COLLEGE OF ENGINEERING, PUNE
END SEMESTER EXAMINATION
(ME 305) - MANUFACTURING ENGINEERING-II

Program: - T.Y. B. Tech. | **Time: 3 Hours**
Branch: - Mechanical | **Max. Marks: 50**
Date: 20-11-11 | **Time: 2.00 to 5.00 p. m.**

Instructions to candidates:

1) *All questions are compulsory.*
2) *Neat Diagrams must be drawn wherever necessary.*
3) *Assume suitable data, if necessary.*
4) *Use of non-programmable electronic calculators is allowed.*

Q.1. **a.** Draw the Merchant circle diagram and label it properly. **2**

b. Prove that in ultrasonic machining of the brittle material the MRR for 100% efficiency is given as

$$MRR = 4.17\, D^{1/2}\, Y_o^{1/2}\, (\sigma/H)\, f$$

Where

D- Abrasive particle size
Y_o- Amplitude of vibration
f- Frequency of operation
σ- Stress in tool
H- Hardness of material

OR

b Derive an expression for material removal of an alloy using Faraday's Laws for ECM process and for an alloy steel of

40 Cr 2 Ni Al 1 Mo 18

find out the material removal rate with 1000 Amp current.
Given-

Element	Atomic Weight	Valency
Iron	55.85	2,3
Carbon	12.01	-4,4,2
Chromium	52	2,3,6
Aluminum	26.98	3
Molybdenum	95.94	3,5,6
Nickel	58.71	2,3

8

Q.2. **a.** With the help of neat diagram explain gear Hobbing as a method of manufacturing gears.

OR

a. What do you understand by the jigs and fixtures? Differentiate in between them. State the various types of jigs and fixtures. **3**

b. Prove in ECM die sinking process the machining gap is self regulated for a constant voltage application. **5**

c. What do you understand by absolute positioning and incremental positioning?

Q.3. a. The following observations are made during an orthogonal cutting operation 2

Tool rake angle-10°, co-efficient of friction-0.85, chip thickness ratio-0.6, chip thickness & width before cutting-1.5mm & 15mm and cutting speed- 40 m/min.

Calculate- shear angle, shearing force, friction angle and power consumed at the cutting.

OR

a. State the various functions of CNC. 4

b. Explain the mechanism of material removal by thermal theory in EDM. 6

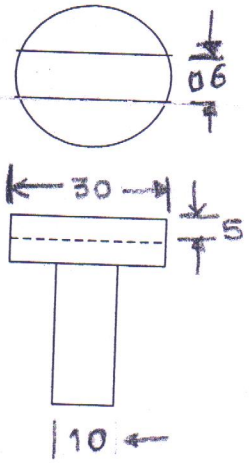
Q.4 a. With the help of suitable diagram explain NC motion control systems. State at least three possible applications of Numerical control. 5

b. Discuss the process to manufacture miniaturized gears for wristwatches.

OR

b With the help of neat figure explain 3-2-1 principle of location. Also explain what do you understand by redundant location and fool proofing with the help of neat figures. 5

Q.5. Design and draw the suitable milling fixture to mill the slot of 6 mm and 5 mm deep for the component as shown below. 10



Mechanical Engineering Department
College of Engineering, Pune
End –Semester Examination (2011-12)
B. Tech (5th Semester /Autumn)
ME302-Fluid Machinery and Fluid Power

Max Mark-50 Time -180 minutes

1. Question 1 is compulsory
2. Solve any three questions from Que 2,3,4,5
3. Assume suitable data whenever necessary
4. Accuracy and complete calculation and relevant theory are expected for scoring marks

Que-1(a)	Explain the concept of FRL unit of Pneumatic circuit	3
Que-1(b)	The diameters of the two parts of ram of differential accumulator are 150mm and 120mm and stroke length is 1.25 m. If the pressure of water is 7850 KN/m^2 when the load is at rest at the upper end of the stroke or when the load is moving with the uniform velocity, what will be weight of loaded cylinder? How much energy can be stored in accumulator? Find also the diameter of the ram of an ordinary accumulator to move the same load with the help of same water pressure	3
Que-1(c)	A hydraulic lift is required to lift a load of 60 Kn through a height of 12m once in every seconds if the speed of lift is 0.6m/s determine 1. Power required to drive the lift 2. Working period of lift 3. Ideal period of the lift	3
Que-1(d)	Differentiate between positive displacement pump and non positive displacement pump (minimum 6 relevant points)	3
Que-1(e)	Derive the expression for minimum starting speed of centrifugal pump	2
Que-2(a)	Explain with neat sketch of governing mechanism of pelton wheel turbine	5
Que-2(b)	A conical draft tube having inlet and outlet diameters 1.2 m and 1.8 m discharges water at outlet with velocity of 3 m/s. The total length of draft tube is 7.2 m and 1.44m of the length of draft tube is immersed in water. If the atmospheric pressure head is 10.3 m of water and loss of head due to friction in the draft tube is equal to (0.2x velocity of head at outlet of the tube), Determine: (i) Pressure head at inlet (ii) Efficiency of the draft tube	2+2
Que-2©	Differentiate between Francis turbine and Kaplan turbine (nine relevant points are expected)	3
Que-3(a)	Derive the expression for Eular momentum equation for centrifugal pump	3
Que-3(b)	A three stage centrifugal pump has impeller 400mm in diameter and 20 mm wide. The vane at outlet is 45^0 and the area occupied by the thickness of the vanes may be assured 8 percentage of total area. If the pump delivers 3.6 m3 of water per minute when running at 920 rpm Determine : 1. Manometric head 2. Power of pump 3. Specific speed	3+2+1
Que-3©	Explain, harmful effects of the cavitation in centrifugal pump and also	1.5+1.5

	illustrate factors which facilitate onset of cavitation	
Que-4(a)	**Explain the construction , working, efficiency and field application of jet pump**	**1+1+1+1**
Que-4(b)	**The ram and plunger of Hydraulic press are 250mm and 30mm respectively and the leverage of handle is 12.1. with plunger stroke of 250 mm the press is able to lift 180 kN through 1.25m in 2 minutes, Determine:** **1. Force applied at the end of lever** **2. Number of strokes to be performed by the plunger in one second and** **3. Power required to derive the plunger** **Take the packing friction of the plunger as well as ram as 5% of the load**	**2+1+1**
Que-4©	**What is step-less regulation? Explain how it can be obtained with torque converter**	**1+3**
Que 5(a)	**Explain the various features and working of balanced vane motor**	**3**
Que 5(b)	**Explain with suitable sketch Hydraulically operated grinding machine**	**5**
Que 5(c)	**Explain with neat sketch pilot operated check valve**	**4**

College of Engineering, Pune

End Semester Examination

Year – T.Y B.Tech (Mechanical) Timing: 3 hrs

Course – Theory of Machines II Max. Marks: 50

Important Instructions:

1. All questions are compulsory.
2. Figures to right indicate full marks
3. Answer should be precise and to the point.
4. Draw neat sketch/figures wherever necessary to support the answer.

Q. 1 A. A four stroke engine has five identical cylinders in-line and spaced at equal intervals of 150 mm. The reciprocating parts per cylinder are 1.4 kg, the stroke is 100 mm and the connecting rods are 175 mm between the centers. The firing order is 1-4-5-3-2 at equal intervals and the engine speed is 600 rpm. Show that primary and secondary forces are balanced and find the maximum primary and secondary couples and the positions of the crank 1 when these occur. What is the total unbalanced couple at the instant when crank 1 has turned 10^0 From top dead center. 5

OR

Attached to a uniformly rotating shaft are four discs, A, B, C and D, spaced at equal intervals along the shaft, of mass 7.5 kg, 12.5 kg,7 kg and 6 kg respectively. The centers of mass of the discs are at 4mm, 3mm, 5mm and 8mm respectively from the axis of rotation. An additional mass **M** may be attached to **D** at an effective radius of 60mm from the axis of rotation. Find the minimum value of the mass of M, and the relative angular positions of the centers of mass of all the masses to ensure complete dynamic balance for the rotating shaft.

B Explain in detail with neat diagram Static and Dynamic Balancing. 5

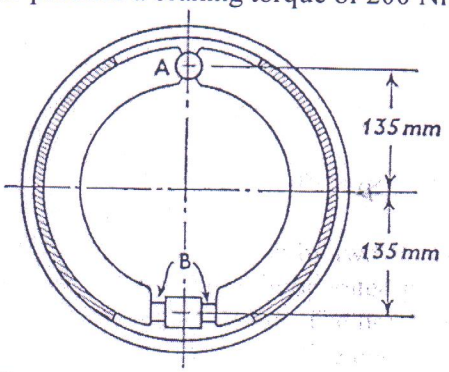
Q.2 A Construct a cam profile consists of two circular arcs, of 24 mm and 12 mm, joined by straight lines, giving the follower a lift of 12 mm. The follower is a roller of 24 mm radius and its line of action is a straight line passing through the camshaft axis. When the camshaft has a uniform speed of 500 rev/min, find the maximum value of the velocity and acceleration of the follower while in contact with straight side of the cam 5

B A pulley 350 mm diameter running at 1700 rpm transmits 20 kW to an elastic belt driving a similar pulley. Find the required width of belt and the uniform tension when stationary if the maximum total tension under load is 17.5 kN/m width. $e^{\mu\theta}=2$ and mass of the belt is 7 kg/m of width per meter of length. If the belt is 5 mm thick and E = 300MN/m^2, find also the frictional loss of speed of driven pulley 5

Q. 3 A. A four wheeled motor car of mass 2000 kg has a wheel base 2.5 m, track width 1.5m and height of center of gravity 500mm above the ground level. The center of gravity lies at 1m from the front axis. Each wheel has effective diameter of 0.8m and moment of inertia of 0.8 kg-m^2. The engine axis is at right angles to the wheel axes. The drive shaft, engine flywheel and transmission are rotating at 4 times the speed of road wheel, in clockwise direction when viewed from front and is equivalent to a mass of 75 kg having a radius of gyration of 100 mm. If the car is taking a left turn of 60 m radius at 60km/h, find load on each wheel. 5

B. What is gyroscopic effect? Discuss the gyroscopic effect on ship 5

Q. 4 A Fig shows a brake drum 350mm diameter, acted on by two brake shoes which are mounted on a pin A, and pushed apart by two hydraulically operated pistons at B, which exerting a force of P N on the shoe on which it makes contact. The brake lining on each shoe extends 60^0 above and 60^0 below the horizontal center line. The coefficient of friction is 0.25. The radial pressure between the lining and the drum is proportional to the rate of wear of the lining. Find the value of P to produce a braking torque of 200 Nm. 5

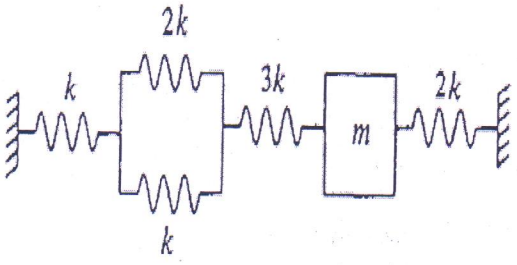


B Classify brakes with neat diagrams and derive an expression of tension ratio for band and block brake. 5

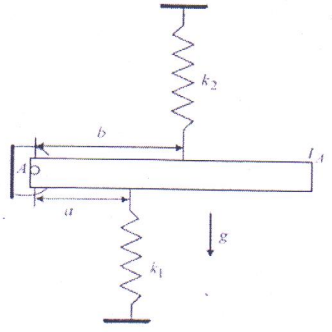
OR

A motor drives a machine through a friction clutch which slips when the torque on it reaches 40 Nm. The moment of inertia of the motor armature is 1.6 kg-m^2 and that of the rotating part of machine is 3.0 kg-m^2. The torque developed by the motor is 27 Nm assumed constant at all speeds and when the clutch is engaged the steady speed of motor and machine is 500rpm.At a given instant the clutch is disengaged and remains so for 4 s and then it is re-engaged. Find the time of slipping after re-engagement and determine how much energy is lost during slipping.

Q. 5 A. Calculate the natural frequency of given system 5



B. Determine the natural frequency of the given system 5



College of Engineering, Pune
(T.Y.B. Tech.)- (MECHANICAL)
(ME-301)- (Machine Design-I)

Date-26/11/2011
Academic Year: 2011- 12

Timing: 3 hrs
Max. Marks: 50

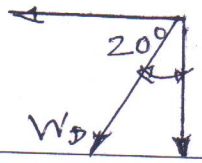
END SEM EXAM (AUTUMN)

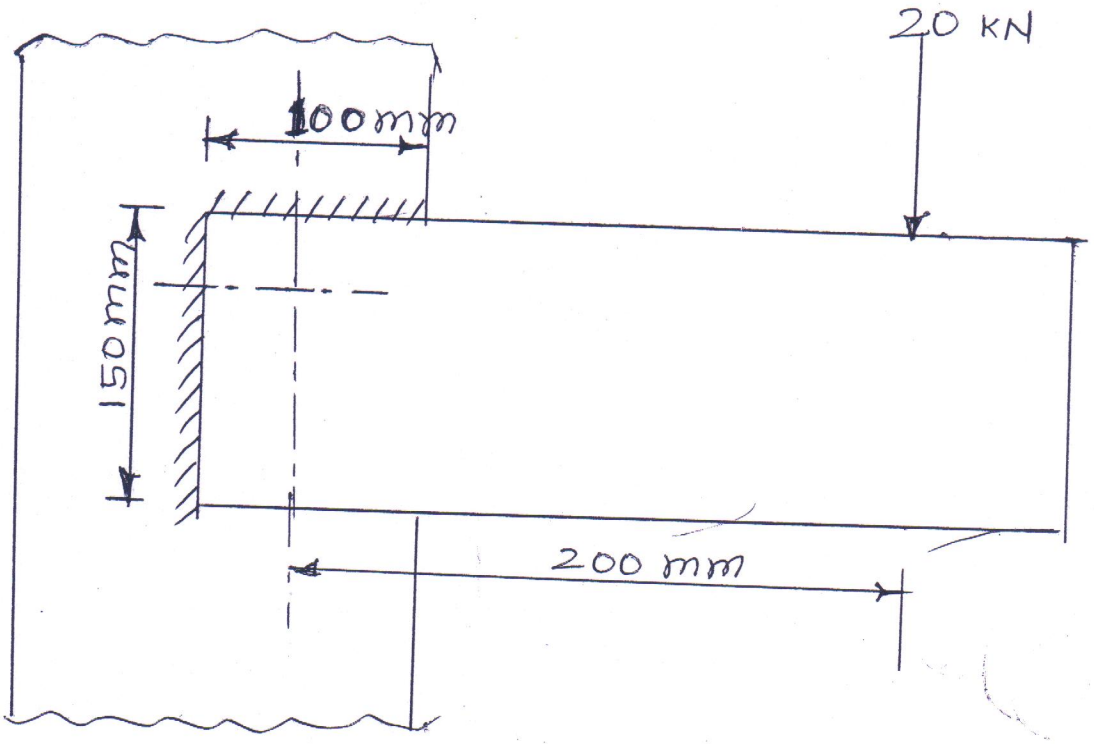
Instructions:

1. **Question 1 is compulsory.**
2. **Answer any five question from Q2 to Q7**
3. **Assume suitable data if necessary.**
4. **Figures to the right indicate full marks.**
5. **Use of only non-programmable calculator is allowed.**

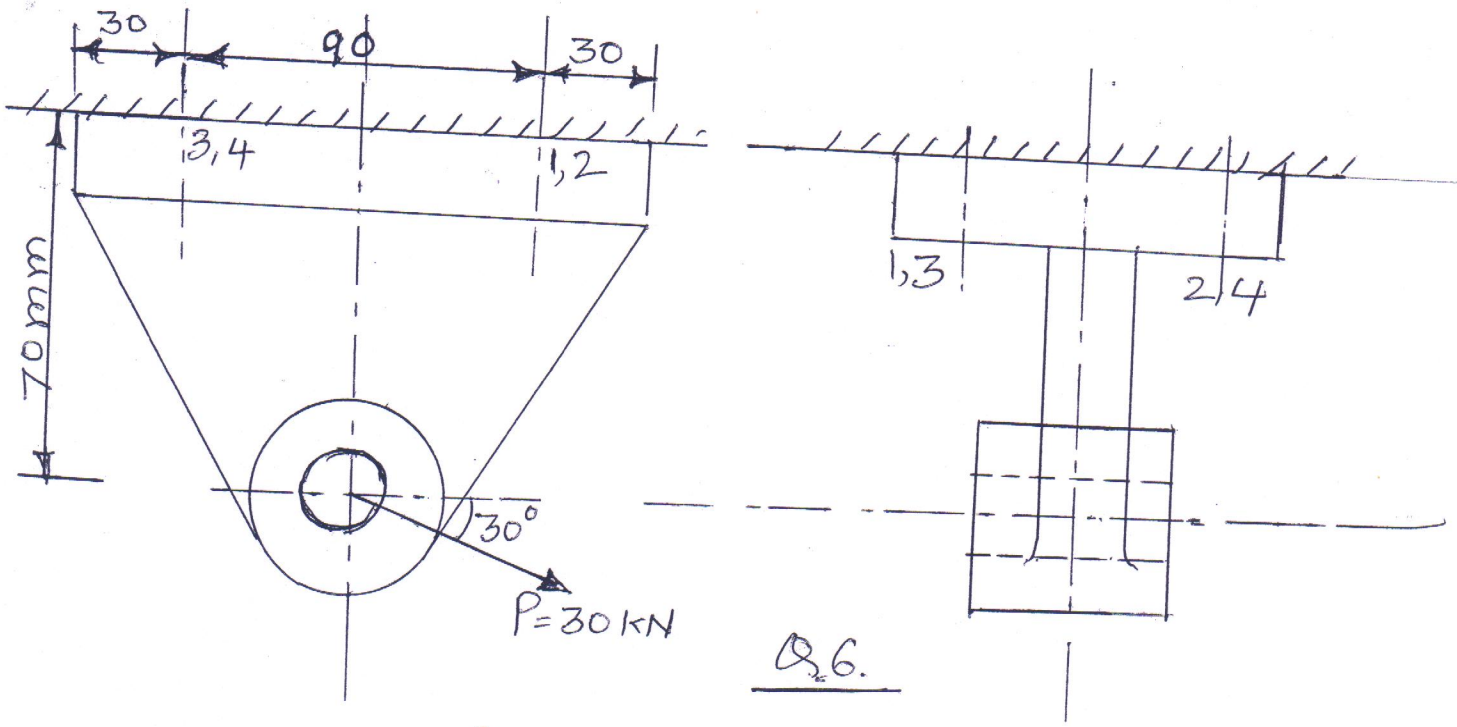
Q.1		Answer any five.	
	A.	Prove that in a spring, using two concentric coil springs made of same material, having same length and compressed equally, by an axial load, the load shared by two spring are directly proportional to the square of the diameters of the wires of the two springs.	**03**
	B.	What a nipping in a leaf spring? Discuss its role. List the material commonly used for manufacture of the leaf springs.	**03**
	C.	Draw toggle jack and explain its working in short.	**03**
	D.	Derive the equation for maximum efficiency of a square threaded screw.	**03**
	E.	Explain ASME code for shaft design.	**03**
	F.	Derive the equation for length of weld in axially loaded unsymmetrical welded sections.	**03**
	G.	Design a muff coupling to connect two mild steel shafts to transmit 35 kW at 1440 r.p.m. The cast iron sleeve connects the shaft through two mild steel sunk keys. The maximum torque transmitted is 25% greater than mean torque. Material properties are: Allowable shear stress for mild steel – 65 N/mm^2. Allowable shear stress for cast iron – 15 N/mm^2. Allowable crushing stress for mild steel – 120 N/mm^2. Assume additional data if required.	**03**
	H.	Explain any two theories of failure, its mathematical expressions and the type of material for which it is used.	**03**

Q. 2	A concentric spring for an aircraft engine valve is to exert a maximum force of 5000 N under an axial deflection of 40 mm. Both the spring have same free length, same solid length and are subjected to equal maximum shear stress of 850 MPa. If the spring index for both the springs is 6, find a. the load shared by each spring , b. the main dimensions of both the spring , c. the number of active coils in each spring . Assume G= 80 kN/mm^2 and diametral clearance to be equal to the difference between the wire diameters.	**07**
Q. 3	A screw jack is to lift a load of 80 kN through a height of 400 mm.The elastic strength of screw material in tension and compression is 200 MPa and in shear is 120 MPa. The material for nut is phosphor-bronze for which elastic limit may be taken as 100 MPa in tension, 90 MPa in compression and 80 MPa in shear. The bearing pressure between the nut and screw is not to exceed 18 N/mm^2. Design and draw the screw jack. Assume factor of safety two.The design includes, design of 1.screw 2. nut 3. handle 4. cup 5. Body	**07**
Q. 4	A solid steel shaft is supported on two bearings 1.8 m apart and rotates at 250 r.p.m. A 20^0 involute gear D, 300 mm diameter is key to the shaft at a distance of 150 mm to the left on the right hand bearing. Two pulleys B and C are located on the shaft at a distance of 600 mm and 1350 mm respectively to the right of the left hand bearing. The diameters of the pulleys B and C are 750 mm and 600 mm respectively. 30 kW is supplied to the gear, out of which 18.75 kW is taken off at the pulley C and 11.25 kW from pulley B. The drive from B is vertically downward while from C the drive is downward at an angle 60^0 to the horizontal towards left. In both cases the belt tension ratio is 2 and angle of lap is 180^0 . The combined fatigue and shock factor for torsion and bending may be taken as 1.5 and 2 respectively. Design a suitable shaft taking working stress to be 42 MPa in shear and 84 MPa in tension. The normal load on gear D acts at 20^0 to the vertical and is given by $W_D = F_{tD} / \cos 20^0$ where $F_{tD} = T_D / R_D$	**07**

	F_{tD} -Tangential force acting on gear D T_D -Torque transmitted by gear D R_D - Radius for gear D 	
Q 5	Figure shows a welded joint subjected to an eccentric load of 20 kN. The welding is only on one side. Determine the uniform size of weld on the entire length of two legs. Take the permissible shear stress for weld material 80 MPa.	**07**
Q 6	Figure shows a bracket of job crane. It is connected to the crane by using four bolts. The bracket carries a maximum pull of 30 kN as shown. Calculate the size of bolt required to fix the bracket. Assume permissible tensile stress for the bolt material as 70 MPa.	**07**
Q 7.	Write the design procedure with the help of diagrams and failure equations for any one joint from the following. a. Knuckle joint b. Cotter joint c. Turn buckle	**07**



Q-5



Q.6.

Number of Questions 6 (Six)

ME 312 ESE HT 1112

COLLEGE OF ENGINEERING, PUNE

2011-2012

End Semester Examination (Autumn)

ME-312: Heat Transfer

Programme: T.Y. B. Tech | Branch: Mechanical

Duration: 3.00 Hrs | Date: 28/11/2011 | Max. Marks: 50

Instructions: **1. Solve any FIVE questions.** 2. Illustrate your answer with neat sketches wherever necessary. 3. Assume suitable standard data, if necessary. 4. Figures to the right indicate full marks. 5. Use of non-programmable electronic calculator, steam table and heat transfer data book is permitted.

Q.1 a) Derive an expression for the temperature distribution for one dimensional steady state heat conduction in a slab (uniform k) with heat generation. Assume that the two walls are at different temperatures. **5**

b) A sphere of 10 mm diameter made of Tungsten Steel is initially at a temperature of 300 °C. It is suddenly exposed to a stream of air at a temperature of 30 °C. The surface convective heat transfer coefficient is 100 W/m^{2}K. Find the time required for the sphere to reach a temperature of 100 °C. Also calculate the instantaneous heat transfer rate after one minute from the start of the cooling process and the total heat transferred from the sphere in one minute. **5**

Assume for Tungsten Steel, $\rho = 7897\ kg/m^3$, $C = 0.452\ kJ/kgK$, $\alpha = 2.026 \times 10^{-5}\ m^2/s$ and $k = 73\ W/mK$.

Q.2 a) An electric wire of 1 mm diameter is covered with 2 mm thick layer of plastic insulation ($k=0.5\ W/mK$). Air surrounding the wire is at 25 °C and $h= 10\ W/m^2K$. The wire temperature is 100 °C, and it is not affected by the presence of insulation. Estimate the rate of heat dissipation from the wire per unit length with and without the insulation. Find the radius of insulation when the rate of heat dissipation is maximum. What is the maximum value of this heat dissipation?

b) The handle of ladle used for pouring molten lead at 327 °C is 30 cm long and is made of 2.5 x 1.5 cm mild steel bar stock (k = 40 W/m °C). In order to reduce the grip temperature, it is proposed to make a hollow handle of mild steel plate 1.5 mm thick of same rectangular shape. If surface heat transfer coefficient is 12. 5 W/m^2 °C and ambient air temperature is 27 °C, estimate the reduction in the grip temperature.

Neglect the heat transfer from inner surface of hollow shape.

Q. 3 a) Explain the concept of Critical radius of Insulation and Economic Insulation. Also explain why the overhead HT electric cables are un-insulated. **5**

b) Using general form of energy equation for an extended surface derive an expression for heat transfer in a triangular fin with constant cross section. **5**

Also explain why the triangular fins are truncated at the tip,

Q. 4 a) A vertical plate 300 mm wide and 1.2 m high is maintained at 70 °C and is exposed to saturated steam at 1 atm pressure. Calculate the heat transfer coefficient and total mass of steam condensed per hour. What would be the heat transfer coefficient if the plate is inclined at 30° to the vertical? **5**

b) Prove that **5**

$$\left(\frac{Q}{A}\right)_{\text{with N shields}} = \frac{1}{N+1}\left(\frac{Q}{A}\right)_{\text{without shield}}$$ where N is Number of Shields

Q. 5 a) (i) Explain with a neat sketch "Boundary Layer Growth for Flow along a curved surface. **3**

(ii) Explain with neat sketch "Thermal Boundary Layer Thickness" **2**

b) (i) Assuming the sun to radiate as a black body, calculate its surface temperature from **3**

the data given below:

Solar constant, i.e. average radiant heat flux incident on the earth's surface = 1380 W/m^2.

Radius of Sun = 7×10^8 m.

Distance between the Sun and the Earth = 15×10^{10} m.

(ii) Show that the emissive power of a black body is π-times the intensity of emitted radiation. 2

Q. 6 a) Two parallel plates 2m x 1m are spaced 1m apart. The plates are at temperatures of 727 °C and 227 °C and their emissivities are 0.3 and 0.5 respectively. The plates are located in a large room, the walls of which are at °C. Determine the rate of radiant heat loss from each plate and the heat gain by walls. Assume surroundings as black body. 5

b) Water (Cp=4.187 kJ/kgK) is heated at the rate of 1.4 kg/s from 40 °C to 70 °C by an oil (Cp=1.9 kJ/kgK) entering at 110 °C and leaving 60 °C. If U_o=350 W/m^2K, calculate the surface area required. Using the same entering fluid temperature and the same oi flow rate, calculate the exit temperatures of oil and water and the rate of heat transfer, when the water flow is reduced to 50 %. 5