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Ph.D. Entrance Examination of MECHANICAL ENGG (ME)

Q1. Matrix algebra, Systems of linear equations, Eigen values and eigen vectors.

- a) 0 b) -1
c) 1 d) 2

Q2. Suppose the determinant of a 2×2 matrix A is equal to 5. What is the determinant of 2A?

- a) 5 b) 10
c) 20 d) 25

Q3. Eight coins are tossed simultaneously. Find the probability of getting atleast six heads.

- a) $37/256$ b) $35/256$
c) $46/256$ d) $26/256$

Q4. Calculate the velocity of a body having a mass of 9 kg and linear momentum of 63 kg m/s ?

- a) 6 m/s b) 7 m/s
c) 8m/s d) 10 m/s

Q5. 1 kg ball drops vertically onto the floor with a speed of 25 m/s. It rebounds with an initial speed of 10 m/s. The impulse action on the ball during contact will be:

- a) 15N-s b) 25N-s
c) 35 N-s d) 45N-s

Q6. The length of a wire is increased by 1 mm on the application of a certain load. In a wire of the same material but of twice the length and half the radius, the same force will produce an elongation of

- a) 0.5 mm b) 2 mm
c) 4 mm d) 8 mm

Q7. A cantilever beam of length of 2m carries a U.D.L. of 150 N/m over its whole span. The maximum shear force in the beam will be:

- a) 100 N-m b) 300 N-m
c) 150 N-m d) 600 N-m

Q8. A thick cylinder is subjected to an internal pressure of 60 MPa. If the hoop stress on the outer surface is 150 MPa, then the hoop stress on the internal surface is:

- a) 105 MPa b) 180 MPa
c) 210 MPa d) 135 MPa

Q9. Spring shackles are used to join

- a) chassis frame and spring b) Spring and Axle
c) chassis frame and axle d) all of the above

Q10. A solid circular shaft of diameter 100 mm is subjected to an axial stress of 50 Mpa. It is further subjected to a torque of 10 kNm. The maximum principal stress experienced on the shaft is closest to

- a) 41Mpa
- b) 82 Mpa
- c) 164 Mpa
- d) 204 Mpa

Q 11. A closed system receives 60 kJ heat but its internal energy decreases by 30KJ Then the work done by the system is

- a) 90 kJ
- b) 30 kJ
- c) -30 kJ
- d) - 90 kJ

Q 12. The total pressure on a horizontally immersed surface is (where w = Specific weight of the liquid, A = Area of the immersed surface, and x = Depth of the centre of gravity of the immersed surface from the liquid surface)

- a) wA
- b) wx
- c) wAx
- d) wA/x

Q 13. Carnot cycle comprises of

- a) two isentropic processes and two constant volume processes
- b) two isentropic processes and two constant pressure processes
- c) two isothermal processes and three constant pressure processes
- d) none of the above

Q 14. Heat transfer takes place according to which of the following law?

- a) Newton's second law of motion
- b) First law of thermodynamics
- c) Newton's law of cooling
- d) Second law of thermodynamics

Q 15. A body floats in stable equilibrium

- a) When its metacentric height is zero
- b) When the metacentre is above c.g.
- c) When its c.g. is below its center of buoyancy
- d) Metacentre has nothing to do with position of c.g. for determining stability

Q 16. Which of the following condition is correct for natural convection?

- a) $(Gr / Re^2) = 1$
- b) $(Gr / Re^2) \gg 1$
- c) $(Gr / Re^2) \ll 1$
- d) none of the above

Q 17. The Grashof number in natural convection plays same role as

- a) Prandtl number (Pr) in forced convection
- b) Reynolds number (Re) in forced convection
- c) Nusselt number (Nu) in forced convection
- d) none of the above

Q 18. The ratio of the inertia force to the _____ is called Euler's number.

- a) Pressure force
- b) Elastic force
- c) Surface tension force
- d) Viscous force

Q 19. When air is compressed, the enthalpy is increased from 100 to 200 kJ/kg. Heat lost during this compression is 50kJ/kg. Neglecting kinetic and potential energies, the power required for a mass flow of 2 kg/s of air through the compressor will be

- a) 300 kW
- b) 200 kW
- c) 100 kW
- d) 50 kW

Q 20. Heating and humidification is done in.

- a) summer air conditioning
- b) winter air conditioning
- c) both of the mentioned
- d) none of the mentioned

Q 21. Which of the following relations is true, for coefficient of performance (C.O.P)?

- a) $(C.O.P)_{\text{heat pump}} - (C.O.P)_{\text{refrigerator}} = 0$
- b) $(C.O.P)_{\text{heat pump}} - (C.O.P)_{\text{refrigerator}} > 1$
- c) $(C.O.P)_{\text{heat pump}} - (C.O.P)_{\text{refrigerator}} = 1$
- d) $(C.O.P)_{\text{heat pump}} - (C.O.P)_{\text{refrigerator}} < 1$

Q 22. Which of the following statement is incorrect according to heat transfer?

- a) Heat flow doesn't depend on temperature
- b) A material medium is not necessary for heat transmission
- c) The process of heat transfer is an irreversible process
- d) For heat exchange, a temperature gradient must exist

Q 23. The knocking in spark ignition engines can be reduced by

- a) Retarding the spark
- b) Increasing the engine speed
- c) Both (A) and (B)
- d) None of these

Q 24. In the aqua-ammonia absorption system,

- a) water is the refrigerant and ammonia is the absorbent
- b) ammonia is the refrigerant and water is the absorbent
- c) both ammonia and water can be used as refrigerant or absorbent
- d) none of the mentioned

Q 25. Why is wet compression not preferred?

- a) the liquid refrigerant can be trapped in the head of cylinder
- b) this may damage the valves or cylinder head
- c) liquid refrigerant can wash away the lubricating oil thus accelerating wear
- d) all of the mentioned

- Q 26. In a gating system, the ratio 1:2:4 represents
- a) Sprue base area: runner area: ingate area
 - b) Pouring basin area: ingate area: runner area
 - c) Sprue base area: ingate area: casting area
 - d) Runner area: ingate area: casting area
- Q 27. Following process is used to increase the hardness
- a) cold working
 - b) age hardening
 - c) hot hardening
 - d) work hardening
- Q 28. Tools which are preferred for negative rake angle
- a) High speed steel tool
 - b) low speed steel tool
 - c) diamond
 - d) none of the above
- Q 29. Type of wear results from rubbing between newly work surface and flank face adjacent to cutting edge
- a) abrasion wear
 - b) crater wear
 - c) flank wear
 - d) adhesion wear
- Q 30. Which type of welding is used to weld ship hulls
- a) Manual Metal Arc Welding
 - b) Gas Metal Arc Welding
 - c) Submerged Arc Welding
 - d) Flux Coated Arc Welding
- Q 31. In brazing, the joint strength
- a) Decreases with increase in gap between two joining surfaces
 - b) Increases with increase in gap between two joining surfaces
 - c) Decreases up to certain gap between the two joining surfaces beyond which it increases
 - d) Increases up to certain gap between the two joining surfaces beyond which it decreases
- Q 32. Any workpiece which is freely move in any direction can have
- a) 12 DOF
 - b) 6 DOF
 - c) 9 DOF
 - d) 3 DOF
- Q 33. The mechanism of material removal in EDM process is by
- a) melting and evaporation
 - b) melting and corrosion
 - c) erosion and cavitation
 - d) cavitation and evaporation

Q 34. In ECM process, the electrolyte used is

- a) Water
- b) Brine Solution
- c) Air
- d) Kerosene

Q 35. Welded tubes and pipes are produced by

- a) Hot working
- b) Cold working
- c) Roll Piercing
- d) None of these

Q 36. How many elements are present in tool signature?

- a) 4
- b) 7
- c) 5
- d) 6

Q 37. Ideal conditions suited for continuous chips in metal cutting:

- a) sharp cutting edge
- b) low rake angle
- c) low cutting speed
- d) large chip thickness

Q 38. Which finishing operation is used to improve the mechanical properties of a powder metallurgy part

- a) Coining
- b) Sizing
- c) Repressing
- d) Impregnation

Q 39. A manometer is used to measure

- a) Atmospheric pressure
- b) Pressure in pipes and channels
- c) Pressure in Venturi meter
- d) Difference of pressures between two points in a pipe

Q 40. Two streams of liquid metal, which are not hot enough to fuse properly, result into a casting defect

- a) Cold shut
- b) Swell
- c) Sand wash
- d) Scab

ANSWER KEYS (Mechanical)

1	(a)	2	(c)	3	(a)	4	(b)	5	(c)
6	(d)	7	(b)	8	(c)	9	(a)	10	(b)
11	(a)	12	(c)	13	(b)	14	(d)	15	(b)
16	(b)	17	(b)	18	(a)	19	(a)	20	(b)
21	(c)	22	(a)	23	(c)	24	(b)	25	(a)
26	(a)	27	(d)	28	(c)	29	(c)	30	(c)
31	(d)	32	(a)	33	(a)	34	(b)	35	(c)
36	(b)	37	(a)	38	(c)	39	(b)	40	(a)

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