ISRO SDSC TA 2018

Q1. The Joule Kelvin expansion (throttling) process is
(a) reversible process
(b) irreversible process
(c) isothermal process
(d) isochoric process

Q2. Rankine cycle consists of following processes
(a) two isentropic and two constant volume processes
(b) two isentropic and two constant pressure process
(c) two isothermal and two constant pressure process
(d) two isothermal and two constant volume process

Q3. What is SI unit of temperature ?
(a) Fahrenheit
(b) Centigrade
(c) Kelvin
(d) Rankine

Q4. The austenitic stainless steel contains
(a) 18% Chromium and 8% Nickel
(b) 8% Chromium and 18% Nickel
(c) 18% chromium and 18% Nickel
(d) 8% chromium and 8% Nickel

Q5. Bernoulli's equation is derived based on the following assumptions
I. There is no loss of energy in a liquid flow and flow is uniform
Ii. The flow is rotational
Iii. Except gravity and pressure forces, no external force acts on liquid flow
Iv. The flow is viscous, incompressible flow
(a) i, iii
(b) i, ii, iv
(c) ii, iii
(d) i,iii,iv

Q6. Gantt chart is used for
(a) inventory control
(b) material handling
(c) production schedule
(d) machine utilization

Q7. Two identical simply supported beams in which beam 'A' carries a central load of W and beam 'B' carries a uniformly distributed load such that wl =W, where w = uniformly distributed load and l = span of the identical beams, then the ratio of maximum deflection between B and A
(a) 5/8
(b) 8/5
(c) 5/4
(d) 4/5

Q8. Which of the following is the relation between Young's modulus E and rigidity modulus G and poison's ratio ?
(a) E = 2 $\mu G(1+\mu)$
(b) E = 2 $\mu G/(1+\mu)$
(c) E = 2G(1+ μ)
(d) E = $\mu G(1+\mu)$

Q9. Thrust generation in the rocket propulsion is based on the following:
(a) newton second law of motion
(b) buoyance force
(c) pascal's law
(d) newton third law of motion

Q10. A block of mass 20 kg is placed on a horizontal surface. Co-efficient of static friction and coefficient of kinematic friction between the block and surface are 0.5 and 0.4 respectively. What is the minimum force required to be applied on the block in horizontal direction so that the

block just starts to move. Consider g = 10 m/s² .
(a) 10N
(b) 8N
(c) 80 N
(d) 100 N

Q11. In an impulse reaction turbine, the enthalpy drop in fixed and moving blades are 20 kJ/kg and 40 kJ/kg respectively. Then the degree of reaction of stage is .
(a) 0.33
(b) 0.5
(c) 0.66
(d) 0.75

Q12. Match the following related to theories of failure
A. Max normal stress theory **1. Von-mises Theory**
B. Max shear stress theory **2. Haigh's theory**
C. Max Strain energy theory **3. Guest and Tresca's Theory**
D. Max distortion energy theory **4. Rankine's theory**
(a) A-4,B-3,C-2,D-1
(b) A-3,B-4,C-1,D-2
(c) A-4,B-3,C-1,D-2
(d) A-3,B-4,C-2,D-1

Q13. If the radius is doubled and angular speed is reduced to half of its original value, the centrifugal force relative to its original value is
(a) 2 times
(b) 0.5 times
(c) 0.2 times
(d) 0.1 times

Q14. Gun metal which is used in Journal bearing contains
(a) 88% Cu, 10% Sn, 2% Zn
(b) 80%Cu, 10% Zn, 10% Al
(c) 85% Cu, 5% Mg, 10% Al
(d) 85% Cu, 5% Sn, 10% Pb

Q15. Which of the following is a solid state welding process?
(a) Arc Welding (AW)
(b) Resistance Welding (RW)
(c) Friction Welding (FRW)
(d) Oxy-Fuel Welding (OFW)

Q16. For improving the strength of steel at elevated temperatures, which of the following alloying element is used.
(a) Copper
(b)Tungsten
(c) Aluminium
(d) Zinc

Q17.Buckling load of given material depends on
I Slenderness ratio
Ii Area of cross section
Iii Modulus of elasticity
Iv Poisson's ratio
(a) i, ii, iii
(b) i,ii,iv
(c) ii,iii,iv
(d)i,iii,iv

Q18. A freely supported beam at its ends is loaded by a central concentrated load then maximum moment is M. If the same weight be equally distributed over the beam, then its maximum moment will be
(a) M
(b) M/2
(c) 2M
(d) M/4

Q19. Match the following
A. Power **1. Joules**
B. Pressure **2. Newton**
C. Force **3. Watt**
D. Kinematic Energy **4. Pascal**

(a) A-3, B-4, C-1, D-2
(b) A-3, B-4, C-2, D-1
(c) A-2, B-3, C-4, D-1
(d) A-2, B-3, C-1, D-4

20. The predominant fluid property associated with cavitation phenomena is
(a) surface tension
(b) vapor pressure
(c) mass density
(d) Bulk modulus of elasticity

Q21. What is the maximum efficiency of an engine operable between 727℃ to 127℃.
(a) 60%
(b) 80%
(c) 30%
(d) 40%

Q22. A refrigerator based on reverse Carnot cycle works between two such temperatures that ratio between low and high temperature is 0.8. What is COP?
(a) 2
(b) 3
(c) 4
(d) 5

Q23. If two closely coiled helical springs A&B with the mean diameter of spring A is half of that of spring B and having equal number of active coils and same wire diameter are subjected to same axial load of W., then the ratio of deflection in spring A to B.
(a) 1/8
(c) 2
(b) 1/4
(d) 8

Q24. In an automobile radiator is used to cool cooling water of the engine. The mode of heat transfer between radiator body and surrounding is
(a) conduction
(b) convection
(c) radiation
(d) all of the above

Q25. A jet travelling at supersonic speed, then its Mach number (M) is
(a) M<1
(b) M>1
(c) M=1
(d) None of these

Q26. Heat is conducted through a 10 cm thick wall at rate of 30 W/m^2. When the temperature difference across wall is 10 K ? What is the thermal conductivity of wall?
(a) 0.03 W/mk
(b) 0.3 W/mk
(c) 3 W/mk
(d) 30 W/Mk

Q27. In a four bar chain mechanism, there are 4 links and 4 turning pairs. If one of the link is fixed, the degree of freedom of mechanism is
(a) 1
(b) 2
(c) 3
(d) 6

Q28. A simple spring mass vibrating system has a natural frequency of fn. If the spring stiffness is halved and mass is double, then the natural frequency will become
(a) fn/2
(b) 2 fn
(c) 4 fn
(d) 8 fn

Q29. Square threads are used in which of the following
(a) lead screw
(b) jackscrew
(c) power transmission

(d) all of the above

Q30. In a single point turning operation with a cemented carbide and steel combination having Taylor exponent 0.25, if the cutting speed is halved, the tool life will be
(a) half
(b) 2 times
(c) 8 times
(d) 16 times

Q31. Expressing a dimension as 18.3 $^{+0.00/-0.002}$ is a case of
(a) unilateral tolerance
(b) bilateral tolerance
(c) limiting dimensions
(d) all of the above

Q32. In a psychrometric chart, what does vertical downward line represent
(a) sensible cooling process
(b) adiabatic saturation process
(c) humidification process
(d) dehumidification process

Q33. Dynamic viscosity of most liquid with rise in temperature
(a) increases
(b) decreases
(c) remains unaffected
(d) unpredictable

Q34. In two stage reciprocating compressor, suction pressure is 1.5 bar and delivery pressure is 54 bar with a perfect inter cooler. If both stages follow same polytropic process, the intermediate pressure will be equal to
(a) 6 bar
(b) 9 bar
(c)27.75 bar
(d) $9\sqrt{2}$ bar

Q35. Calculate the change in length of a steel bar whose temperature is raised by 125 ℃. Coefficient of linear expansion $\alpha = 12 \times 10^{-6}$ Per degree Celsius, initial length of bar L = 3 meters.
(a) 0.045 cm
(b) 0.45 cm
(c) 4.5 cm
(d) 450 cm

Q36. The heat flows from a cold body to a hot body with aid of an external source. The statement is given by.
(a) Kelvin
(b) Joule
(c) Claussius
(d) Gay-Lussac

Q37. Which of the following is a false statement?
(a) No thermodynamic cycle can have thermal efficiency of 100%
(b) All reversible cycles operating between the same two thermal reservoirs have same thermal efficiency
(c) Thermal efficiency of an irreversible cycle is more than a reversible cycle
(d) All of the above

Q38. Match the following related to type of steel and its product

A. Mild steel	**1. Hammers**
B. Tool steel	**2. Crane hooks**
C. Medium carbon steel	**3. Milling cutters**
D. High carbon steel	**4. Commercial beams**

(a) A-3, B-,C-1,D-2
(b) A-4,B-1, C-2,D-3
(c) A-3,B-2,C-4,D-1
(d) A-4,B-3,C-1,D-2

Q39. Match the following

A. Ductility	**1. Impact Test**
B. Toughness	**2. Fatigue test**

C. Endurance limit 3. Tension Test
D. Resistance to penetration 4. Hardness Test
(a) A-3, B-,C-1,D-2
(b) A-4,B-1, C-2,D-3
(c) A-3,B-1,C-2,D-4
(d) A-4,B-3,C-1,D-2

Q40. A hemi spherical end of pressure vessel is fastened to cylindrical portion of pressure vessel with help of gasket, bolts and lock nuts. The bolts are subjected to
(a) Tensile stress
(b) Compression stress
(c) Shear stress
(d) Bearing stress

Q41. Percentage of carbon in Cast iron is
(a) 0%
(b) 0 to 1%
(c) 1% to 2%
(d) 2% to 4%

Q42. Match the following
A. Young's modulus 1. Shear strain
B. Modulus of rigidity 2. Normal strain
C. Bulk modulus 3. Transverse strain
D. Poisson's strain 4. Volumetric strain
(a) A-1,B-2,C-3,D-4
(b) A-2,B-1,C-3,D-4
(c) A-2,B-1,C-4,D-3
(d) A-1,B-2,C-4,D-3

Q43. Which of the following has the highest lateral strain when there's a longitudinal strain because of longitudinal force ?
(a) Iron
(b) Rubber
(c) Copper
(d) Bronze

Q44. Two shafts of same material, one hollow and other solid cross section have equal outer diameter. The inner diameter of hollow shaft is half the outside diameter, then the ratio (hollow to solid) of torque that can be transmitted by these two shafts is
(a) 15/16
(b) 1/16
(c) 1/4
(d) 1/32

Q45. The material of patterns in the case of investment casting is
(a) thermosetting resin
(b) special plastic
(c) wax
(d) synthetic sand

Q46. The operation of producing cup shaped parts from flat sheet metal blanks by bending and plastic flow of metal is known as
(a) drawing
(b) bending
(c) coining
(d) blanking

Q47. A centrifugal pump operating at N rpm develops a head of H m. If the speed is doubled and the pump operates with same efficiency. What is the head developed by the pump?
(a) 2H
(b) 1/2H
(c) 4H
(d) 8H

Q48. In general sense, water turbines may be put in the following decreasing order of specific speeds as.
(a) Kaplan turbine, Francis turbine and Pelton wheel
(b) Pelton wheel, Francis turbine and Kaplan turbine

(c) Francis turbine, Pelton wheel and Kaplan turbine
(d) Francis turbine, Kaplan turbine and Pelton wheel

Q49. Match the following related to gears
LIST I
A. Spur Gears
B. Helical gears
C. Worm gears
D. Bevel gears
LIST II
1. Transmit motion between non-parallel and non-intersecting shafts
2. Transmit motion between parallel shafts
3. Transmit motion between intersecting shafts
4. Transmit motion between parallel shafts or non-parallel
(a) A-2,B-3,C-4,D-1
(b) A-3,B-4,C-1,D-2
(c) A-2,B-4,C-1, D-3
(d) A-3, B-2,C-1,D-4

Q50. If Bearing pressure P, Absolute Viscosity Z and Speed of journal N are doubled, then bearing characteristic number to its original number will be
(a) 1/2
(b) 2 times
(c) 1/4
(d) 4 times

Q51. The gear box in automobile is placed between
(a) the clutch and differential
(b) the steering and engine
(c) the engine and clutch
(d) clutch and hooks joint

Q52. The spring controlled governor is
(a) hartnell
(b) hartung
(c) pickering
(d) all of the above

Q53. Which of the following is used to store energy and give up whenever required ?
(a) clutch
(b) gear
(c) governor
(d) flywheel

Q54. Two circular bars A & B of same material are subjected to uniaxial loading. If the diameter and load acting on bar B is double than that of A, then the ratio of factor of safety of bar B to A is
(a) 2
(b) 1/2
(c) 1/4
(d) 4

Q55. A column of rectangular cross-section of 10mm x 20mm and a length of 2 m. What is the slenderness ratio of the column?
(a)503
(b) 692
(c) 550
(d) 450

Q56. A shaft of diameter D is subjected to a twisting moment of T and Bending moment of M. If the maximum bending stress is equal to maximum shear stress developed. Then M is equal to
(a) T/2
(b) T
(c) 2T
(d) 4T

Q57. If two pumps identical in all aspects of delivering a discharge Q against a head H are connected in series, resulting discharge is,

(a) 2Q against head of 2H
(b) 2Q against head of H
(c) Q against head of 2H
(d) $\sqrt{Q}$ against head of $\sqrt{2}$H

Q58. The working depth of an involute gear is equal to
(a) Addendum
(b) Dedendum
(c) 2 x addendum
(d) 2 x dedendum

Q59. Stretching in a belt controlled by
(a) decreasing the belt length
(b) increasing the centre distance
(c) increasing pulley diameter
(d) reducing the stress in the belt

Q60. Wire ropes are used for application experiencing
(a) low speed and low tension
(b) low speed and high tension
(c) high speed and low tension
(d) high speed and high tension

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Ans1. b
Solution:

Ans2. b
Solution:

Ans3. a
Solution:

Ans4. a
Solution:

Ans5. a
Solution:

Ans6. c
Solution: A Gantt chart helps you schedule your project tasks and then helps you track your progress

Ans7. a
Solution:

Ans8. c
Solution:

Ans9. d
Solution: Thrust is produced according to Newton's third law of motion. The amount of thrust produced by the rocket depends on the mass flow rate through the engine, the exit velocity of the exhaust, and the pressure at the nozzle exit.

Ans10. d
Solution:
Coefficient of static friction (μ_s) = 0.5
Coefficient of kinematic friction(μ_k) $= 0.4$
M = 20 kg
G = 10m/s^2
Normal reaction force =N

Force balancing
R =mg = 20 x 10 = 200 N
P = $(F_s)_{max} = \mu_s R$
= 0.5 x 200
P = 100 N

Ans11. c
Solution:
DOR = $\frac{Enthalpy\ drop\ in\ rotor}{enthalpy\ drop\ in\ stage}$
= 40/60 = 2/3 = 0.66

Ans12. c
Solution:

Ans13. b
Solution:
$F_c = m\omega^2 r = \frac{mv^2}{r}$
$F_c = m(\frac{\omega}{2})^2 \times 2r$
$= m \times \frac{\omega^2}{4} \times 2r$
$= 0.5\ m\omega^2 r$

Ans14. a
Solution: Gunmetal is composed of 88 % copper, 105 tin and 2%zinc and is used for gears and bearings that are to be subjected to heavy loads and low speeds.

Ans15. c
Solution:

Ans16. b
Solution: Tungsten is kNown for its high temperature properties along with its hardness. It improves the strength of steel at high temperature.

Ans17. a
Solution:

Ans18. b
Solution: With point load ta mid point
F = P/2
M_1 = PL/4
With udl
M_2 = PL/8
$M_2 = M_1/2$

Ans19. b
Solution:

Ans20. b
Solution: Cavitation includes formation of vapor bubbles of the flowing liquid and collapsing of the vapor bubbles. Formation of vapor bubbles of the flowing liquid take place only whenever the pressure in any region falls below vapor pressure.

Ans21. a
Solution: Given
T_1 = 727 + 273 = 1000 K
T_2 = 127 + 273 = 400 K
Efficiency of engine
$\eta_{max} = 1-T_2/T_1$
$\eta_{max} = 1 – 400/1000$
$\eta_{max} = 0.6$

Ans22. b
Solution:
Low temperature = T_2
High Temperature = T_1
Given $T_2/T_1 = 0.8$
$COP_R = \frac{T_2}{T_1-T_2}$
$= \frac{T_2}{T_1\left(1-\frac{T_2}{T_1}\right)} = \frac{0.8}{1-0.8} = 4$

Ans23. a
Solution:
$\delta_A = \frac{8WD^3n}{Cd^4}$
$\delta_B = \frac{8W(2D)^3n}{Cd^4}$
$\delta_B = \frac{1}{8}\frac{8WD^3n}{Cd^4}$
$\delta_B = \frac{1}{8}\ \delta_A$

Ans24. b
Solution: The mode of heat transfer between the walls of the radiator and the surrounding fluid is through convection because convection heat transfer is dominant when there is bulk fluid motion.

Ans25. b
Solution:

Ans26. b
Solution:
Given
Q/A = 30 W/m^2
dx = 10 cm = 0.1 m
dt = 10 K
$\frac{Q}{A} = \frac{kdT}{dx}$
$30 = \frac{k\times10}{0.1}$
K = 0.3 W/mk

Ans27. a
Solution:
Apply equation
F = 3(L-1) -2j
= 3(4-1) – 2x4
= 9-8
=1

Ans28. a
Solution:
Natural frequency
$F_n = \sqrt{\frac{k}{m}}$
If stiffness is halved and mass is doubled
Given $K_2 = K_1/2$, $m_2 = 2m_1$
$F_n = \sqrt{\frac{k_2}{m_2}} = \sqrt{\frac{k}{2\times2m}}$
$F_n = \sqrt{\frac{k}{4m}}$

$F_n = \frac{1}{2}\sqrt{\frac{k}{m}}$

Ans29. d
Solution:

Ans30. d
Solution:
We know the Taylor's tool life equation
$C = VT^n$
$\frac{V_1}{V_2} = \left(\frac{T_2}{T_1}\right)^n$
$\left(\frac{2V}{V}\right)^{\frac{1}{0.25}} = \frac{T_2}{T_1}$
$T_2 = 16T_1$

Ans31. a
Solution: Unilateral Tolerance: The dimension of a part is allowed to vary only on one side of the basic size, i.e. Tolerance lies wholly on one side of the basic size either above or below it.

Ans32. d
Solution: Dehumidification: When the temperature remains constant but specific humidity decreases. It is represented by a vertical line.

Ans33. b
Solution: n liquids, the cause of dynamic viscosity is the intermolecular force of attraction or cohesive forces and on increasing the temperature molecules of liquids try to move away from each other which in turn reduces the cohesive force, and hence, dynamic viscosity decreases with an increase in temperature

Ans34. b
Solution:
Given
P_1 = 1.5 bar
P_3 = 54 bar

$P_2 = \sqrt{P_1 \times P_3}$
$= \sqrt{1.5 \times 54}$
P_2 =9 bar

Ans35. b
Solution:
$\delta l = l\alpha\Delta T$
= 3 x 12 x 10^{-6} x 125
= 36 x 125 x 10^{-6}
= 45 x 10^{-4}
= 0.0045 m
= 0.45 cm

Ans36. c
Solution:

Ans37. c
Solution: The efficiency of an irreversible cycle is always less than a reversible cycle.

Ans38. d
Solution:

Ans39. c
Solution:

Ans40. a
Solution: The pressure force inside the pressure vessel applied longitudinal force in the hemispherical part and try to push it but bolts hold it tightly at the same position.
Thus, longitudinal or pushing force causes tensile stress in bolts.

Ans41. d
Solution:

Ans42. c
Solution:

Ans43. b
Solution: Lateral strain $\propto \mu$

And $\mu' \rightarrow$ rubber > bronze > copper > iron
Hence rubber has the highest lateral strain.

Ans44. a
Solution:

Ans45. c
Solution:

Ans46. a
Solution: Drawing: It is the operation of producing cup-shaped parts from the sheet metal blanks. It is a process of changing the blanked part into a hollow vessel.

Ans47. c
Solution:
We kNow
$\frac{H_1}{H_2} = \left(\frac{N_1}{N_2}\right)^2$
$N_2 = 2 \times N_1$
Therefore
$\frac{H_1}{H_2} = \left(\frac{N_1}{2 \times N_1}\right)^2$
= $(1/2)^2$ = ¼
$H_2 = 4H_1$

Ans48. a
Solution:

Ans49. c
Solution:

Ans50. b
Solution:
Bearing characteristics number = $\frac{\mu N}{P} = \frac{ZN}{P}$
Where Z = absolute viscosity
N = speed of journal
P = bearing pressure
= $\frac{2Z \times 2N}{2P} = \frac{2ZN}{P}$

Ans51. D
Solution: It is placed between the clutch and hooks joint. Gearbox act as a link between Engine and Wheel.

Ans52. d
Solution:

Ans53. d
Solution:

Ans54. b
Solution:
$\sigma_A = \frac{F}{A}$
$\sigma_B = \frac{2F}{4A} = \frac{1}{2}\frac{F}{A} = \frac{\sigma_A}{2}$

Ans55. b
Solution:
Se = le/K
K = $\sqrt{\frac{I_{min}}{A}}$
Where le = equivalent length
A = 0.5 A
K = radius of gyration
I_{min} = minimum area moment
Given
A = 10 x 20
Le = L = 2m
For rectangular cross section
I = $bd^3/12$
I = $\frac{20 \times 10^3}{12} = 1666.67\ mm^4$
K = $\sqrt{\frac{100}{12}} = 2.88675425$ mm
Hence
S = le/k = 2000/2.88675425
S = 692.819 mm

Ans56. a
Solution:
$\tau = \frac{16T}{\pi d^3}$
$\sigma = \frac{32M}{\pi d^3}$
$\frac{16T}{\pi d^3} = \frac{32M}{\pi d^3}$
M = T/2

Ans57. c
Solution: When identical Centrifugal pumps are connected in series, the discharge will be same but head increases.
Total discharge = Q
Total head = 2H

Ans58. c
Solution: If both the gear were identical then,
Working Depth = 2 x addendum

Ans59. d
Solution: In order to control belt stretching and secure the life of the belt, the working stress should be limited to one tenth of ultimate tensile strength.

Ans60. c
Solution: Wire ropes are extensively used in hoisting, haulage, and material handling equipment. From the above usage, the wire ropes experiencing low speeds and high tensile stresses.