1.1 Carburized machine components have high endurance limit because carburization

(a) raises the yield point of the material

(b) produces a better surface finish

(c) introduces a compressive layer on the surface

(d) suppresses any stress concentration produced in the component

1.2 A manufacturer of rivets claims that the failure load in shear of his product is 500 ± 25N. This specification implies that

(a) no rivet is weaker than 475N and stronger than 525N

(b) the standard deviation of strength of random sample of rivets is 25 N

(c) there is an equal probability of failure strength to be either 475N or 525N

(d) there is approximately two-to-one chance that the strength of a rivet lies between 475N to 525N

1.3 For resistance spot welding of 1.5 mm thick steel sheets, the current required is of the order of

(a) 10 A (b) 100 A (c) 1000 A (d) 10000 A

1.4 In a green-sand moulding process, uniform ramming leads to

(a) less chance of gas porosity

(b) uniform flow of molten metal into the mould cavity

(c) greater dimensional stability of the casting

(d) less sand expansion type of casting defect

1.5 The thickness of the blank needed to produce, by power spanning a missile cone of thickness 1.5 mm and half cone angle 30°, is:

(a) 3.0 mm (b) 2.5 mm (c) 2.0 mm (d) 1.5 mm

1.6 The true strain for a low carbon steel bar which is doubled in length by forging is

(a) 0.307 (b) 0.5 (c) 0.693 (d) 1.0

1.7 The effect of rake angle on the mean friction angle is machining can be explained by

(a) sliding (coulomb) model of friction

(b) sticking and then siding model of friction

(c) sticking friction

(d) sliding and then sticking model of friction

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1.8 In Ultrasonic Machining (USM) the material removal rate would

(a) increase (b) decrease

(c) increase and then decrease (d) decrease and then increase

With increasing mean grain diameter of the abrasive material.

1.9 The two main criteria for selecting the electrolyte in Electrochemical Machining (ECM) is that the electrolyte should

(a) be chemically stable

(b) not allow dissolution of cathode material

(c) not allow dissolution of anode material

(d) have high electrical conductivity

1.10 In a point-to-point type of NC system

(a) control of position and velocity of the tool is essential

(b) control of only position of the tool is sufficient

(c) control of only velocity of the tool is sufficient

(d) neither position nor velocity need to be controlled

1.11 Two shafts A and B have their diameters specified as 100 $\pm$0.1 mm and 0.1 $\pm$0.0001 mm respectively. Which of the following statements is/are true?

(a) Tolerance in the dimension is greater in shaft A

(b) The relative error in the dimension is greater in shaft A

(c) Tolerance in the dimension is greater in shaft B

(d) The relative error in the dimension is same for shaft A and shaft B

1.12 Alcohols are unsuitable as diesel engine fuels because

(a) the cetane number of alcohol fuels is very low which prevents their ignition by compression

(b) the cetane number of alcohol fuels is very high which prevents their ignition by compression

(c) the cetane number of alcohol fuels is constant which prevents their ignition by compression

(d) None of the above

1.13 Boiler rating is usually defined in terms of

(a) maximum temperature of steam in Kelvin

(b) heat transfer rate in KJ/hr

(c) heat transfer area in metre^2

(d) steam output in kg/hr

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1.14 In stream and other vapour cycles, the process of removing non-condensables is called

(a) scavenging process
(b) deaeration process
(c) exhaust process
(d) condensation process

1.15 Brake thermal efficiency of the three types of reciprocating engines commonly used in road vehicles are given in the increasing order as

(a) 2 stroke SI engine, 4 stroke SI engine, 4 stroke CI engine
(b) 2 stroke SI engine, 4 stroke CI engine, 4 stroke SI engine
(c) 4 stroke SI engine, 2 stroke SI engine, 4 stroke CI engine
(d) 4 stroke CI engine, 4 stroke SI engine, 2 stroke CI engine

1.16 Subsonic and supersonic diffusers have the following geometry

(a) divergent and convergent respectively
(b) both divergent
(c) both convergent
(d) convergent and divergent respectively

1.17 The following is the arrangement of rotary pumps in descending order of specific speed at their best efficiency:

(a) positively displacement, centrifugal, axial
(b) centrifugal, positive displacement, axial
(c) axial, centrifugal, positive displacement
(d) axial, positive displacement, centrifugal

1.18 The theoretical mechanical efficiency of a jet engine (neglecting frictional and thermal losses), when driving a vehicle, has its maximum

(a) only when the vehicle moves at sonic velocity
(b) when outlet gases approach zero absolute velocity
(c) when the vehicle speed approaches the magnitude of the relative velocity of gases at nozzle exit.
(d) only when the relative velocity at nozzle exit is at its maximum

1.19. Jet pumps are often used in process industry for their

(a) high efficiency
(b) easy maintenance
(c) large capacity
(d) capacity to transport gases, liquids and mixtures of both

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1.20. Two rods, one of length L and the other of length 2L are made of the same material and have the same diameter. The two ends of the longer rod are maintained at 100°C. One end of the shorter end is maintained at 100°C while the other end is insulated. Both the rods are exposed to the same environment at 40°C. The temperature at the insulated end of the shorter rod is measured to be 55°C. The temperature at the mid-point of the longer rod would be

(a) 40°C (b) 50°C (c) 55°C (d) 100°C

1.21. A fluid flowing over a flat plate has the following properties:

Dynamic viscosity: $25 \times 10^{-6} kg / ms$

Specific heat : 2.0 kJ/kgK

Thermal conductivity : 0.05 W/mk

The hydrodynamic boundary layer thickness is measured to be 0.5 mm. The thickness of thermal boundary layer would be

(a) 0.1 mm (b) 0.5 mm (c) 1.0 mm

(d) None of the above

1.22. A condenser of a refrigeration system rejects heat at a rate *f* 120kW, while its compressor consumes a power of 30 kW. The coefficient of performance of the system would be:

(a) $\frac{1}{4}$ (b) 4 (c) $\frac{1}{3}$ (d) 3

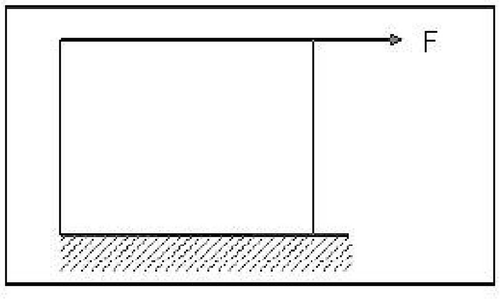
1.23. A block of steel is loaded by a tangential force on its top surface while the bottom surface is held rigidly. The deformation of the block is due to

(a) shear only

(b) bending only

(c) shear and bending

(d) torsion



1.24. Instantaneous centre of a body rolling with sliding on a stationary curved surface lies

(a) at the point of contact

(b) on the common normal at the point of contact

(c) on the common tangent at the point of contact

(d) at the centre of curvature of the stationary surface

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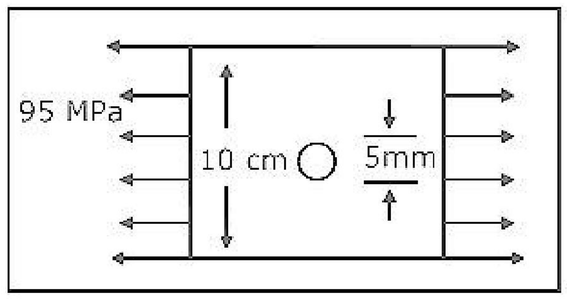
1.25 A large uniform plate containing a rivet-hole is subjected to uniform uniaxial tension of 95 MPa. The maximum stress in the plate is:

(a) 100 MPa

(b) 285 MPa

(c) 190 MPa

(d) Indeterminate



1.26 High damping reduces the transmissibility if the non-dimensional frequency ration ω/ω_n (ω = forcing frequency, ω_n = natural frequency)

(a) is less than $\sqrt{2}$

(b) is greater than $\sqrt{2}$

(c) is less than $\frac{1}{\sqrt{2}}$

(d) is greater than $\frac{1}{\sqrt{2}}$

1.27 For lightly damped heavy rotor systems, resonance occurs when the forcing ω is equal to

(a) $2\omega_{cr}$

(b) $\sqrt{2}\omega_{cr}$

(c) ω_{cr}

(d) $\frac{1}{2}\omega_{cr}$

1.28 Starting friction is low in

(a) Hydrostatic lubrication

(b) Hydrodynamic lubrication

(c) Mixed (or semi-fluid) lubrication

(d) Boundary lubrication

1.29 Spherical roller bearings are normally used

(a) for increased radial load

(b) for increased thrust load

(c) when there is less radial space

(d) to compensate for angular misalignment

1.30 Fatigue strength of a rod subjected to cyclic axial force is less than that of a rotating beam of the same dimensions subjected to steady lateral force because

(a) axial stiffness is less than bending stiffness

(b) of absence of centrifugal effects in the rod

(c) the number of discontinuities vulnerable to fatigue are more in the rod

(d) at a particular time the rod has only one type of stress whereas the beam has both the tensile and compressive stresses

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2.1 In an explosive welding process, the .....(maximum/minimum) velocity of impact is fixed by the velocity of sound in the .....(flyer/target) plate material.

2.2 In horizontal milling process ..... (up/down) milling provides better surface finish and ..... (up/down) milling provides longer tool life.

2.3 A steam turbine operating with less moisture is ..... (more/less) efficient and ..... (less/more) prone to blade damage.

2.4 Blowers deliver gaseous fluids at pressure ratios ..... (below/above) 1.15 and ..... (have/have no) artificial cooling arrangement.

2.5 A refrigeration compressor designed to operate with R 22 ..... (can/cannot) be operated with R 12 because the condensing pressure of R 22 at any give temperature is ..... (higher/lower) than that of R 12.

3.1 Match the terms used in connection with heat-treatment of steel with the micro-structural/physical characteristics:

Terms	Characteristics
(A) Pearlite	(P) Extremely hard and brittle phase
(B) Martensite	(Q) Cementite is finely dispersed in ferrite
(C) Austenite	(R) Alternate layers of cementite and ferrite
(D) Eutectoid	(S) Can exist only above 723°C
	(T) Pertaining to state of equilibrium between three solid phases
	(U) Pertaining to state of equilibrium between one liquid and two solid phase

3.2 Match the following modulating/casting processes with the product:

Moulding/Casting processes	**Products**
(A) Slush casting	(P) Turbine blade
(B) shell moulding	(Q) Machine tool bed
(C) Dry sand moulding	(R) Cylinder block
(D) Centrifugal casting	(S) Hollow castings like lamp shades
	(T) Rain water pipe
	(U) Cast iron shoe brake

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3.3 Match the following components with the appropriate machining processes:

Component	Process
(A) Square hole in a high strength alloy	(P) Milling
(B) Square hole in a ceramic component	(Q) Drilling
(C) Blind holes in a die	(R) ECM
(D) Turbine blade profile on high strength alloy	(S) Jig boring
	(T) EDM
	(U) USM

3.4 Match the following quality control objective functions with the appropriate statistical tools:

Objective functions	Statistical Tools
(A) A casting process is to be controlled with respect to hot tearing tendency	(P) X-chart
(B) A casting process is to be controlled with respect to the number of blow holes, if any, produced per unit casting	(Q) C-chart
(C) A machining process is to be controlled with respect to the diameter of shaft machined	(R) Random sampling
(D) The process variability in a milling operation is to be controlled with respect to the surface finish of components	(S) P-chart
	(T) Hypothesis testing
	(U) X, - charts

3.5 Match the instruments with the physical quantities they measure:

Instrument	Measurement
(A) Pilot tube	(P) R P M of a shaft
(B) McLeod Gauge	(Q) Displacement
(C) Planimeter	(R) Flow velocity
(D) LVDT	(S) Vacuum
	(T) Surface finish
	(U) Area

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