

## M.Tech. Entrance Test – 2013 (AKU, Patna)

Subject: Mechanical Engineering

Time: - 1½ Hrs.

Full marks: 50

**INSTRUCTIONS:** -There are four options given for a question. You have choose the correct option/s. Candidates are required to submit this Question paper with answer book.

1. The radius of gyration for a sphere about its diameter and cylinder of 'R' about its axis are respectively
  - (a) 0.6324R and 0.707R
  - (b) 0.6234R and 0.77R
  - (c) 0.6432R and 1.414R
  - (d) 0.6324R and 1.414R
2. If the momentum of the given body is tripled, its kinetic energy will
  - (a) Increase by 3 times
  - (b) Increase by 9 times
  - (c) Decrease by 3 times
  - (d) Decrease by 9 times
3. A disc has moment of inertia of  $12 \text{ kgm}^2$ . A motor does 125 joules of work to bring the speed of the disc at a level of 75 rpm. The initial speed of the disc was
  - (a) 71 rpm
  - (b) 65 rpm
  - (c) 61 rpm
  - (d) 53 rpm
4. A steel wheel of 600 mm diameter rolls on a horizontal steel rail. It carries a load of 500 N. The coefficient of rolling resistance is 0.3. The force in N, necessary to roll the wheel along the rail is
  - (a) 0.5
  - (b) 5
  - (c) 15
  - (d) 150
5. The bulk modulus is K, modulus of elasticity E, and poisson's ratio is  $1/m$  then which of the following is true.
  - (a)  $E = 3K \{1 + 2/m\}$
  - (b)  $E = 3K \{1 - 1/m\}$
  - (c)  $E = 3K \{1 - 2/m\}$
  - (d)  $E = 3K \{1 + 1/m\}$
6. Two shafts 'A' and 'B' are made of same materials. The diameter of shaft 'A' is twice that of 'B'. The ratio of power transmitted by shafts 'A' to that by 'B'
  - (a) 2:1

- (b) 4:1  
(c) 8:1  
(d) 16:1
7. Proof resilience is the maximum strain energy stored at  
(a) Limit of proportionality  
(b) Elastic limit  
(c) Plastic limit  
(d) None of these
8. A cantilever 3 m long carries uniformly distributed load over the entire length. If the slope at the free end is 1 degree, find the deflection at the free end  
(a) 39.27 mm  
(b) 30.16 mm  
(c) 45.13 mm  
(d) 35.16 mm
9. The number of instantaneous centres for an n-bar chain mechanism will be  
(a)  $n(n-1)/2$   
(b)  $n(n+1)/2$   
(c)  $n(n+1)$   
(d) n
10. A shaft revolving in a bearing forms a  
(a) Sliding pair  
(b) Cylindrical pair  
(c) Higher pair  
(d) Lower pair
11. The tooth profile most commonly used in gear drives for power transmission is  
(a) Parabola  
(b) Ellipse  
(c) Cycloid  
(d) Involute
12. A reverted gear train is one in which the output shaft and input shaft  
(a) Rotate in opposite direction  
(b) Are at right angles to each other  
(c) Are at an angle to each other  
(d) Are co-axial

13. A mass of 1 kg is attached to the end of a spring with a stiffness of 0.8 N/mm. The critical damping coefficient of the system is
- (a) 26.32 Ns/m
  - (b) 56.57 Ns/m
  - (c) 42.85 Ns/m
  - (d) 64.28 Ns/m
14. Determine the natural frequency of the shaft, if  $E = 200 \text{ GN/m}^2$  and shaft diameter is 40 mm.
- (a) 40.1 rad/sec
  - (b) 41.6 rad/sec
  - (c) 42.8 rad/sec
  - (d) 43.9 rad/sec
15. A mass 'm' is fixed at the centre of spring. Mass 'm' = 20 kg, stiffness of the spring is 15 KN/m. Find out the natural frequency
- (a) 6 HZ
  - (b) 3.7 HZ
  - (c) 8.7 HZ
  - (d) 9.8 HZ
16. If a shaft subjected to transverse vibrations, the stress induced in the shaft would be
- (a) Direct compressive
  - (b) Direct shear
  - (c) Bending stress
  - (d) Direct tensile

17. If one principal stress is zero at a point, then the other principal stress, compared to the maximum shear stress at that point will be
- (a) Same      (b) twice      (c) half      (d) thrice
18. Factor of safety for fatigue loading is the ratio of
- (a) elastic limit to working stress      (b) young's modulus to working stress
- (c) endurance limit to the working stress
- (d) elastic limit to linear deformation.

19. The permissible shear stress in a fillet weld is  $100 \text{ N/mm}^2$ . The fillet weld has equal leg lengths of  $15 \text{ mm}$  each. The allowable shear load on weldment per mm length of weld is  
 (a)  $0.75 \text{ kN}$  (b)  $1.06 \text{ kN}$  (c)  $1.58 \text{ kN}$  (d)  $2.25 \text{ kN}$
20. The shock absorbing capacity of a bolt can be increased by  
 (a) tightening it properly  
 (b) increasing shank diameter  
 (c) grinding the shank  
 (d) making shank diameter equal to core diameter of ~~the~~ thread.
21. In the formation of Lewis equation for toothed gearing, it is assumed that tangential tooth load acts on the  
 (a) pitch point (b) tip of the tooth  
 (c) root of the tooth (d) whole face of the tooth
22. The bearings are normally design for a value of bearing characteristic atleast  
 (a) equal to the bearing modulus (b) two times the bearing modulus  
 (c) three times the bearing modulus (d) four times the bearing modulus
23. Capillarity in liquids is due to  
 (a) viscosity and adhesion (b) surface tension and adhesion  
 (c) surface tension and cohesion (d) adhesion and cohesion
24. A hemi-spherical vessel of diameter  $2 \text{ m}$  is completely filled with water. Depth of centre of pressure will be equal to  
 (a)  $2 \text{ m}$  (b)  $1 \text{ m}$  (c)  $0.5 \text{ m}$  (d)  $4/3 \text{ m}$
25. When a laminar flow takes place between two flat plates apart, the average velocity of flow is  
 (a)  $h$  (b)  $2/3 h$  (c)  $0.5 h$  (d)  $0.25 h$

- At the point of boundary layer separation
26. (a) density variation is maximum (b) velocity is negative  
(c) shear stress is maximum (d) shear stress is zero
27. The pressure drop in pipe flow is directly proportional to the mean velocity. It suggests that the  
(a) flow is turbulent (b) flow is laminar (c) pipe is smooth  
~~(c) pipe is smooth~~ (d) pipe is rough
28. Which of the following bends will cause maximum head loss?  
(a)  $90^\circ$  bend (b)  $60^\circ$  bend (c)  $30^\circ$  bend (d) U-bend
29. Up to the critical radius of insulation  
(a) heat flux decreases (b) added insulation increases heat loss  
(c) added insulation decreases heat loss  
(d) convection heat loss is less than conduction heat loss
30. An increase in convective coefficient over a fin  
(a) decreases effectiveness (b) increases effectiveness  
(c) does not influence effectiveness  
(d) influence only the fin efficiency
31. Two radiating surfaces  $A_1 = 6\text{ m}^2$  and  $A_2 = 4\text{ m}^2$  have shape factor  $F_{1-2} = 0.1$ . Then the shape factor  $F_{2-1}$  will be  
(a) 0.10 (b) 0.12 (c) 0.15 (d) 0.18
32. Which one of the following non-dimensional numbers is used to determine the transition from laminar to turbulent flow in free convection?  
(a) Rayleigh number (b) Reynolds number  
(c) Peclet number (d) Grashoff number
33. The normal automobile radiator is a heat exchanger of the type  
(a) direct contact (b) cross flow  
(c) parallel flow (d) counter flow

34. The sequence of processes that finally returns the working substance to its original state is called
- Process
  - Event
  - Property
  - Thermodynamic cycle
35. A process in which, no heat is supplied or rejected from the system and entropy is not constant
- Isothermal
  - Hyperbolic
  - Polytropic
  - Isentropic
36. If the entropy of an isolated system increases during a process, then it is called
- Adiabatic
  - Ideal
  - Irreversible
  - Isothermal
37. During which of the following process does heat rejection takes place in Carnot vapour cycle.
- Constant volume
  - Constant entropy
  - Constant pressure
  - Constant temperature
38. The area of the  $p - v$  diagram for a Carnot cycle is
- Heat supplied
  - Heat rejected
  - Work done
  - Internal energy
39. The statement that the entropy of a pure substance in complete thermodynamic equilibrium becomes zero at absolute zero temperature is known as
- Law of entropy
  - Zeroth law of thermodynamics
  - First law of thermodynamics
  - Third law of thermodynamics
40. Which of the following process is used to improve the thermal efficiency of Rankine cycle
- Reheating
  - Regenerating
  - Both (a) and (b)
  - None of the above
41. For a heat engine working on Carnot cycle, the work output is  $\frac{1}{2}$  of the heat transferred to the cold system. The efficiency of the engine is
- 25%
  - 33%
  - 75%
  - 90%

42. Which of the following refrigerant is not flammable
- R 134a
  - R 143
  - R 152
  - R 152a
43. The difference between Dry bulb and Wet bulb temperature increases as
- Air is wet
  - Air is dry
  - Atmospheric temperature rises
  - Atmospheric temperature decreases
44. In a gas cycle refrigeration system, an expander replaces the throttle valve of a VCRS, because
- It improves the COP, as condenser is small
  - ~~It leads to significant cost reduction~~
  - It considerably reduces system weight
  - The drop in temperature by throttling, is very small.
45. A reversed heat engine that makes 400 kg of ice per hour at -8 degree C. Assume specific heat of ice as 2.09 Kj/kg degree K and latent heat as 334 KJ/kg. The heat absorbed per kg of water at 18 degree C is
- 426 KJ
  - 226 KJ
  - 420 KJ
  - 550 KJ
46. Assuming the refrigerant vapour to behave as an ideal gas, and with perfect inter cooling, the optimum intermediate pressure of a refrigeration system that operates between 4 bar and 16 bar is
- 10 bar
  - 8 bar
  - 6 bar
  - 12 bar
47. Double hemispherical buckets are used in
- Kaplan turbine
  - Francis turbine
  - Propeller turbine
  - Pelton wheel
48. A material for water turbine should be
- High creep resistance
  - High temperature resistance
  - High corrosion resistance
  - Low ductility
49. In a pelton wheel if the angle of deflection of water is decreased by 5 degree i.e. from 165 degree to 160 degree, then the hydraulic efficiency will
- Decrease by 1.33 %
  - Increase by 1.33 %
  - Increase by 2.71 %
  - Decrease by 2.71 %
50. The loss of head due to sudden enlargement is attributed to
- Viscosity of fluid
  - Generation of heat
  - Roughness of pipe
  - Production and dissipation of turbulent energy

