001 In Parson’s reaction steam turbine, the degree of reaction is 
50 %

002 A cylindrical shaped vessel of internal diameter of 100 cm and height of 80 cm contains a gas. The mercury manometer that is connected to the vessel shows 640 mm of Hg above the atmosphere when the barometer reads 760 mm of Hg. What is the absolute pressure of gas inside the vessel? Take: 1 mm of Hg = 133.4 N/m²
186.8 kPa

003 The latent heat of evaporation at critical point is
Equal to zero.

004 In a steam power plant, the power output of the turbine is 4200 kW when the enthalpy of steam at the entry and exit of the turbine is measured as 3400 kJ/kg and 2600 kJ/kg, respectively. Considering the power consumed by the feed pump as 200 kW, what is the steam flow rate through the turbine?
5.0 kg/s

005 If a thermodynamic process can be stopped at any stage and reversed so that the system and surroundings are exactly attained their initial states, then the process is termed as
Ideal process

006 The product of the efficiency of a reversible heat engine that works on the
temperature limits of $T_h$ and $T_c$ and the coefficient of performance of a reversible refrigerator that works on the same temperature limits of $T_h$ and $T_c$ is

Less than 1.0

007 The ignition of charge in a petrol engine before the occurrence of spark plug in the spark plug is termed as

Pre-ignition

008 A piston-cylinder arrangement contains a gas. The gas is allowed to expand from 0.04 m$^3$ to 0.08 m$^3$ at a constant pressure of 2 MPa and it receives 100 kJ of heat during the expansion process. What is the change in internal energy of the gas?

70 kJ

009 One reversible heat engine operates between a temperature limits of 1000 K and $T_x$ K and another heat engine operates between a temperature limits of $T_x$ and 360 K. If both the heat input and the output of the first engine is twice that of the second engine, what is the value of $T_x$?

600 K

010 Related with combustion of fuels, what is the meaning of equivalence ratio?

Equivalence ratio is the ratio between the stoichiometric fuel-air ratio and actual fuel-air ratio.

011 Combustion on Compression Ignition (CI) engine is

heterogeneous.

012 Consider the following statements regarding knock rating of SI engine fuels and identify the correct statements.

A. Iso-octane is assigned a rating of zero octane number.
B. Normal heptane is assigned a rating of hundred octane number.
C. Iso-octane assigned a rating of hundred octane number.
D. Normal heptane is assigned a rating of zero octane number

C and D
013 In Morse test on a 4-cylinder, 4-stroke, spark ignition engine, the brake power was 24 kW whereas the brake powers of individual cylinders with spark cut off were 17.2 kW, 16.6 kW, 16.8 kW, and 16.0 kW. What is the mechanical efficiency of the engine?

81 %

014 What is the speed of the cam shaft of a four stroke internal combustion engine that is running at 1500 RPM?

750 RPM

015 The gravimetric analysis of a fuel is given as 80 % of carbon, 8 % of Hydrogen and 8 % of oxygen and the remaining is incombustible. What is the stoichiometric air/fuel ratio of the fuel?

11.7

016 In thermodynamics, Helmholtz function is expressed as

u – Ts

017 Which one of the following is the correct sequence of the position of the components in turbo-prop engine system?

Propeller, compressor, burner, turbine

018 The velocity of jet at the nozzle exit of a rocket is 3300 m/s while the velocity of the rocket is 1100 m/s. What is the propulsive efficiency of the rocket system?

50.0 %
Fin efficiency defined as the ratio between the actual amount of heat transfer with fins and the amount of heat transfer when the entire surface of the fin is maintained at base temperature.

Thermal diffusivity is a physical property of material.

In a counter flow heat exchanger, the hot fluid enters at 85 °C and leaves at 50 °C and the corresponding temperatures of the cold fluid are 28 °C and 68 °C. Assuming the heat capacity rate of hot fluid as 1.2 times of that of cold fluid, calculate the effectiveness of the heat exchanger.

0.70

A hot fluid flows at a velocity of 1.2 m/s through a pipe having a diameter of 100 mm and 1000 m long. If the heat loss across the wall of the pipe is estimated as 1000 W/m², density of the fluid is 780 kg/m³ and \( C_p = 2.3 \) kJ/kgK, what is the difference in temperature of fluid between the inlet and exit of the pipe?

18.6 °C

A 5 kW water heater with 30 liters of water is switched on for 20 minutes. What is the rise in temperature of water? Assume zero loss in electrical energy and specific heat of water as 4 kJ/kgK?

50 °C

The Biot number is defined as the ratio of internal conduction resistance to the external convection resistance.
A hollow sphere of internal diameter of 100 mm and an external diameter of 150 mm is to be insulated by an insulation material having a thermal conductivity of 1.2 W/mK. If the convective heat transfer coefficient for the system is 20 W/m^2K, what is the critical thickness of insulation?

45 mm

What is the meaning of hydro-dynamically developed region in a flow through pipe?

It is the region in which the velocity profile of the fluid is fully developed.

The predominant mode of heat transfer in electrical transmission line is Natural convection

A composite wall consists of three different materials (slabs) with the thermal conductivities of k, k/2, k/4, respectively. The temperature drop across the individual will be in the ratio of

4 : 2 : 1

Peclet is the product of Reynolds number and Prandtl number

Temperature inside a furnace is measured by Optical pyrometer

An enclosure consists of four surfaces 1, 2, 3, and 4. The view factors for radiative heat transfer are F_{11} = 0.1, F_{12} = 0.4, F_{13} = 0.25. If the surface area of A_1 and A_4 are 4 m^2 and 2 m^2, respectively, what is the value of view factor, F_{41}?

0.500
032  The wavelength range for thermal radiation is (in microns) 
\[10^{-1} \text{ to } 10^{2}\]

033  Emissivity and absorptivity of a body are equal, if the body is 
in thermal equilibrium.

034  The ratio of thermal diffusivity to mass diffusivity is termed as 
Lewis number

035  What is dimension of mass diffusion coefficient?
\[L^2 T^{-1}\]

036  Related to refrigeration system, a hermetically sealed unit implies 

Compressor and motor are sealed as single unit.

037  What is the technical definition for the relative humidity?
Relative humidity is the ratio of the actual mass of water vapour 
in a unit mass of dry air to the mass of water vapour in the same 
mass of dry air when it is saturated at the same temperature and 
pressure.

038  A heat pump working on a reversed Carnot cycle has a COP of 4. If the 
same system is employed as a refrigerator for refrigerating effect of 10 kW, 
what is the required work input?
\[3.3 \text{ kW}\]
039 Which of the expansion device is commonly employed in domestic refrigerators working on vapour compression refrigeration cycle?

**Capillary tube**

040 Cryogenics refers to

*Engineering system that are concerned with very low temperature (in the range of -180 °C)*

041 What is the process in which the addition of moisture to air at constant dry bulb temperature called as?

**Humidification**

042 What is the function of flash chamber in vapour compression refrigeration system?

*The flash chamber is used for removing the dry vapour after the throttling process.*

043 A room is to be maintained at 50% relative humidity and 25 °C dry bulb temperature when the outside condition is 75 % relative humidity and 45 °C. What are the processes to be applied?

**Dehumidification and cooling**

044 What is the boiling point of ammonia?

*-33.3 °C*

045 Centrifugal compressors are normally employed in refrigerant cycle that require

**Large refrigerant flow rate and high condensing pressure.**
Which of the following refrigerant has the maximum ozone depletion potential in the stratosphere?

**Fluorine**

The capacity of a domestic refrigerator is in the range of

0.1 to 0.3 TR

In case of sensible cooling of air, the bypass factor is given by (where \( t_{d1} \) = Dry bulb temperature of air entering the cooling coil, \( t_{d2} \) = Dry bulb temperature of air leaving the cooling coil, and \( t_{d3} \) = Dry bulb temperature of the cooling coil)

\[
\frac{(t_{d2} - t_{d1})}{(t_{d1} - t_{d3})}
\]

In a vapour compression refrigeration system, the throttle valve is used in place of an expander because the positive work from the expansion is very small.

The refrigerant used for absorption refrigerators that works on heat from solar collectors is a mixture of water and **Lithium bromide**

Which of the following cycles uses air as the refrigerant?

**Bell Coleman Cycle**

Boiler rating is usually defined in terms of

**Steam output in kg/hr**

The steam expansion in a reaction turbine is represented in Mollier diagram as

**Vertical straight line from bottom to top.**
054 What is the value of degree of reaction for an impulse (steam) turbine?
0.0

055 What is the meaning of regeneration in a steam power plant?
Extraction of some useful steam during the expansion in the turbine stage and heating the feed water by the extracted steam.

056 The analysis of a coal sample is given as (by weight), carbon = 85 %, hydrogen = 6 %, Oxygen = 6 % and the remainder being incombustible products. What is minimum quantity of air is required per kg of coal to achieve complete combustion?
11.70 kg

057 What is the meaning of equivalent evaporation in boiler?

It is actual amount of water converted from water at 100 °C to dry saturated steam at 100 °C.

058 Which one of the following parameters is constant (for ideal condition) in a fluid flow through a convergent-divergent nozzle?
Stagnation enthalpy

059 The effect of considering friction in steam nozzles for the same pressure rations leads to

Increase in dryness fraction of exit steam.

060 The reheat factor of multi stage steam turbine is normally in the range of 1.03 to 1.07

061 Condenser efficiency defined as the ratio between
Actual rise in temperature of cooling water and ideal rise in temperature of cooling water.
Work ratio of a gas turbine unit is defined as

*Ratio between the net-work output and the turbine work.*

The velocity of steam at the exit of nozzle vanes of a simple axial flow impulse turbine is 500 m/s and the tangential velocity of rotor blades is 250 m/s. The nozzle vanes are set at angle of 30° (with reference to direction of rotation of rotor) and the steam leaves rotor exactly parallel to the axis of the rotor. By neglecting the effects of friction, what is diagram power and blade efficiency for a mass flow rate of 1 kg/s?

108.3 kW and 86.6 %, respectively.

In fast breeder reactor

*More fuel than the consumed is produced.*

What is the mathematical expression to estimate the axial thrust produced on the shaft of an axial flow steam turbine? (m = mass flow rate of stream, \( V_{fi} \) = Flow velocity at the turbine inlet, \( V_{fo} \) = Flow velocity at the turbine outlet, \( V_{wi} \) = Tangential velocity at the turbine inlet, \( V_{wo} \) = Tangential velocity at the turbine outlet)

\[ m \left( V_{fi} - V_{fo} \right) \]

Air enters into the combustor of a gas turbine unit at a velocity of 112 m/s and a temperature of 223 °C. What is the Mach number at the entry?

0.250

The peak load on a power plant is 60 MW. The loads having a maximum demand of 20 MW, 10 MW, 16 MW, and 30 MW are connected to the plant. If the capacity of the power plant 80 MW, what is diversity and demand factor?

0.79 and 1.27, respectively.

What is the purpose(s) of providing lacing wires in a steam turbine?

*Lacing wires is used to keep the blades alignment and to control the effects of vibration in longer blades in low pressure stages.*
069  The half-life of radium 226 (Atomic mass = 226.095) is 1620 years. What is the decay constant of radium 226?

\[ 1.3566 \times 10^{-11} \text{ s}^{-1} \]

070  In a jet propulsion engine system, what is the ideal relation between the compressor work and turbine?

\textbf{The compressor work is equal to the turbine work.}

071  Which one of the following is an inversion of double-slider crank chain?

\textbf{Scotch yoke}

072  A mechanism has 7 links with all binary pairs except one which is a ternary pair. The number of instantaneous centers of this mechanism is 28

073  The direction of the Coriolis component of acceleration is

\textit{Perpendicular to the surface of sliding and in the same direction of angular velocity.}

074  Governor power is defined as the product of

\textit{Mean force exerted on the governor sleeve due to change in speed and the sleeve lift.}

075  If the unbalanced force developed by an eccentric mass that is rotating at 3000 rpm is X times more than the 50% of the unbalanced force that is developed by the same mass rotates at 300 rpm, what is the value of X?

\[ X = 200 \]

076  In a system, which is subjected to forced harmonic excitation, the ratio between the frequency of excitation and the natural frequency of the system (\( \beta \)) is 1.4142, then the transmissibility vibrations will be

\[ 1.000 \]
The Whitworth quick return mechanism is formed in a slider-crank chain when the

**Smallest link is a fixed link.**

In a simple epicyclic gear train, the number of teeth in sun gear, and planetary gear is 18 and 24, respectively. If the internal gear is kept as stationery and the sun gear rotates at 100 RPM, what is the speed and direction of rotation of the arm that is connected to planetary gear?

**21.4 RPM, direction of rotation is same as sun gear.**

In a compound gear train, if the axes of first and last gear are coaxial, the gear train is called as

**Reverted gear train**

A mass of 1 kg is fixed at the middle of a spring of stiffness of 10 N/mm as shown in the figure (fig. 1). What is the natural frequency (in Hz) of the system?

**31.8 Hz**

**Fig. 1**

Related to slider crank mechanism, Klein’s construction **enables the determination of acceleration of components.**
082 Consider the given two sets and select the correct answer using codes.

<table>
<thead>
<tr>
<th>Set I</th>
<th>Set II</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Flywheel</td>
<td>E. Speed control on par with load</td>
</tr>
<tr>
<td>B. Governor</td>
<td>F. Turning moment diagram</td>
</tr>
<tr>
<td>C. Critical speed</td>
<td>G. D’Alembert’s principle</td>
</tr>
<tr>
<td>D. Inertia force</td>
<td>H. Dunkerley’s method</td>
</tr>
</tbody>
</table>

A – F, B – E, C – H, D – G

083 If the rotating mass of a rim type fly wheel is distributed on another rim type flywheel whose mean radius is half of the mean radius of former, then energy stored in the later at the same speed

One-fourth of first one.

084 In a slider-crank mechanism, what is the position of the crank and the connecting rod at which the velocity of the slider is maximum?

Crank is perpendicular with the line motion of slider.

085 Consider the following follower motions with respect of given lift, speed of rotation of cam and angle of stroke of cam

A. Cycloidal motion
B. Simple harmonic motion
C. Uniform velocity motion

What is the correct sequence of the above stated motions in the descending order of maximum velocity?

1. A – B – C

086 What is condition in a shaft-rotor system to achieve dynamic balancing?

\[ \Sigma M = 0 \text{ and } \Sigma F = 0 \]

087 Two shafts, which are parallel but not-inline with varying distance between the axes, are to be connected. Which of following device is the most suitable?

Oladham’s coupling
088 Which one of the following statements is correct in terms of direction of linear velocity of any point on a kinematic link relative to any other point on the same link?

Perpendicular to the line joining the points.

089 Two shafts; A and B are made of same material. The diameter of the shaft A is 1.5 times of that of B. The torque transmitting capacity of shaft A is 3.375 times of capacity of shaft B.

090 A boiler shell having an internal diameter of 2 m and plate thickness of 15 mm is subjected by an internal pressure of 1.5 MPa. What is the hoop stress induced in the shell wall?

100 MPa

091 A solid shaft is subjected to a bending moment and a twisting moment of 3 kN-m and 4 kN-m. If the allowable shear stress for the shaft material is 50 MPa, what is the minimum diameter of the shaft based on equivalent twisting moment?

80 mm

092 The induced stresses at a point of a loaded member are given by $\sigma_x = 40$ MPa (compressive), $\sigma_y = 50$ MPa (tensile), $\tau_{xy} = 20$ MPa. The maximum principal and shear stresses are

55 MPa (Tension) and 50 MPa, respectively.

093 If the ratio of the diameter of the rivet hole to the pitch of rivets is 0.25, then the tearing efficiency of the joint is

75%
A steel ball of mass 1 kg and specific heat 0.4 kJ/kg is at a temperature of 60 °C. It is dropped into 1 kg water at 20 °C. The final steady state temperature of water is 23.5 °C.

The deflection of a spring with 24 active turns under a load of 2400 N is 24 mm. The spring is cut into two springs in such a way that one spring has 16 turns and another with 8 turns. If the two springs are arranged in parallel and subjected under the same load; 2400 N, what would be the deflection of the system? 5.33 mm

In a simple quick return mechanism shown in the figure (fig. 2), AC = 100 mm, AB = 200 mm. What is the ratio of time for forward motion to that for return motion? 3.0

Deflection of a closed coil helical spring when it is loaded axially is directly proportional to Number of effective coils.

In a belt drive system, the tension on the tight side and the slack side is measured as 6500 N and 1500 N, respectively when the mean velocity of the belt is 20 m/s. What is the power transmitted by the belt? 10 kW

A flat plate of width of 60 mm has a hole of diameter of 10 mm at the center. The plate is subjected by an axial (tensile) load of 10 kN. What is the minimum thickness of the plate? Take: Yield point of the plate material = 300 MPa, Factor of safety = 2.5, Form stress factor = 2.55 4.25 mm
A 80 mm shaft transmits a power of 250 kW to a machine tool. The power is taken off through a gear whose hub is 200 mm long and the rotational speed of 240 RPM. The key is made up of steel having an ultimate shear stress of 350 MPa. Assuming the factor of safety as 5, what is the minimum of the key?

15 mm

Tapered roller bearings can take both radial and axial load.

What is the purpose of cages in deep groove ball bearings?

To ensure that the balls do not cluster at one point and maintain the proper angular position of balls.

Addition of magnesium to cast iron increases its ductility and tensile strength.

Which of following pairs is not correctly matched?

Belt drive - Positive drive

In a power transmission, the maximum shear stress induced in a solid shaft is 60 MPa. If the solid shaft is replaced by a hollow shaft, whose outer diameter is same as solid shaft diameter, inner diameter is 0.5 times of outer diameter and made up of same material, what would be maximum induced shear stress in the hollow shaft?

64 MPa

What is the composition of German Silver?

1. 60% Copper, 20% Nickel and 20% Zinc
107 What is main purpose of adding tungsten in high speed steel?

To improve the toughness.

108 Which of the following materials has better shock absorbing capacity?

Cast iron

109 The materials having same elastic properties in all directions are called as isotropic materials.

110 In compression, a prism of brittle material will break by shearing along oblique plane.

111 When the temperature of a solid metal increases strength of the metal decreases but ductility increases.

112 Which of the following element is mainly added to improve the endurance strength of steel?

Vanadium

113 Which is the softest among the following?

Ferrite

114 What is the tensile strength of a structural steel that is represented as St50?

500 to 600 MPa

115 An eutectoid steel consists of wholly pearlite

116 The percentage of carbon in cast iron varies from 1.7 to 4.5
117 Which of the following has a fine gold colour and is used for making imitation jewellery?
   Aluminium bronze

118 The heat treatment process which is used for softening hardened steel is Tempering

119 A steel is heated at about 875° C where the structure consists of entirely austenite. It is then cooled suddenly at a temperature of about 250° C to 525° C. This process of heat treatment is known as Austempering

120 Duralumin contains 3.5 to 4.5% copper, 0.4 to 0.7% magnesium, 0.4 to 0.7% manganese and rest aluminium

121 In low carbon steels, presence of small quantities of sulphur improves Machinability

122 What are the constituents in Inconel alloy?
   Nickel (76 %), iron (8 %) and chromium (16 %)

123 Thermoplastic polymer materials are made up of Covalent bond backbone and weak Van de Waal’s forces interconnecting it.

124 Impact strength is the combination of Toughness and strength

125 Metal matrix composites is mostly a composite material of Metal matrix with ceramic reinforcement.
126 What is the interplanar spacing between the (1,1,0) planes of a cubic lattice of length 160 µm?

80 µm

127 Carburizing is the process of

Increasing the carbon content on the surface region of low carbon steel.

128 Thermit welding process involve

Local heating of base metals by means of ignition powder followed by exothermic reactions produced by thermit.

129 Creep can be defined as

Time dependent strain occurs under stress at high temperature.

130 The purpose of preheating before welding is to

prevent cold cracks.

131 Porosity of welded joint is due to

poor base metal.

132 Whether coolant is needed in gray cast iron machining cool? Why?

Not needed, because of presence of graphite.

133 The mechanism of material removal in EDM process is

Melting and Evaporation.

134 The welding process which uses a blanket of fusible granular flux is

Submerged arc welding.

135 A 1000 hours life test is conducted on 20 components. If one component fails after 400 hours and the remaining components passed the life test, what is failure per hour?

$5.1 \times 10^{-5}$
Which of the following processes are commonly employed to manufacture the tooth paste tubes?

Extrusion

The force required for metal cutting operation increases with increase in both the feed of the tool and the depth of cut.

In connection with net work analysis, dummy activity does not require both time and utilization of resources.

AOQL stands for Accepted Outgoing Quality Limit.

The manufacturing area of a plate is divided in to four quadrants. Four machines have to be located, one in each quadrant. The total number of possible layout is 24.

What is the maximum allowable legal limit of noise value during personnel exposure for 4 hours of working time?

95 dBA

Refer the following data that is related to a product supply unit, what is the number of annual orders per year?

Number of units on demand per year = 5000
Cost to make one order = Rs. 100/-
Holding cost per unit per year = Rs. 50/-

200

Related to riveted joint, Unwin’s formula represents the relation between Diameter of the rivet and plate thickness.
144 Which of the following layouts is suited for mass production?  
**Product layout**

145 Which of the following wage incentive plan guarantees minimum wage to a worker and bonus is paid for the fixed percentage of time saved?  
**Gantt plan**

146 A project consists of activities A to F and the details of activities given below. What are the activities in the critical path and the corresponding project completion time?

<table>
<thead>
<tr>
<th>Activity</th>
<th>immediate predecessor(s)</th>
<th>duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Nil</td>
<td>5</td>
</tr>
<tr>
<td>B</td>
<td>A</td>
<td>8</td>
</tr>
<tr>
<td>C</td>
<td>A</td>
<td>7</td>
</tr>
<tr>
<td>D</td>
<td>A</td>
<td>3</td>
</tr>
<tr>
<td>E</td>
<td>D</td>
<td>2</td>
</tr>
<tr>
<td>F</td>
<td>B, C, E</td>
<td>10</td>
</tr>
</tbody>
</table>

**A-B-F, 23**

147 The following details are the budget of a company for a particular year.  
Estimated sales (1,00,000 units @ Rs. 20) = Rs. 20,00,000/-  
Fixed cost = Rs. 4,00,000/-  
Variable cost (1,00,000 units @ Rs. 10) = Rs. 10,00,000/-  
Net profit (Estimated) = Rs. 6,00,000/-  
What will be the impact on the company’s profit (with reference to the estimated profit), if the following changes taken place?  
Increase in selling cost of unit = 20 %  
Decrease in volume of sales = 25 %  
Increase in fixed cost = 5 %  

**The net profit will decrease by 7.5 %**

148 The following data refer to a factory that has several machines and wants to install its own service facility for repairing the machines (the repair time has exponential distribution).  
The average number of breakdown per day = 3  
Loss incurred due to inoperative machine = Rs. 40 per day  
Service facility, X
Cost of installation of facility = Rs. 20,000/
Labour cost to operate the facility = Rs. 5000/- per year
Number of repair can perform per day = 4
Life span of the service facility = 4 years

Service facility, Y
Cost of installation of facility = Rs. 40,000/-
Labour cost to operate the facility = Rs. 8000/- per year
Number of repair can perform per day = 4
Life span of the service facility = 4 years
Considering the annual cost, which of the service facility is better?

**Facility Y is better than facility X**

149 The cost of a machine is Rs. 24000 and the estimated scrap value after an average life of 30000 hours is Rs. 1200. What will be the depreciation charge at the end of the first year if the machine is operated for a total duration of 1500 hours?

**Rs. 1140**

150 In A-B-C control policy, the maximum attention is given to

**those items which consume more money.**