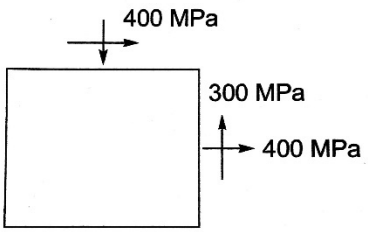
S1. Ans.(c)
Sol.



Principal stress,

= = 500 MPa

S2. Ans.(b)
Sol. While selecting the elements of power transmission with speed reduction, the order of preference based on a minimum cost is belt pulley, spur gear, worm and worm and worm wheel.

S3. Ans.(c)
Sol. Plane stress condition for thin plates. Plane strain condition for thick plates.

S4. Ans.(b)
Sol. V = = 0.3636 (for E = 210 & G = 77)
V = = 0.24375 (For E = 199 & G = 80)
So, the best option is 2 and 4.

S5. Ans.(a)
Sol. = 0.0013
= –0.0013
E = 2 × = 0.3

= 200 MPa
= –200 MPa
= = 200 MPa

S6. Ans.(d)
Sol. Section modulus (Z) represents the strength of the section. A beam is said to be of uniform strength if the bending stress is the same at every section along its longitudinal axis.

S7. Ans.(c)
Sol. Power, P = 50 kW
= 26.167 rad/s
Torque, T = = 1910.828 N.m

=
= 106.85 N/mm²
FOS = = = 3.996 4

S8. Ans. (b)
Sol. Newton's Law of viscosity states that shear stress is directly proportional to rate of shear strain or velocity gradient.

S9. Ans. (c)
Sol. The capillary rise of water in the glass tube h will be

But, for water the value of is zero.
So,

S10. Ans. (b)
Sol.

S11. Ans. (c)
Sol. Given that Force (F) = 400 N, Gauge Pressure (P) = 70 kPa
Area of diaphragm(A)

S12. Ans. (a)
Sol. Critical Reynold number,

Given that radius of circular pipe
So, Diameter
Also given that Kinematic viscosity,

S13. Ans. (b)
Sol. A fluid is at rest means that the fluid has non-zero normal stress and zero shear stress.

S14. Ans. (b)
Sol. Flammable fuels have the flash point at the temperature of
below 37.8ºC i.e., 100ºF

S15. Ans. (a)
Sol. Let, the angle turned by crank during fuel injection is

So,

We know that,

S16. Ans. (c)
Sol. In S.I. engine, the throttle valve of carburetor controls the quantity of fuel and air mixture.

S17. Ans. (b)
Sol. Cetane number decide the ignition quality of diesel fuel

S18. Ans. (d)
The chemical equation is

It means that 1 kg of carbon requires 8/3 kg of for its complete combustion and produce 11/3 kg of

S19. Ans (d)
Sol. Given,
Swept volume (
Clearance volume (

S20. Ans.(d)
Sol. we know that relation between E, G and K
$E = 2G(1+\mu)$ ---------(1)
$E = 3K(1-2\mu)$ ----------(2)
From (1) and (II)

S21. Ans.(a)
Sol. Poisson's ratio is the ratio of lateral strain to longitudinal strain. So, Rubber has the poison's Ratio approximately $0.48 \approx 0.50$.

S22. Ans.(a)

Sol. in a tensile test of a specimen, the ratio of maximum load to the original cross – sectional area of the test piece is called ultimate stress.

S23. Ans.(a)
Sol. A steel bar is fixed at both. If the bar is heated, it will develop – compressive stress.

S24. Ans.(d)
Sol. the value of Poisson's ratio is always less than 0.5.

S25. Ans.(a)
Sol. Stress due to change in temperature developed in a bar depends upon coefficient of thermal expansion.

S26. Ans(d)
Sol. Corrosion resistance of steel is increased by adding chromium. Effect of elements on steel.

Element	Effect
Chromium	Corrosion resistance
Boron	Increase hardenability
Nickel	Toughness
Carbon	Increase strength

S27. Ans. (c)
Sol. Austenite is the interstitial solid solution of carbon into gamma iron. It has FCC crystal structure.
The three forms of irons are alpha, delta and gamma irons.
Alpha iron is called ferrite which is stable until 910
Gamma iron is called austenite and stable from 910 to 1394
Delta is called delta ferrite and it is stable from 1394 to 1539

S28. Ans. (b)
Sol. If steel is cooled in still air, the structure obtained is sorbite.
Sorbite: - It is a microstructure consisting of ferrite and finally decide cementite produced on tempering martensite above 450°C. The constituents also known as sorbite pearlite is produced by the decomposition of outside when cooled at a rate faster than that which will produce pearlite and slower than that which will produce troostite.

S29. Ans(b)
Sol. A satellite is kept on moving in its orbit around the earth due to its centripetal force acting on it.

S30. Ans(a)
Sol. For the combined effect of all the forces on a body the term is used is known as LOAD.

S31. Ans(c)
Sol. The use of the D Alembert's principle is for reduction of problems of kinetics to equivalent static problem.

S32. Ans(d)
Sol. Effort lost in friction in a simple machine is

S33. Ans(c)
Sol. Kinetic equilibrium is used to state the dynamic equilibrium

S34. Ans.(b)
Sol. Function of the washer-
To distribute the concentrated load
To lock the nut and keep it at its place'
To provide load bearing area

S35. Ans.(a)
Sol. In compression test brittle material fails along an oblique plane. Usually at 45° because brittle material is week in shear and Max shear stress generated along 45° plane.

S36. Ans.(d)
Sol. A cotter joint subjected to tensile and compressive loads.

S37. Ans.(c)
Sol. Rankine cycle consist of two isobaric & two isentropic processes.
Isentropic compression
Isobaric heat addition
Isentropic expansion.
Isobaric heat rejection.

S38. Ans.(d)
Sol. in a Rankine cycle, the work output from a turbine is a change of enthalpy between inlet and outlet

Where,
= enthalpy at turbine inlet
enthalpy at turbine outlet.

S39. Ans.(b)
Sol. Cochran boiler is a vertical fire tube boiler with multi-tube. It is an internally fired boiler and having the feasibility of natural circulation and it is easily portables from one place to another.

S40. Ans.(d)
Sol. the steam in boiler drum is always wet or dry. It is not 100% saturated dry, it contains same water vapour, for which it is passed through superheater to get superheated,

S41. Ans.(c)
Sol. in a water tube boiler the following sequence will follows by flue gases.
Superheater

Economizer

Air pre heater

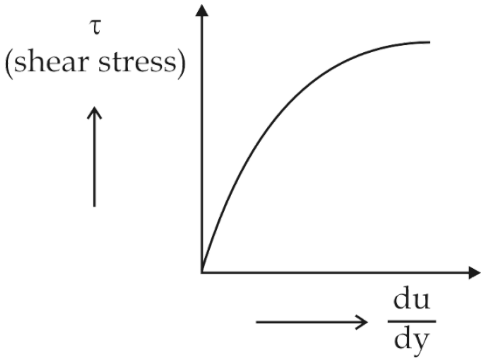
ID fan

S42. Ans.(a)
Sol. Feed check valve is used to control the supply of feed water to the boiler and to prevent the escaping of water from the boiler when the pump pressure is less or pump is stopped.

S43. Ans.(a)
Sol. Things which are assembled with boiler are classified in two categories
Accessories
Mounting

Accessories are used to improved performance e.g., Economizer, superheater, air preheater etc.
Mountings are used for safety purposes e.g., Fusible plug, pressure gauge etc.

S44. Ans.(a)
Sol.



Dynamic viscosity of Pseudo plastic fluid is decrease as the rate of shear increases.

S45. Ans.(a)
Sol.
Pressure intensity inside a soap bubble,

= 0.625 N/m

S46. Ans.(d)
Sol. The centre of buoyancy is defined as the centre of the volume of the displaced fluid.

S47. Ans.(c)
Sol.
For irrotational motion, the circulation around any path is zero because circulation is the product of vorticity and area. Vorticity is twice of rotation. Hence for an irrotational motion, vorticity is zero and hence circulation is zero.

S48. Ans. (a)
Sol. The robot which is most accurate is Cartesian robot.

S49. Ans. (a)
Sol. In JIT production, the ideal batch size consists of one part.

S50. Ans. (a)
Sol. The indication of positive slack in PERT is the project is Ahead of schedule.

S51. Ans. (a)
Sol. The north west corner rule in LPP is used to find an initial feasible solution.

S52. Ans. (b)
Sol. In sampling, AQL is acceptable quality level.

S53. Ans. (c)
Sol. Acceptance sampling is used in Mass Production.

S54. Ans. (d)
Sol. Gilberth identified 16 basic motions using which any job can be performed.

S55. Ans. (d)
Sol. The various types of symbols which are used in process chart

Operation	O
Transport	
Inspection	
Storage	Δ

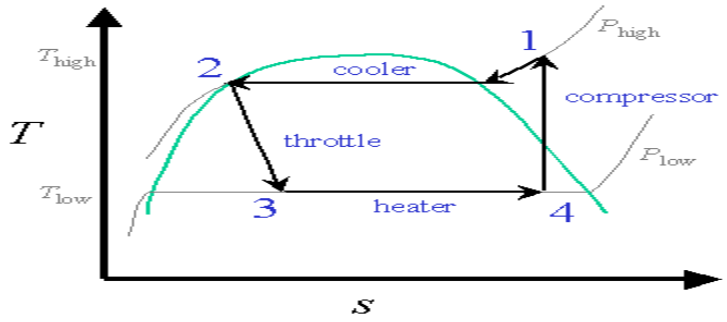
S56. Ans. (a)
Sol. The motor which will be suitable for traction is compound motor suitable for traction.

S57. Ans. (d)
Sol. Garnet, Emery and Diamond are a natural abrasive. Carborundum is not a natural abrasive.

S58. Ans. (c)

Sol. Crater wear occur on the rake face at a short distance from the cutting edge by the action of chip particles.
It is usually found in Brittle material
Flank Wear occurs mainly on the nose part, front relief face and side relief face of cutting tool.
It is due to work hardening.

S59. Ans (a)
Sol.



Given,

(Isenthalpic process)

COP of cycle
COP of cycle

S60. Ans (b)
Sol. Since, we know that Thermal diffusivity is given as,
(
It means for high Thermal diffusivity; k should be high (conduction of heat) and should be low (heat capacity).

S61. Ans (a)
Sol. Time constant is the time that is required by a thermocouple to reach 63.2% of the initial temperature.

S62. Ans (b)
Sol. Passive tracker uses low boiling point liquid which vaporizes after absorbing solar heat. The tracker can tilt to one or other side due to imbalance caused by vaporization of liquid.

S63. Ans (a)
Sol. Viscosity is defined as the internal resistance offered by the layers of fluid. It is defined by the Newton's law of viscosity also
i.e.,

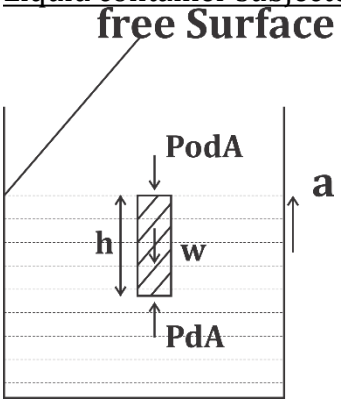
If, , then .
Viscosity is defined as the shear stress acting on the layers of fluid for unit shear strain rate.

S64. Ans (c)
Sol. We know that
In equilibrium, Weight of cube in air = Weight of cube in water + weight of the water displaced by the cube
= W +
= 2000 + 1000
= 12000 N

S65. Ans (a)
Sol. Given,
F = 400 N
P = 50 kPa
Area of Diaphragm(A)
=
= 0.008

S66. Ans (b)
Sol. When a fluid is contained in a container then extent of force on all sides of the container walls is same, hence it does not depend on the orientation of the surface.
Pressure is a scalar quantity and it has only magnitude that is why it is a zero-order tensor.

S67. Ans (a)
Sol. We know that
Liquid container subjected to constant vertical acceleration-



atmospheric pressure
a vertical acceleration (in Fig upward)
Applying D' lambert's principal,
----------(i)
Here, = gauge pressure
and
(Moving downward) --------(ii)

Case- If a = g in equation (ii)
then
Hence No force acts on the walls of container and the surface of the liquid will be horizontal.

S68. Ans (a)
Sol. We know that
Free Vortex flow is defined by
So, it depends upon angle (

S69. Ans (a)
Sol. Frictional losses in the nozzle reduces the enthalpy of the fluid.

S70. Ans (b)
Sol. In the MIG welding, metal is transferred in the form of fine spray. This type of transfer takes place at higher current setting which results in bead structure. Due to least spatter and smoke, it has high deposition efficiency.

S71. Ans (b)
Sol. There are following things required for continuous chip formation-

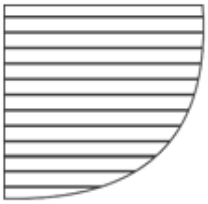
1. High cutting speed
2. Low feed
3. High rake angle
4. Ductile material of workpiece
5. It generates very high frictional heat
6. It is very complicated to handle.

S72. Ans (d)
Sol. Thickness of the chip during slab milling operation is directly proportional to the feed rate of the workpiece. i.e.,
Here, is thickness of chip (in mm) and f is table feed (in mm/rev).

S73. Ans (d)
Sol. Abrasive particles are hard and brittle in nature and Aluminium oxide, Boron carbide and Silicon carbide, all are of the same nature. All of the above can be used in ultrasonic machining in its slurry.

S74. Ans (b)
Sol. Tailstock offset method is used only for producing external tapers on lathe machine while compound rest method and taper attachment method both can be used to produce external as well as internal tapers on lathe machine.

S75. Ans (a)
Sol. If -ve pressure gradient exists, fluid particles move down the pressure hill and velocity increases or velocity gradient becomes positive. This condition supports the attached flow.



$\left|\frac{du}{dy}\right|_{y=0} = +ve$

No Separation
(Attached flow)

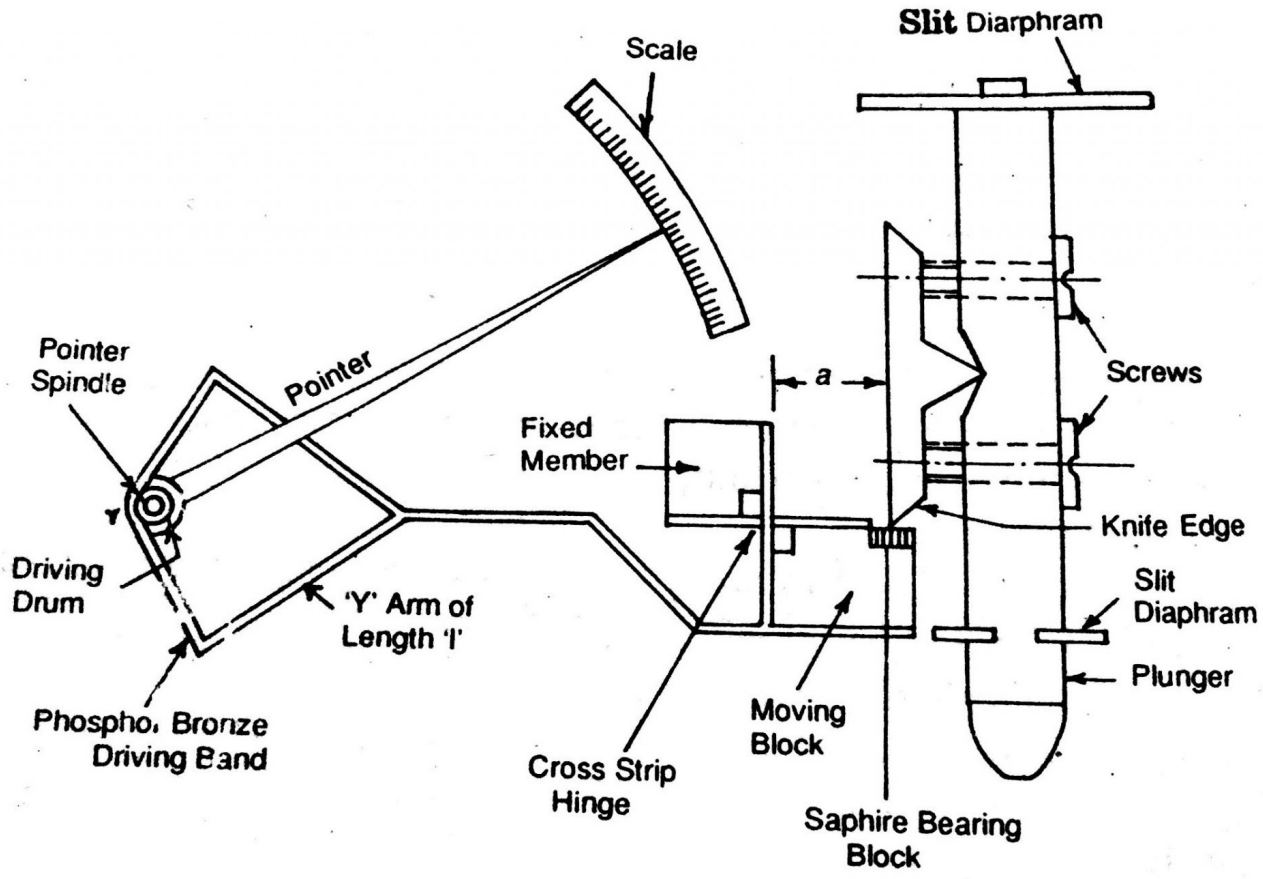
$\left|\frac{du}{dy}\right|_{y=0} = 0$

About to separate
(Separation point ( )

$\left|\frac{du}{dy}\right|_{y=0} = -ve$

Detached flow

S76. Ans.(c)
Sol. Sigma comparator is a type of mechanical comparator.
In the sigma comparator, a plunger is fitted through the slit diaphragm to give a frictionless surface when the plunger is pushed upward due to the uneven element it displaced the knife-edge either upward or downward.
Due to upward and downward movement of the knife-edge, the moving block moves accordingly as it is hinged.
Y – arm is connected to cross-strip, the movement of cross strip is transferred to the driving drum with the help of y-arm driving drum is fitted with spindle and pointer, any movement in driving drum results in the pointer moving and we get the magnified result on the display unit or scale.



S77. Ans.(a)
Sol. Given,
1 Main scale division (MSD) = 0.1 mm
Also, 9 Vernier scale division (VSD) = 10 MSD
1 VSD = 0.9 MSD
= 0.9 × 0.1 mm
= 0.09 mm
We know that
Least count (LC) =MSD – VSD
= 0.1 – 0.09
= 0.01 mm

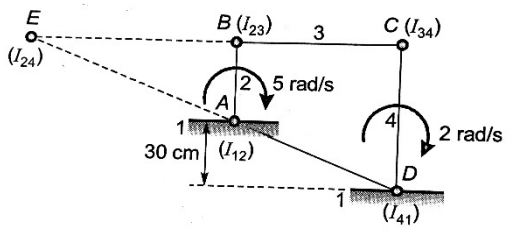
S78. Ans.(d)
Sol. As we know,
Taylor's tool life equation

We see that it is dependent on cutting speed

S79. Ans.(b)
Sol. The minimum temperature at which the replacement of cold – worked structure by a new set of strain free approximately equi-axed grains to replace all the deformed crystal.

S80. Ans.(a)
Sol. Camber is provided on the rolls to unavoidable Bending to get the uniform thickness of the plate by rolling process.

S81. Ans.(b)
Sol.



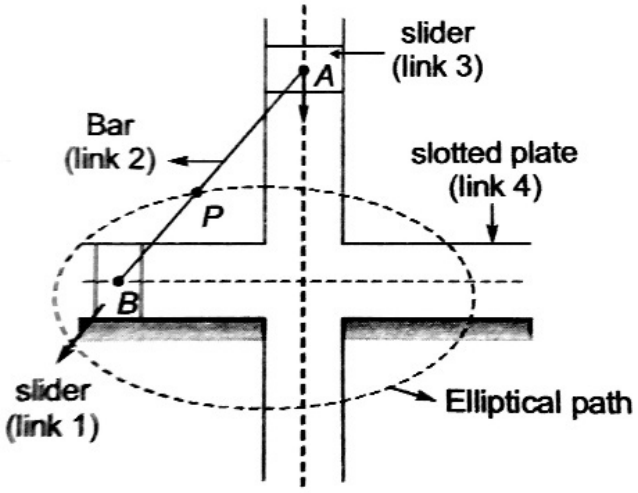
5(AE) = 2 (DE)
2.5 = … (i)
ABE and DCE are similar triangles
= … (ii)
From (i) and (ii)
2.5 = = = 1 +
= 1.5
AB = 20 cm

S82. Ans.(b)
Sol. Hart mechanism has six links.

S83. Ans.(d)
Sol. F = 3 (n – 1) –2j (With no higher pair)
For constrained mechanism,
F = 1 = 3 (n – 1) –2j
Or 2j – 3n + 4 = 0 (Grubler's criteria)
The number of links must be even for Grubler's criteria for plane constrained mechanism.
For 4 revolute pair and zero higher pair
2 × 4 – 3 × 4 + 4 = 8 + 4 – 12 = 0
Revolute pairs, 2 higher pairs,
F = 3 (n – 1) – 2j – h
As mechanism is constrained
F = 1 = 3n – 3 – 2j – 2
So, 3n – 2j = 6 Grubler's criteria for constrained mechanism with higher pair.
3 × 4 – 2 × 4 = 4 6 (for n = 4)
3 × 6 – 2 × 6 = 18 – 12 = 6 (for n = 6)

So, the minimum number of links in a constrained planer mechanism with revolute pairs and two higher pairs is 6.

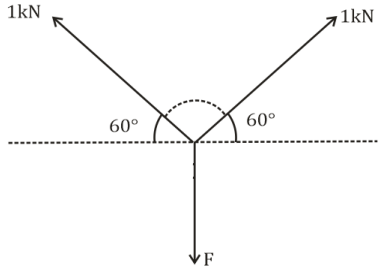
S84. Ans.(a)
Sol.



S85. Ans.(d)
Sol. While designing a cam, pressure angle is one of the most important parameters which is directly proportional to base circle diameter.

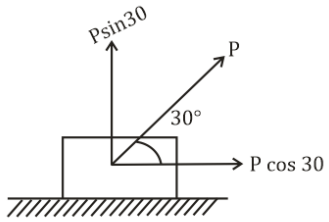
S86. Ans.(c)
Sol. Torque transmitted torque shaft

S87. Ans.(a)
Fig.



Sol. from lami's theorem
=
F =
F = N

S88. Ans.(b)

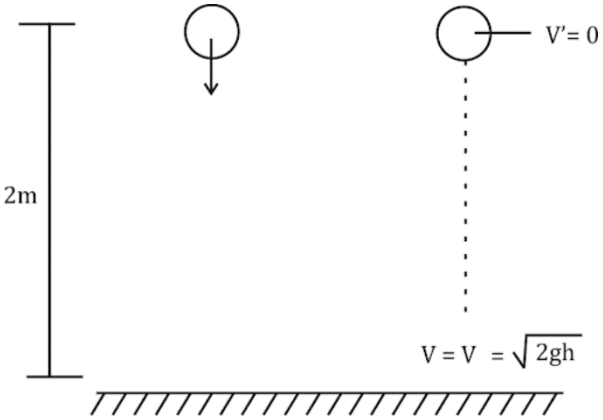


Sol. P cos 30 = ma
P cos 30 = 5 × 2
P = N

S89. Ans.(d)
Sol. The machine is called to be an ideal Machine when It convert Total Input Total output without any Loss. i.e. 100% efficiency.

S90. Ans.(b)
Sol. For a system if degree of freedom is zero than it can be called truss or frame because there is no relative motion between the member of the system. A machine part is designed as a strut, when it is subjected to an axial compressive stress.

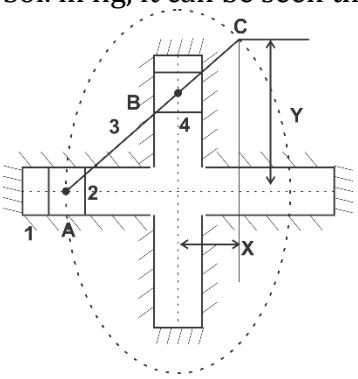
S91. Ans.(b)
Fig.



Sol. When it comes to the floor its velocity is
V =
After rebounding it will go with the same speed.
$v^2 = u^2 + 2gh$
$v'^2 = 2gh$
$0 = ()^2 - 2gh$
h = 2m

S92. Ans.(d)
Sol. The input which cause a change in inputs-output relationship for either desired input or interfering inputs or for both are called interfering inputs.

S93. Ans.(b)
Sol. in fig, it can be seen that point c on link 3 will trace an ellipse while moving.

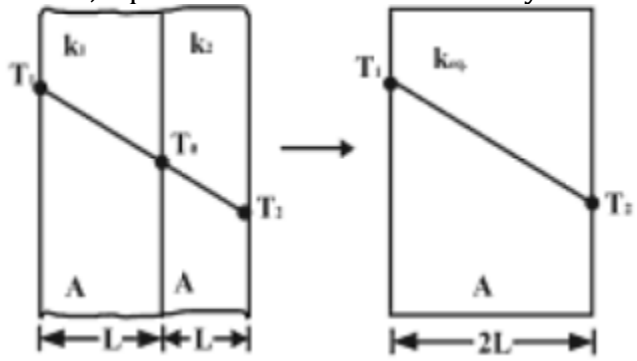


S94. Ans (b)
Sol. Time period of oscillations is inversely proportional to meta centric height. Thus, more the GM less will be time period, and body regains its position in less time. So more stable.

S95. Ans (a)
Sol. According to Newton's cooling law,
Net rate of cooling
Here,
T = Instantaneous temperature
= Temperature of surrounding
As, temperature decreases from 80 to 70; hence, it will take more than 10 minutes to cool.

S96. Ans (d)
Sol. Thermal diffusivity is given as,
(
Its unit is and it depends on temperature because all three properties (, and) are the function of temperature.

S97. Ans (d)
Sol. Let, equivalent thermal conductivity is and total thermal resistance is , then



S98. Ans (c)
Sol. The angle of the diffuser portion of a venturimeter is less than the angle of the converging portion to minimize the loss of energy due to separation of flow. The angle of diverging section of venturimeter is 6 to 7 while angle of converging section is 20 to 22.

S99. Ans (d)
Sol. Flow of water over a long weir and flow of exhaust gases could be modelled as in-viscid flow.

S100. Ans (b)
Sol. In a given duct system, the total pressure drop varies in a parabolic manner with flow rate according to this formula and when the filters are new then the air pressure drop is less as diameter of holes is more for new filters as compared to old filters which are clogged with dirt.