B.E. (Metallurgy) Part - II 4th Semester Examination 2010 j ^ o . *Lf* . / c

General Mechanical Engineering - II
(ME-405)

Time: 3 hours Full Marks: 70

Use separate answer script for each half.
Answer SIX questions, taking THREE from each half
The questions are of equal value.

FIRST HALF

1. (a) What do you understand by 'tool signature'?

   (b) The signature of a single point turning tool is given as "(- 4°) - 8° - 6° - 6° - 30° - 45° - 1mm". Sketch the different views of the tool and show the tool angles.

   (c) Define 'cutting plane' and 'basic plane*. With reference to these planes define the first three angles of the above tool signature.

2. (a) Discuss the role of inclination angle ***(X)*** and cutting edge angle ((J)) in turning operation performed on lathe.

   (b) During cylindrical turning operation of a 38mm diameter shaft with a single point tool, having signature "0° - 8° - 6° - 6° - 20° - 60° - 1mm", the tool was by mistake fixed 0.73mm above the correct position. With necessary sketch show how the rake angle and clearance angle have changed. Calculate the effective rake angle and clearance angle.

   (c) What are the desirable properties of an ideal cutting fluid?

3. (a) With the help of necessary sketches describe the different type of chip formation in machining operation.

   (b) What do you understand by 'tool life*? State the Taylor's tool life equation.

   (c) Calculate the percentage change in cutting speed required to increase the tool life by 80%. Assume m = 0.2.

4. (a) Explain the terms 'chip reduction coefficient* and 'shear plane* in machining operation.

   (b) Derive the expression for shear angle (8) in machining operation.

   (c) During machining C-30 steel with a HSS tool having signature "0° - (-10°) - 6° - 6° - 20° - 60° - 1mm", the following parameters were obtained:
   Chip thickness = 0.39 mm, feed = 0.2 mm/ revolution.
   Find (i) chip reduction coefficient (4), (ii) shear angle (6) and (iii) shear strain (e).

5. (a) State the assumptions made by Merchant for his theory on machining forces.

   (b) Draw the Merchant's circle diagram and label the force components in orthogonal machining operation.

   (c) During orthogonal machining of mild steel, the following data were obtained: Cutting force (F_c) = 950 N, thrust force (**FT**) = 475 N, chip thickness (a_c) = 0.75 mm, uncut chip thickness (a) = 0.25 mm, cut width (w) = 2.5 mm, rake angle (y_o) = 0° . Find the coefficient of friction (u,) between chip and rake surface, and the shear stress in job material (t).

Second Half

(a) Write down the differences between a shaft and an axle

(b) Find the diameter of a solid shaft to transmit 20 kW at 300 r.p.m. The ultimate shear strength of the shaft material may be taken as 360 MPa and a factor of safety as 4. If a hollow shaft has to be used instead off the solid shaft, determine inside and outside diameter of the hollow shaft. Assume the ratio of inside to outside diameter of the hollow ' shaft is 0.5 and it is made of same material as the solid shaft.

(a) Write down the utilities of idler pulley (draw necessary diagrams).

(b) Explain the phenomena slip and creep in flat belt drive

(c) Drive an expression for the length of cross belt drive.

(a) A centrifugal blower is driven by an electric motor through a horizontal flat belt drive transmitting 15 kW power. The speed of the driving motor and driven pulley are 1750 and 600 respectively. Assume centre distance is twice the diameter of larger diameter pulley. **Ae** peripheral velocity of the belt is 20 m/s. The density of belt material is 1500 kg/m^3 and maximum allowable stress 4 MPa. The coefficient of friction between the motor pulley and the belt is 0.5 and between the blower pulley and belt is 0.4. Determine the following

(i) Pulley diameter

(ii) Length of the belt

(iii) Cross sectional area of the belt

; Design a bushed pin type of flexible coupling to connect a pump shaft to a motor shaft transmitting 28 kW at 960 r.p.m. The maximum torque is 25% more than mean torque. The material properties are as follows.

(i) The allowable shear and crushing stress for shaft and key material is 40 MPa and 80 MPa respectively.

(ii) The allowable shear stress for cast iron is 15 MPa.

(iii) The allowable bearing pressure for rubber bush is 0.8 N/mm^2.

(iv) The material of the key is same as that of the shaft and key.

(a) Define efficiency of rivet joint

(b)Design a double riveted butt joint with two cover plates for the longitudinal seam of a boiler shell 1.5 m in diameter and subjected to a steam pressure of 0.95 N/mm^2. Assume joint efficiency as 75%, allowable tensile stress in the plate 90 MPa, compressive stress 140 MPa and shear stress in the rivet 56 MPa.