B) Spiral spring
(C) Torsion spring (D) Belleville spring
76. A long helical springs having a spring stiffness of 12 kN/m and number of turns 20, breaks into two parts with number of turns 10 each in both the parts. If the two parts are connected in series, then the stiffness of the resultant spring will be
- (A) 6 kN/m (B) 12 kN/m
(C) 24 kN/m (D) 30 kN/m
77. The ratio of the mean diameter of the coil to the wire diameter is known as
- (A) Pitch (B) Spring index
(C) Resilience (D) None of the above

78. In a partial journal bearing, the angle of contact of the bearing with the journal is
(A) 120° (B) 180°
(C) 270° (D) 360°
79. The property of a bearing material which has the ability to accommodate shaft deflection and bearing inaccuracies by plastic deformation without excessive wear and heating, is known as
(A) Bond ability (B) Embed ability
(C) Conform ability (D) Fatigue strength
80. The flow of fluid over a body is in a random fashion with components of fluctuations in the three directions is known as
(A) Laminar flow (B) Turbulent flow
(C) Stream flow (D) Parallel flow
81. The ratio of the velocity of object and the velocity of sound of the medium is known as
(A) Mach Number (B) Crocco number
(C) Reynolds Number (D) Webber Number
82. The region in which the Mach number is always greater than unity
(A) Sonic region (B) Incompressible region
(C) Supersonic region (D) Compressible region
83. In ideal expansion process in turbine
(A) Entropy increases
(B) Entropy remains constant
(C) Enthalpy remains constant
(D) Temperature remains constant
84. The Mach number at the throat of the convergent-divergent nozzle is
(A) $M = 1$ (B) $M = 0.5$
(C) $M = 0$ (D) $M = 1.5$
85. In subsonic region friction causes
(A) Normal shock (B) Oblique shock
(C) Pressure drop (D) Pressure rise

86. Prandtl-Meyer relation is used to find out the _____ before and after the shock
- (A) Stagnation pressure (B) Stagnation temperature
(C) Fluid velocities (D) Densities
87. Turbojet and Ramjet engines can operate at
- (A) Subsonic speeds (B) Sonic speeds
(C) Supersonic speeds (D) Hypersonic speeds
88. As temperature increases, _____.
- (A) viscosity of a fluid increases
(B) viscosity of a fluid decreases
(C) viscosity of a liquid increase
(D) viscosity of a liquid decreases
89. Barometer is used to measure _____ pressure.
- (A) absolute (B) gauge
(C) atmospheric (D) difference in
90. The value of Reynolds number in the case of Laminar flow is ____
- (A) less than 2000
(B) above 4000
(C) between 2000 and 4000
(D) less than 1000
91. Rotary actuators are also called _____
- (A) fixed displacement pumps
(B) variable displacement pumps
(C) hydraulic cylinders
(D) hydraulic motors
92. Cavitations in pumps occurs when _____
- (A) the suction pressure is very high
(B) the temperature is very low
(C) the suction pressure is very low
(D) the temperature is very high

93. The valve that is suitable for a Single-acting cylinder is a _____ valve.
- (A) 4/2 way (B) 4/3 way
(C) 5/3 way (D) 3/2 way
94. The device used to shut down the pump once the accumulator has been fully charged is _____.
- (A) Solenoid (B) Pressure switch
(C) Relay (D) Intensifier
95. The ratio of energy transferred by convection to that by conduction is called
- (A) Stanton number (B) Nusselt number
(C) Biot number (D) Prandtl number
96. Bubbles originate from the heating surface during _____
- (A) Saturated boiling (B) Sub-cooled boiling
(C) Evaporation (D) Condensation
97. The ratio of molar density of species to the total molar density of the mixture is defined as
- (A) Molar concentration (B) Mass fraction
(C) Mole fraction (D) Fick's law
98. Spur gears are used for.....
- (A) connecting skew shafts
(B) connecting intersecting shafts
(C) transmitting power from one shaft to another shaft
(D) connecting two parallel shafts to transmit power
99. Laser Beam Machining economically effective to drill holes of diameter _____.
- (A) 0.005 – 1.27 mm (B) 0.05 – 12.7 mm
(C) 0.0005 – 0.0127 mm (D) 5 – 120 mm
100. Reaction turbines have an efficiency of
- (A) 75% (B) 90% (C) 70% (D) 80%