

AEE Mains Mechanical 15.05.2019

Question No. 1 Which of the following is not a pure substance?

Mixture of air and liquid air

Question No. 2

3000 cm³ of a gas at a pressure of 100 kPa is compressed according to relation $PV^n = \text{Constant}$ ($n = 0$) until the volume becomes 1500 cm³, the work transfer in this process is

-0.15 kJ

Question No. 3 Consider the following thermodynamic relations

- A. $Tds = dh + Pdv$
- B. $Tds = du + Pdv$
- C. $Tds = dh - vdP$
- D. $Tds = du - vdP$

Which of the following relations are incorrect?

A and D

Question No. 4 Experimental values of Critical compressibility factor (Z_c) for most gases fall in a narrow range of

0.2 to 0.3

Question No. 5

Consider the following statements about a mechanical energy reservoir (which is a large body)

- A. Enclosed by an adiabatic impermeable wall
- B. Capable of storing work as potential energy kinetic energy
- C. In which all processes of interest may or may not be quasi-static
- D. Capable of storing work as kinetic energy

Which of the above mentioned statements are incorrect?

C

Question No. 6

A heat engine works between temperature limits of 27°C and 227°C, receives 500 kJ of heat from reservoir at 227°C and rejects 100 kJ of heat to 27°C reservoir.

Such a heat engine is impossible

Question No. 7

Entropy of wet steam is given by (T_s = Saturation temperature of steam and other symbols have usual meaning)

$$S = S_f + \frac{X \cdot hfg}{T_s}$$

Question No. 8

A gas is enclosed by a piston at initial condition of 4 bar, 300 K and 1 m³. In a particular process, the gas expands isothermally until the volume becomes 10 m³. Heat exchange occurs with the atmosphere at 300 K during this process. The entropy changes for the universe during this process is

0 kJ/K

Question No. 9

A thermal reservoir at 600 K transfers 100 kJ of heat to another reservoir at 400 K. The entropy generation, considering environment temperature as 300 K, is

0.083 kJ/K

Question No. 10 Entropy generation number is mathematically expressed as

$$\frac{\dot{S}_{gen}}{\dot{m} C_p}$$

Question No. 11

Which of the following for water is a compressed liquid state ?

1.01325 bar and 25 °C

Question No. 12

In a Brayton cycle, use of maximum pressure ratio gives

- A. Maximum work output
- B. Work output is more than zero but less than maximum
- C. Efficiency equal to Carnot Efficiency
- D. Zero work output

The correct statements from the above options are

C and D

Question No. 13

A power producing device is supplied with 'Q' kJ of heat from a reservoir at T_1 and produces 'W' kJ of work, when operating between temperature limits of T_0 and T_1 (where $T_1 > T_0$), the second law efficiency of this device is given by the expression :

$$\frac{W}{Q \left(1 - \frac{T_0}{T_1}\right)}$$

Question No. 14

m_1 kg of water at temperature T_1 is isobarically and adiabatically mixed with m_2 kg of water at temperature T_2 (where $T_2 > T_1$). The entropy change of the universe is:

Necessarily positive

Question No. 15

A thermal energy reservoir at 1200 K supplies 500 kJ heat to a reversible heat engine E_1 . Engine E_1 rejects heat Q_2 to a reversible heat engine E_2 at temperature T_2 . The engine E_2 rejects heat to a thermal energy reservoir at temperature 300 K. If the efficiency of both the engines is same, then the ratio of temperatures $T_1: T_2: T_3$ is

2: 1: 0.5

Question No. 16

For a steady flow process from state 1 to 2, enthalpy changes from $h_1 = 450$ kJ/kg to $h_2 = 120$ kJ/kg and entropy changes from $s_1 = 1.2$ kJ/kg K to $s_2 = 0.9$ kJ/kg K. The dead state temperature is 37 °C. The maximum work obtained in the process will be

237 kJ/kg

Question No. 17

Consider the following thermodynamic processes

- (A) Throttling process
- (B) Isentropic process
- (C) Isothermal process
- (D) Isopiestic process.

Which set of processes can be considered as irreversible?

A and B

Question No. 18

The pressure, temperature and specific volume of water at critical point are

221.2 bar, 374.15 °C, 0.00317 m³/kg

Question No. 19

A thermal energy reservoir at 800 K transfers 1000 kJ of heat to another thermal reservoir at 500 K. The ambient temperature is 27°C. The loss of available energy during the heat transfer is equal to

225 kJ

Question No. 20

Consider the following statements about the regenerator used in an ideal gas turbine cycle.

- A. The use of regenerator reduces heat rejected in the cycle.
- B. The use of regenerator increases heat supplied in the cycle.
- C. The use regenerator increases efficiency of the cycle up to a particular value of pressure ratio
- D. The use of regenerator increases work output.

Out of the above statements, the correct statements are

A and C

Question No. 21

The major exergy destruction in a Rankine cycle takes place in

Steam Generator

Question No. 22

Which of the following non dimensional numbers represents the ratio of thermal and velocity boundary layers

Prandtl number

Question No. 23

Heat is conducted through a 10 cm thick wall at the rate of 30 W/m² when the temperature difference across the wall is 12°C. The thermal conductivity of the wall material is

0.25 W/mK

Question No. 24

A 10 cm thick plane wall ($k = 15 \text{ W/mK}$) generates heat at the rate of 40 kW/m³ when an electric current is passed through it. The wall surface temperature is 60 °C. The maximum temperature at the center of the wall will be

63.33 °C

Question No. 25

For steady one dimensional heat transfer through a plate of thickness L, there can be various type of boundary conditions. The insulated boundary condition is given by

$$-k \frac{dT}{dx} = 0$$

Question No. 26

For a hollow cylinder, inside and outside radii, areas and heat transfer coefficients are r_i, h_i and r_o, h_o respectively. Thermal conductivity of the cylinder material is k . The overall heat transfer coefficient based on inside area of cylinder is given by the expression

$$\frac{1}{\frac{1}{h_i} + \frac{r_i}{k} \ln \frac{r_o}{r_i} + \frac{A_i}{h_o A_o}}$$

Question No. 27

In an infinite long fin if the parameter $m = \sqrt{\frac{hP}{kA}}$ increases, other parameters being maintained constant, then

The temperature drop along the length will be steeper

5For fully developed laminar flow in a circular tube with constant surface heat flux, the Nusselt number based on diameter is equal to

4.364

Question No. 29

Colburn analogy for turbulent flow in a tube is given by the following expression (St = Stanton Number, Pr = Prandtl number, C_{fx} = local skin friction coefficient and f = friction factor)

$$\text{St.Pr}^{2/3} = f / 8$$

Question No. 30

The equivalent diameter (hydraulic diameter) for flow through annulus between two concentric cylinders of diameters d and $2d$ is

d

Question No. 31

An enclosure consists of four surfaces 1, 2, 3 and 4. The view factors for radiation heat transfer (where the subscripts refer to the respective surfaces) are $F_{11}=0.1$, $F_{12} = 0.4$ and $F_{13}= 0.25$. The surface areas A_1 and A_4 are 4m^2 and 2m^2 respectively. The view factor F_{41} is

0.50

Question No. 32

Consider the following statements about Wein's displacement law

- A. Maximum spectral emissive power is displaced to longer wavelengths with increasing temperature.
- B. Maximum spectral emissive power increases with decrease of temperature

- C. Maximum spectral emissive power is displaced to shorter wavelengths with increasing temperature
- D. Maximum spectral emissive power decreases with decrease of temperature

The statements which are correct are

C and D

Question No. 33

For a convex surface 'i', the value of *shape factor*, F_{ii} is

0

Question No. 34

In a counter flow heat exchanger the hot and cold fluids enter at T_1 and T_2 respectively whereas cold fluid leaves at T_3 and hot fluid leaves at T_4 , then LMTD is given by

$$\frac{(T_1 - T_3) - (T_4 - T_2)}{\ln \frac{(T_1 - T_3)}{(T_4 - T_2)}}$$

Question No. 35

in condensation over a vertical surface, the convection coefficient varies with the thermal conductivity of liquid (k), as

$k^{0.75}$

Question No. 36

A fin will be effective only when Biot number is

Less than one

Question No. 37

For a temperature excess value of about 50 °C, the following regime of pool boiling is observed

Nucleate boiling

Question No. 38 Typical values of convective heat transfer coefficient for boiling and condensation lie in the range of

2500 to 100000 W/m²K

Question No. 39

For flow over a flat plate the hydrodynamic boundary layer thickness is 0.5 mm. The dynamic viscosity is 25×10^{-6} Pas, specific heat is 2 kJ/kg K and thermal conductivity is 0.05 W/mK. The thermal boundary layer thickness would be

0.5 mm

Question No. 40

The device necessary to be installed in a refrigerating machine to make it work as a heat pump is

Four way valve

Question No. 41

The suction volume requirement per ton in m^3 / min is given by (q_e is specific refrigerating effect in kJ / kg , v_1 is specific volume at entry to compressor)

$$\frac{211}{q_e} v_1$$

Question No. 42

The specific enthalpies at entry and exit of compressor are 515 kJ/kg and 530 kJ/kg respectively, 525 kJ/kg and 450 kJ/kg at entry and exit respectively of condenser. The COP of the Vapour compression cycle is

4.33

Question No. 43

An azeotropic refrigerant

Behaves as a pure refrigerant

Question No. 44 Consider the following statements

- A. Multistage compression is used when pressure ratio is greater than 4 or 5.
- B. Multistage compression results in reduction of compressor work
- C. Multistage compression results in higher refrigerating capacity
- D. Multistage compression results in lower volumetric efficiency of compressor

Out of the above mentioned statements, the correct statements are

A, B and C

Question No. 45

The optimum intermediate pressure in a compound compression refrigeration systems is (T_c is condenser temperature and T_e is evaporator temperature)

Geometric mean of condenser and evaporator temperatures $\times \sqrt{\frac{T_c}{T_e}}$

Question No. 46

One of the desirable thermodynamic requirements of refrigerant absorbent pair for an absorption system is boiling point requirement. According to this requirement, the minimum temperature difference between the boiling points of absorbent and refrigerant should be

200 °C

Question No. 47

The maximum COP of a Vapour absorption system is 0.5. The heat source and sink temperatures are 110°C and 55°C . The approximate refrigeration temperature is

-18°C

Question No. 48

The mass of water vapour in a sample of 2 kg of air is 0.15 kg . The specific humidity of air is

0.081 kg of w.v. / kg of d.a.

Question No. 49

Consider the following statements about heating and humidification psychrometric process

- A. Enthalpy of air increases
- B. Specific humidity increases
- C. Relative humidity may increase
- D. Relative humidity may decrease

Out of the above statements, the correct statements are

A, B, C and D

Question No. 50

Two air streams are mixed adiabatically. First air stream is having DBT = t_1 and WBT = t'_1 and second stream is having DBT = t_2 and WBT = t'_2 , the final condition after mixing lies on

A vertical line joining the two states in the inverse ratio of their masses

Question No. 51

In sensible cooling process, the initial DBT and DPT of the air are t_1 and t_d respectively, temperature of the cooling coil (t_c) should be such that

$$t_1 > t_c > t_d$$

Question No. 52

Sol Air temperature (t_e) can be considered

equivalent outside air temperature such that the total heat transferred is the same as due to the combined effect of the incident solar radiation and outside air and wall temperature difference

Question No. 53 In connection with fluorescent tubes, it may be stated that the electric power absorbed at the fitting is about

25% more than necessary to produce the required lighting.

Question No. 54

ERSH (effective room sensible heat) is given by (notations : RSH is room sensible heat, OASH is outside air sensible heat and BPF is bypass factor)

$$\text{ERSH} = \text{RSH} + (\text{OASH}) (\text{BPF})$$

Question No. 55

A thermostatic valve maintains

Constant degree of superheat in the evaporator

Question No. 56

When using a liquid line suction line heat exchanger,

Change in COP depends on refrigerant used

Question No. 57

The cooling capacity of a household refrigerator (165 ltr) is approximately equal to

90 W

Question No. 58

The maximum velocity of fluid (C_{max}) is given by (h and h_0 is are enthalpy and stagnation enthalpy of fluid)

$$C_{max} = \sqrt{2(h_0 - h)}$$

Question No. 59

In supersonic flow through a C-D nozzle, the density of the fluid

Decreases

Question No. 60

Euler equation is given by $\frac{1}{2}[(C_2^2 - C_1^2) + (U_2^2 - U_1^2) + (V_1^2 - V_2^2)]$ where C is absolute velocity of fluid at rotor, U is mean blade velocity and V is relative velocity. For an axial flow machine the following factor is zero.

$$(U_2^2 - U_1^2)$$

Question No. 61

Consider the following statements

- A. For backward curved vanes, Euler head remains constant and flow rate drops
- B. For forward curved vanes, Euler head increases with increase in flow rate
- C. For forward curved vanes, Euler head increases with decrease in flow rate
- D. For backward curved vanes, Euler head goes on falling with increase in flow rate

The correct statement/s is/are

B and D

Question No. 62

Non dimensional combination of different variables, represented by $\frac{E/\rho}{N^2 D^2}$ is known as (E = elastic constant, ρ = density, N is rpm and D is diameter)

Mach number

Question No. 63

If net positive suction head (NPSH) requirement for the pump is not satisfied, then

Cavitation will take place

Question No. 64

To prevent the jet from striking the back of the following bucket in a Pelton wheel, the speed ratio is usually kept

0.46

Question No. 65

Muschel curve of a hydraulic turbine are basically

Constant efficiency characteristic curve

Question No. 66

The small stage efficiency for an expansion process in a turbine is given by (γ = ratio of specific heats, n = polytropic index of expansion)

$$\frac{(n-1)}{n} \frac{\gamma}{(\gamma-1)}$$

Question No. 67

The flow through a cascade can be considered as incompressible when

Mach number is below 0.3

Question No. 68

In the compressor cascades, the various losses are

Profile losses $\approx 40\%$, Secondary losses $\approx 40\%$ and annulus loss $\approx 20\%$

Question No. 69

In a multistage velocity compounded impulse turbine with n stages, the optimum value of blade speed ratio is given by ($\alpha =$ Nozzle angle)

$$\frac{1}{2n} \sin \alpha$$

Question No. 70

Consider the following statements about cooling of turbine blades

- A. Internal cooling of blades can be achieved by passing cooling air from air compressor through internal cooling passages from hub to the blade tips.
- B. Internal cooling of blades can be achieved by passing cooling air from air compressor through internal cooling passages from blade tips to the hub.
- C. In external cooling, the cooling air enters the internal passages from the hub towards the tips. On its way upwards it is allowed to flow over the blade surface through a number of small orifices.

The correct statements are

A and C

Question No. 71 Specific speed of a hydraulic turbine is (H is head)

Indirectly proportional to $H^{5/4}$

Question No. 72 A turbine develops 9000 kW when running at 100 rpm at 64 m head. If the head is reduced to 16 m, then the speed of the turbine will be

50

Question No. 73

Following points relates to Surging in a compressor

Complete breakdown of the steady flow through compressor

Question No. 74

Stagnation temperature in a diffuser at exit

Is equal to the inlet stagnation temperature

Question No. 75

The total to total efficiency of a turbine is ratio of (Δh is enthalpy drop, Δh_o is stagnation enthalpy, subscript 's' and 'a' stand for isentropic and actual respectively)

$$\frac{\Delta h_{o,a}}{\Delta h_{o,s}}$$

Q76. In reverse engineering process, what refers to the sophistication of the design information that can be extracted from the source code?

Abstraction level

Q77. Forward engineering is also known as-

Both renovation and reclamation

Q78. What is the expansion of CASE tools?

Computer Aided Software Engineering

Q79. Which of the following is not an element of CAD/CAM package?

Computer aided Testing.

Q80. NC contouring is an example of

Continuous path positioning

Q81. Which of the following is not an analytical entity?

Spline

Q82. For generating coons patch we require?

Four bounding curves defining surface.

Q83. Which of the following is not true of computer numerically controlled (CNC) machines?

They can learn from process errors.

Q84. Which of the following is a flying robot?

NETRA

Q85. A 'block' of information in N.C.machine program means

One complete instruction

Q86. What is the purpose of satellite computers in Distributed Numerical Control machines?

To serve a group of NC machines

Q87. Which is not a commercially available CAM Tools?

MaxCAM

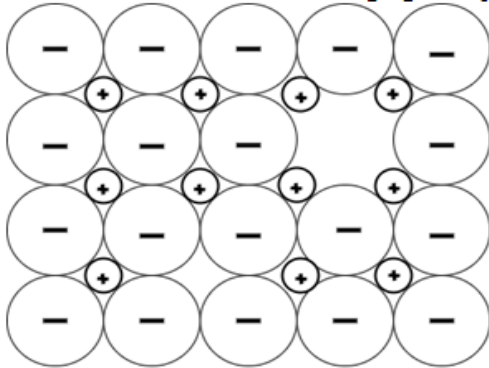
Q88. How many grams are there in one amu of a material?

1.66 x 10⁻²⁴ g/amu

Q89. Copper has, 0.128 nm- atomic radius, FCC-crystal structure, and 63.5 g/mol-atomic weight. Compute its theoretical density?

8.89 g/cm³

Q90. Which defect does the following figure depict?



Schottky defect

Q91. Durometers are used to measure?

Hardness of non-metallic materials like plastics

Q92. In a Jominy end-quench test of the eutectoid plain-carbon steel, which of the following represents the sequence of microstructures observed from the quenched end of the specimen?

Martensite, Martensite and Pearlite, Fine Pearlite, Coarse Pearlite

Q93. Thermosetting plastics in general?

have no long range crystalline lattice structure

Q94. Consider the following statements in a binary phase diagram:

[a] Freezing point of the alloy is minimum.

[b] Eutectic mixture solidifies at a constant temperature like pure metal.

[c] Eutectic reaction is irreversible.

[d] At eutectic temperature, liquids of two metals will change into two solids

Which of the above statements are correct?

a , b and d only

Q95. Consider the following statements regarding material:

[A] In micro structure external forms of the crystal may reflect the internal symmetry of atom.

[B] Electronic structure is arrangement of electrons in different orbit of atom.

[C] Nuclear structure can be studied by Mossbauer studies.

Which of these statements are correct?

A, B and C

Q96. Fe-C alloy containing less than 0.83% carbon is called

- hypo-eutectoid steel**
- Q97. Austempering is employed to obtain:
100% bainitic structure
- Q98. For improving the strength of steel at elevated temperatures, which one of the following alloying element is used?
Tungsten
- Q99. Which is the purest form of Iron?
Wrought Iron
- Q100. The crystal structure of austenite is
face centered cubic
- Q101. The coordination number for FCC crystal structure is
12
- Q102. A shell of 100 mm diameter and 100 mm height with the corner radius of 0.4 mm is to be produced by cup drawing. The required blank diameter is-
224 mm
- Q103. Which statement is true for E.D.M.
A.M.R.R increases with decreasing resistance
B.M.R.R increases with decreasing capacitance
C. M.R.R increases till optimum spark gap then decreases with increasing spark gap.
Select the correct answer using the codes given below.
A and C
- Q104. The stick-slip motion is found to occur in machine tools slides under certain conditions which are-
At very low feed rates and when there is small difference between the coefficients of static and dynamic friction at the slider and guide way interfaces.
- Q105. Consider the correct sequence of following steps involved in hammer forging a connecting rod from barstock:
a. Blocking
b. Trimming
c. Finishing
d. Fullering
e. Edging
deacb
- Q106. In an interference fit between a shaft and a hub, the state of stress in the shaft due to interference fit is
a compressive tangential stress and a compressive radial stress
- Q107. Assertion (A): Straight polarity is always recommended for Carbon-Electrode Welding.
Reason (R): Carbon arc is stable in straight polarity.
1. **Both A and R are individually true but R is NOT the correct explanation of A**

108. Which of the following factors affect the

mechanical properties of a material under applied loads?

Shape of material

109. The material property which depends only on the basic crystal structure is

Fracture strength

110. By adding chromium to steel which of the following property is enhanced?

Resistance to corrosion

111. Which of the following alloy is used for making castings of firearm chamber?

Wood's metal

112 Rate of solid-state diffusion does not depend on which of the following?

Gravity

113. What is the shape of the graph for steady state diffusion where the concentration of diffusion species is in the y-axis and position is in x-axis?

Straight line

114. Which type of microscopic technique has been developed that generate topographical maps representing the surface features and characteristics of the specimen?

Scanning probe

115. In which of the following Bravais lattices, not all axial angles are right angles?

Rhombohedral

116 Which of the following statements are correct concerning the use of antithetic variates as part of a Monte Carlo experiment?

- (i) Antithetic variates work by reducing the number of replications required to cover the whole probability space
- (ii) Antithetic variates involve employing a similar variable to that used in the simulation, but whose properties are known analytically
- (iii) Antithetic variates involve using the negative of each of the random draws and repeating the experiment using those values as the draws
- iv. Antithetic variates involve taking one over each of the random draws and repeating the experiment using those values as the draws

(i) and (iii) only

117 Monte Carlo simulation ensures that:

The simulated probability distribution will be the same as the actual probability distribution

118. State model representation is possible
All of the above

119. Implicit functions are those functions

Which cannot be solved for a single variable

- 120 In a certain factory, 80% of the parts fabricated conform to the norms. Every part fabricated in this factory is subjected to three independent quality control operations. We suppose that each of these operations classifies as non-defective 95% of the parts that effectively conform to the norms, and 10% of the parts that are in fact defective. The probability that a part that has been sold conforms to the norms:

0.9997

- 121 A product is made-to-stock. Annual demand is 60,000 units. Each unit costs \$4.00 and the annual holding cost rate = 25%. Setup cost to produce this product is \$300. Total inventory costs for this situation is:

\$6000

- 122 Four basic characteristics of an optimal process are:

Economy, efficiency, productivity, quality

- 123 Fifty observations of a production operation revealed a mean cycletime of 10 min. The worker was evaluated to be performing at 90% efficiency. Assuming the allowances to be 10% of, the normal time, the standard time (in seconds) for the job is:

9.9

- 124 A stopwatch time study on an operator with a performance rating of 120 yielded a time of 2 min. If allowances of 10% of the total available time are to be given, the standard time of the operation is:

2.64 min

- 125 A manufacturing shop processes sheet metal jobs, wherein each job must passthrough two machines (M₁ and M₂, in that order). The processing time (in hours)

Machine	Jobs					
	P	Q	R	S	T	U
M1	15	32	8	27	11	16
M2	6	19	13	20	14	7

for these jobs is:

The optimal make-span (in hours) of the shop is:

115

- 126 The current date in the production calendar of the XYZ Company is day 15. There are three orders (A, B, and C) to be processed at a particular work center. The orders arrived in the sequence A-B-C at the work center. The following table indicates the remaining process time and production calendar due date for each order:

Order Remaining	process time	Due date
A	5 days	Day 25
B	16 days	Day 34
C	7 days	Day 24

The sequence of the orders that would be scheduled using critical ratio:

B - C - A

- 127 Quality control chart for averages was maintained for a dimension of the product. After the control was established, it was found that the standard deviation (σ) of the process was 1.00 mm. The dimension of the part is 70 ± 2.5 mm. Parts above 72.5 mm can be reworked but parts below 67.5 mm have to be scrapped. What should be the setting of the process to ensure production of no scrap and to minimize the rework?

70.5 mm

- 128 In a weaving operation, the parameter to be controlled is the number of defects per 10 square yards of material. Control chart appropriate for this task is:

C-chart

- 129 In an MRP system, component demand is

calculated by the MRP system from the master production schedule

- 130 Given the data 63, 64, 66, 67, 67, 69, 71, 72.

Forecast for the ninth period using linear regression:

73.11

- 131 Regarding supply chain which statement is correct?

Information and money flow in one direction and the goods flow in the other direction.

132. The distance between the two parallel shafts connected by Oldham's coupling is 25mm. If the speed of the driving shaft is 60rpm then the maximum speed of sliding of the tongue of intermediate piece will be:

$$\underline{50\pi}$$

133. The crank and slotted lever quick return motion mechanism used in a shaping machine is

an inversion of the single slider-crank chain.

134. The profile of a cam in a particular zone is given by $x=\sqrt{3}\cos\theta$ and $y=\sin\theta$. The normal to the cam profile with respect to x axis at $\theta=45^\circ$ is at an angle

$$\underline{\pi/3}$$

135. In a single cylinder IC engine with effective reciprocating mass of 1kg, has a crank length of 60mm and a connecting rod length of 180mm. If the flywheel rotates at 600rpm then the magnitude of maximum secondary force developed by the engine is

$$\underline{8\pi^2 N}$$

136 For circular arc cam with flat footed follower in contact with the flank, the acceleration of the follower is given by (where notations have their usual meanings)

$$\underline{\omega^2(R-r)\cos\theta}$$

137. A leather belt of mass 1.0 g/cm^2 has a maximum permissible tensile stress is 20bar. If the cross section of the belt is 250mmX10mm then for maximum power transmission, theoretical centrifugal tension in the belt is given by:

$$\underline{5000/3 N}$$

138. A prime mover running at 300rpm drives a DC generator at 600 rpm by a flatbelt drive. Diameter of pulley on the output shaft of the prime mover is 600mm with a slip of 4%. If the thickness of the belt is 6mm then the diameter of the generator pulley is approximately

$$\underline{285\text{mm}}$$

139 In a chain drive, each link subtends at an angle of 45° at the centre of the sprocket. If pitch is 20mm and sprocket speed is 120rpm then average speed of the chain is equal to

$$\underline{0.32 \text{ m/s}}$$

140. Minimum number of teeth for rack and pinion arrangement with involute profile and pressure angle of 20° is

$$\underline{17}$$

141. In Scott-Russel mechanism for generating straight line which of the following statements is correct:

The mechanism have two lower kinematic turning pairs and have one lower kinematic sliding pairs

142. For a cam and follower arrangement with follower moving with uniform velocity, the acceleration in the follower at the time it starts lifting is

Infinite.

143. A pair of spiral gears is designed to connect two non-intersecting and non-parallel shafts at an angle of 75° , if the spiral angle for the driver gear is 45° and normal reaction at point of contact is 1000N then the magnitude of axial thrust on the shaft of driven gear is

500

144. A solid shaft is designed in simple bending and torsion in such a way that its bending moment is equal to its torsional moment then the bending stress developed in the shaft will be:

2 x the torsional shear stress

145. The state of stress at a point in a component is given by three principal stresses $(\sigma, 0, 0)$. If the same component is subjected to a mean compressive stress of magnitude of $\sigma/3$ simultaneously then what is the maximum shear-stress in the component?

$\sigma/2$

146. In case of a close coil helical spring, the Wahl's correction factor for a minimum possible spring index is nearly

1.4

147. Consider a multiple disk clutch with 4 steel and 3 bronze disks and a cone clutch with a cone pitch angle of θ° , both operating at same speed, same mean diameter and same axial load. If the coefficient of friction is also same for both clutches then the ratio of torque capacity of disk clutch to torque capacity of cone clutch, considering uniform wear is given by

$6\sin\theta$

148. If a hydrodynamic bearing is subjected to large fluctuations of load with heavy impacts, then the bearing characteristic number should be

15 times the bearing modulus

149. If the velocity ratio for a chain drive, containing 60 number of teeth and chain pitch of 12.7mm, is unity then the pitch circle diameter of each sprocket is given by:

25.4mm

150. The diameter of a solid shaft with 100mm has the same cross sectional area and length as that of the hollow shaft of outside diameter as 200mm. If the material of both the shafts is same then the ratio of angle of twist of hollow shaft with that of the solid shaft is

0.5