



JKSSB JE

Mechanical Engineering

Mega Mock Challenge

(October 18th - October 19th 2021)

Questions &
Solutions

1. A block of mass 35kg is suspended from a spring of mass 3kg whose stiffness is 10 N/cm. Calculate the frequency of vibration of the system when a small disturbance is given to it
A. 0.84 Hz
B. 5.28 Hz
C. 10.56 Hz
D. 3 Hz

Ans. A

Sol. Given,

mass of block = 35kg

mass spring = 3kg

stiffness. $k = 10\text{N/cm} = 1000\text{N/m}$

Equivalent mass of the system = $M_{BLOCK} + \left(\frac{M_{SPRING}}{3} \right)$

Equivalent mass = $35 + (3/3) = 36 \text{ kg}$

frequency is given as, f

$$f = \frac{1}{2\pi} \sqrt{\frac{k}{m}} = \frac{1}{2\pi} \sqrt{\frac{1000}{36}} = 0.84\text{Hz}$$

2. For a mechanism to form a structure, the number of degrees of freedom (n) should be equal to
A. 0
B. 1
C. 2
D. - 1

Ans. A

Sol. When $n = 0$, then the mechanism forms a structure and no relative motion between the links is possible.

When $n = 1$, then the mechanism can be driven by a single input motion.

When $n = 2$, then two separate input motions are necessary to produce constrained motion for the mechanism.

When $n = -1$ or less, then there are redundant constraints in the chain and it forms a statically indeterminate structure.

3. When two spur gear having involute profiles on their teeth engaged, the line of action is tangential to the
A. Pitch circles
B. Dedendum circles
C. Addendum circles
D. Base circle

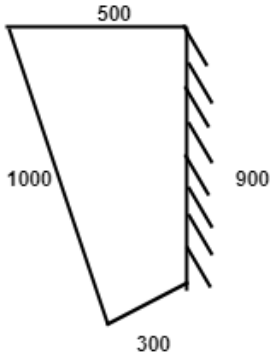
Ans. D

Sol. Two important properties of an involute

(i) A normal to an involute is a tangent to the basic circle.

(ii) The radius of curvature of an involute is equal to the length of the tangent to the base circle.

4. What type of mechanism is shown in the diagram below?



- A. Double rocker mechanism
- B. Crank rocker mechanism
- C. Double crank mechanism
- D. Linkage is not planar

Ans. B

Sol. For given mechanism,
 $300 + 1000 < 900 + 500$

so, Grasshoff's law is satisfied so,

When the link next to the shortest link is fixed, the short link is able to rotate continuously and is called crank. The link opposite to it can only oscillate between limits and is called the rocker. In the given diagram, the link adjacent to the shortest link is fixed, thus crank rocker mechanism is obtained.

5. The controlling force for a governor is related to its radius of rotation as:

$$F(r) = ar + b$$

The governor will be:

- A. Stable
- B. Unstable
- C. Isochronous
- D. Hunting

Ans. B

Sol. For Spring Controlled governor,

$$\text{for } F(r) = ar + b$$

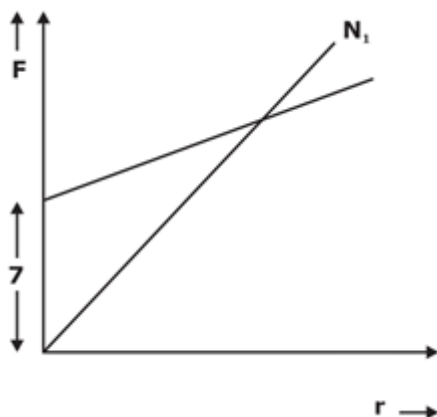
slope of controlling force is less than speed line. So governor will be unstable.

⇒ If slope of controlling force is greater than speed line, governor will be unstable.

⇒ If slope of controlling force is equal to speed line. So governor is isochronous.

For example,

$$F = 25r + 7$$



6. The difference between tensions on the tight and slack sides of a belt drive is 8000 N. If the belt speed is 80 m/s, the transmitted power in kW is
- A. 40 kW
 - B. 100 kW
 - C. 10 kW
 - D. 640 kW

Ans. D

Sol. Given:

$$T_1 - T_2 = 8000 \text{ N}$$

Where, T_1 and T_2 are tensions on tight and slack side respectively

$$V = \text{belt speed} = 80 \text{ m/sec}$$

$$\text{Power} = (T_1 - T_2)V$$

$$P = 8000 \times 80 = 640 \text{ kW}$$

7. Find the tearing efficiency if dia of rivet hole is 8 mm and pitch of rivet is 20 mm ?
- A. 0.4
 - B. 0.8
 - C. 0.6
 - D. 0.5

Ans. C

Sol. Given,

$$\text{Dia of rivet hole} = 8 \text{ mm}$$

$$\text{Pitch of rivet} = 20 \text{ mm}$$

$$\eta_{\text{tearing}} = 1 - \frac{d_h}{p}$$

$$= 1 - \frac{8}{20}$$

$$= 0.60$$

8. Calculate the tangential force for a spur gear setup transmitting 25kW power at a pitch-line velocity of 5m/s
- A. 1000 N
 - B. 2000 N
 - C. 3500 N
 - D. 5000 N

Ans. D

Sol. By definition:

$$\text{Power Transmitted} = \text{Force} \times \text{Velocity}$$

$$\rightarrow 25 \times 10^3 = \text{Force} \times 5$$

$$\rightarrow \text{Force} = \frac{25 \times 10^3}{5} = 5000 \text{ N}$$

9. The damping ratio of a single degree of freedom spring-mass damper system with mass 2 kg and stiffness 50N/m and viscous damping coefficient of 7 Ns/m is_____.
- A. 0.2
 - B. 0.03
 - C. 0.35
 - D. 0.035

Ans. C

Sol. Given,

$$\text{Mass} = 2 \text{ kg},$$

Stiffness = 50N/m,

Viscous damping coefficient = 7 Ns/m

Damping ratio,

$$\begin{aligned}\xi &= \frac{C}{2 \times \sqrt{km}} \\ &= \frac{7}{2 \times \sqrt{2 \times 50}} \\ &= 0.35\end{aligned}$$

10. which of the following cam profile motion has been most preferred during high speed application and has least jerk

- A. constant velocity motion B. simple harmonic motion
C. parabolic D. cycloidal motion

Ans. D

Sol. * Constant velocity profile is the least preferred cam motion and have major problem during application

* Cycloidal cam motion has been mostly preferred as high speed cam to avoid jerking of follower

11. The key which is provided half in the keyway of shaft and half in the keyway of the hub or boss _____.

- A. Round Key B. Saddle Key
C. Tangent Key D. Sunk Key.

Ans. D

Sol.

- The sunk keys are provided half in the keyway of the shaft and half in the keyway of the hub or boss of the pulley.

12. In flat belt drive the condition for maximum power transmission is given by: (where T maximum tension and T_c centrifugal tension in belt) _____.

- A. $T = 3T_c$ B. $T = 2T_c$
C. $T = T_c$ D. $T = 3nT_c$

Ans. A

Sol. **Centrifugal Tension:** Since the belt continuously runs over the pulleys, therefore some centrifugal force is caused, whose effect is to increase the tension on both the tight as well as the slack sides. The tension caused by centrifugal force is called centrifugal tension (T_c). For maximum power transmission:

$$T = 3T_c$$

13. A solid circular shaft of steel 4 cm in diameter is subjected to a permissible shear stress 10 kN/cm². Then value of twisting moment is _____.

- A. 5π kN-cm B. 16π kN-cm
C. 20π kN-cm D. 40π kN-cm

Ans. D

Sol. Given:

Shaft diameter: $d = 4 \text{ cm}$

Shear stress: $\tau = 10 \text{ kN/cm}^2$

Torque (T) is given as:

$$T = \frac{\pi d^3}{16} \tau$$

$$\Rightarrow T = \frac{\pi \times 4^3}{16} \times 10 \text{ kN - cm}$$

$$\boxed{T = 40\pi \text{ kN - cm}}$$

14. The maximum distortion energy theory of failure is suitable to predict the failure of which one of the following type of materials?

- A. Brittle
- B. Ductile
- C. Composite
- D. Plastics

Ans. B

Sol.

- According to maximum distortion energy theory, yielding would occur when total distortion energy absorbed per unit volume due to applied loads exceeds the distortion energy absorbed per unit volume at the tensile yield point.
- It is best theory among all for the ductile materials.
- It defines only the initiation of yielding.

15. is not a permanent joint

- A. Riveted joint
- B. Knuckle joint
- C. Welded joint
- D. Adhesive bonding

Ans. B

Sol.

- A knuckle joint is a mechanical joint used to connect two rods which are under a tensile load, when there is a requirement of small amount of flexibility, or angular moment is necessary.
- Knuckle joint is a temporary joint.

16. In case of a beam of uniform strength_____?

- A. Bending stress developed is same at each and every cross-section.
- B. Bending stress is different at different X-S/Cs.
- C. Bending moment is same at each and every X-S/C
- D. None of the above

Ans. A

Sol.

- A beam of uniform strength is designed in such a way that Bending stress developed is same at each and every cross-section.

- Beams of uniform strength vary in section such that maximum bending stress remains constant. The beam section should have sufficient strength to resist the external bending moment. To ensure strength of a beam it is necessary that the greatest tensile and greatest compressive stresses at the critical section should not exceed their corresponding allowable stresses for the material.

$$\sigma_b = \frac{M}{Z}$$

17. The ratio of Euler's buckling load of columns with same parameters having both end fixed to the one end fixed and other end free is
- A. 2
 - B. 4
 - C. 8
 - D. 16

Ans. D

Sol.

Euler's Buckling load is given by,

$$P_{cr} = \frac{\pi^2 EI}{L_e^2}$$

case 1 : when both end fixed

(i) $L_{e1} = \frac{L}{2}$,

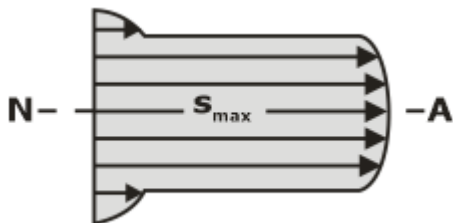
case 2: for one end fixed, and other is free

(ii) $L_{e2} = 2L$

So ratio of both end fixed to the one end fixed and other end free is

$$\begin{aligned} \frac{P_{cr1}}{P_{cr2}} &= \frac{\pi^2 EI}{L_{e1}^2} \times \frac{L_{e2}^2}{\pi^2 EI} \\ &= \frac{L_{e2}^2}{L_{e1}^2} \\ &= \frac{4L}{\left(\frac{L}{2}\right)^2} = 16 \end{aligned}$$

18. Transverse shear stress distribution for a beam is shown below at a cross section.



Identify the X-s/c of the Beam.

- A. Rectangular
- B. I-Section
- C. T-Section
- D. Square

Ans. B

Sol. Transverse shear stress for a beam is given by,

$$\tau = \frac{F \times A \times \bar{Y}}{I \times b}$$

Where F = Maximum shear load

I = moment of inertia of the whole section about neutral axis

b = Width of fibre where shear stress is being measured

$\bar{A}Y$ = Moment of area above the fibre, about N.A

So transverse shear stress varies parabolically in a cross section and given figure represents shear stress diagram for I-section.

19. The number of independent elastic constants for a monoclinic material are_____.

- A. 21
- B. 9
- C. 36
- D. 13

Ans. D

Sol.

- o A monoclinic has one plane of symmetry and it has 13 independent elastic constants.
- o A homogeneous and isotropic material has 2 independent elastic constants.
- o An anisotropic material has 21 independent elastic constants.
- o An orthotropic material has 9 independent elastic constants.

20. A homogeneous and isotropic material have bulk modulus(K) and poisson's ratio(μ) as 80GPa and 0.3 respectively. The young's modulus of elasticity is

- A. 0 GPa
- B. 96 GPa
- C. 170 GPa
- D. 210 GPa

Ans. B

Sol. Given,

Bulk modulus(K) = 80Gpa

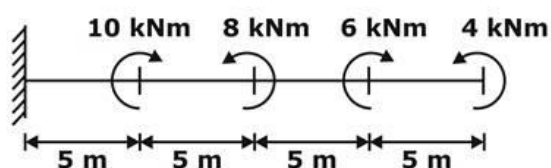
Poisson's ratio(μ) = 0.3

$E=3K(1-2\mu)$

= 3 × 80 (1- 2×0.3)

= 96GPa

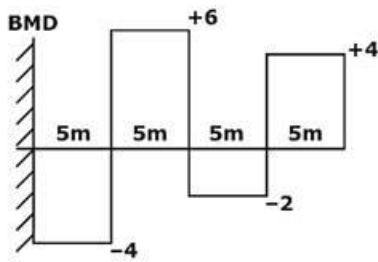
21. What is the area of bending moment diagram (units kNm and m) of a cantilever beam of length 20m subjected to equally spaced point moments of as shown in figure. (Assume area below x axis as negative)



- A. 30
- B. 10
- C. 20
- D. 40

Ans. C

Sol.



$$\text{Area} = 4 \times 5 - 2 \times 5 + 6 \times 5 - 4 \times 5$$

$$\text{Area} = 20 - 10 + 30 - 20$$

$$\text{Area} = 20$$

22. The change of bending moment w.r.t distance is equal to _____.

- A. Shear force at that section
- B. deflection at that section
- C. loading at that section
- D. none of these

Ans. A

Sol. Since bending moment (M) at any location x:

$$M = Fx$$

$$F = \frac{dM}{dx}$$

i.e. Rate of change of bending moment is equal to the shear force.

23. Torque transmitted by a hollow shaft of the same cross-section area and material as that of a solid shaft, will be_____.

- A. Same
- B. Less
- C. More
- D. Cannot be predicted

Ans. C

Sol. Given

Cross-section area is same,

$$\frac{\pi}{4}(d_1^2 - d_2^2) = \frac{\pi}{4}d_s^2$$

$$(d_1^2 - d_2^2) = d_s^2$$

$$d_1^2 = d_s^2 + d_2^2$$

$$\text{So } d_1 > d_s$$

where d_1 = outer dia. of hollow shaft

d_2 = inner dia. of hollow shaft

d_s = solid shaft dia.

For given material $T \propto \frac{J}{r}$

$$\frac{T_H}{T_S} = \frac{\left(\frac{J}{r}\right)_H}{\left(\frac{J}{r}\right)_S}$$

$$= \frac{\left[\frac{d_1^4 - d_2^4}{d_1}\right]}{d_s^3}$$

Since $d_1^2 - d_2^2 = d_s^2$

$$\frac{T_H}{T_S} = \frac{d_1^2 + d_2^2}{d_s d_1}$$

So $T_H > T_S$

24. Which of the following expresses the total elongation of a bar of length L with a constant cross-section of A and modulus of Elasticity E hanging vertically and subject to its own weight W?

- | | |
|---------------------|---------------------|
| A. $\frac{WL}{AE}$ | B. $\frac{WL}{2AE}$ |
| C. $\frac{2WL}{AE}$ | D. $\frac{WL}{4AE}$ |

Ans. B

Sol. The total elongation of a bar of length L with a constant cross-section of A and modulus of Elasticity E hanging vertically and subject to its own weight W is given by $\frac{WL}{2AE}$

25. The system of forces whose line of action meet at a common point and there is no net force or a resultant force due to their effect is called_____.

- | | |
|----------------------|-----------------------|
| A. Coplanar Forces | B. Collinear Forces |
| C. Concurrent Forces | D. Independent Forces |

Ans. C

Sol.

- Concurrent Forces are system of forces whose line of action meet at a common point and there is no net force or a resultant force due to their effect.
- When their line of action is extended, they will meet at a common point.

26. What will be the magnitude of the force P needed to just impend the motion of the block? (If the weight of the block is 80N and coefficient of friction is 0.4)



- A. 80N
B. 0N
C. 32N
D. 112N

Ans. C

Sol. The magnitude of the force P needed to just impend the motion of the block will be equal to the limiting friction or maximum static friction –

$$P = f_r = \mu N$$

$$P = 0.4 \times 80 \rightarrow 32 \text{ N (} N = Mg = 80 \text{ N)}$$

27. If two equal forces are mutually perpendicular, then the resultant force is acting at ____ angle with one of the force?
- A. 45 degree
B. 90 degree
C. 180 degree
D. 0 degree

Ans. A

Sol.

- The forces are mutually perpendicular, this means that the angle between the forces is 90 degree. Thus the resultant will form 45 degrees with any of the force.

28. A kangaroo is capable of jumping to a vertical height of 3m. The take off speed of the kangaroo is
- A. 5.35 m/s
B. 6.37 m/s
C. 7.67 m/s
D. 9.23 m/s

Ans. C

Sol. Using equation of motion

$$v^2 = u^2 + 2as$$

Where,

v = final velocity

u = initial velocity

a = acceleration

s = displacement

$$\Rightarrow 0 = u^2 - 2 \times 9.81 \times 3$$

$$\Rightarrow u^2 = 58.86$$

$$\Rightarrow u = \sqrt{58.86} = 7.67 \text{ m/s}$$

29. A ring of mass 2 kg and radius 1m moves on a plane. $R(t) = t^2$, $\theta(t) = t^3$ at $t = 2$ seconds. The ratio of linear kinetic energy to rotational KE is?
- A. 1/81
B. 1/9
C. 1/36
D. 1/4

Ans. B

Sol. Given,

$$R(t) = t^2, \quad \theta(t) = t^3$$

Time, $t = 2 \text{ sec}$

$$I = mr^2 = 2 \times 1^2 = 2 \text{ kg-m}^2$$

$$v|_{t=2} = \frac{dR}{dt} = \frac{d}{dt} t^2 = 2t = 4 \text{ m/s}$$

$$\omega|_{t=2} = \frac{d\theta}{dt} = \frac{d}{dt} t^3 = 3t^2 = 12 \text{ rad/s}$$

$$\frac{KE_{\text{linear}}}{KE_{\text{rotational}}} = \frac{\frac{1}{2}mv^2}{\frac{1}{2}I\omega^2} = \frac{mv^2}{mr^2\omega^2} = \frac{4^2}{1^2 \times 12^2}$$

$$\frac{KE_{\text{linear}}}{KE_{\text{rotational}}} = \frac{1}{9}$$

30. If the moment of inertia about the centroidal axis of a circular cross section is known, then its polar moment of inertia can be calculated using

- A. Perpendicular axis theorem B. Parallel axis theorem
C. Angular axis theorem D. None of these

Ans. A

Sol. Perpendicular axis theorem is used to determine the polar moment of inertia if the moment of inertia about the centroidal axis is known.

31. Which of the following statement is true?

- A. value of γ for monoatomic gases is $5/3$
B. value of γ for diatomic gases is $7/5$
C. for polyatomic gases, the value of γ is approximately taken as $4/3$
D. all of the mentioned

Ans. D

Sol. These values of γ can be shown by the classical kinetic theory of gases.

Value of $\gamma = 1.67$ for mono atomic gas

$\gamma = 1.4$ for diatomic gas

$\gamma = 1.33$ for poly atomic gas

32. Identify the process for which the two integrals $\int p dv$ and $-\int v dp$ evaluated between any two given states give the same value

- A. Isenthalpic B. Isothermal
C. Isentropic D. Polytropic

Ans. B

Sol. For isothermal process

$$pV = \text{constant}$$

$$pdV + Vdp = 0$$

$$pdV = -Vdp$$

taking integral both side, we get

$$\int pdV = - \int Vdp$$

33. The degree of Freedom of triple point of water is_____.

A. 0

B. 1

C. 2

D. 3

Ans. A

Sol. At triple point number of phases of water are 3.

So, P=3 and there is only one component i.e. water (H₂O) so, C=1.

Therefore, from Gibbs Phase rule we have

$$P+F = C + 2$$

$$F = C + 2 - P = 1+2-3 = 0$$

34. A reversible engine operates between temperature T₁ and T₂. The energy rejected by this engine acts as an input for another reversible engine at temperature T₂, which rejects to a reservoir at temperature T₃. What is the relation between T₁, T₂ and T₃? (Given that the efficiency of both reversible heat engine is same)

A. $T_2 = \frac{T_1 + T_3}{2}$

B. $T_2 = \sqrt{T_1^2 + T_3^2}$

C. $T_2 = \sqrt{T_1 T_3}$

D. $T_2 = \frac{T_1 - T_3}{2}$

Ans. C

Sol. Case -1 Heat engine operates between temperature T₁ and T₂

$$\eta_1 = 1 - \frac{T_2}{T_1}$$

Case -2 Heat engine operates between temperature T₂ and T₃

$$\eta_2 = 1 - \frac{T_3}{T_2}$$

* Since the efficiency of both reversible heat engine is same therefore

$$\eta_1 = \eta_2$$

$$1 - (T_2 / T_1) = 1 - (T_3 / T_2)$$

$$\frac{T_1 - T_2}{T_1} = \frac{T_2 - T_3}{T_2}$$

$$T_2 \frac{T_1}{T_1} = T_1 \times \frac{T_2 - T_3}{T_2}$$

$$T_2 = \sqrt{T_1 T_3}$$

35. Thermodynamic relation for the isothermal compressibility is

- A. $-\frac{1}{V} \left(\frac{dV}{dP} \right)_T$ B. $-V \left(\frac{dP}{dV} \right)_T$
 C. $-P \left(\frac{dV}{dP} \right)_T$ D. $\frac{1}{P} \left(\frac{dV}{dP} \right)_T$

Ans. A

Sol.

We know that, $\text{bulk modulus (B.M.)} = \frac{\text{direct strain}}{\text{volumetric strain}}$

$$\Rightarrow \text{B.M.} = \frac{dP}{-\left(\frac{dV}{V}\right)}$$

Also we know that,

$$\text{compressibility } k = \frac{1}{\text{B.M.}} = -\frac{1}{V} \left(\frac{dV}{dP} \right)$$

Then isothermal compressibility (i.e. compressibility at constant temperature) is

$$k_T = -\frac{1}{V} \left(\frac{dV}{dP} \right)_T$$

36. If the entropy of the saturated liquid and saturated vapor at a particular saturation temperature (300K) are 2 kJ/kg.K and 7 kJ/kg.K. Determine the enthalpy of vaporization?

- A. 1500 kJ/kg B. 700 kJ/kg
 C. 300 kJ/kg D. 3000 kJ/kg

Ans. A

Sol. Given,

- saturated liquid = 2 kJ/kgK,
 saturated vapor = 7 kJ/kgK,
 saturation temperature = 300K,

$$s_{fg} = \frac{h_{fg}}{T}$$

$$h_{fg} = s_{fg} \times T$$

$$h_{fg} = 5 \times 300 = 1500 \text{ kJ/kg}$$

37. A real gas behaves as an ideal gas at ____.

- A. High pressure and low temperature
 B. Low pressure and high temperature
 C. Low pressure and low temperature
 D. High pressure and high temperature

Ans. B

Sol. A real gas behaves as an ideal gas at very low pressure and high temperature.

So, the correct option is (b).

38. For real gas $C_p=C_v$ occurs at?

- A. Critical Temperature B. Triple point
 C. Absolute Zero D. All temperature

Ans. C

Sol. for real gas

$$C_p - C_v = \frac{Tv\beta^2}{K_T}$$

thus,

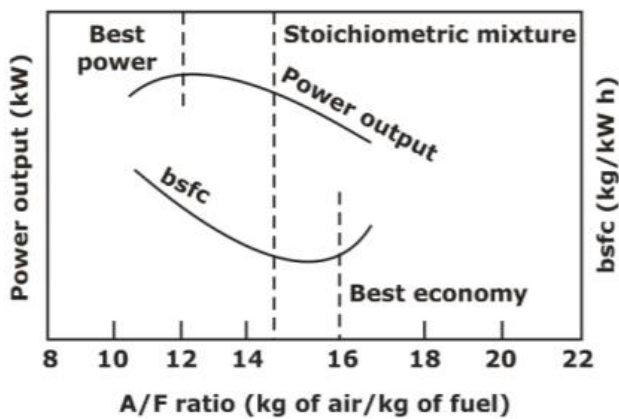
$C_p = C_v$ when $T = 0$ i.e. at absolute zero temperature

39. For maximum power generation the air fuel ratio for a petrol engine is

- A. 16:1
- B. 12:1
- C. 15:1
- D. 20:1

Ans. B

Sol. power characteristics curve of fuel



From the above figure, we can see that for maximum power output, Air to fuel ratio is to be 12:1

40. Diesel engine knock can be reduced by:

- A. Increasing compression ratio
- B. Increasing degree of supercharge
- C. Decreasing injection advance
- D. All of the above

Ans. D

Sol. Diesel engine knock can be reduced by

- Increasing compression ratio
- Decreasing injection advance
- Increasing degree of supercharge
- By decreasing engine speed

41. A power plant working on Rankine cycle produces 10 MW net work, with thermal efficiency of 36% find the heat rate.

- A. 0.1
- B. 2.33
- C. 7.27
- D. 2.77

Ans. D

Sol. Given,

Network output = 10 MW

Thermal efficiency = 36%

$$\text{Heat rate} = \frac{\text{Heat input}}{\text{Network output}} = \frac{1}{\eta}$$

$$\text{Heat rate} = \frac{1}{0.36} = 2.77$$

42. In velocity compounding, steam is passed through _____.
- A. fixed nozzle-moving blades-fixed blades-moving blades
 - B. fixed nozzle-moving blades-fixed nozzles-moving blades
 - C. moving blades-fixed nozzles- fixed blades-moving blades
 - D. fixed blades-moving blades-fixed nozzles- moving blades

Ans. A

Sol. **Compounding of Turbines:**

- o Compounding of steam turbines is the method in which energy from the steam is extracted in a number of stages rather than a single stage in a turbine.
- o A velocity-compounded impulse stage consist of a row of fixed nozzles followed by two or more rows of moving blades and fixed blades (without expansion) respectively.

43. The mechanical efficiency of a 4-stroke engine is 80%. If brake power developed by the engine 150 kW. Find the frictional power_____ (in kW)
- A. 35.7
 - B. 30
 - C. 37.5
 - D. 27.5

Ans. C

Sol. Given,

Mechanical efficiency (η_m) = 80%

Brake power (BP) = 150 kW

$$\text{mechanical efficiency} = \frac{\text{Brake Power}}{\text{indicated Power}}$$

$$\text{Indicated power} = \frac{150}{0.8} = 187.5 \text{ kW}$$

Frictional power = Indicated power – Brake power

$$FP = 187.5 - 150$$

$$FP = 37.5 \text{ kW}$$

44. The efficiency of the Otto cycle for the same compression ratio will be maximum when working fluid is
- A. Air
 - B. Helium
 - C. Carbon Dioxide
 - D. Oxygen

Ans. B

Sol. The efficiency of the Otto cycle is function of the specific heat ratio

$$\eta = 1 - \frac{1}{r^{\gamma - 1}}$$

with increase in the specific heat ratio efficiency of the otto cycle increases.

The highest specific heat ratio is of Helium i.e. 1.66 thus it will give highest efficiency.

45. Back work ratio for gas turbine can also be represented as _____.

A. $\frac{T_2}{T_1}$

B. $\frac{T_4}{T_3}$

C. $\frac{T_2 - T_1}{T_4 - T_1}$

D. $\frac{T_1}{T_4}$

Ans. D

Sol.

$$\text{Back work ratio} = \gamma_{bw} = \frac{W_C}{W_T} = \frac{C_p(T_2 - T_1)}{C_p(T_3 - T_4)}$$

$$\gamma_{bw} = \frac{T_1 \left(\frac{T_2}{T_1} - 1 \right)}{T_4 \left(\frac{T_3}{T_4} - 1 \right)} \Rightarrow \boxed{\gamma_{BW} = \frac{T_1}{T_4}}$$

$$\boxed{\frac{T_2}{T_1} = \frac{T_3}{T_4}}$$

46. The value of COP of refrigeration plant is 5. The heat rejection ratio of this plant is _____.

A. 1

B. 1.2

C. 1.5

D. 2

Ans. B

Sol. HRR is defined as the ratio of heat rejected across condenser to the refrigeration effect.

HRR is given by:

$$HRR = 1 + \frac{1}{(COP)_{ref}}$$

HRR is always > 1.

Here, $HRR = 1 + \frac{1}{5} = 1.2$

47. During dehumidification process, the relative humidity _____.

A. Remains constant

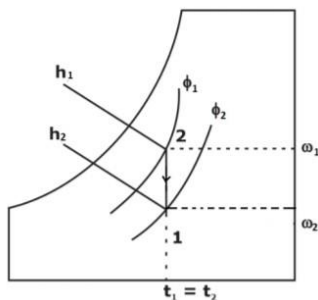
B. Increases

C. Decreases

D. None of these

Ans. C

Sol. Dehumidification process is shown below:



Effects:

- (i). DBT remains constant.
- (ii). Specific humidity decreases.
- (iii). DPT decreases.
- (iv). Relative humidity (ϕ) decreases.
- (v). Specific enthalpy (h) decreases.
- (vi). WBT decreases.
- (vii). Specific volume (v) decreases.

48. An industrial heat pump operated between -12°C and 32°C . The rate of heat addition and heat rejection is 900 W and 1200 W respectively. COP of heat pump is

- A. 6.5
- B. 4
- C. 3
- D. 1.66

Ans. B

Sol. As it's an industrial heat pump, it's not reversible, the temperatures are not to be used in calculation of COP

$$\begin{aligned} \text{Work done} &= \text{Heat Rejected} - \text{Heat Addition} \\ &= 1200 - 900 \\ &= 300 \text{ W} \end{aligned}$$

$$COP_{HP} = \frac{\text{Heat Rejected}}{\text{Work done}} = \frac{1200}{300} = 4$$

49. Which of the following statements regarding a Rankine cycle with reheating is/are TRUE_____?

- (i) Increase in thermal efficiency always
 - (ii) Decrease in thermal efficiency always
 - (iii) Drier steam at the turbine exit
- A. Only (i) & (iii)
 - B. Only (ii) & (iii)
 - C. Only (i)
 - D. Only (iii)

Ans. D

Sol. A Rankine cycle when subjected to reheating,

⇒ Steam quality at exit of steam turbine increases.

⇒ Efficiency of Rankine cycle may increase or decrease, it depends on the reheating pressure.

50. COP of reverse Brayton cycle is depends on

- A. Condenser temperature
- B. Evaporator temperature
- C. Pressure ratio
- D. None of these

Ans. C

Sol. COP of Reverse Brayton Cycle is the function of pressure ratio only.

$$COP=f(r_p)$$

$$COP = \frac{1}{(r_p)^{\frac{\gamma-1}{\gamma}} - 1}$$

51. Bernoulli's equation $\frac{P}{\rho g} + \frac{V^2}{2g} + Z$ represents:

- A. Total energy per unit mass
- B. Total energy per unit volume
- C. Total energy per unit weight
- D. Total energy per unit flow area

Ans. C

Sol. The expression $\frac{P}{\rho g} + \frac{V^2}{2g} + Z$, has units of energy per unit weight.

52. Euler's dimensionless number relates _____.

- A. Inertia force and Pressure force
- B. Inertia force and gravity force
- C. Buoyant force and inertia force
- D. Buoyant force and viscous force

Ans. A

Sol. Euler's dimensionless number relates Pressure force and inertia force.

$$Eu = \sqrt{\frac{F_i}{F_p}} = \frac{V}{\sqrt{\frac{P}{\rho}}}$$

Where F_i =Inertia force

F_p =Pressure force

53. Water flows through a circular tube with a velocity of 2 m/s. The diameter of the pipe is 14 cm. Take kinematic viscosity of water 10^{-6} m²/s and density of water 1000 kg/m³. what will be the Reynolds no?

- A. 2.8×10^8
- B. 2.8×10^5
- C. 2800
- D. 28000

Ans. B

Sol. Given,

Velocity = 2 m/s

Diameter =14 cm= 0.14m

Kinematic viscosity = 10^{-6} m²/s

Density of water =1000 kg/m³

Reynolds number is given by:

$$Re = \frac{\rho V D}{\mu} = \frac{V D}{\nu}$$

Thus,

$$Re = \frac{2 \times 0.14}{10^{-6}} = 2.8 \times 10^5$$

54. For a fully submerged verticle flat plate in water, the centre of pressure is situated _____ the centre of gravity.

- A. Above
 B. Below
 C. At the same level
 D. Cannot be determined

Ans. B

Sol. The formula for centre of pressure is

$$\bar{h}_{cp} = \bar{h} + \frac{I_{CG} \sin^2 \theta}{A \bar{h}}$$

\bar{h}_{cp} = Distance of centre of pressure from surface.

\bar{h} = Distance of CG from surface.

we see that distance of centre of pressure is always more than the centre of gravity from the surface.

55. A manometric liquid should suitably have _____

- A. Low density & Low Vapour pressure
 B. Low density & High Vapour pressure
 C. High density & Low Vapour pressure
 D. High density & High Vapour pressure

Ans. C

Sol.

- A high density is favourable because the height of the column required for the manometer would be low.
- A liquid with high vapour pressure would be less sensitive to changes in pressure and may result in a slower rise of the manometric fluid. Thus, a fluid with low vapour pressure is favourable.
- So, A manometric liquid should suitably have high density & Low Vapour pressure.

56. For a boundary layer, the shape factor (H) is defined as _____.

- A. $\frac{\delta}{\theta}$
 B. $\frac{\delta^*}{\theta}$
 C. $\frac{\theta}{\delta}$
 D. $\frac{\theta}{\delta^*}$

Ans. B

Sol. Where δ^* is displacement thickness, δ = boundary layer thickness and θ is momentum thickness.

$$\text{Shape factor (H)} = \frac{\text{Displacement thickness}(\delta^*)}{\text{Momentum thickness}(\theta)}$$

- H is always greater than one.

57. Stream line is defined as _____

- A. the line that shows the instantaneous positions of all fluid particles that have passed through a given point
- B. an imaginary line, the tangent to which at any point indicates the direction of motion at that point
- C. the line joining the points of equal potential on adjacent flow line
- D. an imaginary line, the normal to which at any point indicates the direction of motion at that point

Ans. B

Sol. Stream lines are the family of curves that are instantaneously tangent to the velocity vector of the flow. These shows the direction a fluid element will travel in at any point. Hence, the correct answer is option (B).

58. In the Laminar flow, if the velocity is doubled then the head loss due to friction is

- A. Twice
- B. Half
- C. Four times
- D. One-fourth time

Ans. A

Sol.

for laminar flow,

$$h_f = \frac{32\mu\bar{u}L}{\rho g d^2} \Rightarrow h_f \propto \bar{u}$$

$$\frac{h_{f2}}{h_{f1}} = \frac{\bar{u}_2}{\bar{u}_1} \Rightarrow \frac{h_{f2}}{h_{f1}} = \frac{2\bar{u}_1}{\bar{u}_1} = 2$$

so on doubling the velocity of flow, head loss will be doubled.

59. Fluid resistance causes damping which is known as _____

- A. Resistance damping
- B. Fluid damping
- C. Viscous damping
- D. Liquid damping

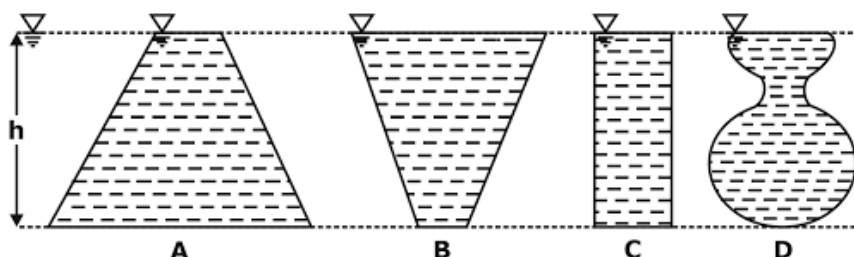
Ans. C

Sol.

- Damping due to the resistance offered by the fluid is known as viscous damping.
- This is because of the reduction in the amplitude caused by the viscous forces of the fluid.

60. Which container is having maximum pressure at bottom of container _____?

(with all having same liquid)?



- A. A & C having same pressure
- B. D
- C. Data insufficient
- D. All having same pressure

Ans. D

Sol.

- The pressure at any point depends only upon the depth below the free surface and unit weight of the liquid.
 - The pressure does not depend upon the size and shape of the container.
- Hence, the pressure at the bottom of all containers will be same if they are filled with same liquid up to the same height.

61. Reynolds number is the ratio of_____.

- A. Square root of Inertia force and viscous force.
- B. Viscous force and inertia force
- C. Inertia force and viscous force.
- D. Inertia force and gravity force.

Ans. C

Sol.

- Reynolds number is dimensionless number and it is the ratio of inertia force and viscous flow.
- We can differentiate between laminar and turbulent flow with the help of Reynolds Number.

62. The excess pressure inside the soap bubble of 50 mm diameter is 2.5 N/m² above the atmosphere. Estimate the surface tension of the soap film _____.

- A. 0.0456N/m
- B. 0.080 N/m
- C. 0.01562 N/m
- D. 0.189 N/m

Ans. C

Sol. For a soap bubble, the pressure in excess of outside pressure is given by:

$$P_i - P_o = \frac{8\sigma}{d}$$

Given: $P_i - P_o = 2.5 \text{ N/m}^2$

$d = 50 \text{ mm} = 0.05 \text{ m}$

$$2.5 = \frac{8\sigma}{50 \times 10^{-3}}$$

$$\sigma = \frac{2.5 \times 50 \times 10^{-3}}{8} = 0.01562 \text{ N/m}$$

63. A horizontal water jet ejected from a nozzle has cross sectional area 3cm² and Given velocity 10m/s strikes a vertical plate which is moving towards the nozzle at 2m/s. What is the force acting on the plate?

- A. 34.26N
- B. 24.2N
- C. 12N
- D. 43.2N

Ans. D

Sol. Given:

$$V = 10\text{ms/s}, \quad u = -2\text{m/s}$$

$$A = 3\text{cm}^2$$

Since the force is given by:

$$F = \rho A(V-u)^2$$

$$F = 1000 \times 3 \times 10^{-4} (10 - (-2))^2$$

$$F = 43.2\text{N}$$

64. Consider fully developed flow in a circular pipe with negligible entrance length effects. Assuming the mass flow rate, density and friction factor to be constant, if the length of the pipe is doubled and the diameter is halved, the head loss due to friction will increase by a factor of _____.

A. 4

B. 16

C. 32

D. 64

Ans. D

Sol. Given:

friction factor (f), flow rate(Q), and density are constant.

so the only variables are length (L) and diameter (D) of the pipe

$$h_f \propto \frac{L}{D^5}$$

$$\frac{h_{f1}}{h_{f2}} = \frac{L_1 D_2^5}{L_2 D_1^5} = \frac{L}{2L} \times \left(\frac{D_2}{D_1}\right)^5 = \frac{1}{2} \times \left(\frac{D}{2D}\right)^5$$

$$h_{f2} = 2^6 h_{f1}$$

$$h_{f2} = 64 h_{f1}$$

65. In turbulent flow, Prandtl's mixing length signifies

A. the magnitude of turbulent kinetic energy

B. the ratio of mean free path to characteristic length of the flow field

C. the wavelength corresponding to the lowest frequency present in the flow field

D. the average distance perpendicular to the mean flow covered by the mixing particles

Ans. D

Sol. Mixing Length: distance that a lump of fluid travels before losing its own momentum and acquiring the momentum of new layer

66. A tool used in cutting an external thread is called a _____.

A. Twist drill

B. Tap

C. Die

D. End mill

Ans. C

Sol.

- Thread cutting is a process that produces a helical ridge of uniform section on the workpiece.
 - External threads are made with the help of a threading die or die-stock.
 - The process of making internal threads is called the tapping and internal threads are cut by serial taps or by nut taps.
67. Which of the below mentioned is not an advantage of cold working process _____?
- A. Less scaling and decarburization.
 - B. Heating of work piece never required.
 - C. Less force and power requirement
 - D. Better accuracy and surface finish.

Ans. C

Sol.

- Cold working is any metalworking process in which metal is shaped below its recrystallization temperature.
- Cold working process need high force and power requirements.
- Better surface finish and better dimensional control is achieved; therefore, no secondary machining is generally needed.
- Better strength, fatigue, and wear properties of material.
- Higher forces are required for deformation, thus heavier and more powerful equipment is required.

68. The mechanism on which servo motor works _____.
- A. Open loop
 - B. Closed loop
 - C. Both Open loop and Closed loop
 - D. None of the above

Ans. B

Sol.

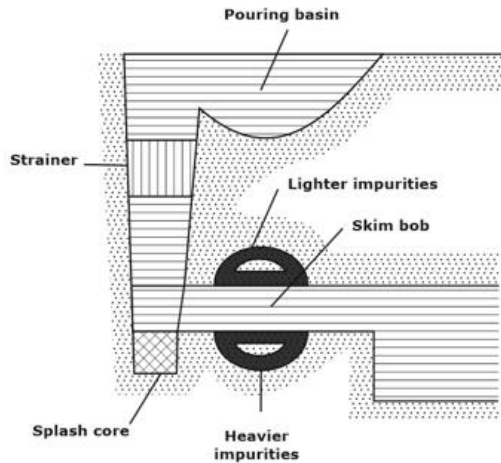
- Servo motor works on the Pulse Width Modulation (PWM) principle i.e., its angle of rotation is controlled by the duration of pulse applied to its control PIN.
- A servo motor is a closed-loop servomechanism that uses position feedback to control its motion and final position.

69. Which of the following has correct sequence in gating design _____.
- A. Sprue→ Runner→splash core→skim bob
 - B. Sprue→ sprue base well→gate→strainer
 - C. Splash core→ Runner→skim bob→strainer
 - D. Pouring Basin→strainer →sprue→splash core

Ans. D

Sol. Correct sequence of the Gating design is:

Pouring Basin →strainer → Sprue →splash core →runner →skim bob →gate →cavity



70. Which of the following is an independent variable in the cutting process?

- A. Surface finish
- B. Force or power requirements
- C. Maximum temperature in cutting
- D. Lubrication

Ans. D

Sol. Dependent variable:

Force or power requirements, maximum temperature in cutting, Surface finish

Independent variable:

Lubrication

So, the correct option is (d).

71. Arc blow is _____.

- A. A casting defect
- B. A welding defect
- C. A forging defect
- D. A fitting defect

Ans. B

Sol.

- Arc blow is the undesirable effect of arc stream wandering from the shortest path between the electrode and the workpiece and is deflected forward or backward from the direction of travel.
- It is due to both the magnetic and thermal effects.

72. In a machining operation, doubling the cutting speed reduces the tool life to (1/8)th of the original value. The exponent n in Taylor's tool life equation_____.

- A. 1/8
- B. 1/4
- C. 1/3
- D. 1/2

Ans. C

Sol.

By Taylor tool life equation,

$$V_1 T_1^n = V_2 T_2^n$$

$$VT^n = 2V \left(\frac{T}{8} \right)^n$$

$$8^n = 2$$

$$n = \frac{1}{3}$$

73. Which of the following components are manufactured by the sheet metal forming process?

- A. Engine blocks
- B. Connecting rods
- C. Electric wires
- D. Car bodies

Ans. D

Sol. Sheet metal forming is a process which uses ductile materials like aluminium or low carbon steel to form lightweight products with versatile features. Car bodies are mainly manufactured by sheet metal forming by performing operations like shearing, slitting, cutting, or sawing of thin metal plates. This method is also used for making parts like beverage cans, metal desks, appliances etc.

74. Which of the following is a surface finishing operation?

- A. Drilling
- B. Honing
- C. Milling
- D. Turning

Ans. B

Sol.

- Honing is a surface finishing operation used to give better surface finish and have very small material removal rate.
- **Honing and Lapping** both are abrasive processes which are used to produce surface finishes with very high accuracy.

75. Strain hardening is due to _____.

- A. Fracture mechanism
- B. Dislocation mechanism
- C. Twinning mechanism
- D. twist mechanism

Ans. B

Sol.

- Strain hardening (also called work-hardening or cold-working) is the process of making a metal harder and stronger through plastic deformation.
- Due to work hardening, additional dislocations are generated. Now the more they will interact and become pinned or tangled due to additional dislocations. Thus, it will result in decrease in the mobility of the dislocations and a strengthening of the material.

76. In a gating system, the ratio of sprue base area: runner area: ingate area is 1:2:4. Thus, it should be a_____.

- A. pressurized gating system
- B. non-pressurized gating system
- C. both A and B
- D. none of the above

Ans. B

Sol. **Non pressurized gating system:**

- A non-pressurised gating system has choke area (minimum area) at the bottom of the sprue base and have total runner area and in-gate areas higher than the sprue area.
- In this system, there is no pressure existing in the metal-flow system and thus it helps to reduce turbulence. Due to low turbulence oxides formation will not takes place thus we can **cast Non-Ferrous alloys such as aluminium and magnesium alloys.**
- The gating ratio of a typical example are Sprue: Runner: In-gate:: 1:4:4, 1:2:2, 1:2:4, 0.5:1.5:1

77. _____ operation is usually performed after polishing.

- A. Lapping
- B. Buffing
- C. Honing
- D. All of the above

Ans. B

Sol.

- **Buffing** is similar to the polishing operation in appearance but its function is different. It is used to produce surfaces with high luster. It is usually performed after polishing.
- **Honing and Lapping** both are abrasive processes which are used to produce surface finishes with very high accuracy.

78. Which of the following is used as a dielectric medium in EDM _____?

- A. Salt solution
- B. Silicon carbide solution
- C. Al₂O₃ solution
- D. Kerosene

Ans. D

Sol.

- Electrical Discharge Machining (EDM) is a controlled metal-removal process that is used to remove metal by means of **electric spark erosion.**
- The electrode and the work piece are both submerged in **a dielectric fluid**, which is generally **light lubricating oil such as kerosene.**
- Any material that is **electrically conductive** can be cut using the EDM process.

79. Grain number of grinding wheel is ____ to grain size.

- A. Directly proportional
- B. Inversely proportional
- C. Does not depend
- D. None of the mentioned

Ans. B

Sol. $Grain\ number = \frac{1}{Grain\ size}$, hence grain number is inversely proportional to grain size. The larger the size of the grains, the more will be the material removal capacity, but the quality of the surface finish deteriorates. Thus, the grain size is determined primarily by surface quality requirement.

80. In casting shape factor is given by _____, (where L = length , W=width, T= thickness).
- A. $(L+T)/W$ B. $(L+W)/T$
C. $(T+W)/L$ D. none of these

Ans. B

Sol. Shape factor of a casting is given as:

$$SF = \frac{L+W}{T}$$

where:

L = length

W=width

T= thickness

81. In a CNC machine tool, the function of an interpolator is to generate _____.
- A. NC code from the part drawing during post processing.
B. error signal for tool radius compensation during machining.
C. signal for the lubrication pump during machining
D. reference signal prescribing the shape of the part of the machined.

Ans. D

Sol.

- The interpolator coordinates the motion along the machine axes, which are separately driven, by providing reference positions instant by instant for the position-and velocity-control loops, to generate the required machining path.
- Typical interpolators are capable of generating linear and circular paths.

82. As per the definition of Gibb’s phase rule, in a binary system, the number of Degree of Freedom (D.O.F) of a eutectic point is _____.
- A. 0 B. 1
C. 2 D. 3

Ans. A

Sol. We know by Gibb’s Phase rule:

$$\rightarrow P + F = C + 1 \text{ (since Pressure is kept constant, we use } P + F = C + 1 \text{)}$$

$$\therefore F = C + 1 - P$$

At Eutectic point: P = 3 and C = 2 (for binary system)

Thus, F = 0

$$F = 2+1 -3 =0$$

83. The total area under the stress-strain curve of a mild steel specimen tested up to failure under tension is a measure of its _____.
- A. Breaking strength B. Toughness
C. Hardness D. Stiffness

Ans. B

Sol.

- Area under stress strain diagram of any specimen tell us energy stored till failure.
- For a mild steel specimen up to elastic limit area is known as resilience while area under stress strain curve up to fracture is known as toughness.

84. The structure of α - iron in iron carbon diagram is _____.

- A. FCC B. BCC
C. tetragonal D. orthorhombic

Ans. B

Sol. Different allotropic forms of Iron and their crystal structure:

Iron Phase	Crystal Structure
α - Iron	BCC structure
γ - Iron	FCC Structure
δ - Iron	BCC

85. In Normalizing cooling is done in which of the following medium?

- A. Air B. Water
C. Oil D. Furnace

Ans. A

Sol.

- Cooling rate is medium during normalizing and hence air cooling is done.
- It imparts hardness to iron and help in forming fine grain structure.

86. A metric thread of pitch 3mm and diameter 30mm, inspected for its pitch diameter using 2- wire method. The diameter of best size wire (in mm) is_____.

- A. 1.44 B. 2.88
C. 1.73 D. 0.72

Ans. C

Sol. Given,

Thread of pitch = 3mm

For metric thread included angle is taken 60°

Best wire size,

$$d = \frac{P}{2} \sec\left(\frac{\alpha}{2}\right)$$

$$= \frac{3}{2} \sec\left(\frac{60}{2}\right)$$

$$= 1.732$$

$$d = 1.732 \text{ mm}$$

87. Plug gauge is used to measure_____.

- A. Shaft size B. Hole size
C. Wire thickness D. Depth of threads

Ans. B

Sol.

- It is in the form of a solid plug and is used for testing the diameters of holes.
- The GO plug gauge is the size of the low limit of the hole while the NOT GO plug gauge corresponds to the high limit of the hole.



88. Which of the following is not a linear measurement device_____.

- | | |
|----------------|---------------------|
| A. Screw gauge | B. Slip gauges |
| C. Comparators | D. Bevel Protractor |

Ans. D

Sol.

- Bevel Protractor is an angular measurement device, used for angle measurement.

89. Feeler gauges are used for measuring the_____.

- A. Thickness of metal sheet
- B. Clearances between mating parts
- C. Pitch of screw threads
- D. Radius of curvature

Ans. B

Sol.

- Feeler gauges are a collection of thin sheets of different sizes used to measure clearance between various mating parts.

90. A shaft of size $25^{+0.020}_{-0.020}$ mm mate with hole of size $25^{+0.02}$ mm then maximum possible clearance (in mm)in the assembly will be_____.

- | | |
|---------|---------|
| A. 0.02 | B. 0.04 |
| C. 0.06 | D. 0.01 |

Ans. B

Sol. Given,

Shaft of size $25^{\pm 0.02}$ mm ,

Hole of size $25^{\pm 0.02}$ mm

$$\begin{aligned} \text{Maximum possible clearance} &= (\text{higher limits of hole}) - (\text{lower limits of shaft}) \\ &= 25.020 - 24.98 \end{aligned}$$

$$\text{Maximum possible clearance} = 0.04 \text{ mm}$$

91. A die in which blanking and piercing operations can be performed simultaneously is called _____.

- | | |
|-----------------|--------------------|
| A. Simple die | B. Progressive die |
| C. Compound die | D. Combination die |

Ans. C

Sol. **Compound die:** A compound die differs from a progressive die in that it performs two or more cutting operations simultaneously during one stroke of the press at one station only.

Progressive die: It is a kind of multitasking sequence die, which has multiple process such as cutting, bending forming and stretch at different stages every time the ram descends is known as Progressive die.

92. Which of the following is false about comparator ?

- A. Comparator is a form of measuring method.
- B. A comparator is able to give deviation of the dimension from the set dimension.
- C. Cannot measure absolute dimension.
- D. Comparators are not as reliable as other measuring method.

Ans. D

Sol.

- Comparator is another form of linear measuring method, which is quick and more convenient for checking large number of identical dimensions.
- During the measurement, a comparator is able to give the deviation of the dimension from the set dimension.
- Cannot measure absolute dimension but can only compare two dimensions.
- Highly reliable.
- To magnify the deviation, a number of principles are used such as mechanical, optical, pneumatic and electrical.

93. Which of the following represent surface roughness on a drawing?

- A. circles
- B. squares
- C. zig-zag lines
- D. triangles

Ans. D

Sol. Surface roughness often shortened to roughness, is a component of surface texture. It is quantified by the deviations in the direction of the normal vector of a real surface from its ideal form. Surface roughness is representing by triangles on drawing.

94. Which System expresses arithmetic average departure of the surface above and below the mean curve_____.

- A. M-system
- B. E-system
- C. Both a and b
- D. None of the above

Ans. B

Sol.

- The E system expresses the arithmetical departure of a surface both above and below a 'mean' curve.
- This mean curve is developed from a contacting envelope by displacing it to a position, where the areas enclosed by the profile above and below the mean curve are equal.

95. Which limit corresponds to maximum material condition of shaft and hole?

- A. Go limit
- B. No Go limit
- C. Shaft limit
- D. Hole limit

Ans. A

Sol.

- Go limit corresponds to maximum material condition of shaft and hole.
96. What is the dominant direction of the tool marks or scratches in a surface texture having a directional quality, called?
- A. Primary texture B. Secondary texture
C. Lay D. Flaw

Ans. C

Sol.

- Lay or directionality is the direction of the predominated surface pattern and is usually visible to the naked eye.
 - Lay is produced by tool marks or scratches.
 - Flaws or defects are random irregularities, Such as scratches, cracks, holes, depression, seams tears or inclusions.
97. Most commonly used lubrication system in automobiles is the_____.
- A. splash system B. pressure system
C. petrol system D. gravity system

Ans. B

Sol.

- Most commonly used lubrication system in automobiles is the pressure system.
 - Splash system is not sufficient in case of bearing loads are high. In that case splash and pressure feed system may be used.
98. In automobiles, the brakes used in hand braking systems are usually
- A. Internal expanding brakes B. External contracting brakes
C. Disc brakes D. All of these

Ans. B

Sol. In automobiles, the brakes used in hand braking systems are usually externally contracting brakes.

99. The concept of an assembly line to produce automobiles is adopted by.....
- A. Henry Ford B. Ramesh Sarwan
C. T.cuppola D. None of these

Ans. A

Sol. Henry Ford adapted the assembly line of a Chicago slaughterhouse (in which slaughtered animals were picked apart by butchers as they came down a conveyor belt) to his new car plant in Detroit.

100. The differential gear is fitted on rear axle of automobiles; its function is
- A. To rotate the front wheels at different speeds
B. To rotate the back wheels at the same speed during turning
C. To rotate the back wheels at different speeds during turning
D. To permit the two back wheels to rotate at the different speeds when driving in the straight path

Ans. C

Sol. When a vehicle takes a turn, its outer rear wheel covers a greater distance than inner rear wheel. Hence differential gears are used so that both the rear wheel can rotate at different speed.

101. In PERT analysis a critical activity has _____.

- A. Maximum float
- B. Zero float
- C. Maximum cost
- D. Minimum cost

Ans. B

Sol.

- The tasks for the critical path must have zero float.
- But if the tasks have some float, then they go on the non-critical path, which means if this task is delayed the project can still finish on time.

102. Which of the following is the measure of forecast error _____?

- A. Mean absolute deviation
- B. Trend value
- C. Moving average
- D. Price fluctuation

Ans. A

Sol.

- The numerical difference in the forecasted demand and actual demand is known as forecasting error.
- It is measured in terms of mean absolute deviation (MAD) and BIAS.

103. Simplex method is used for_____.

- A. Linear programming
- B. Queuing theory
- C. Network analysis
- D. Value engineering

Ans. A

Sol.

- The Simplex Method or Simplex Algorithm is used for calculating the optimal solution to the linear programming problem.
- The simplex algorithm is an iterative procedure carried systematically to determine the optimal solution from the set of feasible solutions.

104. The fixed cost and the variable cost of production of a product are Rs. 20000 and Rs. 50 per unit, respectively. The demand for the item is 500 units. To break even, the unit price of the items in Rs. should be

- A. 50
- B. 75
- C. 90
- D. 120

Ans. C

Sol. Given,

Fixed cost, $F = 20000$ Rs.

Variable cost, $v = \text{Rs.}50$ per unit,

Demand = $x_{\text{BEP}} = 500$

$$x_{\text{BEP}} = \frac{F}{s - v} \Rightarrow 500 = \frac{20000}{s - 50}$$

$$s = 90\text{Rs./unit}$$

105. In Kendall & Lee Representation a/b/c:d/e/f, where a & c represent_____?

- A. probability distribution for service pattern and service rule
- B. probability distribution for arrival pattern and service rule
- C. probability distribution for arrival pattern and number of server
- D. probability distribution for service pattern and number of server

Ans. C

Sol. we know that,

- a- Probability distribution for arrival pattern
- b- Probability distribution for service pattern
- c- Number of server
- d- Service rule
- e- Size of system
- f- Size of calling population

106. The activity time in PERT is given by

- A. Normal distribution
- B. Beta distribution
- C. Gamma distribution
- D. Poisson distribution

Ans. B

Sol. In PERT activity distribution is Beta distribution

In PERT project distribution is normal distribution.

107. The VED analysis is based on _____.

- A. Usage value(cost)
- B. Criticality of the items
- C. Inventory value
- D. Usage rate

Ans. B

Sol.

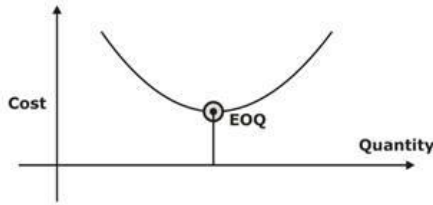
- In VED analysis, the items are classified as vital, essential and desirable as described in the options.
- Vital items, without which the production process would come to a standstill.
- Essential items, which would adversely affect the efficiency of the production system although the system would not altogether stop for want of these items.
- Desirable items, required but may not immediately cause a loss of production.

108. In an infinite replenish inventory control model, at the point of economic order quantity (EOQ), the relation between ordering cost and holding cost is _____.

- A. Ordering cost = Holding cost
- B. Ordering cost > Holding cost
- C. Holding cost > Ordering cost
- D. Ordering cost = Holding cost/2

Ans. A

Sol. At the EOQ:



Holding = Ordering cost

109. Vehicle manufacturing assembly line is an example of _____.

- A. product layout
- B. process layout
- C. manual layout
- D. fixed layout

Ans. A

Sol.

- In product layout the required tools and supplies are located at each section of the assembly line, based on where the product is in production.
- This is common in auto manufacturing where the car being made is moved down the line and stops at stations where different things are assembled.

110. Which of the following is not part of Japanese five principle in TPM (Total productive maintenance) _____?

- A. Self-discipline
- B. Cleanliness
- C. Standardization
- D. Lubrication

Ans. D

Sol. Japanese 5's principle includes:

1. Sort out
2. Self-discipline
3. Standardize
4. Putting things in order
5. Cleaning

111. The layout with a higher material handling effect is a _____.

- A. Product layout
- B. Process layout
- C. Fixed position layout
- D. Group layout

Ans. B

Sol.

- Process layout is characterized by keeping similar machines or similar operations at one location, it is also known as functional layout.
- It is employed for job order production and requires higher material handling effort.

112. The function of Tacho-generator in CNC continuous control loop is –

- A. Reduction of BLV
- B. Faster response of motor
- C. To make 3-D interpolation possible
- D. None of these

Ans. B

Sol. The function of Tacho-generator in CNC continuous control loop is to faster the response of motor.

113. Numerically controlled (NC) machines used what type of input to the system for processing the data and produce the output result ?

- A. stepper motor
- B. punch card
- C. pen drive
- D. floppy disc

Ans. B

Sol.

- o Early, NC machines were often fed with instructions which were punched onto paper tape or punch cards.
- o But on later stage, NC machines are controlled by a computer controller that reads G-code instructions and drives the machine tool and termed as computer numerical control (CNC) machines.

114. In Computer Aided Manufacturing (CAM), preparation of route sheets are done by?

- A. Manufacturing Resource Planning (MRP-II)
- B. Computer Aided Design (CAD)
- C. Computer Aided Process Planning (CAPP)
- D. None of these

Ans. C

Sol. The route sheet listing the operation sequences and workstations required for manufacturing the products and its components are prepared in process planning. These route sheets are prepared now a days using CAPP.

115. There are two types of CNC motion PTP (Point to Point) and contour motion. Which of the following is an example of a point to point motion in a CNC programming?

- A. Drilling
- B. Reaming
- C. Tapping
- D. All of these.

Ans. D

Sol. • In point-to-point (PTP) motion, the end position is designated, but the path used to reach the end position is irrelevant.

Drilling is a PTP motion. Apart from that reaming and tapping are also PTP motions

116. Which of the following is not advantage of CNC machine –

- A. Reduced inspection time
- B. Reduced tooling time
- C. Higher initial cost
- D. Higher rate of production

Ans. C

Sol. Advantages of CNC machine:

1. Higher flexibility
2. Higher productivity
3. Improved quality
4. Reduced scrap rate
5. Reliable and safe operation
6. Reduced inspection time
7. Reduced tooling time

117. A typical Open-loop NC system doesn't contain
- A. NC machine tool
 - B. Feedback device
 - C. Servo-motor
 - D. None of the above

Ans. B

Sol. As compared to a closed loop system, an open loop NC system never contains a feedback mechanism, which is a major drawback due to which the error in the system increases.

118. Through what, CIM allows the computer to assist in minute details and specifications of a customer order or to simulate variation of the order?
- A. Computer Aided Design (CAD)
 - B. Computer Aided Manufacturing (CAM)
 - C. Manufacturing Resource planning (MRP-II)
 - D. None of these

Ans. A

Sol. Through CAD, CIM allows the computer to assist in minute details and specifications of a customer order or to simulate variation of the order. Computer Aided Design is the function that must be completed after a demand for a product has been determined.

119. A point (3, 4) is located in a 2D CAD model drawing. If this point is reflected about X-axis then what is the coordinate of the new point.
- A. (4,3)
 - B. (3,-4)
 - C. (-4,3)
 - D. (-3,-4)

Ans. B

Sol.

The transformation matrix for the reflection about X axis is $= \begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}$

$$\begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix} \times \begin{bmatrix} 3 \\ 4 \end{bmatrix}$$

$$\begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} 3 \\ -4 \end{bmatrix}$$

120. Which of the following is a process planning system based on generative process planning?
- A. METCAPP
 - B. MIAPP
 - C. MIPLAN
 - D. UNIVATION

Ans. A

Sol. Some process planning system based on variant process planning approach are: CAPP, MIPLAN, MIAPP, CINTURN UNIVATION etc.

Some process planning systems based on generative process planning are: METCAPP, CPPP, AUTAP etc.
