Combined Engineering Services Exam

QEME

Booklet Series **A**

Register Number

2008

MECHANICAL AND PRODUCTION ENGINEERING

Time Allowed : 3 Hours] **[Maximum Marks : 300**

Read the following instructions carefully before you begin to answer the questions.

IMPORTANT INSTRUCTIONS

1. This Booklet has a cover (this page) which should not be opened till the invigilator gives signal to open it at the commencement of the examination. As soon as the signal is received you should tear the right side of the booklet cover carefully to open the booklet. Then proceed to answer the questions.
2. This Question Booklet contains **200** questions.
3. Answer **all** questions. **All** questions carry equal marks.
4. The Test Booklet is printed in *four* series *e.g.* [A] [B] [C] or [D] (See Top left side of this page). The candidate has to indicate in the space provided in the Answer Sheet the series of the booklet. For example, if the candidate gets [A] series booklet, he/she has to indicate in the side 2 of the Answer Sheet with Blue or Black Ink Ball point pen as follows :

[A] ■ [B] [C] [D]

5. You must write your Register Number in the space provided on the top right side of this page. Do not write anything else on the Question Booklet.
6. An Answer Sheet will be supplied to you separately by the Invigilator to mark the answers. You must write your Name, Register No. and other particulars on side 1 of the Answer Sheet provided, failing which your Answer Sheet will not be evaluated.
7. You will also encode your Register Number, Subject Code etc., with Blue or Black ink Ball point pen in the space provided on the side 2 of the Answer Sheet. If you do not encode properly or fail to encode the above information, your Answer Sheet will not be evaluated.
8. Each question comprises *four* responses (A), (B), (C) and (D). You are to select ONLY ONE correct response and mark in your Answer Sheet. In case you feel that there are more than one correct response, mark the response which you consider the best. In any case, choose ONLY ONE response for each question. Your total marks will depend on the number of correct responses marked by you in the Answer Sheet.
9. In the Answer Sheet there are **four** brackets [A] [B] [C] and [D] against each question. To answer the questions you are to mark with Ball point pen ONLY ONE bracket of your choice for each question. Select one response for each question in the Question Booklet and mark in the Answer Sheet. If you mark more than one answer for one question, the answer will be treated as wrong. *e.g.* If for any item, (B) is the correct answer, you have to mark as follows :

[A] ■ [C] [D]

10. You should not remove or tear off any sheet from this Question Booklet. You are not allowed to take this Question Booklet and the Answer Sheet out of the Examination Hall during the examination. After the examination is concluded, you must hand over your Answer Sheet to the Invigilator. You are allowed to take the Question Booklet with you only after the Examination is over.
11. Failure to comply with any of the above instructions will render you liable to such action or penalty as the Commission may decide at their discretion.
12. Do not tick-mark or mark the answers in the Question Booklet.
13. The sheet before the last page of the Question Booklet can be used for Rough Work.

Tear here

DO NOT TEAR THIS COVER OF THE QUESTION BOOKLET UNTIL YOU ARE ASKED TO DO SO

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1. If the sum of all the forces acting on a body is zero, it may be concluded that the body

   A) must be in equilibrium

   B) cannot be in equilibrium

   C) may be in equilibrium provided the forces are concurrent

   D) may be in equilibrium provided the forces are parallel.

2. If U_1 and U_2 are the velocities of approach of two moving bodies in the same direction and their corresponding velocities of separation are V_1 and V_2, then as per Newton's law of collision of elastic bodies, the coefficient of restitution e is given by

   A) $e = \frac{V_1 - V_2}{U_1 - U_2}$ B) $e = \frac{U_2 - U_1}{V_1 - V_2}$

   C) $e = \frac{V_1 - V_2}{U_2 - U_1}$ D) $e = \frac{V_2 - V_1}{U_1 - U_2}$.

3. A body of weight W is required to move up on rough inclined plane whose angle of inclination with the horizontal is α. The effort applied parallel to the plane is given by

   A) $P = W \tan \alpha$ B) $P = W \tan (\alpha + \phi)$

   C) $P = W (\sin \alpha + \mu \cos \alpha)$ D) $P = W (\cos \alpha + \mu \sin \alpha)$

   where $\mu = \tan \phi$ = coefficient of friction.

4. A screw jack used for lifting the load is

   A) a reversible machine B) a non-reversible machine

   C) an ideal machine D) none of these.

5. In ideal machines

   A) mechanical advantage is greater than velocity ratio

   B) mechanical advantage is equal to velocity ratio

   C) mechanical advantage is less than velocity ratio

   D) mechanical advantage is unity.

6. For a self-locking lifting machine, the efficiency must be

A) 50% B) more than 50%

C) less than 50% D) 100%.

7. Pick out the correct statement :

A) The path traced by a projectile is trajectory.

B) The area under v-t diagram is acceleration.

C) Efficiency of simple machine is velocity ratio / mechanical advantage.

D) If efficiency is < 50%, that simple machine is reversible.

8. A couple produces

A) translatory motion

B) rotational motion

C) combined translatory and rotational motions

D) none of these.

9. Static friction is always

A) less than dynamic friction

B) equal to dynamic friction

C) greater than dynamic friction

D) has no relation with dynamic friction.

10. If a body is moving with a uniform acceleration (a), then final velocity (v) of the body after time (t) is equal to

A) $ut + \frac{1}{2} at^2$ B) $u + at$

C) $u^2 + 2as$ D) none of these

where u = initial velocity

s = distance travelled in t seconds.

11. In the macroscopic approach, in the study of thermodynamics

I. the structure of matter is taken into account

II. the structure of matter is not considered

III. only a limited number of properties are used to describe the state of matter

IV. the values of the properties needed for the description of the system cannot be measured.

Of the statements :

A) I alone is correct B) I and II are correct

C) II and III are correct D) All are correct.

12. Temperature of a gas is due to

A) its heating value B) kinetic energy of molecules

C) repulsion of molecules D) attraction of molecules.

13. Work done in reversible adiabatic process is given by

A) $\frac{P_2V_2 - P_1V_1}{1 - n}$ B) $\frac{P_2V_2 - P_1V_1}{1 - \gamma}$

C) $\frac{P_2V_2 - P_1V_1}{\gamma - 1}$ D) $\frac{\gamma - 1}{J}\left(P_2V_2 - P_1V_1\right)$.

14. When a perfect gas is expanded through an aperture of minute dimensions, the process is

A) isothermal B) adiabatic

C) isentropic D) throttling.

15. Carnot engine is irreversible due to

A) friction between moving parts

B) losses from working fluid in transit

C) high speed

D) both (A) and (B).

16. During adiabatic expansion

A) internal energy remains constant

B) temperature remains constant

C) entropy remains constant

D) enthalpy remains constant.

17. Heat flows from hot substance to cold substance unaided. This statement is given by

A) Kelvin B) Gay-Lussac

C) Joule D) Clausius.

18. The coefficient of performance of a Carnot refrigerator operating between the reservoirs at –10°C and 40°C is

A) 0·526 B) 5·26

C) 52·6 D) 526.

19. Which of the following is the extensive property of a thermodynamic system ?

A) Pressure B) Volume

C) Temperature D) Density.

20. The work done in steady flow process is given as

A) $\int_1^2 p dv$ B) $-\int_1^2 p dv$

C) $\int_1^2 v dp$ D) $-\int_1^2 v dp$.

21. The function of a distributor in a coil ignition system of I.C. engines is

A) to distribute spark B) to distribute power

C) to distribute current D) to time the spark.

22. The thermal efficiency of petrol engines is about

A) 15% B) 30%

C) 50% D) 70%.

23. A higher compression ratio causes

A) an acceleration in the rate of combustion

B) tendency of an engine to increase detonation

C) pre-ignition

D) all of these.

24. In hit and miss governing

A) mixture strength is maintained constant

B) quantity of fuel is varied to suit load on engine

C) the fuel supply is cut off completely during one or more number of cycles

D) none of these.

25. Fuel having maximum resistance to detonation is

A) benzene B) toluene

C) iso-octane D) *n*-heptane.

26. The operation of forcing additional air under pressure, into the engine cylinder is known as

A) carburation B) supercharging

C) dissociation D) turbulence.

27. The knocking in spark ignition engines gets reduced

A) by retarding the spark advance

B) by increasing the compression ratio

C) by increasing the cooling water temperature

D) by increasing the inlet air temperature.

28. Supercharging is essential in

A) diesel engines B) gas turbines

C) petrol engines D) aircraft engines.

29. Identify the correct order of classification of Internal Combustion Engines :

A) Reciprocating Type, Internal Combustion Engine, Non-reciprocating Type.

B) Reciprocating Type, External Combustion Engine, Non-reciprocating Type.

C) SI Engine, CI Engine, Internal Combustion Engine.

D) Internal Combustion Engine, Reciprocating Type, Non-reciprocating Type.

30. The cetane values for high speed engines vary between

A) 5 to 11 B) 15 to 21

C) 25 to 34 D) 45 to 54.

31. Hypersonic flow exists when Mach number is

A) unknown B) less than 1

C) less than 5, greater than 1 D) greater than 5.

32. Which is the continuity equation ?

A) $h_o = h + \frac{V^2}{2g_c J}$ B) $G = \frac{\dot{m}}{A} = \rho V$

C) $M = \frac{V}{a}$ D) $S = S_o$

33. Stagnation temperature in terms of Mach number is given by

A) $\frac{T_0}{T} = \frac{k-1}{2} \cdot M^2$ B) $\frac{T_0}{T} = \frac{1+k^2}{2} \cdot M^2$

C) $\frac{T_0}{T} = 1 - \frac{k-1}{2} \cdot M^2$ D) $\frac{T_0}{T} = 1 + \frac{k-1}{2} \cdot M^2$

34. In a nozzle, if back pressure is equal to inlet pressure

A) no flow occurs

B) maximum flow occurs

C) flow is subsonic in diverging section

D) flow is supersonic in converging as well as diverging sections.

35. The normal shock wave in compressible flow is analogous to

A) surges in open channel

B) vortex formation in centrifugal pump

C) hydraulic bore in tidal rivers

D) hydraulic jump in channel flow.

36. Ramjet engine

A) is self-operating at zero flight speed

B) is not self-operating at zero flight speed

C) requires no air for its operation

D) produces a jet consisting of plasma.

37. For speed above 3000 km/hour, it is more advantageous to use

A) turbojet engine B) ramjet engine

C) propellers D) rockets.

38. The function of a heat exchanger in a gas turbine unit is

A) to heat the compressed air before inlet to combustion chamber

B) to heat the gas before inlet to gas turbine

C) to exchange heat from hot gases of combustion chamber to the exhaust gases of gas turbine

D) to heat the compressed air in between the stages of air compressor.

39. Which one of the following is true in an isentropic process of expansion from state (1) to state (2) ?

A) $\frac{p_2}{p_1} = \left(\frac{T_1}{T_2}\right)^{\frac{k-1}{k}}$ B) $\frac{p_2}{p_1} = \left(\frac{T_2}{T_1}\right)^{\frac{k-1}{k}}$

C) $\frac{p_2}{p_1} = \left(\frac{T_1}{T_2}\right)^{\frac{k}{k-1}}$ D) $\frac{p_2}{p_1} = \left(\frac{T_2}{T_1}\right)^{\frac{k}{k-1}}$

40. Air refrigerator makes use of

A) Atkinson cycle B) Otto cycle

C) Reversed Joule cycle D) Stirling cycle.

41. In an ammonia-hydrogen refrigeration system, the hydrogen

A) helps evaporation of NH_3

B) acts as a refrigerant

C) helps NH_3 to flow through the circuit

D) burns to supply heat.

42. For a given dry bulb temperature, as the relative humidity increases, the wet bulb depression will be

A) more

B) less

C) same

D) more / less depending on other factors.

43. Dew point is

A) the temperature at which condensation of steam in saturated air will start

B) dependent on pressure of air

C) the lowest attainable temperature for a mixture of air and steam

D) none of these.

44. The ratio of sensible heat to the total heat is known as

A) by-pass factor B) sensible heat factor

C) humidifying efficiency D) none of these.

45. If pure humidification is desired, the spray water through which air passes, has to be maintained as

A) WBT B) DBT

C) DPT D) None of these.

46. The moisture content of air is indicated by

A) dry bulb temperature

B) wet bulb temperature

C) dew point temperature

D) both wet bulb and dew point temperatures.

47. In adiabatic saturation

A) the process consists of increasing the humidity ratio without change in its heat content

B) the process includes change in DBT keeping the humidity ratio of air as constant

C) the process consists of heating the air without changing the humidity ratio

D) the process can be accomplished either by the addition of steam or heated water in air.

48. The ratio of high temperature to low temperature for reversed Carnot refrigerator is 1·25. The COP will be

A) 2 B) 3

C) 4 D) 5.

49. If the specific humidity of moist air remains same but its dry bulb temperature increases,

A) its dew point temperature increases

B) its dew point temperature decreases

C) its dew point temperature remains same

D) its dew point temperature may increase or decrease depending upon increase or decrease of relative humidity.

50. Bernoulli's equation is derived making assumptions that

A) the flow is uniform, steady and incompressible

B) the flow is non-viscous, uniform and steady

C) the flow is steady, non-viscous, incompressible and irrotational

D) none of these.

51. The velocity components in x and y directions in terms of velocity potential (ϕ) are

A) $u = -\frac{\partial \phi}{\partial x}, v = \frac{\partial \phi}{\partial y}$ B) $u = \frac{\partial \phi}{\partial y}, v = \frac{\partial \phi}{\partial x}$

C) $u = -\frac{\partial \phi}{\partial y}, v = -\frac{\partial \phi}{\partial x}$ D) $u = -\frac{\partial \phi}{\partial x}, v = -\frac{\partial \phi}{\partial y}$.

52. The value of the kinetic energy correction factor (α) for the viscous flow through a circular pipe is

A) 1·33 B) 1·50

C) 2·0 D) 1·25.

53. Maximum efficiency of power transmission through pipe is

A) 50% B) 66·67%

C) 75% D) 100%.

54. Power transmitted through pipes, will be maximum when

A) head lost due to friction = $\frac{1}{2}$ total head at inlet of the pipe

B) head lost due to friction = $\frac{1}{4}$ total head at inlet of the pipe

C) head lost due to friction = total head at the inlet of the pipe

D) head lost due to friction = $\frac{1}{3}$ total head at the inlet of the pipe.

55. The boundary layer separation takes place if

A) pressure gradient is zero

B) pressure gradient is positive

C) pressure gradient is negative

D) none of these.

56. The shear stress between two fixed parallel plates with a laminar flow between them

A) is constant across the gap

B) varies parabolically as the distance from the mid-plane

C) varies directly as the distance from the mid-plane

D) varies inversely as the distance from the mid-plane.

57. For a forced vortex flow, the height of paraboloid formed is

A) $\frac{p}{w} + \frac{V^2}{2g}$ B) $\frac{V^2}{2g}$

C) $\frac{V^2}{r^2 \times 2g}$ D) $\frac{wr^2}{2g}$.

58. Match **List I** correctly with **List II** and select your answer using the codes given below :

	List I	**List II**
a)	Navier-Stokes equation is useful in analysis of	1. Momentum
b)	Shear stress in turbulent flow is mainly due to	2. Hydraulic gradient line
c)	Pressure gradient is linear for developed flow obeys	3. Eddy viscosity
d)	Vapour lock in water pipeline may occur if ..... goes below conduit	4. Viscous.

Codes :

	a	*b*	*c*	*d*
A)	1	3	4	2
B)	3	4	1	2
C)	2	3	4	1
D)	4	2	3	1.

59. The metacentric height of a floating body is

A) the distance between metacentre and centre of buoyancy

B) the distance between the centre of buoyancy and centre of gravity

C) the distance between metacentre and centre of gravity

D) none of these.

60. The cavitation in a hydraulic machine is mainly due to

A) low velocity B) high velocity

C) low pressure D) high pressure.

61. Pressure drop in nozzle occurs in

A) reaction turbine B) impulse turbine

C) steam turbine D) all of these.

62. Specific speed of turbine is indicated in

A) $\frac{N\sqrt{Q}}{H^{\frac{3}{4}}}$ B) $\frac{N\sqrt{P}}{H^{\frac{5}{4}}}$

C) $\frac{N\sqrt{Q}}{H^{\frac{2}{3}}}$ D) $\frac{N\sqrt{P}}{H^{\frac{3}{2}}}$

63. Multistage centrifugal pumps are used to obtain

A) high discharge B) high head

C) pumping of viscous fluids D) high efficiency.

64. Specific speed of impulse wheels ranges from

A) 0 to 4·5 B) 10 to 100

C) 80 to 200 D) 250 to 300.

65. Motion of a liquid in a volute casing of a centrifugal pump is an example of

A) rotational flow B) forced cylindrical vortex flow

C) radial flow D) spiral vortex flow.

66. In case of centrifugal fan or blower the gas capacity varies directly with

A) speed B) $(\text{speed})^2$

C) $(\text{speed})^{\frac{3}{2}}$ D) $(\text{speed})^3$.

67. Cavitation damage in the turbine runner occurs near the

A) inlet on the concave side of the blades

B) inlet on the convex side of the blades

C) outlet on the convex side of the blades

D) outlet on the concave side of the blades.

68. A turbine runs at 240 r.p.m. under a head of 9 m. The speed of the turbine operating under a head of 16 m will be

A) 420 r.p.m. B) 320 r.p.m.

C) 240 r.p.m. D) 120 r.p.m.

69. Cavitation parameter σ is defined in terms of net positive suction head (NPSH) and net head H as

A) $\frac{NPSH}{\sqrt{H}}$ B) $\frac{\sqrt{H}}{NPSH}$

C) $\frac{H}{NPSH}$ D) $\frac{NPSH}{H}$

70. In transient heat conduction, two significant dimensionless parameters are

A) Reynolds & Fourier B) Fourier & Prandtl

C) Biot & Fourier D) Biot & Nusselt.

71. The critical radius of insulation for a spherical shell is

A) $\frac{\text{thermal conductivity of insulating material}}{\text{heat transfer coefficient at outer surface}}$

B) $\frac{2 \times \text{thermal conductivity of insulating material}}{\text{heat transfer coefficient at outer surface}}$

C) inverse of (A)

D) inverse of (B).

72. The concept of overall coefficient of heat transfer is used in heat transfer problems of

A) conduction B) convection

C) radiation D) conduction and convection.

73. The value of convective heat transfer coefficient depends upon

A) physical properties of fluid B) nature of fluid flow

C) velocity of fluid flow D) all of these.

74. The unit of Stefan-Boltzmann constant is

A) watt/m ^{2} k B) watt/m ^{4} k

C) watt/m ^{2} k^2 D) watt/m ^{2} k^4.

75. NTU is given by

A) $\frac{UA}{C_{min}}$ B) $\frac{C_{min}}{UA}$

C) $\frac{C_{max}}{UA}$ D) $\frac{C_{min}}{C_{max}}$

76. $(N_u)_x$ for the forced convection in laminar flow over a flat plate is

A) $0{\cdot}116\ P_r^{\frac{1}{3}} R_e^{\frac{1}{2}}$ B) $0{\cdot}332\ P_r^{\frac{1}{3}} R_e^{\frac{1}{2}}$

C) $0{\cdot}037\ R_e^{0{\cdot}8} P_r^{\frac{1}{3}}$ D) $0{\cdot}023\ R_e^{0{\cdot}8} P_r^{0{\cdot}3}$

77. In comparison to parallel flow heat exchangers, counter flow versions have

A) lower LMTD B) larger heat transfer area

C) smaller heat transfer area D) higher LMTD.

78. Thermal resistance (K/W) of a 0·5 m thick, 1 m wide and 1·25 m high furnace wall having a thermal conductivity 0·4 W/mK is

A) 2 B) 10

C) 20 D) 1.

79. Metal temperature rises due to

A) increase in thermal conductivity B) decrease in thermal conductivity

C) increase in heat transfer D) none of these.

80. Thermal efficiency of a diesel engine used for power generation is

A) less than air standard value B) more than air standard value

C) equal to that of air standard value D) twice that of air standard value.

81. Consider the following statements :

I. Run-of-the river plant is cheaper than the storage plant of equal capacity.

II. Run-of-the river plant serves base load, when located upstream of the storage plant.

III. Run-of-the river plant output depends on what storage plants pass on, when located between storage plants.

Of the statements :

A) (I) and (II) are correct B) all are correct

C) (II) and (III) are correct D) (I) and (III) are correct.

82. The size of the reactor is said to be critical when

A) chain reaction can be initiated B) it becomes uncontrollable

C) it explodes D) it produces no power.

83. The most practical fuel for a thermonuclear reactor, both from economical and nuclear considerations, is

A) Plutonium B) Uranium

C) Lithium D) Thorium.

84. Most commonly used moderator in nuclear plants is

A) heavy water B) concrete and bricks

C) graphite and concrete D) graphite.

85. In a throttling process

A) steam temperature remains constant

B) steam pressure remains constant

C) steam enthalpy remains constant

D) steam entropy remains constant.

86. The efficiency of reheat cycle is given by

A) $\frac{\text{Work done}}{\text{Heat supplied}}$ B) $\frac{\text{Total useful heat drop}}{\text{Heat supplied}}$

C) $\frac{\text{Adiabatic heat drop}}{\text{Heat supplied}}$ D) $\frac{\text{Total useful heat drop}}{\text{Total adiabatic heat drop}}$

87. Fast breeder reactors use

A) water as moderator B) carbon dioxide as moderator

C) graphite as moderator D) no moderator.

88. Sulphur in coal results in

A) causing clinkering and slagging

B) corroding air heaters

C) spontaneous combustion during coal storage

D) all of these.

89. In nuclear reactors, control rod is made of

A) lead and tin B) boron and cadmium

C) graphite D) zinc.

90. The overshoot and the settling time are maximum with

A) underdamped system B) overdamped system

C) critically damped system D) damped system.

91. Thermal expansion of solid is employed in

A) thermocouple B) resistance thermometer

C) bimetal element D) Zener diode.

92. The generally used device for temperature measurement inside the furnace is

A) gas thermometer B) optical pyrometer

C) alcohol thermometer D) mercury thermometer.

93. Determining moisture in steam by measuring the temperature in a throttling calorimeter is an example of

A) direct measurement B) indirect measurement

C) measurement by comparison D) measurement by calibration.

94. Match **List I** correctly with **List II** and select your answer using the codes given below :

List I	**List II**
a) Density	1. Mass-spring seismic sensor
b) Power	2. Anemometer
c) Air flow	3. Dynamometer
d) Acceleration	4. Resonant elements.

Codes :

	a	***b***	***c***	***d***
A)	2	1	3	4
B)	2	3	1	4
C)	4	2	3	1
D)	4	3	2	1.

95. A Rossette gauge is employed for the measurement of

A) absolute pressure B) low pressure variations

C) strain in one direction D) strain in more than one direction.

96. In the area of Instrumentation & Control, "PID Control" stands for

A) Proportional plus Integral plus Derivative Control

B) Pneumatic Instruments Differential Control

C) Pneumatically Induced Direct Control

D) Poly-Inductance Division Control.

97. Match **List I** correctly with **List II** and select your answer using the codes given below :

List I	**List II**
a) Sensitivity	1. Ability to reproduce
b) Accuracy	2. Change in output per change in input
c) Precision	3. Change in input for a change in output from a non-zero point
d) Resolution	4. Deviation from theoretical value.

Codes :

	a	***b***	***c***	***d***
A)	1	2	3	4
B)	2	4	1	3
C)	3	4	1	2
D)	4	1	2	3.

98. Which one of the following is a mis-match ?

A) velocity — anemometer

B) flow — rotameter

C) power — load cell

D) level — float.

99. When a continuous linear relationship exists between the position of the final control element and the value of the controlled variable, the controller action is

A) floating B) differential

C) integral D) proportional.

100. During tensile-testing of a specimen using a Universal Testing Machine, the parameters actually measured include

A) true stress and true strain

B) Poisson's ratio and Young's modulus

C) engineering stress and engineering strain

D) load and elongation.

101. The ratio of shear modulus to the modulus of elasticity, when the Poisson's ratio is 0·25 will be

A) 2 B) 1·4

C) 0·4 D) zero.

102. Principal planes are the planes, on which the resultant stress is the

A) shear stress B) normal stress

C) tangential stress D) none of these.

103. Proof resilience is the greatest stored energy at

A) limit of proportionality B) elastic limit

C) plastic limit D) none of these.

104. The maximum deflection of a cantilever beam of length L with a point load W at the free end is

A) $\frac{WL^3}{3EI}$ B) $\frac{WL^3}{8EI}$

C) $\frac{WL^3}{16\,EI}$ D) $\frac{WL^3}{48\,EI}$

105. A point of contraflexure in a beam occurs at a point where

A) bending moment changes sign

B) shear force changes sign

C) loading becomes zero

D) bending moment and shear force become zero.

106. Hoop stress in a thin cylinder of diameter 'd' and thickness 't' subjected to pressure 'p' will be

A) $\frac{pd}{4t}$ B) $\frac{pd}{t}$

C) $\frac{pd}{2t}$ D) $\frac{2pd}{t}$.

107. According to Lame's equation, hoop stress for a thick cylinder at any point at a radius 'r' from centre is equal to

A) $\frac{b}{r^2} + a$ B) $\frac{b}{r^2} - a$

C) $\frac{b}{r} + a$ D) $\frac{b}{r} - a$.

108. Ties are load carrying members which have many

A) torsional loads B) axial compressive loads

C) axial tension loads D) transverse loads.

109. The effective length of a column having both the ends fixed is

A) twice its length B) half its length

C) own length D) $\sqrt{2}$ times its length.

110. Kinematic pairs are those which have

A) two elements that do not permit relative motion

B) two elements that permit relative motion

C) elements of pair held together mechanically

D) elements of pair not held together mechanically.

111. A kinematic 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.

112. Ackermann steering gear consists of

A) sliding pairs B) turning pairs

C) rolling pairs D) higher pairs.

113. The indicator using Watt mechanism is known as

A) Thomson indicator B) Richard indicator

C) Simplex indicator D) None of these.

114. The relation between the no. of pairs (p) forming a kinematic chain and the no. of links (l) is

A) $l = 2p - 2$ B) $l = 2p - 3$

C) $l = 2p - 4$ D) $l = 2p - 5$.

115. The differential mechanism of an automobile is having

A) one degree of freedom B) two degrees of freedom

C) three degrees of freedom D) zero degree of freedom.

116. The effect of gyroscopic couple, acting on a ship pitching upward, will be to

A) move the ship towards star board

B) move the ship towards port

C) move the ship in clockwise direction when viewed from stern

D) none of these.

117. Frictional torque transmitted in a conical pivot bearing considering uniform wear is

A) $\frac{1}{2}\mu WR$ cosec α B) $\frac{2}{3}\mu WR$ cosec α

C) $\frac{3}{4}\mu WR$ cosec α D) μWR cosec α.

118. Creep in belt drive is due to

A) material of the pulley

B) material of the belt

C) expansion of belt

D) uneven extensions and contractions due to varying tension.

119. If 'r' is the pitch circle radius of pinion, 'R' is pitch circle radius of driver and 'ϕ' is pressure angle, the maximum length of arc of contact for two mating gears, in order to avoid interference will be

A) $(r + R) \sin \phi$ B) $(r + R) \cos \phi$

C) $(r + R) \tan \phi$ D) $(r + R) \cot \phi$.

120. Two meshing gears must have same

A) number of teeth B) addendum

C) dedendum D) module.

121. Hunting in a governor occurs due to

A) worn-out guides of the sleeve

B) fixed position of balls for each speed within working range

C) friction

D) none of these.

122. A governor is said to be isochronous when

A) the equilibrium speed is constant for all radii of rotation of the balls within working range

B) the range of speed is zero for all radii of rotation of the balls within working range

C) any one of these

D) none of these.

123. Hammer blow is

A) maximum value of unbalanced force along the line of stroke

B) maximum value of unbalanced force perpendicular to the line of stroke

C) resultant value of the unbalanced force

D) minimum value of unbalanced force perpendicular to the line of stroke.

124. Reference plane is a plane which is

A) passing through the plane of rotation of the rotating weight

B) passing through the plane of rotation of the balancing weight

C) at an angle of 45° to the rotating weight

D) at an angle of 45° to the balancing weight.

125. The rate of decay of oscillations is known as

A) critical damping B) damping coefficient

C) logarithmic decrement D) damped oscillation.

126. Controlling force curve is a plot between controlling force and

A) radius of rotation B) speed of rotation

C) range of speed D) sleeve lift.

127. The number of active surfaces for a multiplate clutch with the number of plates 'n' is

A) $n(n-1)$ B) $n-1$

C) n D) $n+1$.

128. Ratio of maximum displacement of the forced vibration to the deflection due to static force is known as

A) critical damping coefficient B) logarithmic decrement

C) magnification factor D) damping factor.

129. Clinometer is used for

A) angular measurement B) linear measurement

C) bore measurement D) level of flat surfaces.

130. Efficiency of riveted joint is the ratio of

A) shearing strength of rivet to strength of unriveted plate

B) crushing strength of rivet to strength of unriveted plate

C) tearing strength of plate to strength of unriveted plate

D) strength of riveted joint to strength of unriveted plate.

131. The diameter of rivets in mm for a plate of thickness t mm is taken as

A) t B) $2t$

C) $1{\cdot}41\sqrt{t}$ D) $6{\cdot}05\sqrt{t}$.

132. According to I.B.R., the factor of safety of riveted joint should not be less than

A) 1 B) 2

C) 3 D) 4.

133. Snap head rivets are used in

A) aircraft body B) ship building

C) structural work D) all of these.

134. A universal coupling is

A) flexible coupling

B) rigid compiling

C) used to connect perfectly aligned shaft

D) none of these.

135. Lag bolt is generally used in

A) wooden construction B) electrical equipment

C) fastening castings D) all of these.

136. Socket joint is mostly used for pipes which

A) carry steam at high pressure B) carry water at low pressure

C) are buried in the earth D) carry fluid at high pressure.

137. Which of the following is a friction clutch ?

A) Cone clutch B) Band clutch

C) Disc clutch D) All of these.

138. The ratio of maximum fluctuation of speed to the mean speed is called

A) fluctuation of speed B) coefficient of fluctuation of speed

C) maximum fluctuation of speed D) none of these.

139. The maximum shear stress induced in the wire of a circular section of a helical spring depends on

A) material of the wire B) size of cross-section

C) the ratio d/O D) all of these.

140. The wire ropes make contact at

A) bottom of groove of the pulley

B) sides of groove of the pulley

C) sides and bottom of groove of the pulley

D) anywhere in the groove of the pulley.

141. The minimum nominal pitch dia. for a V-pulley is

A) 50 mm B) 65 mm

C) 75 mm D) 90 mm.

142. The ratio of number of teeth and pitch circle diameter of a spur gear is called

A) pitch B) circular pitch

C) diametral pitch D) module.

143. Backlash is

A) sum of clearances of two gears

B) the mutual ply between two gears

C) amount by which the tooth space exceeds the thickness of an engaging teeth

D) none of these.

144. Gears which connect inclined shafts, which if produced, would intersect at same angle in the same plane are known as

A) spur gears B) bevel gears

C) spiral hypoid gears D) worm wheels.

145. The helix angle for single helical gears ranges from

A) 10° to 15° B) 15° to 20°

C) 20° to 35° D) 35° to 50°.

146. In spiral bevel gears, the axes are

A) non-parallel and non-intersecting and the teeth are curved

B) non-parallel and non-intersecting and the teeth are straight

C) intersecting, the teeth are curved and oblique

D) intersecting, the teeth are curved and can be ground.

147. The type of gear used for speed reduction of 50 : 1 will be

A) herring bone B) hypoid

C) bevel D) worm wheel.

148. The axial thrust on the worm (W_A) is given by

A) $W_A = W_T \cdot \tan \phi$ B) $W_A = W_T / \tan \phi$

C) $W_A = W_T \cdot \tan \lambda$ D) $W_A = W_T / \tan \lambda$.

149. The actual length of the belt is slightly less than the calculated

A) to give initial tension B) due to creep

C) due to slip D) to provide strength.

150. High speed steel tool material contains carbon

A) 0·6 – 1·0% B) 2 – 4%

C) 4 – 6% D) 6 – 10%.

151. For drilling operation, cylindrical job should always be clamped on a

A) Vice B) Socket

C) V-block D) Clamp.

152. For drilling brass, a drill with

A) high helix angle is required B) low helix angle is required

C) any helix angle is required D) zero helix angle is required.

153. The angle between the tool face and the ground end surface of flank is known as

A) lip angle B) rake angle

C) clearance angle D) nose angle.

154. Time taken to drill a hole through a 25 mm thick plate at 300 r.p.m. at a feed rate of 0·25 mm/rev. will be

A) 10 sec B) 20 sec

C) 25 sec D) 40 sec.

155. In orthogonal cutting,

A) cutting edge is inclined to axis of job

B) cutting edge is perpendicular to axis of the job

C) cutting edge is perpendicular to line of its motion

D) cutting edge is parallel to line of its motion.

156. A steel containing 0·85% carbon is known as

A) eutectoid steel B) hypo-eutectoid steel

C) hyper-eutectoid steel D) none of these.

157. Crater wear occurs mainly due to

A) abrasion B) diffusion

C) oxidation D) adhesion.

158. A step cone pulley is provided in a lathe to

A) reverse the spindle rotation B) change the spindle speed

C) drive the lead screw D) provide feed.

159. The job length for a shaper is

A) unlimited B) equal to that for a planer

C) limited to smaller size D) more than that for a planer.

160. Gear shaper can be used to cut which of the following types of gear ?

A) Internal B) External

C) Non-conventional D) All of these.

161. For machining ceramics, glass and plastics which method is not applicable ?

A) AJM B) LBM

C) EDM D) USM.

162. Which is incorrect ?

A hob cutter

A) rotates about its axis during cutting

B) moves axially after gear blank has made one rotation

C) moves into the workpiece during feed

D) moves parallel to the axis of workpiece during cutting.

163. Dielectric is a must in

A) EDM process B) ECM process

C) Laser beam machining D) Abrasive jet machining.

164. The ruby rod used in Laser Beam Machining is made up of

A) crystalline aluminium oxide or sapphire

B) copper oxide

C) zinc oxide

D) none of these.

165. The purpose of honing operation is

A) to remove grinding and tool marks left by previous operation

B) to finish holes

C) to correct eccentricity of holes

D) to provide very close fit between two contact surfaces.

166. The precision grinding of round and flat parts with loose, dust type abrasives is known as

A) lapping B) honing

C) polishing D) buffing.

167. With numerical control equipment, which one of the following is not true ?

A) Single-piece machining is possible and feasible because of the nature of the control system.

B) Fixture cost is considerably lower for numerical control machining than for conventional machining.

C) The initial cost of N.C. machine is low.

D) Programming and tape writing take much less time than building jigs & fixtures, and locating gases.

168. In electrochemical machining process metal removal rate depends upon

A) the hardness of tool material

B) the hardness of job material

C) the difference between the hardness of tool and work material

D) independent of the hardness of tool and work material.

169. The tool electrodes used in the ECM process differ from those used in EDM process in that ECM electrodes

A) are made of conducting materials

B) are made of insulating materials

C) are insulated at the sides

D) are insulated in the front.

170. The feature measured by a gear tooth vernier is

A) addendum B) tooth depth

C) pitch line thickness of tooth D) all of these.

171. A sine bar is specified by

A) its total length

B) the centre distance between the two rollers

C) the size of the rollers

D) the weight of sine bar.

172. The accessory of slip gauges is

A) scribing and centre points B) measuring jaws

C) holder D) base and (A), (B) & (C).

173. Scribing block is used to

A) hold the round bars during marking

B) check the trueness of flat surfaces

C) locate the centres of round bars

D) check the surface roughness.

174. Bevel protractor is used to measure

A) angles in the workpiece B) diameter of hole in the workpiece

C) length of the workpiece D) none of these.

175. Method concerned with surface finish measurement is

A) ultrasonic method B) field emission method

C) critical angle of attack method D) all of these.

176. Which of the following are not controllable errors ?

A) Calibration errors B) Environmental errors

C) Avoidable errors D) Random errors.

177. Element of the indicating device carrying the scale is called

A) dial B) transducer

C) housing D) index.

178. Sensitivity and range of measuring instrument have

A) direct relationship B) linear relationship

C) inverse relationship D) none of these.

179. Systematic errors are

A) regular and repetitive B) randomly distributed

C) distributed on either side of mean D) unpredictable.

180. Analysis of an operation, when carried out in terms of individual motions of a worker is known as

A) work analysis B) motion analysis

C) time and motion analysis D) operation analysis.

181. String diagram is used when

A) team of workers is working at a place

B) material handling is to be done

C) idle time is to be reduced

D) all of these.

182. Time standards are used for

A) performance evolution of individual workers

B) incentive payments

C) cost estimating

D) all of these.

183. Material handling system is affected by the factor

A) product to be handled

B) production system

C) type of building within which material is to be handled

D) all of these factors.

184. ABC analysis deals with

A) flow of material B) analysis of process chart

C) controlling inventory costs money D) none of these.

185. MRP indicates

A) Materials Reordering Point B) Materials Reordering Planning

C) Materials Requirements Planning D) Materials Requirements Point.

186. Simplex method is the method used for

A) value analysis B) network analysis

C) linear programming D) queuing theory.

187. Difference of actual sales and breakeven point is called

A) margin of safety B) price-cost margin

C) contribution D) none of these.

188. Standard time is equal to

A) normal time plus allowances B) normal time minus allowances

C) normal time plus idle time D) normal time minus idle time.

189. The function that authorises production and control is

A) routing B) despatching

C) scheduling D) expediting.

190. The input-output analysis is often called as

A) cost benefit analysis B) value analysis

C) non-pricing analysis D) none of these.

191. The incentive wage plan in which savings are expressed as a % of the standard time, is

A) Halsey plan B) Bedaux plan

C) Rowan plan D) Group plan.

192. Slack represents the difference between the

A) earliest completion time and latest allowable time

B) latest allowable time and earliest completion time

C) earliest completion time and normal expected time

D) latest allowable time and normal allowable time.

193. In Emerson's efficiency plan of wage incentive system, bonus is paid to a worker

A) whose output exceeds 67% efficiency

B) on the percentage of time saved

C) on the percentage of time worked

D) on the percentage of standard time.

194. An event is indicated on the network by

A) an arrow

B) a straight line with circle at the end

C) a number enclosed in a circle or a square

D) a dotted line.

195. PERT and CPM are

A) techniques to determine project status

B) decision making techniques

C) aids to determine cost implication of project

D) aids to the decision maker.

196. In order to investigate the shortcomings of the existing and to develop an improved procedure, the analysis carried out is

A) work analysis B) motion analysis

C) time and motion analysis D) operation analysis.

197. Pre-planning

A) is the end of all planning B) is the beginning of control

C) culminates in routing D) is the substance of control.

198. Loading consists of

A) determination of when is to be done

B) determination of requirements and control of men and machines

C) determination of requirements and control of materials

D) determination of requirements and control of tools.

199. The first free trade zone in India was established at

A) Cochin B) Madras

C) Bombay D) Delhi.

200. An organisation containing manufacturing, marketing and finance is called

A) matrix organisation B) functional organisation

C) flow network organisation D) modular organisation.

(SPACE FOR ROUGH WORK)

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