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## Section – II – MECHANICAL ENGINEERING

1 If three forces P, Q and R keep a body in equilibrium, the angle between P & Q is  $90^\circ$  and R is acting vertically downward, then magnitude of forces R and Q respectively in terms of P will be

1)  $\frac{P}{\sqrt{2}}, \sqrt{2}P$

2)  $\sqrt{2}P, \frac{P}{\sqrt{2}}$

3)  $P, \sqrt{2}P$

4)  $\sqrt{2}P, P$

2 The algebraic sum of moments of two unlike parallel forces about any point in their plane will be

1) Zero

2) Constant

3) Always anticlockwise

4) Always clockwise

3 If the number of members (m) in a frame having joints (j) is more than that required by the equation  $m=2j-3$ , then such frames called

1) Ideal frame

2) Imperfect frame

3) Perfect frame

4) Redundant frame

4 A steel bar of 500mm length is under tensile stress of  $100 \text{ N/mm}^2$ . If the modulus of elasticity is  $2 \times 10^{11} \text{ N/m}^2$ , then the total elongation of the bar will be

1) 0.25 mm

2) 2.50 mm

3) 5.00 mm

- 4) 0.50 mm
- 5 Hoop stress for a wooden wheel with steel flat tyre in terms of outside diameter of the wheel  $D$ , inside diameter of the tyre  $d$  and Young's modulus  $E$  is
- 1)  $E(D-d)/d$
  - 2)  $E(D/d)$
  - 3)  $E(D/(D-d))$
  - 4)  $E(d/D)$
- 6 A tensile force of  $P$  is applied on a compound bar having two members  $X$  and  $Y$ . Then the load shared by the member  $X$  is
- 1)  $\frac{PA_x E_x}{A_x E_x + A_y E_y}$
  - 2)  $\frac{PA_y E_y}{A_x E_x + A_y E_y}$
  - 3)  $P/2$
  - 4)  $\frac{PE_x}{E_y}$
- 7 Relation between the elastic constants  $E$  and  $C$  for poisson's ratio of 0.25 is
- 1)  $E=10C$
  - 2)  $E=5C$
  - 3)  $E=2.5C$
  - 4)  $E=0.25C$
- 8 The radius of Mohr's circle represents
- 1) Minimum normal stress
  - 2) Maximum normal stress

- 3) Minimum shear stress
  - 4) Maximum shear stress
- 9 For an inclined plane in a rectangular block subjected to two mutually perpendicular normal stresses 100 MPa and 400 MPa and shear stresses 400 MPa, the maximum normal stress will be
- 1) 1200 MPa
  - 2) 700 MPa
  - 3) 600 MPa
  - 4) 200 MPa
- 10 At a hinge in a beam
- 1) Shear force is zero
  - 2) Bending moment is maximum
  - 3) Bending moment is zero
  - 4) Bending moment changes sign
- 11 The bending moment for a beam with equal overhangs and carrying equal point loads each of  $P$  at the free ends, the shear force for the beam portion between the supports is
- 1) Zero
  - 2) equal to  $P$
  - 3) Linearly varying from  $-P$  to  $+P$
  - 4) Linearly varying from 0 to  $P$
- 12 Assumption made in the theory of bending is
- 1) Radius of curvature is small
  - 2) Radius of curvature is large
  - 3) Transverse sections of the beam do not remain plane after bending

- 4) Doesn't follow Hook's law in bending
- 13 In a beam of rectangular cross section, the ratio of the maximum shear stress to the average shear stress is
- 1) 2.50
  - 2) 2.00
  - 3) 1.50
  - 4) 1.33
- 14 A simply supported beam of 10 m span is carrying a load of 4.8 kN at mid span. If Young's modulus of elasticity (E) is  $2 \times 10^8$  kN/m<sup>2</sup> and moment of inertia (I) is 20 cm<sup>4</sup>, then the maximum deflection will be
- 1) 5.00 mm
  - 2) 2.50 mm
  - 3) 0.50 mm
  - 4) 0.25 mm
- 15 The differential equation of flexure is
- 1)  $EI \frac{d^2y}{dx^2} = -M$
  - 2)  $EI \frac{dy}{dx} = M^2$
  - 3)  $EI \frac{d^2y}{dx^2} = M^2$
  - 4)  $M \frac{d^2y}{dx^2} = -EI$
- 16 The slenderness ratio of free standing column of length 4 m and 40mmx40mm section is
- 1) 115.2

- 2) 230.4
- 3) 692.8
- 4) 346.8

17 Euler's crippling load for a column of length  $l$  with both ends hinged and flexural rigidity  $EI$  is given by

- 1)  $P = 2\pi^2 EI/l^2$
- 2)  $P = \pi^2 EI/l^2$
- 3)  $P = 4\pi^2 EI/l^2$
- 4)  $P = \pi^2 EI/(4l^2)$

18 For shaft in torsion

- 1)  $\frac{q}{r} = \frac{I}{J}$
- 2)  $\frac{C\theta}{l} = \frac{I}{J}$
- 3)  $\frac{q}{r} = \frac{C\theta}{l}$
- 4) All the above

19 The ratio of maximum shear stress of a solid shaft of diameter  $D$  to that of a hollow shaft having external diameter  $D$  and internal diameter  $0.5D$  is

- 1) 0.50
- 2) 1.00
- 3) 1.50
- 4) 2.00

20 Section modulus ( $Z$ ) for a rectangular cross section is

- 1)  $bh^3/12$
- 2)  $bh^3/6$

- 3)  $bh^2/12$
- 4)  $bh^2/6$
- 21 The reaction at a roller support of beam will be
- 1) Tangential to support
  - 2) Normal to support
  - 3) Unknown in direction
  - 4) Inclined to support
- 22 For a beam subjected to point loads, the shear force between point loads
- 1) is constant
  - 2) varies linearly
  - 3) has parabolic variation
  - 4) always remain zero
- 23 The Strain energy stored due to bending for a cantilever beam of span  $l$ , Modulus of elasticity  $E$ , moment of inertia  $I$  and a point load  $P$  at free end is
- 1)  $P^2l^3/(6EI)$
  - 2)  $P^2l^5/(40EI)$
  - 3)  $P^2l^3/(96EI)$
  - 4)  $P^2l^5/(240EI)$
- 24 The method in which a single equation is formed for all loads on the beam and the equation constructed in such a way that the integral constants apply to all the sections of the beam is
- 1) Moment area method
  - 2) Conjugate beam method
  - 3) Macaulay's method
  - 4) method of super position

25 A cantilever beam with UDL of  $w$  N/m for entire length of  $L$  will have maximum deflection equal to

- 1)  $wL^4/(48EI)$
- 2)  $5L^4/(384EI)$
- 3)  $wL^4/(8EI)$
- 4)  $wL^4/(3EI)$

26 What is poise?

- 1) Unit of viscosity
- 2) Dyne-sec/cm<sup>2</sup>
- 3) 0.1 times Ns/m<sup>2</sup>
- 4) All the above.

27 Surface tension has the units of

- 1) Nm
- 2) N/m
- 3) N/m<sup>2</sup>
- 4) N/m<sup>3</sup>

28 The ratio of specific heat of a gas at constant pressure and the specific heat of the gas at constant volume

- 1) is always constant
- 2) varies with temperature
- 3) varies with pressure
- 4) is not constant

29 A perfect gas obeys

- 1) Boyle's law only
- 2) Charles' law only

- 3) both Boyle's law and Charles' law
- 4) None of the above
- 30 The thermal efficiency of an engine, which is supplied heat at the rate of 15000 Nm/s and gives an output of 4500 W is
- 1) 45%
- 2) 50%
- 3) 30%
- 4) 33%
- 31 Micro-manometer is used to
- 1) determine low pressure difference
- 2) determine higher pressure difference
- 3) pressure measurement for gases only
- 4) measure pressure in congested areas
- 32 Prandtl's Pitot tube measures
- 1) Stagnation head only
- 2) Pressure head only
- 3) Velocity head and Stagnation head
- 4) Pressure head and Stagnation head
- 33 Based on principle of conservation of energy, the equation derived for an ideal fluid is
- 1) Bernoulli's Equation
- 2) Newton's Law of Viscosity
- 3) Impulse – momentum equation
- 4) Continuity equation

- 34 Mouthpiece has increased net head when compared to small orifice due to
- 1) turbulence in the tube
  - 2) vena contracta occurred within the tube
  - 3) smaller length of the tube
  - 4) smooth boundary of the tube
- 35 If Velocity potential satisfies Laplace equation the flow will be
- 1) Irrotational flow
  - 2) Free vortex flow
  - 3) Continuous flow
  - 4) Forced vortex flow
- 36 The ratio of viscous forces to inertial forces is called
- 1) Mach number
  - 2) Weber number
  - 3) Reynolds number
  - 4) Froude number
- 37 If the position of meta centre remain lower than centre of gravity of the floating body, the body will remain in a state of
- 1) Stable equilibrium
  - 2) Unstable equilibrium
  - 3) Neutral equilibrium
  - 4) None of the above
- 38 The error in discharge due to error in the measurement of head over a rectangular notch is given by
- 1)  $\frac{dQ}{Q} = \frac{1}{2} \frac{dH}{H}$

$$2) \quad \frac{dQ}{Q} = \frac{3}{2} \frac{dH}{H}$$

$$3) \quad \frac{dQ}{Q} = \frac{3}{4} \frac{dH}{H}$$

$$4) \quad \frac{dQ}{Q} = \frac{5}{2} \frac{dH}{H}$$

39 Impulse momentum equation gives relationship between force (F), mass (m) and velocity (v) as

$$1) \quad F = v \frac{dm}{dt}$$

$$2) \quad F = \frac{1}{m} \frac{dv}{dt}$$

$$3) \quad F = \frac{d(mv)}{dt}$$

$$4) \quad F = v \frac{dv}{dt}$$

40 In turbulent flow, the loss of head is approximately proportional to

1) Velocity

2) (Velocity)<sup>1/2</sup>

3) (Velocity)<sup>3/4</sup>

4) (Velocity)<sup>2</sup>

41 A rigid pipe of length L, diameter D, wall thickness t and modulus of elasticity E is conveying water with a mean velocity of V. If mass density and bulk modulus of water are  $\rho$  and K respectively, then water hammer due to sudden closure in the pipe will cause increase in pressure equal to

$$1) \quad \rho LV/t$$

$$2) \quad V\sqrt{\rho K}$$

3) 
$$V \sqrt{\frac{\rho}{\left(\frac{1}{K} + \frac{D}{Et}\right)}}$$

4) None of the above

42 The discharge from a centrifugal pump is 100 lpm and the leakage is 11 lpm. Then the volumetric efficiency of the pump is

1) 89%

2) 90%

3) 99%

4) 80%

43 Draft tube for a reaction turbine is arranged for

1) Safety purpose only

2) Increasing velocity head

3) Converting kinetic head into pressure head

4) Diverting water only

44 Which hydraulic turbine more efficient at part load operation?

1) Pelton wheel

2) Francis turbine

3) Propeller turbine

4) Kaplan turbine

45 In an inward flow reaction turbine, velocity of flow at the inlet is 2 m/s. if the guide vanes make an angle of  $30^\circ$  to the tangential velocity direction of the runner, the absolute velocity of the water leaving the guide vanes is

1) 1 m/s

2) 2 m/s

3) 3 m/s

- 4) 4 m/s
- 46 In a laminar boundary layer over a flat plate, the growth of the boundary layer with distance  $x$  from leading ledge is given by  $\delta/x$  is proportional to Reynolds number ( $Re_x$ ) as
- 1)  $Re_x^{1/2}$
  - 2)  $Re_x^{-1/2}$
  - 3)  $Re_x^{1/5}$
  - 4)  $Re_x^{-1/5}$
- 47 The cavitation parameter  $\sigma$  is defined in terms of net positive suction head (NPSH) and net head  $H$  as
- 1)  $NPSH/vH$
  - 2)  $H/NPSH$
  - 3)  $H/vNPSH$
  - 4)  $NPSH/H$
- 48 The momentum correction factor is used to account for
- 1) Change in direction of flow
  - 2) Change in pressure
  - 3) Non uniform distribution of velocity
  - 4) Unsteady flow
- 49 Centre of Pressure is
- 1) Always below the centroid of the submerged plane
  - 2) Always at the centroid of the submerged plane
  - 3) Always above the centroid of the submerged plane
  - 4) Anywhere with respect to the centroid of the submerged plane

50 What is a condition for a hydraulically efficient channel

- 1) Minimum flow rate.
- 2) Maximum wetted perimeter.
- 3) Constant velocity.
- 4) Minimum wetted perimeter.

KEY TO Section II MECHANICAL ENGINEERING

Q.NO	Answer		Q.NO	Answer
1	4		26	4
2	2		27	2
3	4		28	1
4	1		29	3
5	1		30	3
6	1		31	1
7	3		32	4
8	4		33	1
9	1		34	2
10	3		35	3
11	1		36	3
12	2		37	2
13	3		38	2
14	2		39	3
15	1		40	4
16	3		41	2
17	2		42	2
18	4		43	3

19	4		44	4
20	4		45	4
21	2		46	2
22	1		47	4
23	1		48	3
24	3		49	1
25	3		50	4

## Section – III – MECHANICAL ENGINEERING

1. Work done in a free expansion process is
  - a. Maximum
  - b. Negative
  - c. Positive
  - d. Zero
2. Which of the following is not a path function
  - a. Thermal conductivity
  - b. Kinetic Energy
  - c. Heat
  - d. Work
3. Under ideal conditions, isothermal, isobaric, isochoric and adiabatic process a
  - a. Stable process
  - b. Quasi static process
  - c. Thermodynamic process
  - d. Dynamic process

4. Carnot cycle has maximum efficiency for

- a. Petrol Engine
- b. Diesel Engine
- c. Reversible Engine
- d. Irreversible Engine

5. Change of entropy depends upon change of

- a. Heat
- b. Specific heats
- d. Temperature
- e. Mass

6. A petrol engine theoretically operates

- a. Constant Temperature Cycle
- b. Constant Volume Cycle
- c. Constant Pressure Cycle
- d. Mixed cycle of constant pressure and constant volume

7. Insulation in cavity walls is

- a. Cork
- b. Wood
- c. Air
- d. Water

8. A heat Exchanger with heat transfer surface area and overall heat transfer coefficient  $U$  handles two fluids of heat capacities  $C_1$  &  $C_2$  such that  $C_1 > C_2$ . The NTU of the heat exchanger is given by

- a.  $AU/ C_1$
- b.  $AU/ C_2$
- c.  $e^{-(AU/C_1)}$

d.  $e^{-AU/C_2}$

9. In a refrigeration cycle heat is \_\_\_\_\_ by a refrigerant in evaporator and heat is \_\_\_\_\_ by refrigerant in a condenser.

- a. Absorbed, Absorbed
- b. Absorbed, Rejected
- c. Rejected, Absorbed
- d. Rejected, Rejected

10. A composite walls of two layers of thickness  $\Delta x_1$ ,  $\Delta x_2$  and thermal conductivities  $k_1$  and  $k_2$  having cross-sectional area  $A$  normal to the path of heat flow. If the wall surface temperatures are at  $t_1$  and  $t_3$ , the rate of heat flow  $Q$  is equal to

- a.  $\frac{(t_1-t_3)}{\left(\frac{\Delta x_1}{k_1}\right)+\left(\frac{\Delta x_2}{k_2}\right)}$
- b.  $\frac{A(t_1-t_3)}{\left(\frac{\Delta x_1}{k_1}\right)+\left(\frac{\Delta x_2}{k_2}\right)}$
- c.  $\left(\frac{Ak_1k_2(t_1-t_3)}{\Delta x_1+\Delta x_2}\right)$
- d.  $\left(\frac{Ak_1+Ak_2(t_1-t_3)}{\Delta x_1+\Delta x_2}\right)$

11. Moisture in Freon refrigeration system causes

- a. Ineffective refrigeration
- b. Breakdown of refrigerant
- c. Corrosion of whole system
- d. Freezing automatic regulating valve

12. The purpose of installing a flash chamber in the refrigeration circuit is to

- a. Improve overall heat transfer coefficient
- b. Reduce pressure losses through evaporator
- c. Reduce the size of evaporator by avoiding vapours going to evaporator
- d. All the above

13. The saturation temperature of the water at the partial pressure of water vapour in the air vapour mixture is known as

- a. Dry bulb temperature
- b. Wet bulb temperature
- c. Dew point temperature
- d. Saturation temperature

14. Fouling factor is used

- a. In heat exchanger design as a safety factor
- b. In case of Newtonian fluids
- c. When a liquid exchanges heat with a gas
- d. None of the above

15. The formation of frost on cooling coils in a refrigerator

- a. Increases heat transfer
- b. Improves C.O.P. of the system
- c. Reduces power consumption
- d. Increases power consumption

16. The capacity of a refrigerator is one tone. This means that the heat removing capacity of the refrigerator is

- a. 1000 kCal/hr
- b. 2000 kCal/hr
- c. 3000 kCal/hr
- d. 4000 kCal/hr

17. De laval turbine is used for applications requiring

- a. Low power, low speed
- b. Low power, high speed

- c. High power, high speed
- d. High power, low speed

18. The maximum blade efficiency in a single stage impulse turbine is obtained when the ratio of blade speed to the entering steam speed is

- a.  $\frac{\cos \alpha}{2}$
- b.  $\frac{\cos(\alpha/2)}{2}$
- c.  $\cos \alpha$
- d.  $\frac{\cos 2\alpha}{2}$

19. Phenomenon of Chocking in compressor means

- a. No flow of air
- b. Fixed mass flow rate regardless of pressure ratio
- c. Reducing mass flow rate with increasing pressure ratio
- d. Increased inclination of chord with air steam

20. The number of fire tubes in a Cochran boiler are

- a. 75
- b. 115
- c. 165
- d. 225

21. In case of Worm Wheel and Worm the maximum efficiency is obtained when

- a. Either Worm or Worm Wheel is driver
- b. Worm Wheel is driver
- c. Worm is driver
- d. Depends on other factors

22. Idler Pulley is used for
- For running during idle periods only
  - Changing Direction of rotation
  - For stopping motion frequently
  - Maintaining Belt Tension
23. The throw of a Cam is the maximum distance of the follower from
- Root Circle
  - Base circle
  - Pitch circle
  - Staring to finish
24. The sum of the tensions when the belt is running on the pulley is
- Less than the initial tension
  - More than the initial tension
  - Half the initial tension
  - More than twice the initial tension
25. Which of the following key transmits power through frictional resistance only
- Woodruff key
  - Sunk key
  - Saddle key
  - Tangent key
26. For the analysis of thick cylinders, the theory applicable is
- Lame's theory
  - Rankine's theory
  - Poisson's theory
  - Courbon's theory

27. The relationship between modulus of elasticity (E) and modulus of rigidity(G) is

a.  $E=G(1+\mu)$

b.  $G=E(2-\mu)$

c.  $G = \frac{E}{2(1+\mu)}$

d.  $G = \frac{E}{1+2\mu}$

28. Stress concentration may be caused by

a. Change in cross sectional area

b. Change in shape

c. Change in dimension

d. A hole or a notch in the body

29. The Solderberg line for ductile materials gives upper limit for

a. Any combination of mean and alternating stress.

b. Alternating Compressive stress

c. Alternating tensile stress

d. Mean stress

30. Gears of watches are generally manufactured by

a. Powder Metallurgy

b. Machining on Gear Shaper

c. Die Casting

d. Stamping

31. Autofrettage is a

a. Surface coating process

b. A means of inducing favorable residual stress in pressure vessels

- c. Extra cover provided on seamless tubes
  - d. A heat treatment for pressure vessels subjected to low temperature
32. Hot tear
- a. Is a physical property of non ferrous metals
  - b. Is a process involving heat
  - c. Is a phenomenon occurring in materials exposed
  - d. Is a defect in casting
33. The loss of strength in compression which occurs when there is a gain in strength in the tension due to over loading is
- a. Isostrain
  - b. Relaxation
  - c. Hysteresis
  - d. Shock absorption
34. Cold heading is a process as
- a. Chipless machining
  - b. Explosive forming
  - c. High energy ratio forming
  - d. Electro machining process
35. Cores are used
- a. In symmetrical casting only
  - b. To get smooth surface on casting
  - c. To get cavity or recess in cavity
  - d. To strengthen mould
36. A soldering iron is used mainly to
- a. Heat the metal

- b. Melt the solder
  - c. Heat the flux
  - d. None
37. The accuracy of a limit gauge can be checked by
- a. Sine bar
  - b. Micrometer
  - c. Slip gauge
  - d. Vernier calipers
38. A piercing operation in which the entire contour is not cut is known as
- a. Burnishing
  - b. Broaching
  - c. Notching
  - d. Lancing
39. In which one of the following machining manual part programming is done?
- a. NC machining
  - b. CNC machining
  - c. DNC machining
  - d. FMS machining
40. Production Flow Analysis (PFA) is a method of identifying part families that uses data from
- a. Engineering drawings
  - b. Production schedule
  - c. Bill of material
  - d. Route sheets
41. Flexible manufacturing systems are generally applied in
- a. High variety and low volume production

- b. High variety and high volume production
  - c. Low variety and low volume production
  - d. Medium volume and medium variety production
42. Which of the following is not a part of inventory carrying cost
- a. Cost of inwards goods inspection
  - b. Cost of obsolescence
  - c. Cost of insurance
  - d. Cost of storage space
43. Which two disciplines are usually tied by a common data base
- a. Documentation and geometric modeling
  - b. Drafting and documentation
  - c. CAD and CAM
  - d. Testing and analysis.
44. Group Technology brings together and organizes
- a. Common parts, problems and tasks
  - b. Automation and tool production
  - c. Documentation and analysis
  - d. Parts and simulation analysis.
45. A display of a 3-dimensional model that shows all of its edges is known as
- a. 2-D model
  - b. 3-D model
  - c. Wire frame
  - d. Solid model
46. Which one of the following statements is not correct?
- a. PERT is probabilistic and CPM is deterministic

- b. In PERT, events are used and in CPM activities are used.
  - c. In CPM, crashing is carried out
  - d. In CPM, the probability to complete the project in a given duration is calculated.
47. In time study, the rating factor is applied to determine
- a. Standard time of a job
  - b. Normal time of a job
  - c. Merit rating of the worker
  - d. Fixation of incentive rate
48. Only two symbols are used to draw the following chart
- a. Flow process chart
  - b. Man-machine chart
  - c. Outline process chart
  - d. Two-handed chart
49. The subdivision of an operation into Therbligs and their analysis is known as
- a. Work study
  - b. Time study
  - c. Micro motion study
  - d. None
50. According to the Emerson plan, a worker gets a bonus whenever the efficiency of a worker is more than
- a. 50%
  - b. 55%
  - c. 60%
  - d. 66.67%

## Section – III – Mechanical Engineering Key

1	d	11	d	21	a	31	b	41	d
2	a	12	d	22	d	32	d	42	a
3	b	13	c	23	b	33	c	43	c
4	c	14	a	24	d	34	a	44	a
5	a	15	d	25	c	35	d	45	c
6	b	16	c	26	a	36	b	46	d
7	c	17	b	27	c	37	c	47	b
8	b	18	a	28	d	38	d	48	c
9	b	19	b	29	a	39	a	49	c
10	a	20	c	30	d	40	b	50	d

