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FUNDAMENTALS OF MECHANICAL ENGINEERING & MECHATRONICS

Fundamentals of Mechanical Engineering & Mechatronics	
Course Outcome (CO)	
At the end of course , the student will be able to understand	
CO 1	Understand the concept of stress and strain, factor of safety, beams
CO 2	Understand the basic component and working of internal combustion engines, electric and hybrid vehicles, refrigerator and heat pump, airconditioning
CO 3	Understand fluid properties, conservation laws, hydraulic machinery used in real life.
CO 4	Understand the working principle of different measuring instrument with the knowledge of accuracy, error and calibration, limit, fit, tolerance and control system
CO 5	Understand concept of mechatronics with their advantages, scope and Industrial application, the different types of mechanical actuation system, the different types of hydraulic and pneumatic systems
CO 6	Apply concepts of strength of material for safe design, refrigeration for calculation of COP, concepts of fluid mechanics in real life, concepts of measurements in production systems
DETAILED SYLLABUS	
Unit	Topic
I	Introduction to Mechanics of Solid: Normal and shear Stress, strain, Hookes' law, Poisson's ratio, elastic constants and their relationship, stress-strain diagram for ductile and brittle materials, factor of safety. Basic Numerical problems. Types of beams under various loads, Statically Determinate Beams, Shear force and bending moment in beams, Shear force and bending moment diagrams, Relationships between load, shear and bending moment. Basic Numerical problems.
II	Introduction to IC Engines and RAC: IC Engine: Basic Components, Construction and Working of Two stroke and four stroke SI & CI engine, merits and demerits, scavenging process; Introduction to electric, and hybrid electric vehicles. Refrigeration: Its meaning and application, unit of refrigeration; Coefficient of performance, methods of refrigeration, construction and working of domestic refrigerator, concept of heat pump. Formula based numerical problems on cooling load. Air-Conditioning: Its meaning and application, humidity, dry bulb, wet bulb, and dew point temperatures, comfort conditions, construction and working of window air conditioner.
III	Introduction to Fluid Mechanics and Applications: Introduction: Introduction: Fluids properties, pressure, density, dynamic and kinematic viscosity, specific gravity, Newtonian and Non-Newtonian fluid, Pascal's Law, Continuity Equation, Bernaulli's Equation and its applications, Basic Numerical problems. Working principles of hydraulic turbines & pumps and their classifications, hydraulic accumulators, hydraulic lift and their applications.

IV	<p>Measurements and Control System: Concept of Measurement, Error in measurements, Calibration, measurements of pressure, temperature, mass flow rate, strain, force and torques; Concept of accuracy, precision and resolution, Basic Numerical problems. System of Geometric Limit, Fit, Tolerance and gauges, Basic Numerical problems.</p> <p>Control System Concepts: Introduction to Control Systems, Elements of control system, Basic of open and closed loop control with example</p>
V	<p>Introduction to Mechatronics: Evolution, Scope, Advantages and disadvantages of Mechatronics, Industrial applications of Mechatronics, Introduction to autotronics, bionics, and avionics and their applications. Sensors and Transducers: Types of sensors, types of transducers and their characteristics.</p> <p>Overview of Mechanical Actuation System – Kinematic Chains, Cam, Train Ratchet Mechanism, Gears and its type, Belt, Bearing,</p> <p>Hydraulic and Pneumatic Actuation Systems: Overview: Pressure Control Valves, Cylinders, Direction Control Valves, Rotary Actuators, Accumulators, Amplifiers, and Pneumatic Sequencing Problems</p>

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Solved MCQ

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1. Unit-I

1. The slope of the stress-strain curve in the elastic deformation region is _____
- Elastic modulus**
 - Plastic modulus
 - Poisson's ratio
 - None of the mentioned

Answer: a

2. What is the stress-strain curve?
- It is the percentage of stress and strain
 - It is the relationship between stress and strain**
 - It is the difference between stress and strain
 - None of the mentioned

Answer: b

3. Which point on the stress strain curve occurs after the proportionality limit?
- Upper yield point
 - Lower yield point
 - Elastic limit**
 - Ultimate point

Answer: c

4. Which point on the stress strain curve occurs after the lower yield point?
- Yield plateau**
 - Upper yield point
 - Ultimate point
 - None of the mentioned

Answer: a

5. Which point on the stress strain curve occurs after yield plateau?
- lower yield point
 - Upper yield point

- Ultimate point**
- Breaking point

Answer: c

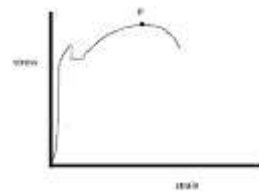
6. Which point on the stress strain curve occurs after the ultimate point?
- Last point
 - Breaking point**
 - Elastic limit
 - Material limit

Answer: b

7. Elastic limit is the point _____
- up to which stress is proportional to strain
 - At which elongation takes place without application of additional load
 - Up to which if the load is removed, original volume and shapes are regained**
 - None of the mentioned

Answer: c

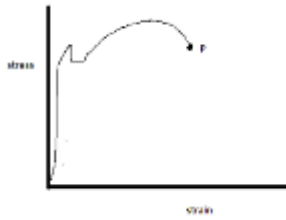
8. What is the point P shown on the stress strain curve?



- Upper yield point
- Yield plateau
- Elastic limit
- Ultimate point**

Answer: d

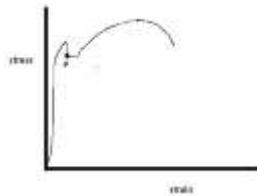
9. What is the point P shown in the stress-strain curve?



- a. Lower yield point
- b. Elastic limit
- c. Proportionality limit
- d. Breaking point**

Answer: d

10. What is the point shown in the stress strain curve?



- a. Elastic limit
- b. Lower yield point**
- c. Yield plateau
- d. Lower strain point

Answer: b

11. Where is the necking region?
- a. The area between lower yield point and upper yield point
 - b. The area between the plastic limit and elastic limit
 - c. The area between the ultimate point and initial point
 - d. The area between the ultimate point and rupture**

Answer: d

12. The dimension of strain is?
- a. LT-2
 - b. N/m²
 - c. N

d. Dimensionless

Answer: d

13. What is tensile strain?

- a. The ratio of change in length to the original length**
- b. The ratio of original length to the change in length
- c. The ratio of tensile force to the change in length
- d. The ratio of change in length to the tensile force applied

Answer: a

14. Find the strain of a brass rod of length 250mm which is subjected to a tensile load of 50kN when the extension of rod is equal to 0.3mm?

- a. 0.025
- b. 0.0012**
- c. 0.0046
- d. 0.0014

Answer: b

15. Find the elongation of an steel rod of 100mm length when it is subjected to a tensile strain of 0.005?

- a. 0.2mm
- b. 0.3mm
- c. 0.5mm**
- d. 0.1mm

Answer: c

16. i) Strain is a fundamental behaviour of a material.

ii) Strain does not have a unit.

- a. Both i and ii are true and ii is the correct explanation of i
- b. Both i and ii are true but ii is not the correct explanation of i**
- c. i is true but ii is false

- d. ii is true but i is false

Answer: b

17. A tensile test was conducted on a steel bar. The gauge length of the bar was 10cm and the extension was 2mm. What will be the percentage elongation?

- a. 0.002
- b. 0.02
- c. 0.2
- d. 2**

Answer: d

18. The lateral strain is _____

- a. The ratio of axial deformation to the original length
- b. The ratio of deformation in area to the original area
- c. The strain at right angles to the direction of applied load**
- d. The ratio of length of body to the tensile force applied on it

Answer: c

19. Find the strain of a brass rod of length 100mm which is subjected to a tensile load of 50kN when the extension of rod is equal to 0.1mm?

- a. 0.01
- b. 0.001**
- c. 0.05
- d. 0.005

Answer: b

20. The stress which acts in a direction perpendicular to the area is called _____

- a. Shear stress
- b. Normal stress**
- c. Thermal stress
- d. None of the mentioned

Answer: b

21. Which of these are types of normal stresses?

- a. Tensile and compressive stresses**
- b. Tensile and thermal stresses
- c. Shear and bending
- d. Compressive and plane stresses

Answer: a

22. In a body loaded under plane stress conditions, what is the number of independent stress components?

- a. 1
- b. 2
- c. 3**
- d. 6

Answer: c

23. If a bar of large length when held vertically and subjected to a load at its lower end, its own weight produces additional stress. The maximum stress will be _____

- a. At the lower cross-section
- b. At the built-in upper cross-section**
- c. At the central cross-section
- d. At every point of the bar

Answer: b

24. Which type of stress does in a reinforcement bar is taken by the concrete?

- a. Tensile stress
- b. Compressive stress**
- c. Shear stress
- d. Bending stress

Answer: b

25. A material has a Poisson's ratio of 0.5. If uniform pressure of 300GPa is applied to that material, What will be the volumetric strain of it?

- a. 0.50

- b. 0.20
- c. 0.25
- d. Zero**

Answer: d

26. A diagram which shows the variations of the axial load for all sections of the part of a beam is called _____
- a. Bending moment diagram
 - b. Shear force diagram
 - c. Thrust diagram
 - d. Stress diagram**

Answer: d

27. The stress induced in a body, when subjected to two equal and opposite forces which are acting tangentially across the resisting section resulting the shearing of the body across its section is called _____
- a. Bending stress
 - b. Compressive stress
 - c. Shear strain
 - d. Shear stress**

Answer: d

28. What is the formula for shear stress?
- a. Shear resistance/shear area**
 - b. Force/unit area
 - c. Bending strain/area
 - d. Shear stress/length

Answer: a

29. The law which states that within elastic limits strain produced is proportional to the stress producing it is known as _____
- a. Bernoulli's law
 - b. Hooke's law**
 - c. Stress law
 - d. Poisson's law

Answer: b

30. What is the factor of safety?
- a. The ratio of stress to strain
 - b. The ratio of permissible stress to the ultimate stress
 - c. The ratio of ultimate stress to the permissible stress**
 - d. The ratio of longitudinal strain to stress

Answer: c

31. What is Hooke's law for the 1-D system?
- a. The relation between normal stress and the corresponding strain**
 - b. The relation between shear stress and the corresponding strain
 - c. The relation between lateral strain and the corresponding stress
 - d. None of the mentioned

Answer: a

32. Limit of proportionality depends upon _____
- a. Area of cross-section**
 - b. Type of loading
 - c. Type of material
 - d. All of the mentioned

Answer: a

33. The stress at which extension of a material takes place more quickly as compared to the increase in load is called _____
- a. Elastic point
 - b. Plastic point
 - c. Breaking point
 - d. Yielding point**

Answer: d

34. Which of these is a non-Hookean material?
- a. Steel
 - b. Rubber**
 - c. Aluminium

d. Copper

Answer: b

35. Where in the stress-strain curve, the Hooke's law is valid?

- a. Strain hardening region
- b. Necking region
- c. **Elastic range**
- d. Valid everywhere

Answer: c

36. Highest value of stress for which Hooke's law is applicable for a given material is called

- a. Stress limit
- b. Strain limit
- c. **Proportional limit**
- d. Significant limit

Answer: c

37. The loading limit under which the deformation entirely disappears on removal of load is called-----

- a. **Elastic limit**
- b. Proportionality limit
- c. Yield point
- d. Yong's modulus

Answer: a

38. The slope of linearly elastic portion of stress strain diagram is a measure of----

- a. **Modulus of elasticity**
- b. Modulus of rigidity
- c. Bulk modulus
- d. Elastic limit

Answer: a

39. If both the modulus of elasticity and shear modulus of a metal are doubled, the Poisson's ratio of the metal will----

- a. Double

b. Half

c. increase four times

d. **remain unaffected**

Answer: d

40. Stress represents the -----

- a. external force acting on the body
- b. pressure setup within the body material
- c. force by which the material of the body opposes the deformation
- d. **resistance per unit area to deformation by internal forces**

Answer: d

41. Young's modulus of elasticity for a perfectly rigid body is—

- a. zero
- b. unity
- c. **infinity**
- d. some finite non-zero value

Answer: c

42. For a given material, the modulus of rigidity is 100 GPa and the Poisson's ratio is 0.25. the value of modulus of elasticity in GPa is—

- a. 12.5
- b. 150
- c. 200
- d. **250**

Answer: d

43. A steel bar of 1.5 m length, 50 mm wide and 20 mm thick is subjected to an axial tensile load of 120 kN. If the extension in length of bar is 0.9 mm, the modulus of elasticity of bar material is---

- a. 50 KPa

- b. 100 KPa
- c. 150 KPa
- d. 200 KPa**

Answer: d

44. A simply supported beam of length 4m and carrying a point load of 15N at mid span will have a maximum bending moment of—
- a. 10 N-m
 - b. 15 N-m**
 - c. 20 N-m
 - d. 25 N-m

Answer: b

45. If a simply supported beam carries a UDL on entire length, the shear force—
- a. has a maximum value at the mid-point
 - b. has a linear variation along entire length**
 - c. is constant at all sections
 - d. is not zero at any section of the beam

Answer: b

46. A cantilever beam of length 3m is carrying a point load of 10 kN at its free end and a UDL of 12 kN/m over its entire span. The value of moment acting at fixed end of the beam is—
- a. 80 KN-m
 - b. 82 KN-m
 - c. 84 KN-m**
 - d. 86 KN-m

Answer: c

47. In stress-strain graph which of the following is taken along x-axis?
- a. stress

- b. strain**
- c. force
- d. Young's modulus

Answer: \b

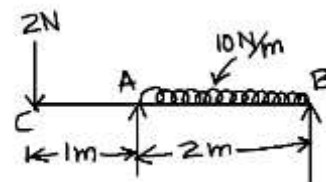
48. In stress-strain curve, the point occurring after elastic limit is
- a. Proportionality limit
 - b. ultimate point
 - c. yield point**
 - d. breaking point

Answer: c

49. Which of the following are statically determinate beams?
- a. only simply supported beams
 - b. Cantilever, simply supported and overhanging beams**
 - c. Fixed beams
 - d. Continuous beams

Answer: b

50. What is the distance of point of contra-flexure from point A in the beam loaded as shown in following figure—



- a. 1m
- b. 0.5m
- c. 0.2m**
- d. 0.3m

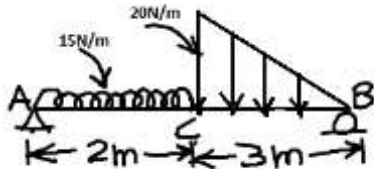
Answer: c

c. 1.3 mm

d. 13mm

51. The value of reaction at point B in following beam is---

Answer: b



- a. 21N
b. 22N
c. 23N
d. 24N

Answer: d

52. A force of 1000 kN is applied on a metallic bar of 10 cm diameter and 50 cm length. The change in diameter is observed as 0.25 mm. If factor of safety of 2.5 is considered; the value of ultimate stress for the material in MPa is---
- a. 218
b. 318
c. 418
d. 518

Answer: b

53. A rectangular bar of length 2m and cross-sectional area 30cmX15cm is subjected to axial tensile force of 500 kN. If the Poisson's ratio and Bulk modulus of the bar material are 0.25 and 110 GPa respectively, the change in length of the bar will be--
- a. 0.013 mm
b. 0.13 mm

54. Hook's law holds good up to—

- a. elastic limit
b. proportionality limit
c. yield point
d. breaking point

Answer: b

55. A block of weight 200 kN is suspended from a vertical copper wire of 20 mm diameter and 3 m length. What will be the decrease in diameter of the wire if $E = 1 \times 10^6$ bar and $\mu = 0.25$.

- a. 0.01 mm
b. 0.02 mm
c. 0.03mm
d. 0.04 mm

Answer: c

56. The value of Poisson's ratio depends upon
- a. nature of load, i.e. tensile or compressive
b. magnitude of load
c. material of test specimen
d. cross-section and dimension of test piece

Answer: c

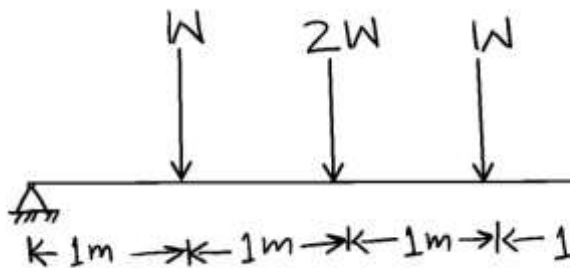
57. The value of stress of 1 N/cm² in MPa will be--
- a. 0.001
b. 0.01
c. 0.1
d. 1

Answer: b

58. If a simply supported beam carries a UVL on the entire span, the bending moment—
- has a maximum value at the mid span
 - has a parabolic variation along the span
 - is constant along the beam
 - is zero at the ends of beam**

Answer: d

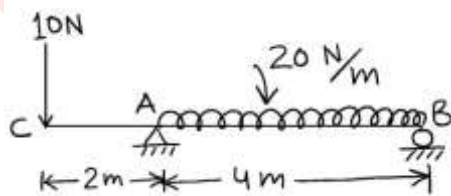
59. A simply supported beam is loaded as shown in the figure given below. The maximum shear force in the beam will be---



- Zero
- W
- 2W**
- 4W

Answer: c

60. The distance of point of contra-flexure from point C in the following beam is—



- 1m
- 2m
- 2.5m**

d. 3m

Answer: c

61. The value of bending moment at the ends in a simply supported beam—
- is always zero
 - is always zero if the beam is not subjected to a couple at the ends**
 - equal to the reaction at the ends
 - Can't be predicted

Answer: b

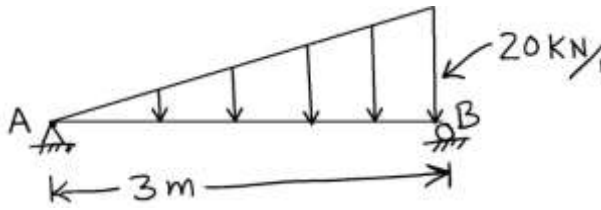
62. A simply supported beam is subjected to a couple at mid-point, the variation of shear force along the entire beam will be---
- constant**
 - linear
 - parabolic
 - cubic

Answer: a

63. The maximum value of bending moment in a simply supported beam of length 4 m subjected to a UDL of intensity 20 kN/m over entire span will be—
- 40 KN-m**
 - 50 KN-m
 - 60 KN-m
 - 70 KN-m

Answer: a

64. The maximum value of shear force in a simply supported beam of length 3 m subjected to a UVL of maximum intensity 20 kN/m, as shown in figure over entire span—



- a. 10 kN
- b. 20 kN**
- c. 30 kN
- d. 40 kN

Answer: b

65. A cantilever beam is carrying several point

loads. The shear force is maximum at—

- a. free end
- b. fixed end**
- c. at the point of largest load
- d. mid point of beam

Answer: b

66. A cantilever beam of length 2 m is carrying a UDL of 10 kN/m over half of its length starting from free end, the value of maximum bending moment is—

- a. 10 kN-m
- b. 15 kN-m**
- c. 20 kN-m
- d. 25 kN-m

Answer: b

Unit-II

1. Compression ratio of I.C. Engines is
 - a. **The ratio of volumes of air in cylinder before compression stroke and after compression stroke**
 - b. Volume displaced by piston per stroke and clearance volume in cylinder
 - c. Ratio of pressure after compression and before compression
 - d. Swept volume/cylinder volume
 Answer: a

2. In an internal combustion engine, the process of removing the burnt gases from the combustion chamber of the engine cylinder is known as
 - a. **Scavenging**
 - b. Detonation
 - c. Supercharging
 - d. Polymerisation
 Answer: a

3. The theoretically correct air fuel ratio for petrol engine is of the order of
 - a. 6: 1
 - b. 9: 1
 - c. 12: 1
 - d. **15: 1**
 Answer: d

4. Which of the following is the lightest and most volatile liquid fuel?
 - a. Diesel
 - b. Kerosene
 - c. Fuel oil
 - d. **Gasoline**
 Answer: d

5. The working pressure and temperature inside the cylinder of an internal combustion engine is _____ as compared to a steam engine.
 - a. Low
 - b. Very low
 - c. High
 - d. **Very high**
 Answer: d

6. The rating of a diesel engine, with increase in air inlet temperature, will
 - a. Increase linearly
 - b. **Decrease linearly**
 - c. Increase parabolically
 - d. Decrease parabolically
 Answer: b

7. Pick up the wrong statement about supercharging
 - a. Supercharging reduces knocking in diesel engines
 - b. There can be limited supercharging in petrol engines because of detonation
 - c. Supercharging at high altitudes is essential
 - d. **Supercharging results in fuel economy**
 Answer: \d

8. If the temperature of intake air in internal combustion engine increases, then its efficiency will
 - a. Remain same
 - b. **Decrease**
 - c. Increase
 - d. None of these
 Answer: b

9. The operation of forcing additional air under pressure in the engine cylinder is known as
- Scavenging
 - Turbulence
 - Supercharging**
 - Pre-ignition

Answer: c

10. The ignition quality of petrol is expressed by
- Cetane number
 - Octane number**
 - Calorific value
 - All of these

Answer: b

11. The mean effective pressure obtained from engine indicator indicates the
- Maximum pressure developed
 - Minimum pressure
 - Instantaneous pressure at any instant
 - Average pressure**

Answer: d

12. The maximum temperature in the I.C. engine cylinder is of the order of
- 500-1000°C
 - 1000-1500°C
 - 1500-2000°C
 - 2000-2500°C**

Answer: d

13. The pressure at the end of compression in the case of diesel engine is of the order of
- 6 kg/cm
 - 12 kg/cm
 - 20 kg/cm
 - 35 kg/cm**

Answer: d

14. If the temperature of intake air in IC engines is lowered, then its efficiency will
- Increase**
 - Decrease
 - Remain same
 - Increase up to certain limit and then decrease

Answer: a

15. Which of the following medium is compressed in a Diesel engine cylinder?
- Air alone**
 - Air and fuel
 - Air and lub oil
 - Fuel alone

Answer: a

16. Pick up the false statement
- Thermal efficiency of diesel engine is about 34%
 - Theoretically correct mixture of air and petrol is approximately 15:1
 - High speed compression engines operate on dual combustion cycle
 - S.I. engines are quality governed engines**

Answer: a

17. The ratio of indicated thermal efficiency to the corresponding air standard cycle efficiency is called
- Net efficiency
 - Efficiency ratio
 - Relative efficiency**
 - Overall efficiency

Answer: c

18. The minimum cranking speed in case of petrol engine is about

- a. Half the operating speed
- b. One fourth of operating speed
- c. 250 - 300 rpm
- d. 60 - 80 rpm**

Answer: d

19. Number of working strokes per min. for a two stroke cycle engine is _____ the speed of the engine in r.p.m.

- a. Equal to**
- b. One-half
- c. Twice
- d. Four-times

Answer: a

20. In petrol engines, advancing of the spark timing will _____ the knocking tendency.

- a. Not effect
- b. Decrease
- c. Increase**
- d. None of these

Answer: c

21. In a naturally aspirated diesel engine, the air is supplied by

- a. A supercharger
- b. A centrifugal blower
- c. A vacuum chamber**
- d. An injection tube

Answer: c

22. Which of the following is not an internal combustion engine?

- a. 2-stroke petrol engine
- b. 4-stroke petrol engine
- c. Diesel engine
- d. Steam turbine**

Answer: d

23. The spark ignition engines are governed by

- a. Hit and miss governing
- b. Qualitative governing
- c. Quantitative governing**
- d. Combination of (B) and (C)

Answer: c

24. In the crankcase method of scavenging, the air pressure is produced by

- a. Supercharger
- b. Centrifugal pump
- c. Natural aspirator
- d. Movement of engine piston**

Answer: d

25. Thermal efficiency of a two stroke cycle engine is _____ a four stroke cycle engine.

- a. Equal to
- b. Less than**
- c. Greater than
- d. None of these

Answer: b

26. Scavenging is usually done to increase

- a. Thermal efficiency
- b. Speed
- c. Power output**
- d. Fuel consumption

Answer: c

27. The pressure and temperature at the end of compression stroke in a petrol engine are of the order of

- a. 4-6 kg/cm² and 200-250°C
- b. 6-12 kg/cm² and 250-350°C**
- c. 12-20 kg/cm² and 350-450°C
- d. 20-30 kg/cm² and 450-500°C

Answer: b

28. Engine pistons are usually made of aluminium alloy because it

- a. **Is lighter**
- b. Wear is less
- c. Absorbs shocks
- d. Is stronger

Answer: a

29. _____ is a chemical reaction in which certain elements of the fuel like hydrogen and carbon combine with oxygen liberating heat energy and causing an increase in temperature of the gases.

- a. Compression
- b. Expansion
- c. **Combustion**
- d. None of the mentioned

Answer: c

30. In spark ignition engines a nearly _____ mixture of air and fuel is formed in the carburettor.

- a. heterogeneous
- b. **homogeneous**
- c. solid
- d. none of the mentioned

Answer: b

31. The thermal efficiency of a standard Otto cycle for a compression ratio of 5.5 will be _____

- a. 25%
- b. **50%**
- c. 70%
- d. 100%

Answer: b

32. The efficiency of an Otto cycle is increased by increasing _____

- a. **pressure ratio**

b. **compression ratio**

- c. temperature ratio
- d. none of the mentioned

Answer: b

33. The Otto cycle consists of _____

- a. two constant pressure processes and two constant volume processes
- b. **two constant pressure and two constant entropy processes**
- c. two constant volume processes and two constant entropy processes
- d. none of the mentioned

Answer: b

34. The thermal efficiency of theoretical Otto cycle _____

- a. decreases with increase in compression ratio
- b. increases with decrease in compression ratio
- c. **does not depends upon the pressure ratio**
- d. none of the mentioned

Answer: c

35. What is the work output of the theoretical Otto cycle?

- a. increases with increase in compression ratio
- b. increases with increase in pressure ratio
- c. **increases with increase in compression & pressure ratio**
- d. none of the mentioned

Answer: c

36. The mean effective pressure of an Otto Cycle increases with an increase in _____

- a. pressure ratio
- b. **compression ratio**

- c. temperature ratio
- d. none of the mentioned

Answer: b

37. In Otto cycle, heat addition takes place at

- _____
- a. constant temperature
 - b. constant pressure
 - c. constant volume**
 - d. none of the mentioned

Answer: c

38. If compression ratio of an engine working on Otto cycle is increased from 5 to 6, its air standard efficiency will increase by

- _____
- a. 1%
 - b. 20%
 - c. 16.67%
 - d. 8%**

Answer: d

39. If the compression ratio of an engine working on Otto cycle is increased from 5 to 7, the percentage increase in efficiency will be

- _____
- a. 2%
 - b. 4%
 - c. 8%
 - d. 14%**

Answer: d

40. The constant volume cycle is also called

- _____
- a. Carnot cycle
 - b. Joule cycle
 - c. Diesel cycle
 - d. Otto cycle**

Answer: d

41. What does 1 Tonne (TR) in refrigeration mean?

- a. Weight of gases
- b. Weight of coolant
- c. Capacity of 1 tonne air to be cooled to 0 C in 24 hours
- d. Capacity of 1 tonne water to be cooled to 0 C in 24 hours**

Answer: d

42. 1 Tonne = _____ KJ/s.

- a. 2.67
- b. 1.087
- c. 3.5**
- d. 232.6

Answer: c

43. Which is the S.I. unit to measure pressure in refrigeration?

- a. Newton
- b. Joule
- c. Pascal**
- d. Bar

Answer: c

44. 0 Kelvin = _____ Celsius.

- a. -273 C**
- b. 273 C
- c. -273 K
- d. 0 C

Answer: a

45. The heat removing capacity of one tonne refrigeration is equal to?

- a. 210 KJ/min**
- b. 620 KJ/min
- c. 240 KJ/min
- d. 430 KJ/min

Answer: a

46. What does 35 Celsius (C) mean on Kelvin scale (K)?

- a. 350
- b. 135
- c. 308**
- d. 298

Answer: c

47. What is S.I. unit of refrigeration?

- a. J/min
- b. KJ/s**
- c. KWh
- d. Kg/s

Answer: b

48. $1 \text{ N/mm}^2 = \underline{\hspace{1cm}}$ mm of Hg (mercury).

- a. 1
- b. 256
- c. 760**
- d. 720

Answer: c

49. What is the S.I. unit required to measure the work done in refrigeration is?

- a. Joule/kg
- b. KJ/kg
- c. Joule/m. s
- d. Joule/s**

Answer: d

50. Which one of the following is not a component of a simple air cooling system?

- a. Main compressor
- b. Cooling fan
- c. Heat exchanger
- d. Generator**

Answer: d

51. Which of the following is true about the optimum effective temperature for human comfort?

- a. Same in winter and summer
- b. Not dependent on season
- c. Lower in winter than in summer**
- d. Higher in winter than in summer

Answer: c

52. The heat production from a normal healthy man when asleep is about _____

- a. 50 W
- b. 40 W
- c. 70 W
- d. 60 W**

Answer: d

53. When the heat stored in the body is _____ the human body feels comfortable.

- a. zero**
- b. infinite
- c. positive
- d. negative

Answer: a

54. Which of the following does not mainly a factor of dependency for the degree of warmth or cold?

- a. Relative humidity
- b. WBT
- c. Air velocity
- d. DBT**

Answer: d

55. What is the term C.O.P. referred in terms of refrigeration?

- a. Capacity of Performance
- b. Co-efficient of Plant
- c. Co-efficient of Performance**
- d. Cooling for Performance

Answer: c

56. C.O.P. can be expressed by which equation?

- a. $\text{WorkDoneRefrigerationeffect}$

b. **Refrigeration effect / Work Done**

c. $\frac{\text{Work Done}}{\text{Heat Transfer}}$

d. $\frac{\text{Heat Transfer}}{\text{Work Done}}$

Answer: b

57. What is the term relative C.O.P. referred in terms of refrigeration?

a. **Actual C.O.P. / Theoretical C.O.P.**

b. $\frac{\text{Theoretical C.O.P.}}{\text{Actual C.O.P.}}$

c. $\frac{\text{Actual C.O.P.}}{\text{Average C.O.P.}}$

d. $\frac{\text{Average C.O.P.}}{\text{Theoretical C.O.P.}}$

Answer: a

58. Find the C.O.P. of a refrigeration system if the work input is 40 KJ/kg and refrigeration effect produced is 130 KJ/kg of refrigerant flowing.

a. 3.00

b. 2.25

c. 3.75

d. **3.25**

Answer: d

59. Find the Relative C.O.P. of a refrigeration system if the work input is 60 KJ/kg and refrigeration effect produced is 130 KJ/kg of refrigerant flowing. Also Theoretical C.O.P. is 3.

a. 0.65

b. 0.79

c. **0.72**

d. 0.89

Answer: c

60. Find the C.O.P. of a refrigeration system if the work input is 30 KJ/kg and refrigeration effect produced is 120 KJ/kg of refrigerant flowing.

a. 3.00

b. **4.00**

c. 0.75

d. 0.25

Answer: b

61. Which equation represents efficiency in general?

a. $\frac{\text{Work Done}}{\text{Refrigeration effect}}$

b. $\frac{\text{Heat Transfer}}{\text{Work Done}}$

c. **$\frac{\text{Work Done}}{\text{Heat Transfer}}$**

d. $\frac{\text{Refrigeration effect}}{\text{Work Done}}$

Answer: c

62. The Co-efficient of Performance is always _____

a. **greater than 1**

b. less than 1

c. equal to 1

d. zero

Answer: a

63. In a refrigerating machine, if the lower temperature is fixed, then the C.O.P. of machine can be increased by?

a. Increasing the higher temperature

b. **Decreasing the higher temperature**

c. Operating the machine at lower speed

d. Operating the machine at higher speed

Answer: b

64. If a condenser and evaporator temperatures are 120 K and 60 K respectively, then reverse Carnot C.O.P is _____

a. 0.5

b. **1**

c. 3

d. 2

Answer: b

65. The C.O.P. of reverse Carnot cycle is most strongly dependent on which of the following?

a. **Evaporator temperature**

- b. Condenser temperature
- c. Specific heat
- d. Refrigerant

Answer: a

66. If a condenser and evaporator temperatures are 312 K and 273 K respectively, then reverse Carnot C.O.P is _____
- a. 5
 - b. 6
 - c. 7
 - d. 8

Answer: c

67. The C.O.P for reverse Carnot refrigerator is 2. The ratio of lowest temperature to highest temperature will be _____
- a. twice
 - b. half
 - c. four times
 - d. **three times**

Answer: d

68. If a condenser and evaporator temperatures are 250 K and 100 K respectively, then reverse Carnot C.O.P is _____
- a. 5.5
 - b. 1.5
 - c. **2.5**
 - d. 3.0

Answer: c

69. The reverse Carnot cycle C.O.P. can be expressed as _____ (Where t_1 is the lower temperature and t_2 is the higher temperature).
- a. $(t_1 - t_2)/t_2$
 - b. $(t_2 - t_1)/t_2$
 - c. $(t_2 - t_1)/(t_1 - t_2)$
 - d. **$(t_2 - t_1)/t_1$**

Answer: d

70. What is the difference between Heat Pump and Refrigerator?

- a. Heat Pump Gives efficiency and refrigerator gives C.O.P.
- b. Both are similar
- c. **Both are almost similar, just the desired effect is different**
- d. Work is output in refrigerator and work is input in heat pump

Answer: c

71. What is the equation between efficiency of Heat engine and C.O.P. of heat pump?

- a. $\eta_E = (C.O.P.)_P$
- b. **$\eta_E = 1 / (C.O.P.)_P$**
- c. $\eta_E / (C.O.P.)_P = 1$
- d. $\eta_E \times (C.O.P.)_P = 0$

Answer: b

72. How is the Relative coefficient of performance represented?

- a. Theoretical C.O.P. / Actual C.O.P.
- b. **Actual C.O.P. / Theoretical C.O.P.**
- c. Theoretical C.O.P. x Actual C.O.P.
- d. $1 / \text{Theoretical C.O.P.} \times \text{Actual C.O.P.}$

Answer: b

73. C.O.P. of the heat pump is always _____

- a. one
- b. less than One
- c. **greater than One**
- d. zero

Answer: c

74. For the systems working on reversed Carnot cycle, what is the relation between C.O.P. of Refrigerator i.e. $(C.O.P.)_R$ and Heat Pump i.e. $(C.O.P.)_P$?

- a. $(C.O.P.)_R + (C.O.P.)_P = 1$
- b. **$(C.O.P.)_R = (C.O.P.)_P$**

c. $(C.O.P.)_R = (C.O.P.)_P - 1$

d. $(C.O.P.)_R + (C.O.P.)_P + 1 = 0$

Answer: c

75. If the reversed Carnot cycle operating as a heat pump between temperature limits of 364 K and 294 K, then what is the value of C.O.P.?

- a. 4.2
- b. 0.19
- c. **5.2**
- d. 0.23

Answer: c

76. A reversed Carnot cycle is operating between temperature limits of (-) 33°C and (+) 27°C. If it acts as a heat engine gives an efficiency of 20%. What is the value of C.O.P. of a heat pump operating under the same conditions?

- a. 6.5
- b. 8
- c. **5**
- d. 2.5

Answer: c

77. If the coefficient of performance of the refrigerator is 4.67, then what is the value of the coefficient of performance of the heat pump operating under the same conditions?

- a. 3.67
- b. **5.67**
- c. 0.214
- d. 9.34

Answer: b

78. A heat pump is used to maintain a hall at 30°C when the atmospheric temperature is 15°C. The heat loss from the hall is 1200 kJ/min. Calculate the power required to run the heat pump if its C.O.P. is 40% of the Carnot

machine working between the same temperature limits.

- a. 0.495
- b. 4.04
- c. **0.247**
- d. 8.08

Answer: c

79. A heat pump which runs (1/3)rd of time removes on an average 2400 kJ/hr of heat. If power consumed is 0.25 kW, what is the value of the C.O.P.?

- a. 4
- b. 2
- c. **8**
- d. 6

Answer: c

80. C.O.P. of the refrigerator is always _____ the C.O.P. of the heat pump when both are working between the same temperature limits.

- a. **less than**
- b. greater than
- c. equal to
- d. inverse of

Answer: a

Unit-III

1. When a body is placed over a liquid, it will sink down if

- a. Gravitational force is equal to the up-thrust of the liquid
- b. Gravitational force is less than the up-thrust of the liquid
- c. Gravitational force is more than the up-thrust of the liquid**
- d. None of the above

Answer: c

2. The property by virtue of which a liquid opposes relative motion between its different layers is called

- a. Surface tension
- b. Coefficient of viscosity
- c. Viscosity**
- d. Osmosis

Answer: c

3. When a body floating in a liquid, is displaced slightly, it oscillates about

- a. C.G. of body
- b. Center of pressure
- c. Center of buoyancy
- d. Metacentre**

Answer: d

4. The pressure of the liquid flowing through the divergent portion of a Venturimeter

- a. Remains constant
- b. Increases
- c. Decreases**

- d. Depends upon mass of liquid

Answer: c

5. In an immersed body, centre of pressure is

- a. At the centre of gravity
- b. Above the centre of gravity
- c. Below the centre of gravity**
- d. Could be above or below e.g. depending on density of body and liquid

Answer: c

6. Steady flow occurs when

- a. The direction and magnitude of the velocity at all points are identical
- b. The velocity of successive fluid particles, at any point, is the same at successive periods of time**
- c. The magnitude and direction of the velocity do not change from point to point in the fluid
- d. The fluid particles move in plane or parallel planes and the streamline patterns are identical in each plane

Answer: b

7. fluid which obeys the Newton's law of viscosity is termed as

- a. Real fluid
- b. Ideal fluid
- c. Newtonian fluid**
- d. Non-Newtonian fluid

Answer: c

8. A one dimensional flow is one which

- a. Is uniform flow
- b. Is steady uniform flow
- c. Takes place in straight lines

d. Involves zero transverse component of flow

Answer: d

9. Dimensions of surface tension are

- a. ML^0T^{-2}
- b. ML^0T
- c. MLr^2
- d. ML^2T^2

Answer: a

10. The property of fluid by virtue of which it offers resistance to shear is called

- a. Surface tension
- b. Adhesion
- c. Cohesion
- d. Viscosity**

Answer: d

11. A fluid in equilibrium can't sustain

- a. Tensile stress
- b. Compressive stress
- c. Shear stress**
- d. Bending stress

Answer: c

12. Fluid is a substance that

- a. Cannot be subjected to shear forces
- b. Always expands until it fills any container
- c. Has the same shear stress at a point regardless of its motion
- d. Cannot remain at rest under action of any shear force**

Answer: d

13. The unit of viscosity is

- a. Meters² per sec
- b. kg-sec/meter**
- c. Newton-sec per meter²
- d. Newton-sec per meter

Answer: b

14. A pressure of 25 m of head of water is equal to

- a. 25 kN/ m²
- b. 245 kN/ m²**
- c. 2500 kN/m²
- d. 2.5 kN/ m²

Answer: b

15. Dynamic viscosity of most of the gases with rise in temperature

- a. Increases**
- b. Decreases
- c. Remain unaffected
- d. Unpredictable

Answer: a

16. Low specific speed of a pump implies it is

- a. Centrifugal pump**
- b. Mixed flow pump
- c. Axial flow pump
- d. None of the above

Answer: a

17. Head developed by a centrifugal pump is

- a. Proportional to diameter of impeller
- b. Proportional to speed of impeller
- c. Proportional to diameter and speed of impeller**
- d. None of the above

Answer: c

18. In centrifugal pumps, maximum efficiency is obtained when the blades are

- a. Straight
- b. Bent forward
- c. Bent backward**
- d. Radial

Answer: c

19. A double overhung Pelton wheel has

- a. Two jets

b. **Two runners**

- c. Four jets
- d. Four runners

Answer: b

20. Medium specific speed of a pump implies it is

- a. Centrifugal pump
- b. **Mixed flow pump**
- c. Axial flow pump
- d. Any one of the above

Answer: b

21. If the ratios of all the corresponding linear dimensions are equal, then the model and the prototype are said to have

- a. **Geometric similarity**
- b. Kinematic similarity
- c. Dynamic similarity
- d. None of these

Answer: a

22. The optimum value of vane exit angle for a centrifugal pump impeller is

- a. 10-15°
- b. **20-25°**
- c. 30-40°
- d. 50-60°

Answer: b

23. Which of the following pump is suitable for small discharge and high heads?

- a. Centrifugal pump
- b. Axial flow pump
- c. Mixed flow pump
- d. **Reciprocating pump**

Answer: d

24. For small discharge at high pressure, following pump is preferred

- a. Centrifugal

b. Axial flow

c. Mixed flow

d. **Reciprocating**

Answer: b

25. A hydraulic press is a device used

- a. To store pressure energy which may be supplied to a machine later on
- b. To increase the intensity of pressure of water by means of energy available from a large quantity of water at a low pressure
- c. **To lift larger load by the application of a comparatively much smaller force**
- d. All of the above

Answer: c

26. Low specific speed of turbine implies it is

- a. Propeller turbine
- b. Francis turbine
- c. **Impulse turbine**
- d. Any one of the above

Answer: c

27. The function of guide vanes in a reaction turbine is to

- a. Allow the water to enter the runner without shock
- b. Allow the water to flow over them, without forming eddies
- c. Allow the required quantity of water to enter the turbine
- d. **All of the above**

Answer: d

28. Hydraulic accumulator is used for

- a. Accumulating oil
- b. Supplying large quantities of oil for very short duration
- c. Generally high pressures to operate hydraulic machines

d. Supplying energy when main supply fails

Answer: d

29. The jet ratio is defined as the ratio of the
- Diameter of jet to the diameter of Pelton wheel
 - Velocity of jet to the velocity of Pelton wheel
 - Diameter of Pelton wheel to the diameter of jet**
 - Velocity of Pelton wheel to the velocity of jet

Answer: c

30. Maximum impulse will be developed in hydraulic ram when
- Waste valve closes suddenly**
 - Supply pipe is long
 - Supply pipe is short
 - Ram chamber is large

Answer: a

31. In a single casing, multistage pump running at constant speed, the capacity rating is to be slightly lowered. It can be done by
- Designing new impeller
 - Trimming the impeller size to the required size by machining**
 - Not possible
 - Some other alterations in the impeller

Answer: b

32. Which of the following pump is successfully used for lifting water to the turbines?
- Centrifugal pump
 - Reciprocating pump
 - Jet pump**
 - Air lift pump

Answer: c

33. If a pump is handling water and is discharging a certain flow Q at a constant total dynamic head requiring a definite B.H.P., the same pump when handling a liquid of specific gravity 0.75 and viscosity nearly same as of water, the horse power required will be
- Same
 - 0.75 B.H.P.**
 - B.H.P./0.75
 - 1.5 B.H.P.

Answer: b

34. A jet of water is striking at the centre of a curved vane moving with a uniform velocity in the direction of jet. For the maximum efficiency, the vane velocity is _____ of the jet velocity
- One-half
 - One-third**
 - Two-third
 - Three-fourth

Answer: b

35. In a centrifugal pump, the liquid enters the pump
- At the top
 - At the bottom
 - At the center**
 - From sides

Answer: c

36. Kinematic similarity is said to exist between the model and the prototype, if both of them
- Have identical velocities**
 - Are equal in size and shape
 - Are identical in shape, but differ only in size

d. Have identical forces

Answer: a

37. For very high discharge at low pressure such as for flood control and irrigation applications, following type of pump is preferred

- a. Centrifugal
- b. Axial flow**
- c. Reciprocating
- d. Mixed flow

Answer: b

38. The flow ratio of Francis turbine is defined as the ratio of the

- a. Velocity of flow at inlet to the theoretical jet velocity**
- b. Theoretical velocity of jet to the velocity of flow at inlet
- c. Velocity of runner at inlet to the velocity of flow at inlet
- d. None of the above

Answer: a

39. The maximum number of jets generally employed in impulse turbine without jet interference is

- a. 4
- b. 6**
- c. 8
- d. 12

Answer: b

40. The specific speed (N_s) of a centrifugal pump is given by

- a. $(N\sqrt{Q})/H^{2/3}$
- b. $(N\sqrt{Q})/H^{3/4}$**
- c. $(N\sqrt{Q})/H$

d. $(N\sqrt{Q})/H^{5/4}$

Answer: b

41. . Medium specific speed of turbine implies it is

- a. Propeller turbine
- b. Francis turbine**
- c. Impulse turbine
- d. Any one of the above

Answer: b

42. A turbine is required to develop 1500 kW at 300 r.p.m. under a head of 150 m. Which of the following turbine should be used?

- a. Pelton wheel with one nozzle**
- b. Pelton wheel with two or more nozzles
- c. Kaplan turbine
- d. Francis turbine

Answer: a

43. Pick up the wrong statement about centrifugal pump

- a. Discharge a diameter**
- b. Head a speed²
- c. Head a diameter
- d. Power a speed⁴

Answer: a

44. The flow ratio in case of Francis turbine varies from

- a. 0.15 to 0.3**
- b. 0.4 to 0.5
- c. 0.6 to 0.9
- d. 1 to 1.5

Answer: a

45. In reaction turbine, draft tube is used

- a. To transport water downstream without eddies

b. **To convert the kinetic energy to flow energy by a gradual expansion of the flow cross-section**

- c. For safety of turbine
- d. To increase flow rate

Answer: b

46. Air vessels in reciprocating pump are used to

- a. Smoothen flow
- b. **Reduce acceleration to minimum**
- c. Increase pump efficiency
- d. Save pump from cavitations

Answer: b

47. For 450 m head of water, _____ shall be used.

- a. **Pelton wheel**
- b. Kaplan turbine
- c. Francis turbine
- d. None of these

Answer: a

48. According to fan laws, for fans having constant wheel diameter, the air or gas capacity varies

- a. **Directly as fan speed**
- b. Square of fan speed
- c. Cube of fan speed
- d. Square root of fan speed

Answer: a

49. The speed ratio in case of Francis turbine varies from

- a. 0.15 to 0.3
- b. 0.4 to 0.5
- c. **0.6 to 0.9**
- d. 1 to 1.5

Answer: c

50. The specific speed of turbine is defined as the speed of a unit

- a. Of such a size that it delivers unit discharge at unit head
- b. Of such a size that it delivers unit discharge at unit power
- c. Of such a size that it requires unit power per unit head
- d. **Of such a size that it produces unit horse power with unit head**

Answer: d

51. The undershot water wheels are those in which

- a. The wheel runs entirely by the weight of water
- b. **The wheel runs entirely by the impulse of water**
- c. The wheel runs partly by the weight of water and partly by the impulse of water
- d. None of the above

Answer: b

Unit-IV

1. Science of precise and accurate measurement of various physical quantities is termed as _____

- a. **Metrology**
- b. Meteorology
- c. Pedology
- d. Mineralogy

Answer: a

2. In a measuring system quantity under measurement is termed as _____

- a. **Measurand**
- b. Controllers
- c. Sensors
- d. Indicators

Answer: a

3. In a measurement, what is the term used to specify the closeness of two or more measurements?

- a. **Precision**
- b. Accuracy
- c. Fidelity
- d. Threshold

Answer: a

4. Accuracy and Precision are dependent on each other.

- a. True
- b. **False**

Answer: b

5. During a measurement, for a measure value "B", absolute error is obtained as "A", what will be the relative error of measurement?

- a. **A/B**
- b. B/A
- c. (A+1)/B
- d. (B+A)/A

Answer: a

6. The degree of closeness of the measured value of a certain quantity with its true value is known as

- a. **Accuracy**
- b. Precision
- c. Standard
- d. Sensitivity

Answer a

7. Error of measurement =

- a. **True value – Measured value**
- b. Precision – True value
- c. Measured value – Precision
- d. None of the above

Answer a

8. The ability by which a measuring device can detect small differences in the quantity being measured by it, is called its

- a. Damping
- b. **Sensitivity**
- c. Accuracy
- d. None of the above

Answer b

9. The following term(s) is (are) associated with measuring devices

- a. Sensitivity
- b. Damping
- c. **Both 'a' and 'b'**
- d. None of the above

Answer c

10. To compare an unknown with a standard through a calibrated system is called

- a. Direct comparison
- b. **Indirect comparison**

- c. both 'a' and 'b'
- d. None of the above

Answer b

11. The following is an internationally recognized and accepted unit system
- a. MKS
 - b. FPS
 - c. **SI**
 - d. All of the above

Answer c

12. The following is a line standard of measurement
- a. **Measuring tape**
 - b. Slip gauge
 - c. Micrometer
 - d. End bars

Answer a

13. 1 Angstrom (\AA) = _____
- a. 10^{-6}m
 - b. 10^{-8}m
 - c. **10^{-10}m**
 - d. 10^{-12}m

Answer c

14. The principle of 'Interchangeability' is normally employed for
- a. Mass production
 - b. Production of identical parts
 - c. Parts within the prescribed limits of sizes
 - d. **All of the above**

Answer d

15. Following is the theoretical size which is common to both the parts of a mating pair
- a. Normal size
 - b. Actual size
 - c. **Base size**
 - d. All of the above

Answer c

16. What are the functional dimensions?
- a. **Have to be machined and fit with other mating components**
 - b. Which have no effect on the performance of quality
 - c. Need not to be machined to an accuracy of the high degree
 - d. Function is more important than accuracy

Answer a

17. Why tolerances are given to the parts?
- a. **Because it's impossible to make perfect settings**
 - b. To reduce weight of the component
 - c. To reduce cost of the assembly
 - d. To reduce amount of material used

Answer a

18. What is bilateral tolerance?
- a. Total tolerance is in 1 direction only
 - b. **Total tolerance is in both the directions**
 - c. May or may not be in one direction
 - d. Tolerance provided all over the component body

Answer b

19. Which type of tolerance provided in drilling mostly?
- a. Bilateral
 - b. **Unilateral**
 - c. Trilateral
 - d. Compound

Answer b

20. What is mean clearance?
- a. Maximum size of hole minus maximum size of shaft

- b. Minimum size of hole minus minimum size of shaft
- c. **Mean size of hole minus mean size of shaft**
- d. Average of both size of shaft and hole

Answer c

21. Which of the following is incorrect about tolerances?

- a. **Too loose tolerance results in less cost**
- b. Tolerance is a compromise between accuracy and ability
- c. Too tight tolerance may result in excessive cost
- d. Fit between mating components is decided by functional requirements

Answer a

22. Quality control charts doesn't depend on which factor?

- a. Normal distribution
- b. Random sampling
- c. Independence between samples
- d. **Binomial distribution**

Answer d

23. Which of the following option is true for given statements?

Statement 1: Bilateral tolerances are used in mass production techniques.

Statement 2: The basic size should be equal to upper and lower limits.

- a. T, T
- b. F, F
- c. **T, F**
- d. F, T

Answer c

24. If a clearance fit is present between shaft and hole, what is the tolerance on shaft or hole for a complete interchangeable approach?

- a. **$\frac{1}{2}$ of maximum clearance – $\frac{1}{2}$ of minimum clearance**
- b. $\frac{1}{4}$ of maximum clearance – $\frac{1}{4}$ of minimum clearance
- c. Maximum clearance – minimum clearance
- d. $\frac{3}{4}$ of maximum clearance – $\frac{3}{4}$ of minimum clearance

Answer a

25. The maximum allowable limit that a measurement may vary from the true value is called

- a. **Permissible error**
- b. Expected error
- c. Wind
- d. Gravity

Answer a

26. Natural error in measurement may be due to

- a. Humidity
- b. Temperature
- c. Wind
- d. Gravity
- e. **Any of the above**

Answer e

27. Which of the following is not a type of pressure sensing element?

- a. **Bellows**
- b. Bourdon tube
- c. Manometer
- d. Orifice plate
- e. Diaphragm

Answer d

28. Another word for "pressure" is:

- a. pH

- b. Flow
- c. Density
- d. Force
- e. Head

Answer e

29. In pressure thermometers when mercury is used, the bulb and capillary should be made of:

- a. copper
- b. alloys of copper
- c. **stainless steel**
- d. none of the above.

Answer c

30. Mercury is used in liquid filled systems as it gives:

- a. wide temperature range
- b. high sensitivity
- c. **wide temperature range and approximately linear scale**
- d. wide temperature range and high sensitivity.

Answer c

31. The advantages of thermistor are:

- a. the resistance of thermistors is high and therefore error due to resistance of leads is negligible
- b. errors due to self-heating are small
- c. their sensitivity is about 10^6 as high as that of Platinum resistance thermometers
- d. **all of the above**

Answer d

32. Which of the following device can be used for force measurement?

- a. **Beams**
- b. Bellows
- c. Capsule
- d. Bourdon tube

Answer a

33. Load cells are used for measuring

- a. Large weights only
- b. Small weights only
- c. Weights moving in high speed
- d. **Slowly moving weights**

Answer d

34. Which of the following is caused by careless handling?

- a. Systematic error
- b. **Gross error**
- c. Random error
- d. None of the mentioned

Answer b

35. 'A system will be error free if we remove all systematic error'.

- a. True
- b. **False**

Answer: b

36. Which of the following is not a fundamental quantity?

- a. Length
- b. **Angle**
- c. Time
- d. Luminous intensity

Answer b

37. Which standard is fixed and used for industrial laboratories?

- a. International standard
- b. Primary standard
- c. **Secondary standard**
- d. Working standard

Answer c

38. Which of the following error is caused by poor calibration of the instrument?

- a. Random error
 - b. Gross error
 - c. Systematic error**
 - d. Precision error
- Answer a

Answer c

39. How systematic errors are eliminated?

- a. Frequent measurement
- b. Replacement of instrument**
- c. Finding mean of reading
- d. Finding variance of reading

Answer b

40. Which of the following represents an SI unit of luminous intensity?

- a. Lumen
- b. Candela**
- c. Diopetre
- d. None of the mentioned

Answer b

41. The amount by which the actual size of a shaft is less than the actual size of mating hole in an assembly

- a. Clearance
- b. Interference**
- c. Allowance
- d. None of the above

Answer b

42. ____ is equal to the differences of the two limits of size of the part

- a. Tolerance**
- b. Low limit
- c. High limit
- d. Design size

Answer a

43. In an open loop control system

- a. Output is independent of control input**
- b. Output is dependent on control input

- c. Only system parameters have effect on the control output
- d. None of the mentioned

Answer a

44. For open control system which of the following statements is incorrect ?

- a. Less expensive
- b. Recalibration is not required for maintaining the required quality of the output**
- c. Construction is simple and maintenance easy
- d. Errors are caused by disturbances

Answer b

45. A control system in which the control action is somehow dependent on the output is known as

- a. Closed loop system**
- b. Semi closed loop system
- c. Open system
- d. None of the mentioned

Answer a

46. In closed loop control system, with positive value of feedback gain the overall gain of the system will

- a. decrease**
- b. increase
- c. be unaffected
- d. none of the mentioned

Answer a

47. Which of the following is an open loop control system ?

- a. Field controlled D.C. motor**
- b. Ward leonard control
- c. Metadyne
- d. Stroboscope

Answer a

48. Which of the following statements is not necessarily correct for open control system ?

- a. Input command is the sole factor responsible for providing the control action
- b. Presence of non-linearities causes malfunctioning**
- c. Less expensive
- d. Generally free from problems of non-linearities

Answer b

49. In open loop system

- a. the control action depends on the size of the system
- b. the control action depends on system variables
- c. the control action depends on the input signal
- d. the control action is independent of the output**

Answer d

50. The following has tendency to oscillate.

- a. Open loop system
- b. Closed loop system**
- c. Both (a) and (b)
- d. Neither (a) nor (b)

Answer b

51. A good control system has all the following features except

- a. good stability
- b. slow response**
- c. good accuracy
- d. sufficient power handling capacity

Answer b

52. A car is running at a constant speed of 50 km/h, which of the following is the feedback element for the driver ?

- a. Clutch
- b. Eyes
- c. Needle of the speedometer**
- d. Steering wheel

Answer c

Unit-V

1. Where and when was the word mechatronics invented?
 - a. **Japan 1969**
 - b. Japan 1980
 - c. Europe 1960
 - d. Europe 1980

Answer: a
2. The mechatronics is an interdisciplinary field in which the discipline those act together
 - a. Mechanical system & electronics system
 - b. Mechanical system & information technology
 - c. Electronics system & information technology
 - d. **Mechanical system, electronics system & information technology**

Answer: d
3. A mechatronics system contains feedback
 - a. **True**
 - b. False
4. Where is the feedback generated by sensor in a mechatronics system?
 - a. I/P sensor
 - b. **Comparator**
 - c. Mechanical actuators
 - d. O/P sensor

Answer: b
5. In which system does the output not affect the process in any way
 - a. **Open loop system**
 - b. Closed loop system
 - c. Both a and b
 - d. None of the above

Answer: a
6. The temperature control system which maintains the temperature of a room at 30° c when it is set is an example of-
 - a. Open loop system
 - b. **Closed loop system**
 - c. Both a and b
 - d. None of the above

Answer: b
7. What is the function of an input signal conditioning unit?
 - a. To produce control signals
 - b. **To amplify the signal & convert it into digital form**
 - c. To perform mechanical work
 - d. To produce electrical signals

Answer: b
8. A servo motor is an example of
 - a. Electronics system
 - b. Mechanical system
 - c. Computer system
 - d. **Mechatronics system**

Answer: d
9. A humanoid robot is an example of
 - a. **Artificial intelligence**
 - b. Stand-alone system
 - c. Large factory system
 - d. High level distributed sensor microcontroller actuator

Answer: a
10. Which among the following carry out the overall control of a system?
 - a. Graphical display
 - b. Sensors
 - c. Actuators

d. Digital controls**Answer: d**

11. The most commonly used power plant in automobile is

a. Gas turbine

b. I C Engine

c. Battery

d. None of these

Answer: b

12. Following are the examples of Autotronics

a. ABS System in automobile

b. Engine controlling system

c. Both a and b

d. None of the above

Answer: c

13. Which of the following is not the example of Avionics?

a. Aviation system

b. Weather radar system

c. Neuroelectronic interface

d. Cockpit instrumentation

Answer: c

14. Which is not the examples of Bionics?

a. Glucose detection and DNA sensing

b. Photodynamic therapy

c. B P Testing m/c

d. All are the examples of bionics**Answer: d**

15. The sensors are classified on the basis of

a. Functions

b. Performance

c. Output

d. All of the above**Answer: d**

16. A transducer is basically a device which converts

a. Mechanical energy in to electrical

b. Energy or information from one form to another

c. Mechanical displacement in to electrical

d. None of these

Answer: b

17. Pressure transducer for measuring blood pressure is

a. Strain gauge transducer only

b. Resistive transducer

c. Fiber optic transducer

d. Strain gauge and capacitive transducer**Answer: d**

18. Following is not an examples of transducer

a. Analogue voltmeter

b. Thermocouple

c. Photoelectric cell

d. Pneumatic cylinder

Answer: a

19. Kinematics chain requires at least

a. 2 links and 3 turning pairs

b. 3 links and 4 turning pairs

c. 4 links and 4 turning pairs

d. 5 links and 4 turning pairs

Answer: c

20. A kinematics chain is known as mechanism, when

a. None of the link is fixed

b. One of the links is fixed

c. Two of the links are fixed

d. None of these

Answer: b

21. The size of cam depends upon

a. Base circle

b. Pitch circle

c. Prime circle

- d. Pitch curve

Answer: a

22. In a radial cam, the follower moves
- In a direction perpendicular to cam axis**
 - In a direction parallel to cam axis
 - In any direction irrespective of the cam axis
 - Along the cam axis

Answer: a

23. Cam is a rotating machine element, which can
- Reciprocate the follower
 - Oscillate the follower
 - Reciprocate and oscillate the follower**
 - None of the above

Answer: c

24. A cam with a roller follower would constitute following type of pair
- Lower pair
 - Higher pair**
 - Open pair
 - Closed pair

Answer: b

25. Higher pair are those which have
- Point or line contact between the two elements when in motion**
 - Surface contact between the two elements when in motion
 - Elements of pairs not held together mechanically
 - None of the above

Answer: a

26. Who invented Ratchet wheel which further used in power loom?
- Grueblerowen
 - Vitaly abalakov
 - Robert owen

- d. William Radcliffe

Answer: d

27. What is the purpose of pawl, when it is used against a Ratchet which is attached to a shaft?
- It allows unidirectional motion of shaft**
 - It allows bidirectional motion of shaft
 - It does not allow motion of shaft
 - It is used to create additional friction force for the shaft

Answer: a

28. What is the minimum number of teeth, a Ratchet should have?
- 2
 - 4
 - 8
 - 0**

Answer: d

29. It is not necessary to have teeth on the surface of the Ratchet
- True**
 - False

Answer: a

30. Ratchet screw driver can apply turning force in one direction only
- True**
 - False

Answer: a

31. What does "12- points" indicates when the term 12-pointreversible Ratchet is used?
- Its diameter is 12
 - Its radius is 12
 - It has 12 teeth**
 - Its pitch is 12

Answer: c

32. The tooth of Ratchet is symmetrical

a. True

b. False

Answer: b

33. The gears are used to connect two parallel shafts except-

a. Spur gear

b. Helical gear

c. Double helical gear

d. Bevel gear

Answer: d

34. To connect two intersecting shafts, we use

a. Spur gear

b. Helical gear

c. Worm and wheel

d. Bevel gear

35. Which of the following type of gear has inclined teeth?

a. Spur gear

b. Helical gear

c. Spiral gear

d. All of the above

Answer: b

36. The gear used to convert rotary motion into translating motion is-

a. Worm and wheel

b. Spur gear

c. Rack and pinion

d. Spiral bevel gear

Answer: c

37. Belt slip occurs due to

a. Heavy load

b. Loose belt

c. Driving pulley too small

d. Any one of the above

Answer: d

38. In case of V-belt drive

a. The belt should touch the bottom of groove in the pulley

b. The belt should not touch the bottom of groove in the pulley

c. The belt should not touch the sides of groove in the pulley

d. None of the above

Answer: b

39. The groove angle of pulley for V-belt is

a. $34^\circ - 36^\circ$

b. $42^\circ - 45^\circ$

c. More than 40°

d. $30^\circ - 32^\circ$

Answer: a

40. The included angle between the sides of V-belt is

a. 40°

b. 45°

c. 38°

d. 42°

Answer: a

41. The following is (are) the example(s) of plain Bearing-

a. Thrust bearing

b. Linear bearing

c. Journal bearing

d. All of the above

Answer: d

42. The following types of bearing have No rolling element

a. Thrust bearing

b. Linear bearing

c. Journal bearing

d. All of the above

Answer: d

43. The types of bearing used in crankshaft is-

- a. **Plain bearing**
- b. Roller bearing
- c. Ball bearing
- d. Magnetic bearing

Answer: a

44. Hydrostatic bearing usually uses _____ as lubricant

- a. **Oil**
- b. Grease
- c. Nothing
- d. Any of the above

Answer: a

45. Hydrostatic bearing enters hydrodynamic state when the journal is

- a. Stationary
- b. **Rotating**
- c. Both a and b
- d. None of the above

Answer: b

46. The basic function of the spring in a control valve is to

- a. Characterized flow
- b. **Oppose the diaphragm so as to position the valve according to signal pressure**
- c. Close the valve if air failure occurs
- d. Open the valve if air failure occurs

Answer: b

47. The main purpose of a control valve positioner is to

- a. Alter the fail-safe status of the valve
- b. **Improve the precision of the valve**
- c. Alter the characterization of the valve
- d. Increase transmitter accuracy

Answer: b

48. The purpose of valve packing is to

- a. Help reduce cavitation in valve trim
- b. Increase stiction
- c. Cushion the valve against harm during shipment
- d. **Seal process fluid from escaping past the stem**

Answer: d

49. The main function of actuator is

- a. **To produce motion**
- b. Detect I/P
- c. Detect O/P
- d. Detect the state of the system

Answer: a

50. Which of the following gas is used in gas charged accumulators?

- a. Oxygen
- b. **Nitrogen**
- c. Carbon dioxide
- d. All the above

Answer: b

51. A weight loaded accumulator

- a. Loses pressure as fluid discharge
- b. Gain pressure as fluid discharge
- c. **Stays at the same pressure as fluid discharge**
- d. Cannot say

Answer: c

52. A spring-loaded accumulator

- a. Loses pressure as fluid discharge
- b. Gain pressure as fluid discharge
- c. **Stays at the same pressure as fluid discharge**
- d. Cannot say

Answer: c

53. . An accumulator may be used to

- a. **Make a pump run faster**

- b. Make a valve shift more quickly
- c. Make for system leak
- d. All the above

Answer: a

54. Accumulator pre-charge pressure is normally

- a. 95% of minimum system pressure
- b. 85% of minimum system pressure
- c. 75% of minimum system pressure**
- d. 55% of minimum system pressure

Answer: c

55. . Which of the following statements are true for accumulator used in hydraulic system?

- (1) Accumulators stores fluid with pressure
- (2) Accumulators stores fluid without any pressure
- (3) Accumulators stores compressible liquid
- (4) Spring is used as an external source to keep the fluid under hydraulic pressure

- a. 1, 3 & 4
- b. 2 & 3
- c. 1 & 4**
- d. 2, 3 & 4

Answer: c

56. Which factor decides the working pressure of a hydraulic cylinder?

- a. Diameter of circular flange
- b. Bore diameter of cylinder**
- c. Stroke length
- d. All the above

Answer: b

57. Double acting cylinder can be used as a single acting cylinder

- a. True**
- b. False

Answer: a

58. What happens when supply of oil to a single acting cylinder is stopped?

- a. No pressure is exerted on the piston
- b. More pressure is exerted on the piston
- c. Less pressure is exerted on the piston**
- d. None of the above

Answer: c

59. When does expansion of spring and retraction of cylinder takes place in spring type single acting cylinder

- a. Oil pressure exerted is less than spring compression pressure**
- b. Oil pressure exerted is more than spring compression pressure
- c. Oil pressure exerted and spring compression pressure are same
- d. None of the above

Answer: a

60. In a telescopic cylinder, as the number of stages increases

- a. Diameter of piston rod also increases
- b. Diameter of piston rod decreases**
- c. Diameter of piston rod remains the same
- d. None of the above

Answer: b

61. What is full form of FMEM

- a. Fundamental of machine
- b. Fundamental of mechanical engineering
- c. Fundamental of mechanical engineering & mechatronics**
- d. Fundamental of mechanical engineering & machine

Answer: c



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