

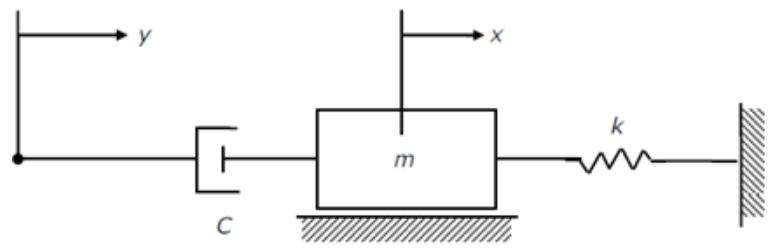
BEL

Mechanical Engineering

Mock Test - 2

Questions & Solutions

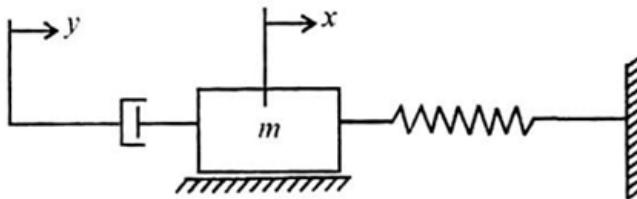
1. The differential equation governing the vibrating system is:



- A. $m\ddot{x} + c\dot{x} + k(x - y) = 0$
- B. $m(\ddot{x} - \ddot{y}) + k(\dot{x} - \dot{y}) + kx = 0$
- C. $m\ddot{x} + c(\dot{x} - \dot{y}) + kx = 0$
- D. $m(\ddot{x} - \ddot{y}) + c(\dot{x} - \dot{y}) + k(x - y) = 0$

Ans. C

Sol.



$$\therefore m \frac{d^2x}{dt^2} + c \left(\frac{dx}{dt} - \frac{dx}{dt} \right) + kx = 0$$

This differential equation governing the above vibrating system.

2. For an under damped harmonic oscillator, resonance

- A. occurs when excitation frequency is greater than undamped natural frequency
- B. occurs when excitation frequency is less than undamped natural frequency
- C. occurs when excitation frequency is equal to undamped natural frequency
- D. never occurs

Ans. B

Sol. In no damping situation resonance occur at $\omega = \omega_n$ but in under damping it occur when $\omega < \omega_n$

3. Select the most appropriate antonym of the given word.

- Enmity
- A. Rivalry
 - B. Amicability
 - C. Animosity
 - D. Proximity

Ans. B

Sol. Enmity = a state or feeling of active opposition or hostility.

Rivalry = a situation in which people, businesses, etc. compete with each other for the same thing.

Amicability = a friendliness or goodwill between people or groups.

Animosity = strong dislike, opposition, or anger.

Proximity = nearness in space, time, or relationship.

So, option B is the correct Ans..

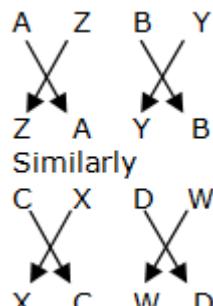
4. In the following question select the related word/letters/number from the given alternative

AZBY : ZAYB : : CXDW : ?

- A. AYZB
- B. EVFU
- C. BYAZ
- D. XCWD

Ans. D

Sol. AZBY : ZAYB



→ CXDW : XCWD

5. Find a word that is the antonym of – STINGY

- A. clumsy
- B. talkative
- C. generous
- D. cheap

Ans. C

Sol. Stingy = unwilling to spend money; small in amount

Clumsy = awkward in movement or in handling things.

Talkative = inclined to talk a great deal

Generous = willing to give money, help, kindness, etc., especially more than is usual or expected

Cheap = low in price, especially in relation to similar items or services

Hence, option C is the correct Ans..

6. Select the most appropriate synonym of the given word.

FASTIDIOUS

- A. Ugly
- B. Shabby
- C. Meticulous
- D. Discourteous

Ans. C

Sol. Fastidious: being careful that every detail of something is correct, meticulous.

Ugly: unattractive, plain, displeasing

Shabby: neglected, uncared-for, ramshackle

Meticulous: showing great attention to detail; very careful and precise.

Discourteous: rude, impolite, ill-mannered

Hence, option C is the correct Ans..

7. Which one of the following is NOT a necessary assumption for the air-standard Otto cycle?

- A. All processes are both internally as well as externally reversible.
- B. Intake and exhaust processes are constant volume heat rejection processes.
- C. The combustion process is a constant volume heat addition process.
- D. The working fluid is an ideal gas with constant specific heats.

Ans. B

Sol. In air-standard Otto cycle intake process is constant volume heat addition process.

8. Which law is used in calculation in black and grey heat transfer?

- A. Stefan-Boltzmann law
- B. Young's Modulus
- C. Keplers law
- D. None of these

Ans. A

Sol. The small blackbody still emits a total heat flow given by the Stefan-Boltzmann law. The small blackbody still emits a total heat flow given by the Stefan-Boltzmann law. However, the small blackbody also receives and absorbs all the thermal energy emitted by the large enclosing blackbody, which is a function of its temperature. If the surface emissivity is independent of wavelength, then the body is called a "gray" body, in that no particular wavelength is favored.

9. Which among the following is correct regarding Mohr's Circle?
- It visualize relationships between normal and shear stresses
 - It estimate the maximum stresses
 - It shows stress and strain transformations
 - All of above

Ans. D

Sol. Mohr's Circle was the leading tool used to visualize relationships between normal and shear stresses, and to estimate the maximum stresses. It illustrates principal stresses and stress transformations in a graphical format.

10. Universal Testing Machine can be used to perform tests on:
- Spring
 - Steel samples
 - Electrical cables samples
 - All of above

Ans. D

Sol. A universal testing machine is used to test the tensile stress and compressive strength of materials. It is named after the fact that it can perform many standard tensile and compression tests on materials, components, and structures. Universal Testing Machine can be used perform tests on Rope, Steel Rope, Winches, Steel Wire, Electrical Wire, Webbing, Spring, Slings, Cable, Nylon Rope, Links, Chain and Steel Chain samples.

11. Which assumptions are incorrect in column theory?
- The column is initially straight and the applied load is truly axial.
 - The material of column is homogeneous, linear and isotropic.
 - The length of the column is small as compared to the cross-sectional dimensions of the column.
 - The cross-section of the column is uniform throughout.

Ans. C

Sol. Column buckling consists of finding maximum load on column which support before it collapses.

Assumption used are:-

- 1) The column is initially straight and the applied load is truly axial.
- 2) The material of column is homogeneous, linear and isotropic.
- 3) The cross-section of the column is uniform throughout.
- 4) The length of the column is large as compared to the cross-sectional dimensions of the column.

12. What has features of Francis Turbine?

- A. It has a circular plate fixed to rotating shaft perpendicular to surface and passing through its center.
- B. The circular plate has curved channels on it called as runner.
- C. The runner is encircled by a ring of stationary channels called as guide vanes.
- D. All of these

Ans. D

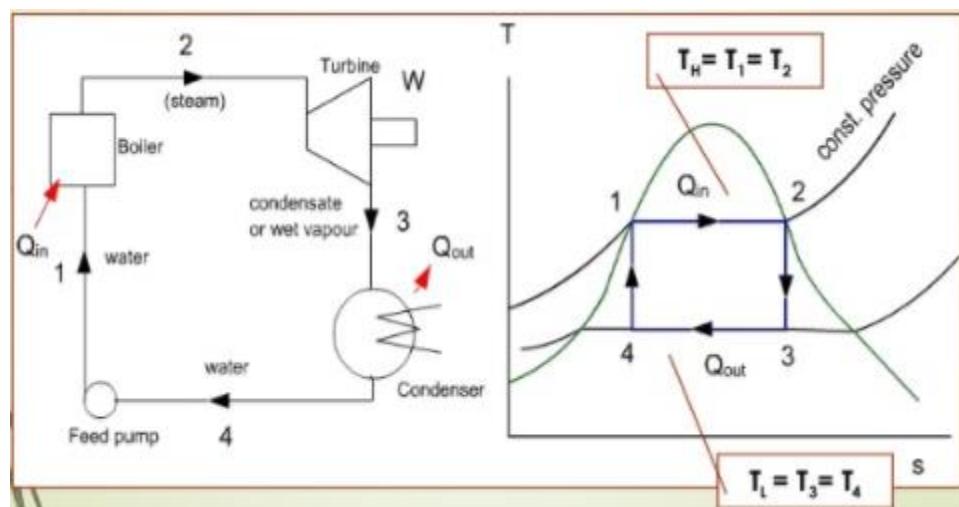
Sol. The major part of pressure drop occurs in the turbine itself, unlike the impulse turbine where complete pressure drop takes place up to the entry point and the turbine passage is completely filled by the water flow.

13. In a Carnot vapour cycle, the thermodynamic process takes place in boiler is:

- A. Isobaric
- B. Isochoric
- C. Isentropic
- D. Polytropic

Ans. A

Sol. It is seen that in a Carnot vapour cycle,



thermodynamic process taking place in boiler is isobaric.

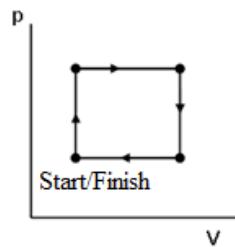
Consider the cycle 2 to 3 which is an Isentropic expansion (Steam turbine)

Cycle 3 to 4 is an Isobaric heat rejection (Condenser)

Cycle 4 to 1: Isentropic compression (Pump)

Cycle 1 to 2 is an Isobaric heat supply (Boiler)

14. A device containing an ideal gas executes the cycle shown.



This is a.

- A. Heat engine
- B. Refrigerator
- C. Neither because the net work done by/on the device is zero
- D. None of above

Ans. A

Sol. It is an Heat Engine where more positive work is done in its environment as it shows outward pressure on expansion. So the heat engines will have capability of converting heat into more useful work output. On the other hand, refrigerator will absorb the work and uses energy to move heat from cold to hot reservoirs.

15. In a spring, if energy is stored in mass, then:

- A. Mass stores kinetic energy
- B. Spring stores potential energy
- C. If energy is pumped into mass and spring, the energy source needs to feed the energy in at a rate equal to the natural frequency.
- D. All of these

Ans. D

Sol. In case of resonance if a spring and mass as energy is stored, then the mass storing kinetic energy and spring storing potential energy is conserved.

16. What is vibration isolator?

- A. It is an elastic mounting system that realized by incorporating
- B. It serves as strategy which lowers noise and vibrations thereby interrupting propagation path among source and receiver.
- C. It is a vibration generating machinery and processes showing total noise and vibration.
- D. All of above

Ans. B

Sol. Vibration Isolator reflects and absorbs waves of oscillatory energy that extends from piece of machinery or electrical equipment and vibrate insulation. It establish vibration isolation among body transferring mechanical fluctuations and support body. Noise and vibrations have undesirable effects on both human quality of life, and on our material goods.

17. What will be the transmission ratio of gear train?

- A. $\mu_M = N_D / N_F = T_F \times T_D$
- B. $\mu_M = N_D / N_F = T_F + T_D$
- C. $\mu_M = N_D / N_F = T_F - T_D$
- D. $\mu_M = N_D / N_F = T_F / T_D$

Ans. D

Sol. When the same direction of rotation is required for both the driver and the follower, an idler wheel is used. Transmission or movement ratio can be expressed as $\mu_M = N_D / N_F = T_F / T_D$

where

μ_M = movement ratio

N_D = revolutions of driver (rpm)

N_F = revolutions of follower (rpm)

T_F = number of teeth on follower

T_D = number of teeth on driver

18. The ratio of Euler's buckling loads of columns with the same parameters having (i) both ends fixed, and (ii) both ends hinged is

- A. 2
- B. 4
- C. 6
- D. 8

Ans. B

Sol. (i) For both ends fixed, $L_{eff} = \frac{L}{2}$

(ii) For both ends hinged $L_{eff} = L$

Euler's buckling load

$$P_{cr} = \frac{\pi^2 \times E\ell}{L_e^2}$$

$$\therefore \frac{(P_{cr})_i}{(P_{cr})_{ii}} = \frac{\pi^2 \times E\ell}{(L/2)^2} \frac{L^2}{\pi^2 E\ell} = 4$$

19. The total area under the stress-strain curve of a mild steel specimen tested up to failure under tension is a measure of

- A. ductility
- B. ultimate strength

- C. stiffness
- D. modulus of toughness

Ans. D

Sol. The total area under tensile stress-strain curve of a specimen upto failure is a measure of modulus of toughness of the material.

20. Which one of the following is a CFC refrigerant?

- A. R744
- B. R290
- C. R502
- D. R7 18

Ans. C

Sol. From all the given refrigerants R502 is the only CFC refrigerant

21. An adjustable blade propeller turbine is called as _____.

- A. Banki turbine
- B. Pelton turbine
- C. Kaplan turbine
- D. Francis-Pelton turbine

Ans. C

Sol. Kaplan turbine has blades mounted on servo motor which can be adjusted in accordance to the flow to maintain high efficiency.

22. In a concentric double-pipe heat exchanger where one of the fluids undergoes phase change

- A. The two fluids should flow opposite to each other
- B. The two fluids should flow parallel to each other
- C. The two fluids should flow normal to each other
- D. The directions of flow of the two fluids are of no consequence

Ans. D

Sol. The capacity ratio becomes zero when one of the fluids undergoes phase change as in this case of condenser or evaporator. So, effectiveness is same for parallel and counter flow heat exchanger. As the effectiveness is same, the direction of flow is no consequence.

23. The equation of effectiveness $\epsilon = 1 - e^{-NTU}$ for a heat exchanger is valid in the case of

- A. boiler and condenser for parallel flow
- B. boiler and condenser for counter flow

- C. boiler and condenser for both parallel flow and counter flow
- D. gas turbine for both parallel flow and counter flow

Ans. C

Sol. In condenser, the vapour gets condensed, hence the heat capacity of hot fluid ($mc_p)_h$ can be assumed to be infinity.

In evaporate, the liquid gets vapourized by taking the required energy. Hence the heat capacity of cold fluid ($mc_p)_c$ can be assumed to be infinity. We get, $\varepsilon = 1 - e^{-NTU}$

24. Find the odd number/letters/number pair from the given alternatives.

- A. Orange
- B. Apple
- C. Potato
- D. Grapes

Ans. C

Sol. Potato is vegetable but remaining are fruits

25. Tooth interference in an external involute spur gear pair can be reduced by

- A. decreasing center distance between gear pair
- B. decreasing module
- C. decreasing pressure angle
- D. increasing number of gear teeth

Ans. D

Sol. Interference is a phenomenon in which the addendum tip of gear undercuts into the dedendum or base circle of pinion. This tooth interference can be reduced by increasing the number of teeth above a certain minimum number. For example, For 20° full depth involute teeth system, minimum number of teeth to avoid interference is 18.

26. The COP of a Carnot heat pump operating between 6°C and 37°C is

- A. 15
- B. 10
- C. 30
- D. 20

Ans. B

Sol. (COP) of Carnot Heat Pump = $\frac{T_H}{T_H - T_L}$

$$= \frac{37 + 273}{31} = 10$$

27. Which of the following is a pressure compounded turbine?

- A. Parsons
- B. Curtis
- C. Rateau
- D. all the three

Ans. C

Sol. Pressure compounding is the method in which pressure in a steam turbine is made to drop in a number of stages rather than in a single nozzle. This method of compounding is used in Rateau and Zoelly turbines.

Curtis – Velocity compounded

Rateau – Pressure compounded

Parsons – Reaction turbine

28. Availability of a system at any given state is

- A. a property of the system
- B. the minimum work obtainable as the system goes to dead state
- C. the total energy of the system
- D. the maximum useful work obtainable as the system goes to dead state

Ans. D

Sol. Availability is defined as the maximum useful work (total work minus pdV work) obtained in a process as system goes to dead state.

29. After interchanging ÷ and × and 12 and 18 with each other, which one of the following equations becomes correct?

- A. $(90 \times 18) \div 12 = 60$
- B. $(18 \times 6) \div 12 = 2$
- C. $(72 \div 18) \times 18 = 62$
- D. $(18 \times 6) \div 12 = 36$

Ans. D

Sol. $(18 \times 6) \div 12 = 36$

$(12 \div 6) \times 18 = 36$

Hence Option D is correct

30. Direction: Select the one which is different from the other three responses.

- A. SORE
- B. SOLTU

- C. NORGAE
- D. MEJNIAS

Ans. C

Sol. These are jumbled words. If rearranged,

- Sore - Rose (Flower)
- Soltu - Lotus (Flower)
- Norgae - Orange (Fruit)
- Mejnias - Jasmine (Flower)

31. A mixture contains wine and water in the ratio 3: 2 and another mixture contains them in the ratio 4 : 5. How many liters of the latter must be mixed with 3 litres of the former so that the resulting mixture may contain equal quantities of wine and water?

- A. $5\frac{2}{5}$ litre
- B. $5\frac{2}{3}$ litre
- C. $4\frac{1}{2}$ litre
- D. $3\frac{3}{4}$ litre

Ans. A

Sol. Short Trick (TD):

ratios of wine:water are

mixture 1 = 3:2

mixture 2 = 4:5

final mixture = 1:1

again making sum of all of them equal, we get

LCM(5,9,2)=90

mixture 1 = 54:36

mixture 2 = 40:50

final mixture = 45:45

now using allegation on wine

54 40

45

5 : 9

5 units = 3 L

1 unit = $3/5$ L

9 units = $27/5$ L

$$= 5 \frac{2}{5} \text{ L}$$

Basic Method:

The first mixture contains wine and water in the ratio of 3:2

=> 3 liters of first mixture has 1.8 liters of wine and 1.2 liters of water. (To maintain the 3:2 ratio)

Let us say that the first mixture is mixed with the second mixture that has quantity as $9x$ liters (4x liters of wine and 5x liters of water).

After mixing,

Total quantity of wine = Total quantity of water

$$=> 1.8 + 4x = 1.2 + 5x$$

$$=> x = 0.6 \text{ liters}$$

$$=> 9x = 9 \times 0.6 = 5.4 \text{ liters}$$

We need 5.4 liters or $5 \frac{2}{5}$ liters of second mixture to get equal quantities of water and wine.

Hence option A is correct

32. Which one of the given responses would be a meaningful order of the following words?

1. Type
 2. Print
 3. Open
 4. Save
 5. Close
- A. 3, 4, 1, 2, 5
B. 3, 5, 4, 2, 1
C. 3, 1, 4, 2, 5
D. 3, 2, 1, 4, 5

Ans. C

Sol. For any document or file it has to be opened first, then typing is done, then the document is saved, Then the print is taken and then it is closed

Hence option C is correct

33. Due to an increase of 50% in the price of eggs, 4 eggs less are available for ₹ 24. The present rate of eggs per dozen is:

- A. ₹ 24
B. ₹ 27

- C. ₹ 36
- D. ₹ 42

Ans. C

Sol. Short Trick:

Ratio of price increase: 2 : 3
Ratio of decrease in quantity: 3 : 2
Difference of 1 is equal to 4
So, quantity after decrease = 8 eggs
8 eggs in 24, So Rs 3 per egg
Dozen egg = $12 \times 3 = 36$ Rs

Alternate Method:

The original price of 1 egg = ₹ x

$$\text{Present price} = ₹ \frac{3}{2}x$$

$$\therefore \frac{24}{x} - \frac{24}{\frac{3x}{2}} = 4$$

$$\frac{24}{x} \left(1 - \frac{2}{3}\right) = 4$$

$$\frac{8}{x} = 4$$

$$x = \frac{8}{4} = 2$$

$$\therefore \text{Present price of eggs per dozen} = 12 \times \frac{3}{2} \times 2 = ₹ 36$$

34. Blade erosion in steam turbines takes place

- A. Due to high temperature steam
- B. Due to droplets in steam
- C. Due to high rotational speed
- D. Due to high flow rate

Ans. B

Sol. Near the exit of the turbine, steam is usually wet. The water particles in wet steam have no capacity to do work but they are to be carried along with the steam and some kinetic energy is lost in dragging them. Further the impact of water droplets reduce life of the turbine blade as they cause erosion of blades.

35. Which one of the following statements is not correct for a regenerative steam cycle?

- A. It increases the thermodynamic efficiency
- B. It reduces boiler capacity for a given output
- C. It reduces temperature stresses in the boiler due to hotter feed
- D. The efficiency increases with increases number of feed heaters

Ans. B

Sol. Due to regeneration, work output decreases due to less amount of flow of steam. For a fixed output, high amount of steam is required, thus boiler capacity increases.

36. The average age of A and B is 20 years if A is to be replaced by C, the average would be 19 years. The average age of C and A is 21 years. The ages of A, B and C in order (in years) are

- A. 18, 22, 20
- B. 18, 20, 22
- C. 22, 18, 20
- D. 22, 20, 18

Ans. C

Sol. $A + B = 2 \times 20 = 40$

$C + B = 2 \times 19 = 38$

$C + A = 2 \times 21 = 42$

On adding all the three;

$$2(A+B+C) = 40+38+42 = 120$$

$$\Rightarrow A+B+C = 60$$

Therefore;

$$A = (A+B+C) - (B+C) = 60-38 = 22 \text{ years}$$

$$B = (A+B+C) - (A+C) = 60-42 = 18 \text{ years}$$

$$C = (A+B+C) - (A+B) = 60-40 = 20 \text{ years}$$

Hence Option C is correct

37. In the following question, select the odd number from the given alternatives.

- A. 729
- B. 144
- C. 343
- D. 512

Ans. B

Sol. $728 = 9 \times 9 \times 9$

$$343 = 7 \times 7 \times 7$$

$$512 = 8 \times 8 \times 8$$

$$\text{But, } 144 = 12 \times 12$$

Here, except the number 144, all other numbers are perfect cubes.

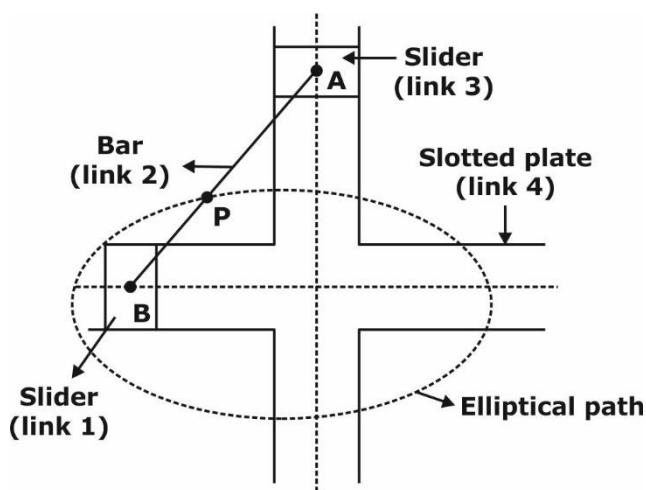
Hence, option B is correct.

38. Which one of the following mechanism is an inversion of double slider-crank chain?

- A. Elliptic trammels
- B. Beam engine
- C. Oscillating cylinder engine
- D. Coupling rod of a locomotive

Ans. A

Sol.



39. Consider the following statements pertaining to an example for a cylindrical pair

- 1) Piston and cylinder of an IC engine
- 2) Shaft supported by a foot step bearing
- 3) Doctor's injection syringe
- 4) A screw driver operating on a screw

Which of these statements are correct?

- A. 1 and 4
- B. 2 and 3
- C. 1 and 3
- D. 3 and 4

Ans. B

Sol. Cylindrical Pair: A cylindrical pair allows both rotation and translation between elements 1 and 2, which can be expressed as two independent coordinates angle 'theta' and 'S'. Thus a cylindrical pair has two degrees of freedom.

40. The static deflection of a shaft under a flywheel is 4 mm. Taking $g=10 \text{ m/s}^2$, What is the critical speed in rad/s?

- A. 50
- B. 20
- C. 10
- D. 5

Ans. A

Sol. Given,

$$\text{static deflection of a shaft} = 4\text{mm} = 0.004 \text{ m}$$

$$\text{Critical speed in rad/s} = \sqrt{\frac{g}{\delta}} = \sqrt{\frac{10}{4 \times 10^{-3}}} = 50 \text{ rad/sec}$$

41. Which one of the following causes whirling of shafts?

- A. Non-homogeneity of shaft material
- B. Misalignment of bearing
- C. Fluctuation of speed
- D. Internal damping

Ans. A

Sol. The whirling action occurs due to many reasons. However, the most valid reasons is the mass unbalance in rotating system, non-homogeneity of the material and manufacturing tolerances.

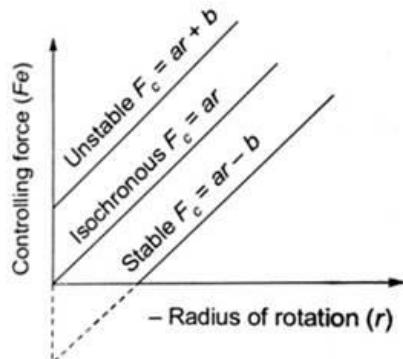
42. The governor becomes isochronous, when

- A. $F = ar + b$
- B. $F = ar - b$
- C. $F = ar^2 + b$
- D. $F = ar$

Where F is controlling force, r is radius of rotation for governor balls and a, b are constant.

Ans. D

Sol.



43. In a watt governor the weight of the ball is 50 N and the friction at the sleeve is 10 N. The coefficient of detention would be:

- A. 5.0
- B. 0.5
- C. 0.2
- D. 0.1

Ans. C

Sol. Coefficient of detention by friction

$$= \frac{f}{Mg} = \frac{\text{Friction force at sleeve}}{\text{Weight of ball}}$$

$$\therefore \text{coefficient of detention} = \frac{10}{50} = 0.2$$

44. The discharge of hydrocarbons from petrol automobile exhaust is minimum when the vehicle is

- A. Idling
- B. Cruising
- C. Acceleration
- D. Decelerating

Ans. B

Sol. It is minimum when vehicle is Acceleration

45. The Poisson's equation of general conduction heat transfer applies to the case

- A. steady state heat conduction with heat generation
- B. steady state heat conduction without heat generation
- C. unsteady state heat conduction without heat generation
- D. unsteady state heat conduction with heat generation

Ans. A

Sol. Generalized heat conduction equation is

$$\nabla^2 T + \frac{q_G}{k} = \frac{1}{\alpha} \frac{\partial T}{\partial t}$$

Laplace's equation, $\nabla^2 T = 0$

$$\text{Poisson's equation, } \nabla^2 T + \frac{q_G}{k} = 0$$

$$\text{For Steady state, } \frac{1}{\alpha} \frac{\partial T}{\partial t} = 0$$

So, Poisson's equation applies to steady state heat condition with heat generation.

46. What is the critical radius of insulation for a sphere equal to_____?

Where k = Thermal conductivity of insulation

h = Convective heat transfer coefficient

A. $2 kh$

B. $\frac{2k}{h}$

C. $\frac{k}{h}$

D. $\sqrt{2kh}$

Ans. B

Sol. Critical radius of insulation for sphere is $\frac{2k}{h}$

Where k = Thermal conductivity of insulation

h = Convective heat transfer coefficient

47. What is the main advantage of hydro-dynamic bearing over roller bearing?

A. Easy to assemble

B. relatively low price

C. Superior load carrying capacity at higher speeds

D. Less frictional resistance

Ans. C

Sol. The main advantage of journal bearing is the they carry very high load at higher speed due to hydrodynamic pressure developed by the film.

48. Which of the following processes has very high material removal rate efficiency?

A. Ultrasonic Machining

B. Electrochemical machining

C. Electron discharge matching

D. Laser Beam Machining

Ans. B

Sol. Among all the machining processes given above, Plasma arc machining has highest rate of metal removal.

- Generally the rate of metal removal for various machining processes are as follows:

1. Electric Discharge Machining (EDM) has metal removal rate of about $10\text{-}20 \text{ mm}^3/\text{s}$.

2. Electro-Chemical Machining (ECM) has the metal removal rate of about $200\text{-}300 \text{ mm}^3/\text{s}$.

3. Ultrasonic Machining (USM) has metal removal rate of about $5\text{-}10 \text{ mm}^3/\text{s}$.

4. Laser Beam Machining (LBM) has the lowest metal removal rate of about $0.001\text{-}0.002 \text{ mm}^3/\text{s}$.

5. Chemical Machining (CHM) has metal removal rate of about $0.15\text{-}30 \text{ mm}^3/\text{s}$.

49. Match List-I (Forging/Technique) with List-II (Process) and select the correct Ans. using the code given below the lists:

List-I

- A). Smith Forging
- B). Drop Forging
- C). Press Forging
- D). Machine Forging

List-II

- 1. Material is only upset to get the desired shape
 - 2. Carried out manually in open dies
 - 3. Done in closed impression dies by hammers in blows
 - 4. Done in closed impression dies by continuous squeezing force
- A. A-2, B-3, C-4, D-1
 - B. A-4, B-3, C-2, D-1
 - C. A-2, B-1, C-4, D-3
 - D. A-4, B-1, C-2, D-3

Ans. A

Sol. Smith Forging: Carried out manually in open dies

Drop Forging: Done in closed impression dies by hammers in blows

Press forging: Done in closed impression dies by continuous squeezing force

Machine Forging: Material is only upset to get the desired shape

50. What does hydrostatic pressure in extrusion process improve?

- A. Ductility
- B. Compressive strength
- C. Brittleness
- D. Tensile strength

Ans. A

Sol. Hydrostatic pressure increases the ductility of the material. Therefore, brittle material can be extruded by this method.

51. A, B, C, D, and E are five rivers. A is shorter than B but longer than E. C is one longest and D is little shorter than B and little longer than A. Which is the shortest river?

- A. B
- B. C
- C. D
- D. E

Ans. D

Sol. According to decreasing in length, they are as follow-

$$C > B > D > A > E$$

Thus, E is the shortest river.

Hence, option D is correct.

52. In the following question, select the related word/letters/number from the given alternatives.

Window : Pane :: Book : ?

- A. Novel
- B. Glass
- C. Cover
- D. Page

Ans. D

Sol. Pane is smaller compartment or side of a window. Similarly, pages are components of a book.

53. Direction: In the following question, select the related word/letters/number from the given alternatives.

Hen : Egg :: Tree : ?

- A. Bark
- B. Seed
- C. Leaves
- D. Rain

Ans. B

Sol. Hen lays egg and egg develops into its offspring. Similarly, tree produces seeds which germinate into sapling.

54. From the given alternatives, select the word which cannot be formed using the letters of the given word.

BANGALORE

- A. GARBAGE
- B. ORANGE
- C. LARGE
- D. BANGLE

Ans. A

Sol. There is only one 'G' in the given word. Therefore, the word GARBAGE cannot be formed.

55. The region of the z plane for which $\left| \frac{z-a}{z+a} \right| = 1$ ($\operatorname{Re} a \neq 0$) is

- A. x-axis
- B. y-axis
- C. The straight line $z = |a|$
- D. None of the above

Ans. B

Sol. Let $Z = x + iy$

$$\begin{aligned}
 \frac{|z-a|}{|z+a|} &= 1 \\
 |z-a| &= |z+a| \\
 |z-a|^2 &= |z+a|^2 \\
 |x+iy-a|^2 &= |x+iy+a|^2 \\
 (x-a)^2 + y^2 &= (x+a)^2 + y^2 \\
 x^2 - 2ax + a^2 &= x^2 + 2ax + a^2 \\
 x &= 0
 \end{aligned}$$

Hence the region of Z-Plane will be y-axis.

56. If $u = \log(\tan x + \tan y)$, then $\sin 2x \frac{\partial u}{\partial x} + \sin 2y \frac{\partial u}{\partial y}$ is

- A. 1
- B. -2
- C. 2
- D. -1

Ans. C

Sol. $u = \log(\tan x + \tan y)$

$$\frac{\partial u}{\partial x} = \frac{\sec^2 y}{\tan x - \tan y} \quad \dots\dots\dots (i)$$

$$\frac{\partial u}{\partial y} = \frac{\sec^2 x}{\tan x + \tan y} \quad \dots\dots\dots (ii)$$

$$\begin{aligned}
 &\sin 2x \frac{\partial u}{\partial x} + \sin 2y \frac{\partial u}{\partial y} \\
 &= 2 \left(\text{put } \frac{\partial u}{\partial x} \text{ and } \frac{\partial u}{\partial y} \text{ from equation (i) and (ii)} \right)
 \end{aligned}$$

57. The value of the determinant given below is _____.

$$\begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & 1+a & 1 & 1 \\ 1 & 1 & 1-b & 1 \\ 1 & 1 & 1 & 1+c \end{bmatrix}$$

- A. -abc
- B. abc
- C. 1
- D. 0

Ans. A

Sol. Given determinant:

$$I = \begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & 1+a & 1 & 1 \\ 1 & 1 & 1-b & 1 \\ 1 & 1 & 1 & 1+c \end{bmatrix}$$

$R_2 \Rightarrow R_2 - R_1$, $R_3 \Rightarrow R_3 - R_1$ and $R_4 \Rightarrow R_4 - R_1$

$$I = \begin{bmatrix} 1 & 1 & 1 & 0 \\ 0 & a & 0 & 0 \\ 0 & 0 & -b & 0 \\ 0 & 0 & 0 & c \end{bmatrix}$$

$$I = 1 \begin{vmatrix} a & 0 & 0 \\ 0 & -b & 0 \\ 0 & 0 & c \end{vmatrix} - 0 + 0 - 0$$

$$I = a(-bc) - 0 + 0 = -abc$$

58. In a fluid machinery, the relationship between saturation temperature and pressure decides the process of

- A. Flow separation
- B. Cavitation
- C. Turbulent mixing
- D. Water hammer

Ans. B

Sol. The formation of an empty space within a solid object or body. The relationship between saturation temperature and pressure decides the process of Cavitation

59. Engineering strain of a mild steel sample is recorded as 0.100%. The true strain is _____.

- A. 0.010%
- B. 0.055%

- C. 0.0999%
- D. 0.101%

Ans. C

Sol. Engineering strain is given by:

$$e = \frac{L_f - L_o}{L_o}$$

Given: $e = 0.1\% = 0.001$

Engineering and true strain relationship is given by:

$$\text{True Strain} = \ln(1 + e)$$

$$\therefore \text{True Strain } (\varepsilon_T) = \ln(1.001) = 0.000999$$

$$\varepsilon_T = 0.099\%$$

60. A and B can do a piece of work in 10 days and 5 days respectively. They start together but B works for 2 days and then left. In how many days A completes the remaining work?

- A. 6
- B. 4
- C. 3
- D. 5

Ans. B

Sol. Let total work = LCM of (10, 5) = 10 unit

$$\text{Effi. of A} = 10/10 = 1 \text{ unit}$$

$$\text{and Effi. of B} = 10/5 = 2 \text{ unit}$$

$$\text{Work of (A+B) of 2 days} = (1+2) \times 2 = 6 \text{ unit}$$

$$\text{Remaining work} = 10 - 6 = 4 \text{ unit}$$

$$\text{Time taken by A to complete remaining work} = 4/1 = 4 \text{ days.}$$

61. The speed of the current is 2 km /h. A boat goes 20 km upstream and back again to the starting point in 110 min. What is the speed of the boat in still water?

- A. 25 km/h
- B. 22 km/h
- C. 15 km/h
- D. 19 km/h
- E. 16 km/h

Ans. B

Sol. Let the speed of the boat in still water be x km/h.

\therefore Speed of the boat in the direction of current = $(x + 2)$ km/h and speed of the boat against the current = $(x - 2)$ km/h

∴ According to the question,

$$\frac{20}{x+2} + \frac{20}{x-2} = \frac{110}{60}$$

$$\frac{20(x-2+x+2)}{(x+2)(x-2)} = \frac{11}{6}$$

$$\frac{40x}{x^2 - 4} = \frac{11}{6}$$

$$11x^2 - 44 = 240x$$

$$11x^2 - 240x - 44 = 0$$

$$(x-22)(11x+2) = 0$$

$$x - 22 = 0 \Rightarrow x = 22 \text{ km/h}$$

Here factors of quadratic equations are 242 and 2

62. If 35% of a number is subtracted from another number the second number reduces to its three-fourths. What is the ratio between the second number and the first number?

- A. 8 : 5
- B. 7 : 5
- C. 5 : 7
- D. 5 : 8

Ans. B

Sol. Let the first number = X

and second number = Y

According to the question,

$$y - \frac{7}{20}x = \frac{3}{4}Y \Rightarrow \frac{Y}{4} = \frac{7}{20}x$$

$$\therefore Y : X = 7 : 5$$

63. The simple interest at $x\%$ for x yr will be Rs. x on a sum of

- A. Rs. x
- B. Rs. 100 x
- C. Rs. $\left(\frac{100}{x}\right)$
- D. Rs. $\left(\frac{100}{x^2}\right)$

Ans. C

Sol. As, sum = $\frac{100 \times SI}{Time \times Rate}$

Here, let $R = x\%$, $T = x$ yr. and simple interest = Rs. x

$$\therefore \text{Sum} = \frac{100 \times SI}{x \times x} = \text{Rs. } \frac{100}{x}$$

64. Average age of six people is decreased by 1 when a new person is included in the group.

What is the age of new person, if the average age of six people was 42 yr earlier?

- A. 25 yr
- B. 35 yr
- C. 45 yr
- D. 55 yr

Ans. B

Sol. Total ages of 6 people = $42 \times 6 = 252$ yr

Total ages of 7 people = $41 \times 7 = 287$ yr

So, the age of new person = $(287 - 252)$ yr = 35 yr

65. Select the most appropriate synonym of the given word.

FEASIBLE

- A. practical
- B. rejoice
- C. accentuate
- D. accurate

Ans. A

Sol. Let us understand the meaning of the given words :-

Feasible = that is possible and likely to be achieved.

Eg. :- It is not feasible to monitor such a range of organisms.

Practical = likely to succeed or be effective in real circumstances; feasible.

Eg. :- For all practical purposes, we have an unlimited supply of air to breathe.

Rejoice = feel happiness or joy.

Accentuate = single out as important; draw attention to (something).

Accurate = characterized by perfect conformity to fact or truth; strictly correct.

Hence, option A is the correct Ans..

66. Select the most appropriate synonym of the given word.

GARNISH

- A. honour
- B. respect
- C. obey
- D. decorate

Ans. D

Sol. Let us understand the meaning of the given words :-

Garnish = to decorate or embellish (something, especially food).

Eg. :- Garnish with chopped parsley and serve with jacket potatoes and steamed young stinging nettles.

Honour = bestow honour or rewards upon.

Respect = the condition of being honoured.

Obey = be obedient to.

Decorate = make more attractive by adding ornament, colour, etc.

Eg. :- Mosaics are employed to decorate the spandrels of the arches.

Hence, option D is the correct response.

67. Select the most appropriate meaning of the given idiom.

To talk through one's hat

- A. to talk carefully
- B. to talk softly
- C. to talk nonsense
- D. to talk secretively

Ans. C

Sol. The idiom "to take through one's hat" means to say silly things while you are talking about a subject you do not understand. Hence, option C is the correct Ans..

68. Select the most appropriate meaning of the given idiom.

To keep up one's appearances

- A. to make public appearances now and then
- B. to maintain one's looks and appearance
- C. to show-off one's things and possessions
- D. to pretend that everything is good

Ans. D

Sol. The idiom 'to keep up one's appearances' means to hide the true situation and pretend that everything is going well.

E.g. :- She just wanted to keep up appearances for the kids.

Hence, option D is the correct Ans..

69. In the following question, four words are given out of which one word is correctly spelt. Select the correctly spelt word.

- A. Millionair
- B. Millionnaire
- C. Millionaire
- D. Milionaire

Ans. C

Sol. Option C has the correctly spelt word. A millionaire is a person whose assets are worth one million pounds or dollars or more.

70. Which one of the following is the antonym of the word written in capital letters in the sentence, "They made SPURIOUS claims of personal injury in the robbery"?

- A. Truthful
- B. Authentic
- C. Credible
- D. Original

Ans. B

Sol. Let's first learn the meanings of the words:

Spurious = false; not genuine; counterfeit; based on false ideas.

Authentic = known to be real and genuine; true and accurate.

Credible = able to be believed; convincing.

Truthful = telling or expressing the truth; honest.

Original = not dependent on other people's ideas; inventive or novel.

Hence, option B is the correct Ans..

71. The equation of vibration as a system is $\ddot{x} + 36\pi^2x = 0$. Its natural frequency is _____

- A. 46 Hz
- B. 3π Hz
- C. 3 Hz
- D. 6π Hz

Ans. C

Sol. Given,

$$\ddot{x} + 36\pi^2 x = 0$$

compare with

$$m\ddot{x} + \omega_n^2 x = 0$$

$$\omega_n = \sqrt{\frac{k}{m}} = 6\pi$$

$$\omega_n = 2\pi f_n$$

$$f_n = 3$$

72. A system of masses rotating in different parallel planes is in dynamic balance. If the resultant
- A. force is equal to zero
 - B. couple is equal to zero
 - C. force and the resultant couple both are equal to zero
 - D. Force is numerically equal to the resultant couple but neither of them need necessarily be zero.

Ans. C

Sol. For dynamic balance, resultant force and resultant couple are equal to zero:

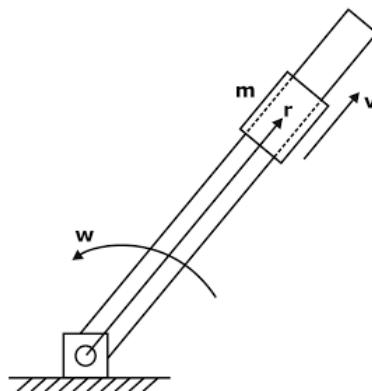
$$\Sigma F = 0$$

$$\Sigma M = 0$$

73. Coriolis component of acceleration is always _____.
 - A. Parallel to link
 - B. Perpendicular to link
 - C. Radially outward along link
 - D. Coincident with the axis of link

Ans. B

Sol.



Coriolis components of acceleration is in the direction perpendicular to the link. The direction of coriolis acceleration is found by rotating the velocity vector by 90° in the sense of the angular velocity of rotating link.

74. The Grubler's criteria for planer mechanism is given by $f = 3(n - 1) - 2J$, J in the equation is.

- A. Number of Mobile links
- B. Number of links
- C. Number of binary joints
- D. Number of longest links

Ans. C

Sol. In the equation

$$J = \text{number of binary joints}$$

$$n = \text{no of links}$$

$$f = \text{Degree of freedom}$$

75. Young's Modulus is defined as the ratio of

- A. longitudinal stress to longitudinal strain
- B. Lateral strain to longitudinal strain
- C. Lateral stress to longitudinal strain
- D. longitudinal stress to lateral strain

Ans. A

Sol. Young's Modulus

$$E = \frac{\text{Normal Stress}}{\text{Normal Strain}}$$

76. The specific heat at constant pressure for an ideal gas is given by $C_p = 0.9 + 2.7 \times 10^{-4} T$ kJ/kg-k

Where T is in Kelvin. The change in enthalpy for this ideal gas undergoing a process in which the temperature changes from 27°C to 127°C is most nearly.

- A. 90 kJ/kg
- B. 108.9 kJ/kg
- C. 99.45 kJ/kg
- D. 105.2 kJ/kg

Ans. C

Sol. Given:

Initial temperature: $T_1 = 27^{\circ}\text{C} = 300 \text{ K}$

Final Temperature: $T_2 = 127^{\circ}\text{C} = 400 \text{ K}$

$$\text{Sp. Heat} = C_p = 0.9 + 2.7 \times 10^{-4} T \text{ kJ/kg-k}$$

Enthalpy for ideal gas is given by

$$\begin{aligned} dh &= M C_p dt \\ \int dh &= \int_{300}^{400} 0.9 + (2.7 \times 10^{-4}) T dT \\ &= 0.9T + (2.7 \times 10^{-4}) \frac{T^2}{2} \Big|_{300}^{400} = 99.45 \text{ kJ/kg} \end{aligned}$$

77. In a steam condenser the partial pressure of Steam and Air are 0.06 bar and 0.007 bar respectively, the condenser pressure is.

- A. 0.067 bar
- B. 0.06 bar
- C. 0.053 bar
- D. 0.007 bar

Ans. A

Sol. Given,

The partial pressure of steam = 0.06 bar

The partial pressure of air = 0.007

$$\begin{aligned} \text{Condenser Pressure} &= P_z + P_a \\ &= 0.06 + 0.007 = 0.067 \text{ bar} \end{aligned}$$

78. A hydraulic press has a ram of 15 cm diameter and plunger of 1.5 cm. It is required to lift a mass of 1000 kg. The force required on plunger is nearly equal to.

- A. 100 N
- B. 1000 N
- C. 10.000 N
- D. 10 N

Ans. A

Sol.

$$\left(\frac{F}{A}\right)_{\text{plunger}} = \left(\frac{F}{A}\right)_{\text{ram}}$$
$$\frac{F}{\pi / 4(1.5)^2} = \frac{1000 \times 10}{\pi / 4(15)^2}$$
$$F = 100 N$$

79. Given $\phi = 3xy$ and $\psi = \frac{3}{2}(y^2 - x^2)$ the discharge passing between the stream lines through the point (1, 3) and (3, 3) is.

- A. 2 unit
- B. 4 unit
- C. 8 unit
- D. 12 unit

Ans. D

Sol. given,

$$\phi = 3xy \text{ and } \psi = \frac{3}{2}(y^2 - x^2)$$

Difference between two stream line is discharge per unit width.

$$dQ = |\psi_2 - \psi_1|$$

$$\psi_1 = \psi \text{ at } (1, 3)$$

$$= \frac{3}{2}(9 - 1) = 12 \text{ unit}$$

$$\psi_2 = \psi \text{ at } (3, 3)$$

$$= 0$$

$$\therefore dQ = |\psi_2 - \psi_1|$$

$$= 12 \text{ units}$$

80. Fluid is a substance which offers no resistance to change of _____.

- A. Volume
- B. Pressure
- C. Shape
- D. Flow

Ans. C

Sol. Characteristics of Fluid

- It has no definite shape of its own, but conforms to the shape of the containing vessel without offering any resistance to change of shape.
- Even a small amount of shear force exerted on a fluid will cause it to undergo a deformation which continues as long as the force continues to be applied.
- It is interesting to note that a solid suffers strain when subjected to shear forces whereas a fluid suffers Rate of Strain i.e. it flows under similar circumstances.

81. The amount of energy absorbed by a fly wheel is determined from the

- A. Torque-Crank angle diagram
- B. Acceleration – Crank angle diagram
- C. Speed – Space diagram
- D. Speed – Energy diagram

Ans. A

Sol. The amount of energy absorbed by a fly wheel is determined from the torque – crank angle diagram. The area under torque – crank angle diagram is known as energy.
$$\text{energy, } W = T \times \theta$$

82. As we know Pitch Circle is one of the characteristic dimension of Gear Design, similarly

one of the characteristic dimension of CAM is _____

- A. Base circle
- B. Prime circle
- C. Pitch circle
- D. Pitch

Ans. A

Sol. Base circle is the smallest circle tangent to the cam profile and concentric with the cam. The base circle decides the overall size of the cam and is therefore a fundamental feature of the cam.

83. The Bending moment diagram of the beam shown in figure is _____.

- A. A rectangle
- B. A triangle
- C. A trapezium
- D. A parabola

Ans. B

Sol. First consider vertical forces:

$$R_A + R_B = 0 \quad \dots \quad (1)$$

Taking moments about A:

$$\Sigma M_A = 0$$

$$M = R_B \times L$$

$$R_B = \frac{M}{L} \text{ and } R_A = -\frac{M}{L}$$

Bending moment at any section x-x from A is given by:

$$M_x = R_A x + M = -\frac{M}{L} x + M$$

This is the linear variation.

$$M_A(x=0) = M$$

$$M_B(x=L) = 0$$

84. A closed-coil helical spring is subjected to a torque about its axis. The spring wire would experience a_____.
- bending stress
 - direct tensile stress of uniform intensity at its cross-section
 - direct shear stress
 - torsional shearing stress

Ans. A

Sol. When a closed coil helical spring, fixed at one end is subjected to a twisting couple about the central axis of the spring, then bending moment will be produced at every cross-section of the spring. The twisting couple will try to wind up or unwind the spring.

85. A closely coiled helical spring of diameter D, contains n turns and is subjected to an axial load P. If the diameter of the coil wire is d and Modulus of the rigidity of the coil material is G, the deflection of the coil is:

A. $\frac{16 PD^3n}{Gd^4}$

B. $\frac{2 PD^3n}{Gd^4}$

C. $\frac{4 PD^3n}{Gd^4}$

D. $\frac{8 PD^3n}{Gd^4}$

Ans. D

Sol.

Given,

θ = angle of twist (radians)

M_t = torsional moment ($PD/2$)

l = length of bar (πDN)

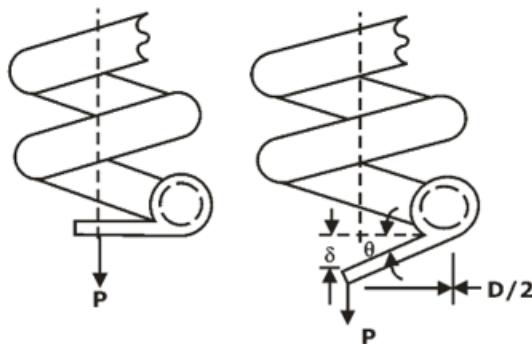
J = polar moment of inertia of bar ($\pi d^4/32$)

G = modulus of rigidity

The angle of twist (θ) for the equivalent bar is given by,

$$\theta = \frac{M_t l}{J G}$$

Therefore, $\theta = \frac{(PD/2)(\pi DN)}{(\pi d^4/32)G} = \frac{16PD^2N}{Gd^4}$



The axial deflection ' δ ' of the spring, for small values of θ , is given by

$$\begin{aligned}\delta &= \theta \times (\text{length of bracket}) \\ &= \theta \times (D/2)\end{aligned}$$

Substituting value of θ from previous equation,

$$\delta = \frac{8PD^3N}{Gd^4}$$

86. Coefficient of volume expansivity is given by _____.

A. $\frac{1}{V} \left(\frac{\partial V}{\partial T} \right)_p$

B. $\left(\frac{\partial V}{\partial T} \right)_s$

C. $-\left(\frac{\partial P}{\partial S} \right)_V$

D. $-\frac{1}{V} \left(\frac{\partial V}{\partial T} \right)_p$

Ans. A

Sol. Coefficient of volume expansivity (β) is given as:

$$\beta = \frac{1}{V} \left(\frac{\partial V}{\partial T} \right)_p$$

87. A diathermic wall is one which
- A. prevents thermal interaction
 - B. permits thermal interaction
 - C. encourages thermal interaction
 - D. discourages thermal interaction

Ans. B

Sol. Diathermic wall can be defined as the wall which permits the flow of heat.

88. In a Carnot Engine, when working substance gives heat to the sink _____
- A. temperature of sink increase
 - B. temperature of sink remains same
 - C. temperature of source decrease
 - D. temperature of both the sink and source decrease

Ans. B

Sol. In carnot engine, source and sink is thermal energy reservoir hence as heat is rejected or extracted, temperature of reservoir does not change.

89. At triple point of a pure substance _____.
 - A. Liquid and vapour phase co-exist
 - B. Solid and vapour phase co-exist
 - C. Liquid and solid phase co-exist
 - D. Solid, Liquid and vapour phase co-exist.

Ans. D

Sol. The triple point is a line on the P – V diagram where all the three phases solid, liquid and gases exist in equilibrium. At a pressure below the triple point line, the substance cannot exist in liquid phase and the substance when heated, transforms from solid to vapours by absorbing the latent heat of sublimation from the surrounding.

90. Variation of pressure and volume at constant temperature are correlated through
- A. Charle's law
 - B. Boyle's law
 - C. Joule's Law
 - D. Gay Lussac's Law

Ans. B

Sol. As per Boyle's law

At constant temperature

$PV = \text{Contant}$

$$p \propto \frac{1}{V}$$

91. Clausius inequality is stated as:

A. $\oint \delta Q < 0$

B. $\oint \delta Q = 0$

C. $\oint \frac{\delta Q}{T} \geq 0$

D. $\oint \frac{\delta Q}{T} \leq 0$

Ans. D

Sol. If $\oint \frac{\delta Q}{T} = 0$ cycle is reversible

If $\oint \frac{\delta Q}{T} < 0$ cycle is irreversible

Hence $\oint \frac{\delta Q}{T} \leq 0$ for cycle is possible

This is known as Clausius inequality

92. The specific heat at constant pressure (C_p) is given by:

A. $C_p = T \left(\frac{\partial S}{\partial T} \right)_p$

B. $C_p = T \left(\frac{\partial V}{\partial S} \right)_p$

C. $C_p = T \left(\frac{\partial V}{\partial T} \right)_p$

D. $C_p = T \left(\frac{\partial V}{\partial S} \right)_p$

Ans. A

Sol. From $T \partial S$ equation

$$T \partial S = \partial h - V \partial p$$

for constant pressure process

$$\partial p = 0$$

$$\partial h = C_p \partial T$$

$$T \partial S = C_p \partial T$$

$$C_p = T \left(\frac{\partial S}{\partial T} \right)_p$$

93. Kelvin-plank law deals with

- A. Conservation of Energy
- B. Conservation of heat
- C. Conservation of mass
- D. Conversion of heat into work

Ans. D

Sol. Kelvin – Plank gives the concept of heat engine hence, it is conversion of heat into work.

94. The characteristic equation of gases $PV = mRT$ holds good for _____.

- A. Monoatomic gases
- B. Diatomic gases
- C. Real gases
- D. Ideal gases

Ans. D

Sol. Ideal gas equation is given by:

$$PV = mRT$$

Where:

m = mass of the gas

R = characteristic gas constant

T = temperature of the gas

95. When a gas is to be stored, the type of compression that would be ideal is

- A. isothermal
- B. adiabatic
- C. Polytropic
- D. Constant volume

Ans. A

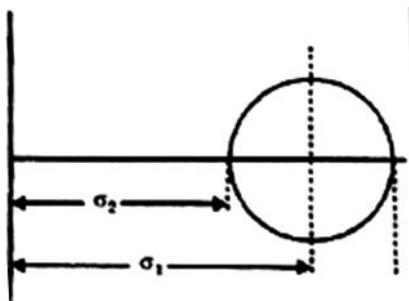
Sol. For isothermal compression, work of compression is minimum hence isothermal compression is an ideal compression process.

96. Maximum shear stress in a Mohr's circle.

- A. is equal to radius of Mohr's circle
- B. is greater than radius of Mohr's circle
- C. is less than radius of Mohr's circle
- D. could be any of the above.

Ans. A

Sol.



$$\text{Radius of the mohr's circle} = \frac{\sigma_1 - \sigma_2}{2}$$

$$\text{Maximum shear stress, } \tau_{\max} = \frac{\sigma_1 - \sigma_2}{2}$$

\therefore Radius of mohr's circle is equal to maximum shear stress

97. The deformation of a bar under its own weight as compared to that when subjected to a direct axial load equal to its own weight will be

- A. the same
- B. one fourth
- C. half
- D. double

Ans. C

Sol. Deformation due to direct axial load

$$\Delta = \frac{WL}{AE}$$

Hence,

$$\text{Deformation due to self weight} = \frac{WL}{2AE}$$

so, deformation of a bar under its own weight=half of deformation due to direct axial load

98. Air is compressed from 1 bar and 40°C to 10 bar isothermally in a flow process. Assume the air is flowing in the pipe with constant velocity.

The magnitude work transfer in the process will be

- A. 202 kJ/kg
- B. 205 kJ/kg

- C. 207 kJ/kg
- D. 209 kJ/kg

Ans. C

Sol. For an isothermal flow process

$$\int P.dV = \int V.dP$$

$$w = P_1 V_1 \ln \frac{V_2}{V_1}$$

$$= RT_1 \ln \left(\frac{P_1}{P_2} \right)$$

$$\frac{V_2}{V_1} = \frac{P_1}{P_2}$$

As T is constant for isothermal and

$$w = RT_1 \ln \left(\frac{P_1}{P_2} \right)$$

$$= 287 \times (40 + 273) \ln \left(\frac{1}{10} \right)$$

$$= 207 \text{ kJ/kg}$$

99. According to first law of thermodynamics, the total energy change of the system + surrounding is equal to _____.

- A. Positive
- B. Negative
- C. Zero
- D. None

Ans. C

Sol. System and its surrounding together comprises a universe and universe is considered as isolated system, hence there is no energy change of the universe.

100. A cylinder filled with 2 kg of oxygen ($\gamma=1.4$) is heated at constant pressure from 27°C to 127°C , the heat supplied is equal to

- A. 201 kJ
- B. 224 kJ
- C. 105 kJ
- D. 182 kJ

Ans. D

Sol. Given,

$$m = 2 \text{ kg oxygen}$$

$$\gamma=1.4$$

$$T_1 = 27^\circ\text{C} \quad T_2 = 127^\circ\text{C}$$

$$Q = mC_p dT$$

$$C_p = \frac{\gamma R}{(\gamma - 1)}$$

For oxygen,

$$R = \frac{R_o}{M} = \frac{8314}{32} = 259.8$$

$$C_p = \frac{259.81 \times 1.4}{0.4} = 909.34 \text{ J/kgK}$$

$$Q = 2 \times 909.34 \times (127-27) = 181868.75 \text{ J}$$

$$Q = 181.86 \text{ kJ} = 182 \text{ kJ}$$

101. The Motion transmitted between the teeth of two spur gear in mesh is generally

- A. Sliding
- B. Rolling
- C. Rotary
- D. Partly sliding and partly rolling

Ans. D

Sol. Pair of teeth is at pitch point have pure rolling action. At any other position they have the sliding and rolling action.

102. Elastic limit is the point _____.

- A. upto which stress is proportional to strain
- B. till which elongation takes place without application of additional load beyond proportional limit
- C. upto which if the load is removed, original volume and shape are regained
- D. at which the toughness is maximum

Ans. C

Sol.

- o When a specimen is loaded beyond proportional limit it has tendency to regain its initial size and shape when the load is removed, this show elastic stage.
- o The point up to which material shows this tendency is called elastic limit.

103. Which of the following uses a single point cutting tool

- A. Drill
- B. Reamer
- C. Milling cutter
- D. Parting tool

Ans. D

Sol. Drill, reamer and milling cutter are the multipoint cutting tool while parting tool is a single point cutting.

104. The flow profile of a fluid depends upon

- A. velocity of the fluid only
- B. the diameter of the tube only
- C. the Reynold number
- D. the surface roughness

Ans. C

Sol. Reynold number is the factor by which type of flow is decided, i.e. laminar or turbulent.

105. The coefficient of velocity (C_v) for an orifice is

A. $C_v = \sqrt{\frac{4x^2}{yH}}$

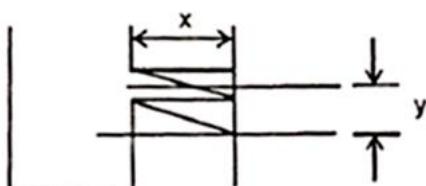
B. $C_v = \frac{2x}{\sqrt{4yH}}$

C. $C_v = \sqrt{\frac{x^2}{4yH}}$

D. None of above

Ans. C

Sol. $C_v = \frac{V}{V_{th}} = \sqrt{\frac{gx^2}{2y}} \times \frac{1}{\sqrt{2gh}}$



$$C_v = \sqrt{\frac{x^2}{4yH}} \Rightarrow \frac{1}{\sqrt{4yH}}$$

106. For a spring controlled governor to be stable the controlling force (f) is related to the radius (r) by the equation.

- A. $f = a - br$
- B. $f = ar - b$
- C. $f = ar$
- D. $f = ar + b$

Ans. B

Sol. Relationship between controlling force (F) and radius of rotation (r) for different Governors are as shown :

Unstable Governor $F = ar + b$

Isochronous Governor $F = ar$

Stable Governor $F = ar - b$

107. The ratio of torque carrying capacity solid shaft to that of a hollow shaft whose outer diameter is same and made up of same material given by _____.
 (where K is ratio of inner diameter to outer diameter of hollow cylinder).

A. $1 - K^4$

B. $(1 - K^4)^{-1}$

C. K^4

D. $\frac{1}{K^4}$

Ans. B

Sol. τ should be same for both hollow and solid shaft.

$$\frac{\frac{T_s}{\pi D_0^4}}{\frac{T_n}{\pi D_0^4}} = \frac{T_s}{T_n} = \frac{\pi (D_0^4 - D_i^4)}{\pi D_0^4}$$

$$\Rightarrow \frac{T_s}{T_n} = \frac{D_0^4}{(D_0^4 - D_i^4)}$$

$$\frac{T_s}{T_n} = \left[1 - \left(\frac{D_i}{D_0} \right)^4 \right]^{-1}$$

$$\frac{T_s}{T_n} = (1 - K^4)^{-1}$$

108. For a circular shaft of diameter d subjected to torque T, the maximum value of the shear stress is

A. $\frac{64 T}{\pi d^3}$

B. $\frac{32 T}{\pi d^3}$

C. $\frac{16 T}{\pi d^3}$

D. $\frac{8 T}{\pi d^3}$

Ans. C

$$\text{Sol. } \frac{T}{J} = \frac{\tau}{\frac{d}{2}}$$

$$\frac{T}{\frac{\pi}{32} d^4} = \frac{\tau}{2}$$

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

109. The velocity profile for turbulent layer over a flat plate is :

A. $\frac{u}{u_x} = \sin\left(\frac{\pi}{2} - \frac{y}{\delta}\right)$

B. $\frac{u}{u_x} = \left(\frac{y}{\delta}\right)^{1/7}$

C. $\frac{u}{u_x} = 2\left(\frac{y}{\delta}\right) - \left(\frac{y}{\delta}\right)^{1/7}$

D. $\frac{u}{u_x} = \frac{3}{2}\left(\frac{y}{\delta}\right) - \frac{1}{2}\left(\frac{y}{\delta}\right)^3$

Ans. B

Sol. Turbulent velocity profile 1/7 power law,

Hence $\frac{u}{u_x} = \left(\frac{y}{\delta}\right)^{1/7}$

will be velocity distribution.

110. The hydrodynamic boundary layer thickness is defined as the distance from the surface where the _____.

- A. Velocity equals to the local external velocity.
- B. Velocity equals the approach velocity.
- C. Momentum equals 99% of the momentum of the free stream.
- D. Velocity equals 99% of the local external velocity.

Ans. D

Sol. Hydrodynamic boundary layer thickness is defined as the distance measured in the y direction from boundary to the point where the velocity is 99% of the free stream velocity.

111. Boundary layer flow separates from the surface if

- A. $\frac{du}{dy} = 0$ and $\frac{dp}{dx} = 0$
- B. $\frac{du}{dy} = 0$ and $\frac{dp}{dx} > 0$
- C. $\frac{du}{dy} = 0$ and $\frac{dp}{dx} < 0$
- D. Boundary layer thickness is zero.

Ans. B

Sol. Boundary layer separation occurs at adverse

i.e., $\frac{dP}{dy} > 0$ and $\frac{dU}{dy} = 0$ pressure gradient.

112. Power transmitted through a pipe is given by formula_____

Where

W = specific weight of the fluid flowing through pipe.

Q = discharge $m^3/sec.$

- A. $W \times Q \times H$
- B. $W \times Q + H$
- C. $W \times Q (H - H_L)$
- D. $W \times Q (H + H_L)$

Ans. C

Sol. Power transmitted through a pipe (When H_L is friction head)

$$P = WQ(H - H_L)$$

113. Power transmitted through a pipe is maximum when where H = total head supplied H_L = Head loss due to friction

- A. $H_L = \frac{H}{2}$
- B. $H_L = \frac{H}{3}$
- C. $H_L = \frac{H}{4}$
- D. $H_L = H$

Ans. B

Sol. For maximum power transmission

$$H_L = \frac{H}{3}$$

114. Which one of the following is extensive property of a thermodynamics system?

- A. Volume
- B. Pressure
- C. Temperature
- D. Density

Ans. A

Sol.

- Since volume depends on mass hence it is extensive property.
- Density as Intensive Property.
- Density is the ratio between the mass of a sample and its volume. Since it is a ratio, it will always be the same regardless of how much of the sample it measured. When a property, like density, is independent of the amount of sample measured, it is known as an "intensive" property.

115. A fluid at temperature of 20°C flowing with a velocity of 199m/s. Its Mach number will be

- A. 0.65
- B. 0.8
- C. 0.6
- D. 0.7

Ans. C

Sol. Given,

$$V = 199\text{m/s}, \text{ speed of sound} = 333\text{m/s}$$

116. In the calculation of induced shear stress in helical springs, the Wahl's correction factor us used to take care of

- A. combined effect of transverse shear stress and bending stress in the wire.
- B. combined effect of bending stress and curvature of the wire.
- C. combined effect of transverse shear stress and curvature of the wire.
- D. combined effect of torsional shear stress and transverse shear stress in the wire.

Ans. C

Sol. Wahl factor includes the effects of both direct shear and wire curvature. It is given by Wahl factor,

$$K = \frac{4C - 1}{4C - 4} + \frac{0.615}{C}$$

where $C = \text{Spring index} = D/d$

where $D = \text{coil diameter}$, $d = \text{wire diameter}$

117. Which one of the following types of compressors is mostly used for supercharging of I.C. engines?

- A. Radial flow compressor
- B. Axial flow compressor.
- C. Centrifugal Compressor
- D. Reciprocating compressor.

Ans. C

Sol. As reciprocating compressors are bulky, they are not used except for stationary installation and radial and axial flow compressors are not suitable due to problem of surging and high speed required for operation.

118. In forced circulation boilers, about 90% of water is re-circulated without evaporation the circulation ratio is _____.

- A. 0.1
- B. 0.9
- C. 9
- D. 10

Ans. D

Sol. Circulation ratio is defined as reciprocal of percentage steam supplied in drum:

$$CR = \frac{m}{m_g} = \frac{m_g + m_i}{m_g} = \frac{1}{m_g / (m_g + m_i)} = \frac{1}{TDF}$$

$$CR = \frac{0.90m + 0.1m}{0.1m} = 10$$

119. During the flow over a circular cylinder, the drag coefficient drops significantly at a critical Reynolds Number of 2×10^5 . This is due to

- A. excessive momentum loss in the boundary layer.
- B. separation point travelling upstream.
- C. reduction in skin-friction drag.
- D. the delay in separation due to transition to turbulence.

Ans. D

Sol. The drag coefficient remains practically constant until a Reynold's number of 2×10^5 is reached. At this stage the C_d drops steeply by a factor of 5.

This is due to the fact that the laminar boundary layer turns turbulent and stays unseparated over a longer distance, then reducing the wake considerably.

120. The reheat cycle in steam power plant is mainly adopted to

- A. Improve thermal efficiency
- B. Decrease the moisture content in low pressure stages to a safe value
- C. Decrease the capacity of condenser
- D. Recover the waste heat of boiler

Ans. B

Sol. The reheat cycle in steam power plant is mainly adopted as decrease the moisture content in low pressure stages to a safe value.

The steam between the intermediate stages of two turbine improves the quality at the exit of turbine.

121. Reciprocating compressors are provided with

- A. simple disc/plate valve
- B. poppet valve
- C. spring-loaded disc valve
- D. solenoid valve

Ans. A

Sol. Type of compressor valves used:

- (i) Plate type valve
 - (ii) Reed type valve
- So Correct option is A

122. The most commonly used moderator in nuclear power plants is

- A. heavy water
- B. concrete and bricks
- C. steel
- D. graphite

Ans. D

Sol. Moderator

It is a material used to slow down neutrons from high velocities. It should have a high macroscopic neutrons scattering cross-section, a low macroscopic neutrons absorption cross-section and a low atomic mass to get maximum kinetic energy transfer from neutrons to the moderator atoms.

Most common moderator used in nuclear plant is graphite.

123. In a centrifugal compressor, the highest Mach number leading to shock wave in the fluid flow occurs at

- A. diffuser inlet radius
- B. diffuser outlet radius
- C. impeller inlet radius
- D. impeller outlet radius

Ans. C

Sol. In a centrifugal compressor, the highest Mach number leading to shock wave in the fluid flow occurs at impeller inlet radius

124. Frictional losses in the nozzle

- A. reduces the enthalpy drop of the fluid
- B. increases the enthalpy drop of the fluid
- C. has no effect on enthalpy drop of the fluid
- D. None of the above

Ans. A

Sol. The nozzle efficiency reduces due to friction as a result the actual enthalpy drop is less than the isentropic enthalpy drop.

125. The component of torque converter that allows torque multiplication is

- A. turbine
- B. impeller
- C. stator
- D. freewheel

Ans. C

Sol.

- A torque converter is a type of fluid coupling which transfers rotating power from a prime mover to a rotating driven load.
- The stator reverses the fluid coming from turbine and sends it back to the impeller, thereby slowing the fluid and the torque is created.

126. The velocity potential function in a two dimensional flow field is given by $\phi = x^2 - y^2$. The magnitude of velocity at point P(1, 1) is

- A. zero
- B. 2
- C. $2\sqrt{2}$
- D. 8

Ans. C

Sol. Given velocity potential f_x_n

$$\phi = x^2 - y^2$$

$$u = \frac{-\partial \phi}{\partial x} = -2x$$

$$v = \frac{-\partial \phi}{\partial y} = 2y$$

$$\text{Magnitude, } M = \sqrt{v^2 + u^2}$$

$$= \sqrt{(-2)^2 + 2^2}$$

$$= 2\sqrt{2}$$

at $x = 1$ and $y = 1$

127. The specific speed of a pump is defined as the speed of the unit of such a size that it

- A. Delivers unit discharge at unit head
- B. Requires unit power to develop unit head
- C. Delivers unit discharge at unit power
- D. Produces unit power with unit head available

Ans. A

Sol. Specific speed of a pump is defined as the speed of the unit of such a size that it delivers unit discharge at unit head.

128. A dimensionless quantity that connects the link between velocity flow field and the temperature field is

- A. Nusselt number
- B. Prandlt number
- C. Reynolds number
- D. Grashof number

Ans. B

Sol. Prandlt number (P_τ) = $\frac{\mu C_p}{k}$

$$= \frac{V}{\alpha}$$

$$P_\tau = \frac{\text{Molecular momentum diffusivity}}{\text{Thermal diffusivity}}$$

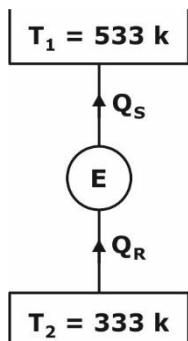
Hence prandtl number gives the link between velocity flow field and temperature field.

129. A reversible engine works between temperature limits of 260°C and 60°C. To improve the performance, we have to

- A. Lower the source temperature to 250°C
- B. Lower the sink temperature to 30°C
- C. Insulate the engine
- D. None of the above

Ans. B

Sol.



Efficiency of reversible engine

$$\eta_{rev} = 1 - \frac{T_2}{T_1} = 1 - \frac{333}{533} = 0.3752$$

Lower the T_2 , (T_2 / T_1) will be reduced and overall efficiency will improved or increased.

130. Constant efficiency curves of turbines are drawn between (on both axes)

- A. power and speed
- B. efficiency and speed
- C. efficiency and power
- D. efficiency and head

Ans. B

Sol. Constant efficiency curve can be drawn between efficiency and speed

131. As per Law of fluid friction for steady streamline flow, the frictional resistance

- A. varies proportionally to pressure
- B. varies in inverse proportion to pressure
- C. does not depend on pressure
- D. first increases then decreases

Ans. C

Sol. Frictional resistance doesn't depend on pressure.

132. For diesel engine, the method of governing employed is

- A. Quality governing
- B. Quantity governing

- C. Hit and miss governing
- D. None of the above

Ans. A

Sol. In quality governing, the air flow rate remain constant but the composition of the mixture is changed by admitting more or less fuel in accordance in variation with load.

The quality governing is mostly used in high speed diesel engine.

133. Compression ratio for diesel engine may have a range of

- A. 8 to 10
- B. 16 to 20
- C. 10 to 15
- D. none of these

Ans. B

Sol. Compression ratio in diesel engine is in the range of 15-20

134. The vanes of a centrifugal pump are generally

- A. Radial
- B. Curved backward
- C. Curved forward
- D. Twisted

Ans. B

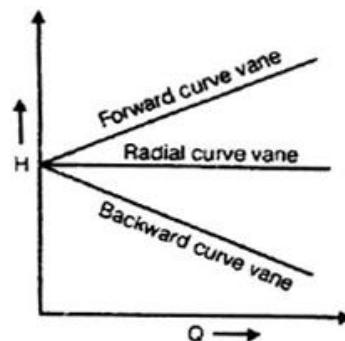
Sol. In practice,

Power required to drive pump $\propto Q \times H$

When $H \propto Q$; then, load on prime mover fluctuates considerably.

When $H \propto \frac{1}{Q}$; load on the prime mover almost remains constant, hence it is preferred to

have backward curved vanes.



135. The use of a draft tube in a reaction type water turbine helps to

- A. Prevent air from entering
- B. Increase the flow rate
- C. Convert the kinetic energy to pressure energy
- D. Eliminate eddies in the downstream

Ans. C

Sol. Purposes of Draft tube

- (i) It permits a negative or suction head to be established at the runner exit, thus making it possible to install turbine above the tail race level without loss of head.
- (ii) It converts a large proportion of velocity energy rejected from runner into useful pressure energy, i.e. it acts as recuperator of pressure energy.

136. The pressure drop in a pipe flow is directly proportional to the mean velocity. It can be deduced that be

- A. Flow is laminar
- B. Flow is turbulent
- C. Pipe is smooth
- D. Pipe is rough

Ans. A

Sol. In laminar flow, pressure drop in a pipe flow is directly proportional to the mean velocity.

$$U = \frac{1}{4\mu} \left(-\frac{dp}{dx} \right) (R^2 - r^2)$$

$$\therefore U \propto \frac{dp}{dx}$$

137. What does the application of centrifugal air compressors lead to?

- A. Large frontal area of aircraft
- B. Higher flow rate through the engine
- C. Higher aircraft speed
- D. Lower frontal area of the aircraft

Ans. A

Sol. Centrifugal air compressor increases frontal area of air craft which increases drag. Thus mostly axial flow compressors are used in aircraft.

138. In case of liquids, what is the binary diffusion coefficient proportional to?

- A. Pressure only
- B. Temperature only

- C. Volume only
- D. All the above

Ans. D

Sol. Diffusion coefficient D. :

It depend upon temperature, pressure and nature of the system component. However, for ideal gases and dilute liquids, it can be assumed to remain practically constant for a given range of temperature and pressure.

139. When can a piezometer be not used for pressure measurement in pipes?

- A. The pressure difference is low
- B. The velocity is high
- C. The fluid in the pipe is a gas
- D. The fluid in the pipe is highly viscous

Ans. C

Sol. Gas pressure cannot be measured by means of piezometers because a gas forms no free atmosphere surface and it can't be used when large pressures in the lighter liquid are to be measured.

140. A reversed Carnot cycle working as a heat pump has a COP of 7. What is the ratio of minimum to maximum absolute temperatures?

- A. 7/8
- B. 1/6
- C. 6/7
- D. 1/7

Ans. C

$$\text{Sol. } (\text{C.O.P.})_{\text{H.P.}} = \frac{T_1}{T_1 - T_2} = 7$$

$$\Rightarrow T_1 = 7T_1 - 7T_2$$

$$\Rightarrow 6T_1 = 7T_2$$

$$\Rightarrow \frac{T_2}{T_1} = \frac{6}{7}$$

141. In order to achieve maximum heat dissipation, the fin should be designed in such a way that

- A. It should have maximum lateral surface at the root side of the fin
- B. It should have maximum lateral surface towards the top side of the fin

- C. It should have maximum lateral surface near the centre of the fin
- D. It should have maximum lateral surface at the end of the fin

Ans. A

Sol. The tin should have maximum lateral surface at the root side to achieve maximum heat dissipation.

142. What is the pressure inside a soap bubble, over the atmospheric pressure if its diameter is

2 cm and the surface tension is $0.1 \frac{\text{N}}{\text{m}}$?

- A. 0.4 N/m^2
- B. 4.0 N/m^2
- C. 40.0 N/m^2
- D. 400.0 N/m^2

Ans. C

$$\text{Sol. } \Delta P = \frac{8\sigma}{d} = \frac{8 \times 0.1}{2 \times 10^2} = 40 \text{ N/m}^2$$

143. For steady incompressible flow, if the u-component of velocity is $u = Ae^x$, then what is the v-component of velocity?

- A. Ae^y
- B. $Ae^x y$
- C. $-Ae^x y$
- D. $-Ae^x$

Ans. C

$$\text{Sol. } \frac{du}{dx} + \frac{dv}{dy} = 0$$

$$\therefore \frac{d(Ae^x)}{dx} + \frac{dv}{dy} = 0$$

$$\Rightarrow Ae^x + \frac{dv}{dy} = 0$$

$$\Rightarrow v = -Ae^x y$$

144. Velocity for flow through a pipe, measured at the centre is found to be 2 m/s. Reynolds number is around 800. The average velocity in the pipe is ____.

- A. 2 m/s
- B. 1.7 m/s

- C. 1 m/s
- D. 0.5 m/s

Ans. C

Sol. Given

$$\text{Reynold Number} = 800$$

Since reynold number is less than 2000, hence flow is laminar. For laminar flow in pipe

Velocity at centre = Maximum Velocity

$$v_{\max} = 2 \text{ m/s}$$

$$V_{\text{avg}} = \frac{V_{\max}}{2}$$

$$V_{\text{avg}} = \frac{2}{2} = 1 \text{ m/s}$$

145. A sum doubles itself in 6 yr at compound interest. In how much time the sum will be eight times at the same rate of interest?

- A. 15 yr
- B. 12 yr
- C. 18 yr
- D. 10 yr

Ans. C

Sol. sum doubles itself in 6 yr at compound interest.

it will double itself again in another 6 years and so on..

We know that

$$2^3 = 8$$

$$\therefore \text{Required time} = 6 \times 3 = 18 \text{ yr}$$

Alternate Method:

Let assume that, initial amount = Rs. P

after 6 years the amount will be 2P.

Since amount is doubling in every 6 years then

After 12 years the amount will be $2 \times (2P) = 4P$.

After another 6 years i.e. 18 years later the amount will again doubled.

So, in 18 years the amount will be $2 \times (4P) = 8P$ means 8 times the initial amount.

146. A shopkeeper earns a profit of 10% after allowing a discount of 20% on the marked price.

The cost price of the article whose marked price is 880, is?

- A. 704
- B. 640

- C. 774
- D. 680

Ans. B

Sol. SP of article = $(100 - 20)\%$ of 880 = 80% of 880

$$= 880 \times \frac{80}{100} = ₹ 704$$

Again, 110% of CP = 704

$$CP = (704/110) \times 100 = ₹ 640$$

∴ Cost price = ₹ 640

147. In the following question, out of the four alternatives, select the alternative which best expresses the meaning of the Idiom/Phrase.

- Diehard
- A. Unwilling to change
 - B. Ready to change
 - C. Egoist
 - D. Arrogant

Ans. A

Sol. Diehard is a person who strongly opposes change or who continues to support something in spite of opposition. Thus, option A is the correct Ans..

148. There are 20 locks and 20 matching keys. Maximum number of trials required to match all the locks is

- A. 190
- B. 210
- C. 400
- D. 40

Ans. B

Sol. 1st lock will need = N tries [i.e. last no. of key not need to compare]

2nd will need= N-1 tries

.

.

Trials = 20, 19, 18, 17.....

it will be A.P. of n=20 and common difference = 1

$$S_n = \frac{(n+1)}{2}N$$

$$= (20+1)20/2$$

$$= 210.$$

So the maximum matching trials needed will be 210.

149. Equation of the line normal to function $f(x) = (x-8)^{2/3} + 1$ at $P(0, 5)$ is

- A. $y = 3x - 5$
- B. $3y = x - 15$
- C. $3y = x + 15$
- D. $y = 3x + 5$

Ans. D

Sol. Let $f = y = (x-8)^{2/3} + 1$

Now slope of line $m_1 = dy/dx$ which is $2/3(x-8)^{-1/3}$ at point $(0,5)$ where $m_1 = -1/3$ for normal line which is $m_1 \times m_2 = -1$

Now $m_1 = -1/3$ and $m_2 = 3$. So equation of line will be $y=mx+c$

$y=3x+c$ at coordinates $(0,5)$ where $c=5$

150. The value of the determinant $\begin{vmatrix} \cos\theta & 0 & \sin\theta \\ 0 & 1 & 0 \\ -\sin\theta & 0 & \cos\theta \end{vmatrix}$ is

- A. 0
- B. -1
- C. 1
- D. 2

Ans. C

Sol. solving determinant,

We will get,

$$\cos\theta(\cos\theta - 0) + \sin\theta(\sin\theta)$$

$$\cos^2\theta + \sin^2\theta = 1$$
