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/m^2
   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?

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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 air - fuel ratio and actual air - fuel 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 %

019   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.

020 Thermal diffusivity is

a physical property of material.

021 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 AND 0.73

022 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/m^2, density of the fluid is 780 kg/m^3 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

023 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

024 The Biot number is defined as

the ratio of internal conduction resistance to the external convection resistance.

025 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

026 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.

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

028 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

029 Peclet is the product of
Reynolds number and Prandtl number

030 Temperature inside a furnace is measured by
Optical pyrometer

031 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} 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 given volume moist air to the mass of water vapour in the volume of saturated air 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 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 low condensing pressure.

046 Which of the following refrigerant has the maximum ozone depletion potential in the stratosphere?

Fluorine

047 The capacity of a domestic refrigerator is in the range of

0**.1 to 0.3 TR**

048 In case of sensible cooling of air, the bypass factor is given by (where t_{d_1} = Dry bulb temperature of air entering the cooling coil, t_{d_2} = Dry bulb temperature of air leaving the cooling coil, and t_{d_3} = Dry bulb temperature of the cooling coil)

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049 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.

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

Lithium bromide

051 Which of the following cycles uses air as the refrigerant?

Bell Coleman Cycle

052 Boiler rating is usually defined in terms of

Steam output in kg/hr

053   The steam expansion in a reaction turbine is represented in Mollier diagram as
          Vertical straight line from top to bottom

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.

062 Work ratio of a gas turbine unit is defined as

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

063 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.

064 In fast breeder reactor
More fuel than the consumed is produced.

065 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)
$m (V_{fi} - V_{fo})$

066 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

067 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.

068 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?
 The compressor work is equal to the turbine work.

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

 Perpendicular to the surface of sliding and in the same direction of angular velocity.

074   Governor power is defined as the product of
 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 (β) is 1.4142, then the transmissibility vibrations will be
 1.000

077 The Whitworth quick return mechanism is formed in a slider-crank chain when the

 Smallest link is a fixed link.

078 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?
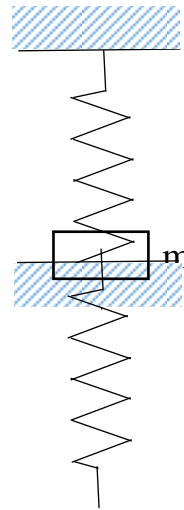
21.4 RPM, direction of rotation is same as sun gear.

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

Reverted gear train

080 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?

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081 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.

Set I		Set II	
A.	Flywheel	E.	Speed control on par with load
B.	Governor	F.	Turning moment diagram
C.	Critical speed	G.	D'Alembert's principle
D.	Inertia force	H.	Dunkerley's method

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?

A – B – C

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

$\Sigma M = 0$ 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 linier 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 %

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

23.5 °C

095 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 deflection of the system?

5.33 mm

096 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

13   Fig. 2

for return motion?

2.0

097 Deflection of a closed coil helical spring when it is loaded axially is directly proportional to

Number of effective coils

098 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

099 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

100 A 80 mm shaft transmits a power of 250 kW to a machines 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

101 Tapered roller bearings can take

Both radial and axial load.

102 What is the purpose of cages in deep grove ball bearings?

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

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

104 Which of following pairs is not correctly matched?
      Belt drive   -   Positive drive

105 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

106   What is the composition of Germen Silver?
          60 % Copper, 20% Nickel and 20 %Zinc

107   What is main purpose of adding tungsten in high speed steel?
          To improve wear resistance of the material

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 Vandewaal'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?
       113 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 and High welding speed

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?

5.1×10^{-5}

136 Which of the following processes are commonly employed to manufacture the tooth paste tubes?

Extrusion

137 The force required for metal cutting operation

increases with increase in both the feed of the tool and the depth of cut.

138 In connection with net work analysis, dummy activity

does not require both time and utilization of resources.

139 AOQL stands for

Average Outgoing Quality Level

140 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

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

95 dBA

142 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/-

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143 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?

Halsey 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?

Activity	immediate predecessor(s)	duration
A	Nil	5
B	A	8
C	A	7
D	A	3
E	D	2
F	B, C, E	10

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 X is better than facility Y

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.