ISRO SDSC TA 2022

Q1. For u.d.l acting on a beam of cantilever, the shear force diagram shows the following.
(a) straight line
(b) parabolic curve
(c) hyperbolic curve
(d) inclined straight line

Q2. A Flywheel is rotating at angular speed of 6 rad/s and its moment of inertia is 2500kg-m^2. Kinetic energy possessed by flywheel is
(a) 50 kJ
(b) 45 kJ
(c) 1
(d) 40 kJ

Q3. Which of the following tool is not used in Forging operations?
(a) Swage block
(b) Tong
(c) Anvil
(d) Auger

Q4. The permissible stress in a fillet weld is 100 MPa and fillet size is 15mm. Then allowable shearing load on weldment per cm length of the weld is
(a) 22.5 kN
(b) 15.0 kN
(c) 10.6 kN
(d) 70.5 kN

Q5. Tool materials in the increasing order of red hardness is
(a) HSS, Plain carbon steel, Carbides, Ceramics
(b) Carbides, HSS, Ceramics, Plain Carbon steel
(c) Plain carbon steel, HSS, Carbides, Ceramics
(d) Ceramics, Plain carbon steel, Carbides, HSS

Q6. A shaft of 10 mm in diameter whose maximum shear stress is 32 N/mm^2 can transmit a maximum torque in N-mm is equal to
(a) 2000π
(b) $1000\ \pi$
(c) $4000\ \pi$
(d) $8000\ \pi$

Q7. A power screw of 32 mm nominal diameter and 5mm pitch is acted upon by an axial load of 12 kN with permissible thread bearing pressure is 6 MPa. Considering bearing action between the threads in engagement, what is the number of threads in engagement with the screw.
(a) 5
(b) 9
(c) 14
(d) 17

Q8. Find the equation of a straight line passing through the point (-2, 1) and perpendicular to the line 2x - 3y = 10
(a) $3x + 2y - 4 = 0$
(b) $2x - 3y + 7 = 0$
(c) $3x - 2y + 8 = 0$
(d) $3x + 2y + 4 = 0$

Q9.Melting point of pure iron in degree centigrade is
(a) 2001
(b) 2010
(c) 1539
(d) 1469

Q10. A plate at a distance of 1 mm from a fixed plate moves at 60 cm/sec and requires a force of 2N per unit area i.e. 2N/m^2 to maintain speed. Determine fluid viscosity between the plates.
(a) 3.3 x 10-3 N.s/m2
(b) 0.33 x 10-3 N.s/m2
(c) 3.3 x 10-2 N.s/m2
(d) 3.3 x 10-5 N.s/m2

Q11.A reversible polytropic process can be described by
(a) PV^n = constant
(b) (PV)n = constant
(c) (P/V)n = constant
(d) PV-n = constant

Q12.The ability of material to exhibit large plastic deformation prior to fracture under tensile loading conditions is called
(a)Malleability
(b) Ductility
(c) Hardenability
(d) Machinability

Q13.In the following system, Steel grades are designed in En series
(a) Indian standard steel designation system
(b) American Iron & Steel Institute (AISI)
(c) British standard designation system
(d) DIN standards

Q14.The rate of change of bending moment at any section is equal to
(a) Shear force at that section
(b) Deflection at that section
(c) Loading at that section
(d) Net moment

Q15. A work study is concerned with
(a) Motivation of workers
(b) Improving production planning and control
(c) Improving the production capability
(d) Improve the method and finding standard time

Q16.Compression ratio for an engine with clearance volume of 120 cm3 and swept volume of 600 cm^3 is -------
(a) 6
(b) 5
(c) 7.2
(d) 4.8

Q17.In a flat belt drive, Driver pulley of 200mm diameter running at 1000RPM drives another pulley of 100 mm diameter with a total slip of 2%. Then speed of Driven pulley is
(a) 2000 RPM
(b) 1960 RPM
(c) 1850 RPM
(d) 2010 RPM

Q18.The mechanism becomes structure when its degree of freedom is equal to
(a) 1
(b) 3
(c)0
(d) 2

Q19.Wet bulb temperature at 100% RH is _____ dry bulb temperature.
(a) equal to
(b) lower than
(c) higher than
(d) inverse of

Q20.In a simply supported beam carrying an u.d.l. w per unit length, then the point of contra flexure.
(a) lies in the centre of the beam
(b) lies at the ends of the beam
(c) depends up on length of beam
(d) does not exist

Q21.A toothed wheel of module 6mm and 60 teeth rotates at 100 rpm. Find the peripheral speed of the gear wheel in m/sec
(a) 0.6π
(b) 6000π
(c) $6\ \pi$
(d) $100\ \pi$

Q22.Stroke length of ram in shaper can be increased by
(a) Increasing radial distance of crank pin
(b) Decreasing radial distance of crank pin
(d) Increasing distance between fixed centers

Q23.Slip gauges are used for
(a) Verification of accuracy of micrometers
(b) Measurement of slip of belts
(c) Measurement of pitch of threads
(d) Verification of sensitivity of governor

Q24. Annual production is 1800 units. Procurement cost is Rs. 450/- Manufacturing cost is Rs45/- Inventory cost is 10% per item Calculate the total number of orders based on EOQ
(a) 3
(b) 2
(c) 6
(d) 4

Q25.Minimum percentage of carbon in cast iron is
(a) 1.0%
(b) 2.0%
(c) 0.8%
(d) 4.4%

Q26.At room temperature, crystal structure of Platinum is
(a) FCC
(b) BCC
(c) HCP
(d) SC

Q27. The length : width in case of an arrow head is
(a) 1:1
(b) 2:1
(c) 3:1
(d) 1:3

Q28.Water flows at the rate of 0.147 m3/sec through a 150mmm diameter orifice inserted in a 300 mm diameter pipe. The pressure gauges fitted on upstream and downstream of the orifice plate have shown reading of 176.58 kN/m2 and 88.29 kN/m2. The value of manometric height
(a) 10m of water ‘
(b) 12 m of water
(c) 9 m of water
(d) 1 m of water

Q29.Total pressure produced by fan in air handling unit is
(a) Static pressure + Velocity pressure
(b) Static pressure + atmospheric pressure
(c) Static pressure – atmospheric pressure
(d) (Static pressure x volumetric efficiency) + Atmospheric pressure

Q30.The thimble of screw gauge has 50 divisions. The spindle advances 1mm when the screw is turned through two revolutions. What is the least count of screw gauge?
(a) 0.1 mm
(b) 0.01mm
(c) 0.001mm
(d) 0.2mm

Q31.Most commonly employed Welding process for joining locomotive rails is
(a) Thermit Welding
(b) Arc Welding
(c) Gas Welding

(d) Electron beam welding

Q32.A cantilever beam of rectangular cross section is subjected to a load 'W' at its free end. If the depth of the beam is doubled and the load is halved, the deflection of free end as compared to original deflection will be

(a) half
(b) one eight
(c) one sixteenth
(d) double

Q33.In a compound belt drive, an engine pulley A of dia. 750mm rotating at 150 RPM drives pulley B of dia.450mm. Pulley C of dia.900mm keyed to the same shaft of pulley B drives dynamo pulley of dia.150mm. Speed of dynamo pulley is

(a) 1200 RPM
(b) 1300 RPM
(c)1500 RPM
(d) 1800 RPM

Q34. A pipe connecting two reservoirs with a difference of 5cm in their surface elevations conveys discharge of 0.1m^3/sec. If the pipe is replaced by another pipe of four times the diameter, then the discharge will be

(a) 1.6 m^3/sec
(b) 3.2 m^3/sec
(c) 0.4 m^3/sec
(d) 0.2 m^3/sec

Q35.One of which NDT method is used to detect internal weld defects.

(a) Radiographic testing
(b) Magnetic particle testing
(c) Liquid penetration testing
(d) None of the above

Q36.A Monoatomic ideal gas ($\gamma = 1.67$ Molecular weight =40) is compressed adiabatically from 0.1 MPa 300 K to 0.2MPa. The universal gas constant is 8.314 kJ/kgK. The work of the compression of gas in kJ/kg is. (Take (2)y-1/y=1.32)

(a) 29.7
(b) 19.9
(c) 13.3
(d) zero

Q37.Roughness values(0.2 to 0.8) microns is indicated by which symbol

(a) one triangle
(b) three triangle
(c) Two triangle
(d) Approximation

Q38.The observed time for an element is 0.7 minutes. The rating factor is 90%. All the allowances put together are 20% of normal time. Calculate the Standard time in minutes.

(a) 0.756
(b) 0.856
(c) 0.5
(d) 2.0

Q39.Dimensional formula of Stefan Boltzmann constant

(a) $M^1L^0T^{-3}K^{-4}$
(b)$M^1L^3T^{-3}K^{-4}$
(c)$M^{-2}L^2T^{-3}K^{-4}$
(d)$M^{-1}L^0T^{-3}K^{-4}$

Q40.The metacentric height of a floating body is

(a) the distance between metacenter and center of buoyancy
(b) the distance between center of buoyancy and center of gravity
(c) the distance between metacenter and center of gravity
(d) none of the above

Q41.What is the mass of air contained in a room of dimension 10m x 10m x 9m if the pressure is 100 kPa and the temperature is 27 C. Take Gas constant R = 0.3 kJ/kg.K

(a) 900 kg
(b) 1000kg
(c) 100kg
(d) 800kg

Q42.In an experimental test conducted on hoisting machine, it was found that an effort of 40 kN was applied to lift a load of 180 kN. An effort of 32 kN was required to lift a load of 140 kN. As per law of machine, effort required to lift 15 kN load is

(a) 15 kN
(b) 10 KN
(c) 7 kN
(d) 2 kN

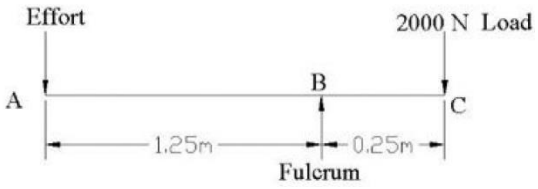
Q43…… is a drawing giving details about size tolerances, heat treatment etc.

(a) Exploded drawing
(b) Production drawing
(c) Assembly drawing
(d) Machine drawing

Q44.In a laboratory test on shaper, feed, depth of cut and length of stroke are 2mm/stroke, 4mm and 300mm respectively. If specific power consumption is 0.05 kW/cm3 per minute and number of working strokes per minute is 20, Power consumption is

(a) 4.5 kW
(b) 2.0 kW
(c) 2.4 kW
(d) 1.2 kW

Q45.What is the value of effort from the following free body diagram.



(a) 200N
(b) 400 N
(c) 600 N
(d) 1000N

Q46. A flywheel is in the form of uniform circular disc of diameter 10 cm & mass 10 kg is rotating about its own axis calculate the kinetic energy when rotating at 1200 rpm

(a) $100\pi^2$ J
(b) $10\pi^2$J
(c) $\pi^2/10$ J
(d) $\pi^2/100\ J$

Q47.For a CNC machine command, S3820 means

(a) Feed rate of 3820 mm per hour
(b) Spindle speed of 3820 rpm
(c) Move present tool to X+ direction by 38.20 mm
(d) Change over to tool no.38 from 20

Q48.Determine the depth of the strongest beam that can be cutout of a cylindrical log of wood whose diameter is 400mm.

(a) 32.66 cm
(b) 23.06 cm
(c) 31.76 cm
(d) 33.26 cm

Q49.Euler's number is the ratio of

(a) Inertia force to pressure force
(b) Inertia force to elastic force
(c) Inertia force to gravity force
(d) Pressure force to elastic force

Q50.When air is compressed, the enthalpy is increases from 100kJ/kg to 200kJ/kg. Heat lost during this compression is 50

kJ/kg. Neglecting Potential and Kinetic Energies, the power required for a mass flow of 2kg/sec of air through compressor will be

(a) 300 kW
(b) 200 kW
(c) 100 kW
(d) 50 kW

Q51.Calculate the HCV & LCV of a coal specimen from the following data per kg of coal . Carbon 70%; Hydrogen6%; Oxygen8%; Sulphur5% and remaining is ash

(a) 31323 kJ/kg & 29992 kJ/kg
(b) 33319 kJ/kg & 25789 kJ/kg
(c) 32689 kJ/kg & 25687 kJ/kg
(d) 32896 kJ/kg & 25876 kJ/kg

Q52.Find the arithmetic mean of below case

Monthly wage	No. Of workers
700	2
800	8
900	8
1000	2

(a) 850
(b) 600
(c) 800
(d) 900

Q53.A ball bearing is characterized by basic static capacity is 11000N and dynamic capacity is 18000N.This bearing is subjected to equivalent static load of 5500N. What is the life in million revolutions.

(a) 52
(b) 35.05
(c)10.1
(d) 4.1

Q54.Which of the following is correct with respect to the following questions?
Y=-2x+10 and 2y-x=12

(a) lines are parallel
(b) lines are passing through origin
(c)lines will intersect at 90^0
(d) lines will intersect at 45^0

Q55.If T be the torque transmitted by a splined shaft 'n' splines at a mean radius of R, then shear force on each spline is

(a) T/R
(b) T/(nr)
(c) (Tn)/R
(d) T/(2nr)

Q56.More shrinkage allowance is considered in pattern making for casting of

(a) Aluminium
(b) Lead
(c) Copper
(d) Gunmetal

Q57.Given that K is coefficient is mean velocity and f-Darcy-Weishbach friction factor and D diameter of pipe. If the head loss in a pipe bend Is given by $h_l = KV^3/2g$, the equivalent length of the pipe is

(a) Kf/D
(B) KD/f
(c) f/KD
(d) Df/K

Q58.The equation (P+an2/V2) (V-nb)= nRT is known as

(a) Real gas equation
(b) Ideal gas equation
(c) Vander Waals equation
(d) Avogadro's equation

Q59.The amount of inertia of a surface about an axis through its centroid is 4200 mm4. If the area of the surface is 100 mm^2 what will be the moment of inertia about a parallel axis 6mm distance from the centroid.

(a) 4200 mm^4
(b) 7800 mm^4

(c) 3600 mm^4
(d) 6000 mm^4

Q60. In Three-piece molding flask, top middle & bottom pieces are called as
(a) Cope, Drag& Cheek
(b) Cope, Cheek& Drag
(c) Drag, Cope& Gate
(d) Cope, Gate & Drag

Q61.For an object of solid hemisphere with radius 'r' then what is the C.G. from its base
(a) (3/8)r
(b) (8/3)r
(c) 3r
(d) 8r

Q62.If a gas of volume 6000cm^3 and pressure of 100 kPa is compressed quasi-statically according to PV^2 =constant until the volume becomes 2000cm^3. Determine the final pressure.
(a) 600 kPa
(b) 800 kPa
(c) 900 kPa
(d) 300 kPa

Q63.Calculate the pressure exerted by 5 kg of Nitrogen gas at a temperature of 27 C if the volume is 0.1m^3. Molecular weight of Nitrogen gas is 28. Assume Ideal gas laws applicable.
(a) 4.4 N/mm^2
(b) 44 N/mm^2
(c) 4.4 N/cm^2
(d) 44 N/cm^2

Q64.A reversible Engine has an ideal thermal efficiency of 75%. The direction of the cycle is reversed and converted in to refrigerator. The coefficient of performance will be
(a) 2/3
(b) 4/3
(c) 1/3
(d) 3/2

Q65.Argon gas is generated due to decay of which among the following isotope
(a) K-40
(b) Ca-40
(c)Ca-48
(d) K-41

Q66.A perfect gas at 27 C is heated at constant pressure till its volume is doubled. The final temperature is
(a) 54C
(b) 327 C
(c) 600 C
(d) 654 C

Q67.A machine element is subjected to the biaxial state of stress $\sigma_x = 80MPa$, $\sigma_y = 20MPa$ and $\tau_{xy} = 40MPa$. If the shear strength of the material is 100 MPa then factor of safety as per maximum shear stress theory is
(a) 1
(b) 2
(c) 2.5
(d) 3.3

Q68.A hole is being drilled by 10mm drill bit at a feed rate of 0.6mm per revolution and with spindle speed of 700 RPM. Energy consumption rate for the work piece material is given as 0.5 J/mm^3 of material removed. Power required is
(a) 550W
(b) 336 W
(c)125 W
(d) 275 W

Q69.If A = $\begin{bmatrix} 2 & 3 & 1 \\ 1 & 4 & 1 \end{bmatrix}$ **and B =** $\begin{bmatrix} 6 & 1 \\ 0 & 3 \\ 5 & 2 \end{bmatrix}$ **Find** $A^T B^T$**?**

(a)
$\begin{bmatrix} 13 & 3 & 12 \\ 3 & 12 & 2 \\ 12 & 23 & 7 \end{bmatrix}$

(b)
$\begin{bmatrix} 13 & 22 & 1 \\ 3 & 12 & 3 \\ 12 & 23 & 5 \end{bmatrix}$

(c)
$\begin{bmatrix} 13 & 3 & 12 \\ 3 & 1 & 23 \\ 12 & 3 & 17 \end{bmatrix}$

(d)
$\begin{bmatrix} 13 & 3 & 12 \\ 22 & 12 & 23 \\ 7 & 3 & 7 \end{bmatrix}$

Q70.A reversible engine has ideal thermal efficiency of 25%. When it is used as a refrigerating machine with all other conditions unchanged, the coefficient of performance will be

(a) 0.25
(b) 4.0
(c) 4.33
(d) 3.0

Q71.The Moment of inertia of a beam section 500 mm deep is 25 x 107 mm4. Find the longest span over which a beam of this section, when simply supported, could carry a uniformly distributed load of 720 kN per meter run. The stress in the material is not to exceed 90 MPa.

(a) 500mm
(b) 600 mm
(c) 1000 mm
(d) 700 mm

Q72.The relation between the pitch of the chain (P) and pitch circle diameter of the sprocket (D) is given by the following question, if T is the no. Of teeth on the sprocket.

(a) P = D sin(90/T)
(b) P = D sin(120/T)
(c) P =D sin(180/T)
(d) P =D sin(360/T)

Q73.One Tesla is equal to ----------

(a) 1 webers per sec
(b) 1 webers per sqm
(c) 100 webers
(d) 100 gauss

Q74.A mixture of gases expands from 0.03m^3 to 0.06m^3 at a constant pressure of 1 MPa and absorbs 84 kJ of heat during the process. The change in Internal energy of the mixture is

(a) 30 kJ
(b) 84 kJ
(c) 54 kJ
(d) 64 kJ

Q75.Between V-threads and square threads transmitting power of ……threads are preferred.

(a) Square
(b) V-threads
(c) both threads
(d) None

Q76.A liquid at 0 C is poured in as beaker of volume 500cm^3 to fill completely. Then the beaker is heated at 100 C how much liquid will over flow assume $\gamma_{liquid} = 2 \times 10^{-4}/C, \gamma_{glass} = 4 \times 10^{-5}/°C$.

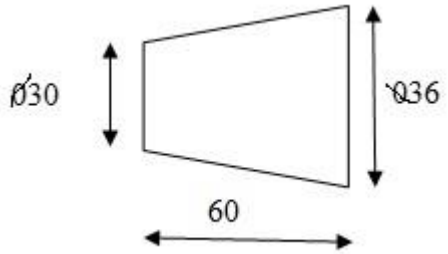
(a) 2 cm3
(b) 8 cm3
(c) 10 cm3

(d) 12 cm3

Q77.The success of precision measurement by slip gauge depends on phenomenon called

(a) rubbing of slip gauges
(b) wringing of slip gauges
(c) sliding of slip gauge
(d) rotation of slip gauge

Q78. What is the taper on shaft diameter for the above sketch?



(a) 1/10
(b) 1/20
(c) 1/15
(d) 1/5

Q79.Sodium Carbonate is a salt because of

(a) Weak acid, strong base
(b) Weak base, strong acid
(c) Strong acid, strong base
(d) Weak acid, weak base

Q80.What is the safe tensile load for a M36x4 bolt of mild steel having yield stress of 280 MPa and a factor of safety 2.

(a) 142.56 kN
(b) 242.56 kN
(c) 342.56 kN
(d) 442.56 kN

SDSC TA 2022 SOLUTION

Ans1.d

Sol. Always remember for point load acting on cantilever beam the SFD shows rectangle for a section. For Uniformly Distributed Load (UDL) acting on a cantilever beam the SFD shows inclined straight line. For Uniformly Varying Load (UVL) acting on a cantilever beam the SFD shows Parabolic curve.

Ans2.b

Sol. Given

$I = 2500\ kg - m^2$

$\omega = 6rad/s$

$K.E = \frac{1}{2}I\omega^2$

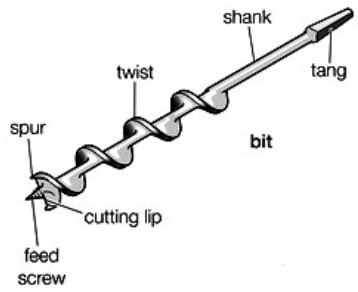
$= \frac{1}{2} \times 2500 \times 6 \times 6$

K.E = 45000 kJ

K.E = 45 kJ

Ans3.d

Sol.



Auger, tool (or bit) used with a carpenter's brace for drilling holes in wood. It looks like a corkscrew and has six parts: screw, spurs, cutting edges, twist, shank, and tang.

The screw looks like a tapered wood screw and is short and small in diameter; it centers the bit and draws it into the work.

Ans4.c

Sol. Given

τ_{allow} = 100 MPa

h = 15mm= 0.15cm

$T = \frac{\sqrt{2}P}{Hl}$

$\frac{P}{L} = \frac{T \times h}{\sqrt{2}}$

$= \frac{100 \times 0.15}{\sqrt{2}}$

$\frac{P}{L} = 10.6\ kN$

Ans5.c

Sol. Tool materials in the increasing order of their red hardness

Plain Carbon Steel < HSS < Carbides < Ceramics

Ans6.a

Sol. Given

D = 10mm

$\tau_{max} = 32\ N/mm^2$

Using formulae

$T = \frac{\pi}{16}D^3.\tau_{max}$

$= \frac{\pi}{16} \times 10^3 \times 32$

$T = 2000\ \pi$ Nmm

Ans7.b

Sol.

Σb = 6 MPa, F = 12 kN, d_n = 32 mm, p = 5mm

$6 \times 10^6 = \frac{2 \times 12 \times 10^3}{\pi \times 32 \times 10^{-3} \times 5 \times 10^{-3} \times \eta_t}$

ηt = 7.95 ~ 8

Therefore the minimum number of threads engaged shall be equal to or greater than 8 for the safe operation of the power screw. (from the given options 9 is close to 10)

Ans8.d

Sol. 2x - 3y = 1

3y = 2x - 1

y = $\frac{2}{3}$X - $\frac{1}{3}$

Comparing above with y = mx + c

m_1 = 2/3

For perpendicular lines

$M_1.m_2 = -1$

Therefore m_2 = -3/2

Using formula of line

$(y - 1) = \frac{-3}{2}(x+2)$

$3x + 2y + 4 = 0$

Ans9.c

Sol. Melting point of pure iron is 1539°C.

Ans10. a

Sol. Given

$y = 1mm = 0.001m$

V = 60 cm/s = 0.6 m/s

F/A = 2N/m2

We know the relation

$\frac{F}{A} = \frac{Mv}{Y}$

$M = \frac{F \times y}{V}$

$= \frac{2 \times 0.001}{0.6}$

$M = 3.3 \times 10^{-3}\ N.s/M^2$

Ans11. a

Sol. Polytropic process described as – PV^N

Isentropic Process described as $-PV^\Gamma$

Isothermal Process described as – PV

Ans12.b

Sol. The ability of material to exhibit large plastic deformation prior to fracture under tensile loading conditions is called Ductility.

Ans13.c

Sol. For British standard designation system, Steels grades are designated in En series.

Ans14.a

Sol. Shear force at any section = Rate of change of bending moment at any section

Ans15.d

Sol. Work study is field used to finding ways of increasing on job performance, optimum usage of plant and machinery, standardization of work methods, etc.

Ans16.a

Sol. Given

Clearance Volume $(V_c) = 120cm^3$

Swept Volume $(V_s) = 600cm^3$

Compression Ratio (r) = $1 + \frac{V_S}{V_C}$

$r = 1 + \frac{600}{120} = 6$

Ans17.b

Sol. Given

$D_1 = 200mm$

$D_2 = 100mm$

$N_1 = 1000\ RPM$

$S = 2\%$

$\frac{N_2}{N_1} = \frac{D_1}{D_2}(1 - S\%)$

$N_2 = N_1 \times \left(\frac{D_1}{D_2}\right)(1 - S\%)$

$N_2 = 1000 \times \frac{200}{100} \times (1 - \frac{2}{100})$

$N_2 = 1960\ RPM$

Ans18.c

Sol. Degree of freedom of structure = 0

Ans19. a

Sol. At 100% RH

DBT = WBT = DPT

Where

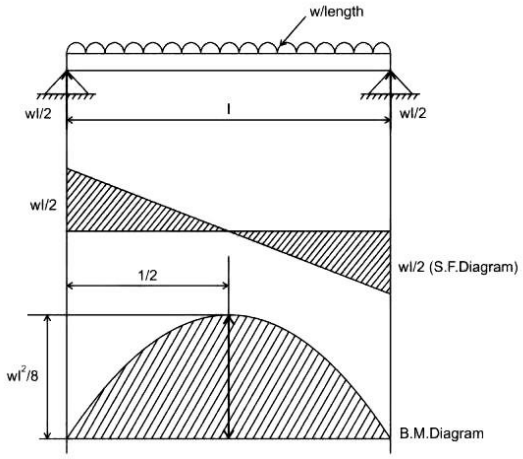
DBT = Dry bulb temperature

WBT = Wet Bulb Temperature

DPT = Dew Point Temperature

Ans20.d

Sol. SFD and BMD shows for the given condition.



Ans21. a

Sol. Given

M = 6mm = 0.006m

T = 60 teeth

N = 100 rpm

$m = \frac{D}{T}$

$D = 0.006 \times 60 = 0.36\, m$

$V = \frac{\pi DN}{60}$

$V = \frac{\pi \times 0.36 \times 100}{60}$

$V = 0.6\pi\ m/s$

Ans22.a

Sol. Stroke length depends on the length of job. Position of stroke is the starting point & end point of stroke. Work piece should be mounted to machine maximum length in one stroke.

Ans23.a

Sol. Slip gauges or gauge blocks are used as standards for precision length measurement. These gauges are made in sets and consist of a number of hardened blocks made of high-grade steel with low thermal expansion.

Ans24.a

Sol. Given

D = 1800 units

C_o = 450 \-

C_h = I. C

$= \frac{10}{100} \times 45$

C_h = 4.5\-

EOQ = $\sqrt{\frac{2DC_o}{C_h}}$

$= \sqrt{\frac{2 \times 1800 \times 450}{4.5}}$

EOQ = 600

No. Of order = D/EOQ

= 1800/600 = 3

Ans25.b

Sol. Minimum percentage of carbon in cast iron is 2%.

Ans26.a

Sol. Crystal structure of Platinum at room temperature is FCC.

Ans27.c

Sol. For arrow head :

Length: width = 3:1

Ans28. c

Sol. Given

$P_1 = 176.58 \times 10^3 KN/m^2$

$P_2 = 88.29 \times 10^3\ kN/m^2$

$\rho_{water} = 1000 kg/m^3$

G = 9.81 m/s2

$h = \frac{P_1}{\rho g} - \frac{P_2}{\rho g}$

H = $\frac{(176.58 - 88.29) \times 10^3}{1000 \times 9.81}$

H = 9m

Ans29.a

Sol. Total Pressure = Static Pressure + Velocity Pressure

Ans30.b

Sol. Pitch of screw gauge is the distance moved by spindle in one revolution = ½ = 0.5mm

Pitch = 0.5 mm or 0.05 cm

The thimble of a screw gauge has 50 divisions for one rotation.

No. Of circular scale divisions = 50

Least count (L.C) = $\frac{\text{Pitch}}{\text{No.of circular scale divisions}}$

L.C = $\frac{0.5}{50} = 0.01$

Ans31.a

Sol. Thermit Welding is used for repair of steel casings and forgings, for joining railroad rails, steel wires and steel pipes, for joining large cast and forged parts. Advantages of Thermit Welding: No external power source is required (heat of chemical reaction is utilized); Very large heavy section parts may be joined.

Ans32.c

Sol. Given

W becomes $\frac{W}{2}$

Depth becomes d/3

We know the deflection for given condition

$\delta = \frac{WL^3}{3EI}$

$\delta \propto \frac{W}{d^3}$ $\quad\quad\quad\quad$ $\therefore I = \frac{bd^3}{12}$

$\delta \propto \frac{W}{2\times(2d)^3}$

$\delta \propto \frac{1}{16}$

Ans33. c

Sol. Given

$N_A = 150\ RPM$

$N_B = N_C$ $\quad\quad\quad\quad$ ∴compound gears

$D_A = 750mm$; DB = 450mm; DC =900mm; DD =150mm

$\frac{N_B}{N_A} \times \frac{N_C}{N_B} \times \frac{N_D}{N_C} = \frac{D_A \times D_C}{D_B \times D_D}$

$\frac{N_D}{N_A} = \frac{D_A \times D_C}{D_B \times D_D}$

$N_D = 150 \times \frac{750\times900}{450\times150} = 1500\ RPM$

Ans34.b

Sol.

$h = 8\frac{fLQ^2}{g\pi^2D^5}$

$\frac{Q_1^2}{D_1^5} = \frac{Q_2^2}{D_2^5}$ (For same head difference)

$\frac{0.1^2}{D^5} = \frac{Q^2}{(4D)^5}$

Q = $\sqrt{10.24}$ = 3.2m^3/sec

Ans35.a

Sol. Radiographic Testing (RT) is a non-destructive testing (NDT) method which uses either x-rays or gamma rays to examine the internal structure of manufactured components identifying any flaws or defects.

Ans36. a

Sol. Given

$\gamma = 1.67$

$M = 40$

$P_1 = 0.1\ MPa$

$T_1 = 300K$

$P_2 = 0.2\ MPa$

$\bar{R} = 8.314\ KJ/kgK$

As we know that

$R = \frac{\bar{R}}{M} = \frac{8.314}{40} = 0.20785\ KJ/kg$

$\frac{T_2}{T_1} = \left(\frac{P_2}{P_1}\right)^{\frac{\gamma-1}{\gamma}}$

$\frac{T_2}{T_1} = (2)^{\frac{\gamma-1}{\gamma}}$ = 1.32

$T_2 = 396\ K$

$\Delta W_{Poly} = \frac{P_1V_1-P_2V_2}{\Gamma-1} = \frac{RT_1-RT_2}{\Gamma-1}$

$\delta W_{poly} = \frac{0.20785\times(396-300)}{1.67-1}$

$\delta W_{poly} = 29.65\ KJ/kg$

Ans37.b

Sol. Roughness value (0.2 to 0.8) microns is indicated by which symbol three triangle.

Ans38. a

Sol. Given

OT = 0.7minutes

Rf = 0.9

Allowances = 0.2

Normal time = OT × Rf
NT= $0.7 \times 0.9 = 0.63$
Standard time = $NT + NT \times allowances$
ST = 0.63 + 0.63× 0.2
ST = 0.756 minutes

Ans39.a
Sol. Dimensional formula of Stefan Boltzmann constant : M1L0T-3K-4

Ans40.c
Sol. Metacentric height is the distance between metacenter and center of gravity.

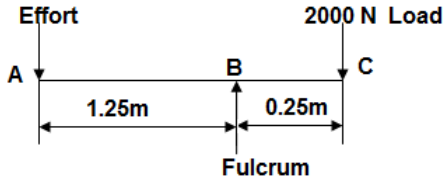
Ans41.b
Sol. Given
V = $10 \times 10 \times 9\ mm^3$
$P = 1000\ kPa$
T = 27°C = $300K$
R = $0.3\ kJ/kg.K$
Using Ideal gas equation
$PV = mRT$
$100 \times 10^3 \times 10 \times 10 \times 9 = m \times 0.3 \times 10^3 \times 300$
M = 1000 kg

Ans42.c
Sol. Given
$P_1 = 40$ kN
$W_1 = 180$ kN
$P_2 = 32$ kN
$W_2 = 140$ kN
P = 15 kN
W = ?
Applying Law of Machine
$P = mw + C$
1st condition
$40 = 180m + C$
2nd condition
$32 = 140m + C$
From equating both equation 1 and 2
We get
M = 0.2 ; C = 4
Put the value of m and C in law of machine
P = $0.2 \times 15 + 4$
P = 7 kN

Ans43.b
Sol. A production drawing is a complete working drawing, representing all the details of the product, regarding size, shape, material, process, tools and equipment.

Ans44.c
Sol.

Ans45.b
Sol.



Using $\sum M_{xx} = 0$
Taking moment about B
$F_A \times 1.25 = 2000 \times 0.25$
$F_A = 400$ N

Ans46.a
Sol. Given
R = 5cm = 0.05m
M = 10kg
N = 1200 rpm
K.E = $\frac{1}{2}\frac{mR^2}{2} \times \left(\frac{2\pi N}{60}\right)^2$
$K.E = \frac{10 \times 0.05^2 \times 4 \times \pi^2 \times 1200^2}{4 \times 3600}$
$K.E = 10\pi^2\ J$

Ans47.b
Sol. G-codes typically instruct the machining functions of the lathe or mill, while M codes handle the operation of the machine itself, with additional letters representing addresses such as F for feed rate and S for spindle speed used throughout a typical program.

Ans48.a

Sol. Given

D = 40cm

Depth of beam = $\sqrt{\frac{2}{3}}\ D$

$\text{Depth} = \sqrt{\frac{2}{3}} \times 40 = 32.65\ \text{cm}$

Ans49.a

Sol. Euler's number is the ratio of Inertia force to pressure force.

Ans50.a

Sol. Given

$h_1 = 100\ kJ/kg$

$h_2 = 200\ kJ/kg$

$Q = -50\ kJ/kg$

$m = 2kg/sec$

Using steady flow energy equation

$h_1 + q = h_2 + W$

$m(h_1 - h_2) + q \times m = W$

$2(100 - 200) + 2 \times (-50) = W$

$= -200 - 100$

$W = -300\ kW$

Ans51.a

Sol.

HCV $= \frac{1}{100}(8080C + 34500(H - \frac{O}{8}) + 2240S)\ Kcal/kg$

HCV = $\frac{1}{100}(8080 \times 70 + 34500(6 - \frac{8}{8}) + 2240 \times 5)$

HCV = $\frac{1}{100}(565600 + 172500 + 11200)$

= 7493 kcal/kg

= 7493 × 4.18 = 31320.74

Ans52.a

Sol. Arithmetic mean = $\frac{700+800+900+1000}{4} = 850$

Ans53.b

Sol. Loading ration = C/P = 18000/5500 = 3.27

Life (million revolutions) = $\left(\frac{C}{P}\right)^3 = \left(\frac{18000}{5500}\right)^3 = 35$

Ans54.c

Sol. Given

Y = -2x + 10…….eq-1

2Y = x+12……eq-2

Compare both equation and get the value of m_1 for eq-1 and m_2 for eq-2

Equation of line

Y = mx + c

On comparing

m_1 = -2

m_2 = ½

and

m_1 x m_2 = -2 x 1/2 =-1

hence

two lines will intersect at 90^0 .

Ans55.b

Sol. Shear force on each spline = T/(nr)

Ans56.b

Sol. More shrinkage allowance is considered in pattern making for casting of Lead.

Ans57.b

Sol. $\frac{flv^2}{2gd} = \frac{KV^3}{2g}$

L = KVD/f

Considering V = 1

L = KD/f

Ans58.c

Sol. According to an Ideal gas equation, PV=nRT

Where P is the pressure, V is the volume, T is the temperature, R is the universal gas constant and n is the number of moles of an ideal gas.

Vander Waals Equation

$\left(P + \frac{an^2}{V^2}\right)(V - nb) = nRT$

Ans59.b

Sol. As per the statement of parallel axis theorem

$I_O = I_C + Ah^2$

Given

$I_c = 4200\ mm^4$

$A = 100mm^2$

$h = 6mm$

$I_O = 4200 + 100 \times 6$

$I_O = 7800mm^4$

Ans60.b

Sol. Three piece molding flask, top middle and bottom pieces are called as Cope , Cheek and Drag.

Ans61.a

Sol. C.G of Solid hemisphere from its base = (3/8)r

Ans62. C

Sol. Given

$V_1 = 6000\ cm^3$

$P = 100\ KPa$

$V_2 = 2000\ cm^3$

Relation

$PV^2 = C$

$\frac{P_2}{P_1} = \left(\frac{V_1}{V_2}\right)^2$

$P_2 = \left(\frac{6000}{2000}\right)^2 \times 100$

$P_2 = 900\ kPa$

Ans63.a

Sol. Given

M = 5kg

T = 27℃ = 300K

V = 0.1m^3

M = 28

$\mathrm{R} = \frac{\bar{\mathrm{R}}}{\mathrm{M}} = \frac{8.314}{28} = 0.2969 \times 10^6\ \mathrm{Nmm/kgk}$

Ideal gas equation

$\mathrm{PV} = \mathrm{mrt}$

$\mathrm{P} \times 0.1 \times 10^9 = 5 \times 0.2969 \times 10^6 \times 300$

$\mathrm{P} = 4.45\ \mathrm{N/mm^2}$

Ans64.c

Sol. Given

$\eta = 0.75$

$COP_{hp} = \frac{1}{\eta}$

$COP_R = COP_{hp} - 1$

$COP_R = \frac{1}{\eta} - 1$

$= \frac{1}{.75} - 1$

$COP_R = \frac{1}{3}$

Ans65.a

Sol. Argon gas is generated due to decay of K-40 .

Ans66.b

Sol. Given

$T_1 = 27℃ = 300K$

$V_1 = V$

$V_2 = 2V$

Applying Charle's law

$\frac{V_1}{T_1} = \left(\frac{V_2}{T_2}\right)$

$T_2 = \left(\frac{V_2}{V_1}\right) \times T_1 = \left(\frac{2V}{V}\right) \times 300$

$T_2 = 600\ K$

$T_2 = 600 - 273 = 327℃$

Ans67.b

Sol.

$\Sigma 1,2 = \frac{\Sigma_x + \Sigma_y}{2} + \sqrt{\left(\frac{\Sigma_x - \Sigma_y}{2}\right)^2 + \mathrm{T}^2}$

$\Sigma 1,2 = \frac{80+20}{2} + \sqrt{\left(\frac{80-20}{2}\right)^2 + (40)^2}$

$\Sigma 1 = 100$ MPa, $\sigma 1 = 0$ $\tau = \frac{\Sigma_1 - \Sigma_2}{2} = 50$MPa

Hence FOS = $\frac{Material\ strength}{Shear\ stress} = \frac{100}{50} = 2$

Ans68.d

Sol. Thickness of plate = 15mm

Diameter of drill bit D = 10mm

Feed rate = 0.25

Spindle speed = 1200rpm

Specific energy required = 0.7 N-m/mm3
Since MRR = π /4 *d2 × f_n
= π /4 × 102 × 0.25 × 1200 = 23561.94 mm3/min = 392.69 mm3/sec
Power required = Sp. Energy consumption * MRR
P = 0.7 * 392.69 = 274.89J/s = 274.89 W

Ans69.d
Sol. Question is doubtful.

Ans70. d
Sol. $\eta = 0.25$
$COP_{hp} = \frac{1}{\eta}$
$COP_R = COP_{hp} - 1$
$COP_R = \frac{1}{\eta} - 1$
$= \frac{1}{.25} - 1$
$COP_R = 3$

Ans71.c
Sol. Given
Depth = 500mm
Y = 250 mm
$I = 25 \times 10^7 MM^4$
$W = 720\ N/mm$
$\Sigma = 90\ MPa = 90\ Pa$
$M = \frac{WL^2}{8}$
Using Pure Bending equation
$\frac{M}{I} = \frac{\Sigma}{Y}$
$\frac{WL^2}{8} = \frac{\Sigma}{Y} \times I$
$L^2 = \frac{\Sigma \times I \times 8}{Y \times w}$
$L^2 = \frac{90 \times 25 \times 10^7 \times 8}{250 \times 720} = 1000000$
$L = 1000\ mm$

Ans72.c
Sol. P = D sin $(180°/T)$

Ans73.b
Sol. One Tesla is equal to 1 webers per sqm.

Ans74.c
Sol. Given
$V_1 = 0.03\ m^3$
$V_2 = 0.06\ m^3$
$P = 1MPa$
$\Delta Q = 84\ kJ$
WE kNow
$\Delta Q = dU + \Delta W$
$\therefore \Delta W = P(V_2 - V_1)$
84 = du + $10^3(0.06 - 0.03)$
$dU = 84 - 30$
$dU = 54\ kPa$

Ans75.a
Sol. Between V threads and Square threads transmitting power of Square threads are preferred.

Ans76.b
Sol. Given
T1 = 0°C
$T_2 = 100°C$
V = 500 cM^3
$\Gamma_{Liquid} = 2 \times 10^{-4}/°C$
$\Gamma_{Glass} = 4 \times 10^{-5}/°C$
Using formula
$\Gamma = \frac{(V_2 - V_1)}{V_1(T_2 - T_1)}$
Increase in volume = $(V_2 - V_1) = \gamma(T_2 - T_1)$
Increase in volume of beaker = $\Gamma_{Glass} \times V_1(T_2 - T_1)$
$= 4 \times 10^{-5} \times 500 \times (100 - 0)$
$\Delta V_B = 2\ cM^3$
Increase in volume of liquid = $\Gamma_{Liquid} \times V_1(T_2 - T_1)$
$= 2 \times 10^{-4} \times 500 \times (100 - 0)$
$\Delta V_L = 10\ cM^3$
∴ Volume of liquid which overflows
$= (10 - 8)CM^3$
$= 8\ cm^3$

Ans77.b
Sol. If two slip gauges are forced against each other on measuring faces, because of

contact pressure, gauges stick together and considerable force is required to separate these blocks. This is known as wringing of slip gauges.

Ans78.a

Sol. Given

$d = 30$

D = 36

L= 60

So we can calculate the taper by the relation:

$Taper = \frac{36-30}{60} = \frac{1}{10}$

Ans79.a

Sol. Sodium carbonate is an organic sodium salt and a carbonate salt.

Ans80.a

Sol. Given

$\text{Yield stress} = 280\ \text{MPa}$

Factor of safety(FOS) = 2

Dia = 36m

$\text{FOS} = \frac{\text{Yield stress}}{\text{Working stress}}$

$2 = \frac{280}{\Sigma_W}$

$\Sigma_W = 140\ \text{Pa}$

$\Sigma_W = \frac{P}{A}$

$P = 140 \times \frac{\Pi}{4} \times 36^2$

$P = 142.56\ \text{kN}$