1 **A heat engine receives half of its heat supply at 1000 K and remaining half at 500 K. Heat is rejected to the sink at 300 K. The maximum thermal efficiency of the heat engine will be:**

(a) 55% (b) 10%

(c) 45% (d) 65%

2 **Clausius inequality statement indicates that**

(a) $\oint \frac{\delta\phi}{T} = 0$ (b) $\oint \frac{\delta\phi}{T} \geq 0$

(c) $\oint \frac{\delta\phi}{T} < 0$ (d) $\oint \frac{\delta\phi}{T} \leq 0$

3 **With the increase of pressure**

(a) The boiling point of water decreases and enthalpy of evaporation increases

(b) The boiling point of water increases and enthalpy of evaporation decreases

(c) Both the boiling point of water and enthalpy of evaporation decreases

(d) Both the boiling point of water and enthalpy of evaporation increases

4 **Region inside the inversion curve is represented by : (where μ is Joule - Kelvin coefficient)**

(a) Cooling region, $\mu < 0$

(b) Heating region, $\mu > 0$

(c) Cooling region, $\mu > 0$

(d) Heating region, $\mu < 0$

5 **The maximum efficiency for Person's reaction turbine is given by**

(a) $\eta_{max} = \frac{\cos\alpha}{1+\cos\alpha}$ (b) $\eta_{max} = \frac{2\cos\alpha}{1+\cos\alpha}$

(c) $\eta_{max} = \frac{2\cos^2\alpha}{1+\cos^2\alpha}$ (d) $\eta_{max} = \frac{1+\cos^2\alpha}{2\cos^2\alpha}$

6 **Mach angle (α) is defined as the**

(a) Quarter angle of the mach cone
(b) Zero angle of the mach cone
(c) Half of the angle of the mach cone
(d) Full angle of the mach cone

7 **For same compression ratio-**

(a) Thermal efficiency of Otto cycle is greater than that of Diesel cycle
(b) Thermal efficiency of Otto cycle is less than that of Diesel cycle
(c) Thermal efficiency of Otto cycle is same as that of Diesel cycle
(d) Mechanical efficiency of Otto cycle is greater than that of Otto cycle

8 **A heat pump working on a reversed Carnot cycle has a C.O.P. of 5. It works as a refrigerator taking 1 kW of work input. The refrigerating effect will be:**

(a) 4 kW (b) 1 kW
(c) 2 kW (d) 5 kW

9 **A body cooling from 80°C to 70°C takes 10 minutes when left exposed to environmental conditions. If the body is to cool further from 70°C to 60°C under the same external conditions, it will take**

(a) more than 10 minutes
(b) same time of 10 minutes
(c) less than 10 minutes
(d) none of these

10 **Thermal conductivity of air with rise in temperature**

(a) Increases
(b) decreases
(c) remains constant
(d) May increases or decrease depending on temperature

11 **What is the affect of thermal conductivity k on fin effectiveness?**

(a) Fin is effective for smaller value of thermal conductivity
(b) Fin is effective for larger value of thermal conductivity
(c) Thermal conductivity does not affect fin effectiveness
(d) Initially Increases and after attaining peak reduces

12 **The non-dimensional parameter known as Stanton number (St) is used in**

(a) Forced convention heat transfer in flow over flat plate
(b) Condensation heat transfer with laminar film layer
(c) Natural convention heat transfer over flat plate
(d) Unsteady heat transfer from bodies in which internal temperature gradients cannot be neglected

13 **According to Wien's law, the wavelength corresponding to maximum energy is proportional to:-**

(a) T^{-1} (b) T^{-2}

(c) T^{-3} (d) T^{-4}

14 **Effectiveness of heat exchanger is function of:**

(a) Heat capacity ratio only

(b) Surface area of heat exchanger only

(c) NTU and heat capacity ratio

(d) NTU only

15 **'A fluid is at rest' means that :**

(a) it has zero normal stress and non-zero shear stress.

(b) it has non-zero normal stress and zero shear stress.

(c) it has non-zero normal stress and shear stress.

(d) it has zero-normal stress and zero shear stress.

Module 1

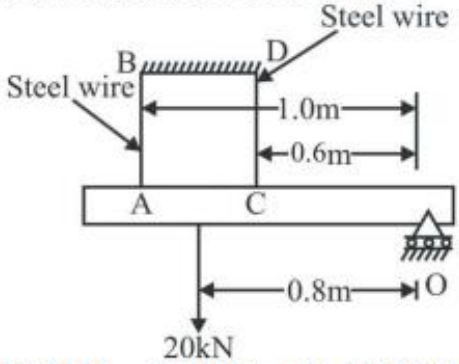
1 **Four forces P, 2P, 3 P & 4P act along the sides of a square, taken in order. The resultant force is**

(a) zero (b) $\sqrt{5}P$

(c) $2\sqrt{2}P$ (d) 2P

2

A rigid bar ACO as shown is hinged at O and is held in a horizontal position by two identical vertical steel wires AB and CD. A point load of 20 kN is hung at the position shown. The tensions in wires AB and CD are



(a) 15.2 kN and 7.1 kN (b) 11.8 kN and 7.1 kN
(c) 15.2 kN and 5.0 kN (d) 11.8 kN and 5.0 kN

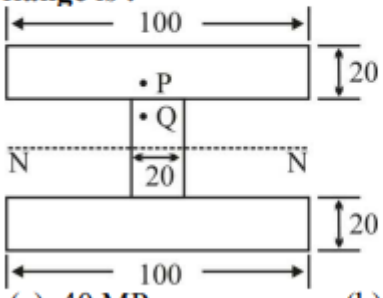
3

Proof stress–

(a) Is the safe stress
(b) Cause a specified permanent deformation in a material usually 0.1% or less
(c) Is used in connection with acceptance tests for materials
(d) Does not exist

4

An I-section of a beam is shown in the figure below. If the shear stress at point P which is very close to bottom of the flange is 12 MPa, the shear stress at the point Q close to the flange is :



(a) 40 MPa (b) 12 MPa
(c) Indeterminate (d) 60 MPa

5

Within elastic limits the greatest amount of strain energy per unit volume that a material can absorb is known as

(a) Shock proof energy (b) Impact energy limit
(c) Proof resilience (d) Strain hardening

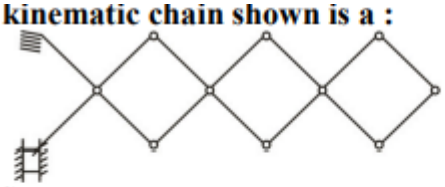
6 **Stress concentration in static loading is more serious in**

(a) ductile materials
(b) brittle materials
(c) equally serious in both cases
(d) none of the above

7 **Which of the following bearings are most suitable for supporting high axial thrust?**

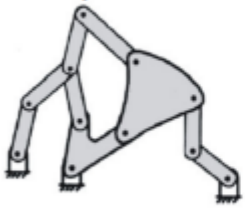
(a) Radial ball bearings
(b) Needle bearings
(c) Cylindrical roller bearings
(d) Tapered roller bearings

8 **The kinematic chain shown is a :**



(a) Structure
(b) Mechanism with one degree of freedom
(c) Mechanism with two degree of freedom
(d) Mechanism with more than two degree of freedom

9 **A mechanism is shown below. The number of ternary links and the DOF, respectively, are :**



(a) 2 ; 3
(b) 2 ; 2
(c) 3 ; 2
(d) 3 ; 3

10 **A flywheel absorbs 24 kJ of energy while increasing its speed from 210 rps to 214 rps. What will be its kinetic energy at 220 rps?**

(a) 825.1 kJ
(b) 790.4 kJ
(c) 936.4 kJ
(d) 684.9 kJ

11 **The resultant unbalanced force is minimum in reciprocating engines, when**

(a) $\frac{1}{3}$ of reciprocating masses are balanced

(b) $\frac{1}{2}$ of reciprocating masses are balanced

(c) $\frac{3}{4}$ of reciprocating masses are balanced

(d) they are completely balanced

12 **An aircraft cruising at 360 kmph takes a right turn on an arc of 100 m radius. The turbines and propellers have a total mass of 500 kg with radius of gyration of 25 cm. The engine rotates at 2000 r.p.m. The magnitude of the gyroscopic couple generated is**

(a) 6.55 kN m (b) 7.65 kN m
(c) 9.81 kN m (d) 13.1 kN m

13 **A shaft carrying two rotors as its ends will have**

(a) no node (b) one node
(c) two node (d) three node

14 **In vibration isolation system, if ω/ω_n is less than $\sqrt{2}$, then for all values of the damping factor, the transmissibility will be where ω-circular frequency of excitation in rad/s and ω_n = Natural circular frequency, rad/s**

(a) less than unity (b) equal to unity
(c) greater than unity (d) zero

15 **In underdamped vibrating system the amplitude of vibration with reference to time**

(a) increases linearly
(b) increases exponentially
(c) decreases linearly
(d) decreases exponentially

Module 3

1 **Which of the following material has non-linear elastic behaviour?**

(a) Mild Steel (b) Aluminium
(c) Cast iron (d) Rubber

2 **When mechanical properties of a material remain same in all directions at each point, such a material is called**

(a) Isotropic (b) Homogenious
(c) Orthotropic (d) Anisotropic

3 **Hot tears results in castings due to:**

(a) Too much shrinkage of molten metal
(b) High content of sulfur in molten metal
(c) Less moisture in mould
(d) Both (a) and (b)

4 **According to Lee and Shaffer theory, the shear angle ϕ is given by the relation (α = rake angle, β = friction angle)**

(a) $\phi=\frac{\pi}{2}+\frac{\beta}{2}+\frac{\alpha}{2}$ (b) $\phi=\frac{\pi}{4}-\beta+\alpha$

(c) $\phi=\frac{\pi}{4}-\frac{\beta}{2}+\frac{\alpha}{2}$ (d) $\frac{\phi}{2}=\frac{\pi}{2}+\alpha+\beta$

5 **In blanking operation, clearance is provided to:**

(a) Stripper (b) Die
(c) Punch (d) Die and Punch

6 **Which of the following processes is used when a small batch of gears are needed to be produced without much accuracy?**

(a) Broaching (b) Gear forming
(c) Gear shaping (d) Gear hobbing

7 **Hot rolling of mild steel is carried out at :**

(a) Below recrystallization temp
(b) Between 100° to 150° C
(c) Above recrystallization temp
(d) At 100° C

8 **Thread rolling is somewhat like :**

(a) cold extrusion (b) cold machining
(c) cold rolling (d) cold forging

9 **Which of the following processes has the highest metal removal rate?**

(a) Ultrasonic machining
(b) Abrasive machining
(c) Chemical machining
(d) Electron beam machining

10 **APT is used**

(a) in teaching of the beginners
(b) in CAM for NC machine tools
(c) in inventory management
(d) None of the above

11 **In the G code of NC part programming, G21 refers to**

(a) Input values specified in millimeters
(b) Return to reference point
(c) Thread cutting in turning
(d) Dwell for a specified time

12 **3-2-1 Principle is related with**

(a) Design of locating devices.
(b) Tool design
(c) Plant layout design
(d) Work sampling

13 **Powder metallurgy techniques are used in the production of**

(a) High carbon steel tool
(b) HSS tools
(c) Tungsten carbide tools
(d) Twist drills

14 **Profile of a gear tooth can be checked by**

(a) Optical projector (b) Optical pyrometer
(c) Bench micrometer (d) Sine bar

15 **H_7g_7 is**

(a) clearance fit (b) interference fit
(c) shrinkage fit (d) transition fit