15134

B. Tech 5th Semester Examination

Machine Design-I (OS)

ME-5002

Time : 3 Hours   **Max. Marks : 100**

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : (i)   Assume any data if necessary.

(ii) Attempt one question from each section A, B, C and D.

(iii) Section E is Compulsory.

SECTION - A

1. (a)   Explain the following Properties:

(i)   Elasticity   (ii)   Plasticity

(iii) Toughness   (iv)   Resilience

(v) Fatigue   (10)

(b)   How do you classify materials for engineering use? (5)

(c)   In the design of power screw, on what factors does the thread bearing pressure depend? Explain.   (5)

2. The recommended class of transition fit between the recess and the spigot of a rigid coupling is 60H6-J5. Assuming that the dimensions of the two components are normally distributed and that the specified tolerance is equal to the natural tolerance, determine the probability of interference fit between the two components.   (20)

SECTION - B

3. A double riveted lap joint is made between 15 mm thick plates. The rivet diameter and pitch are 25 mm and 75 mm respectively. If the ultimate stresses are 400 MPa in tension, 320 MPa in shear and 640 MPa in crushing, find the minimum force per pitch which will rupture the joint. If the above joint is subjected to a load such that factor of safety is 4, find out the actual stresses developed in the plates and the rivets.   (20)

4. A rectangular steel plate is welded as a cantilever to a vertical column and supports a single concentrated load P, as shown in Figure 1. Determine the weld size if shear stress in the same is not to exceed 140 MPa.   (20)
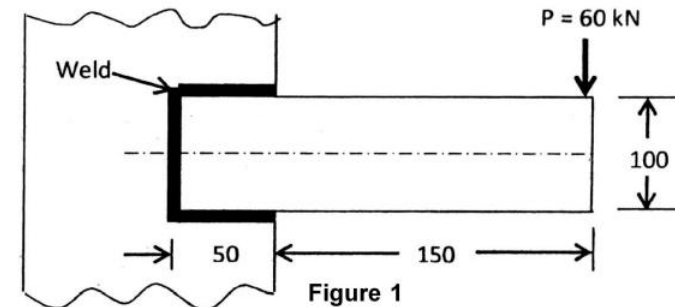

Figure 1

SECTION - C

5. It is required to design a chain drive to connect a 10 kW, 1440 rpm electric motor to a centrifugal pump running at 720 rpm. The service conditions involve moderate shocks.

(i)   Select a proper roller chain and give a list of its dimensions.

(ii) Determine the pitch circle diameters of driving and driven sprockets.

(iii) Determine the number of chain links.

(iv) Specify the correct centre distance between the axes of sprockets.   (20)

6. An otto cycle engine develops 50 kW at 150 rpm with 75 explosions per minute. The change of speed from the commencement to the end of power stroke must not exceed 0.5% of mean on either side. Design a suitable rim section having width four times the depth so that the hoop stress does not exceed 4 MPa. Assume that the flywheel stores 16/15 times the energy stored by the rim and that the work done during power stroke is 1.40 times of work done during the cycle. Density of rim material is 7200 kg/m^3. (20)

SECTION - D

7. An automobile vehicle weighting 13.5 kN is moving on level road at speed of 95 km/hr. when the brakes are applied, it is subjected to an uniform deceleration of 6 m/s^2. There are brakes on all four wheels. The tyre diameter is 750 mm. The kinetic energy of the rotating parts is 10% of the kinetic energy of the moving vehicle. The mass of each brake drum assembly is 10 kg and the specific heat capacity is 460 J/kg°C. Calculate:

(i) The braking time

(ii) The braking distance

(iii) The total energy absorbed by each brake

(iv) The torque capacity of each brake, and

(v) The temperature rise of brake drum assembly. (20)

8. (a) List the important factors upon which the capacity of a break depends. (5)

(b) What are the condition of self-locking in differential band brake? (5)

(c) What are the considerations in designing a friction clutch? (5)

(d) What are the materials used for lining of friction surfaces? (5)

[P.T.O.]

SECTION - E

9. Attempt the following question.

(i) What are fits and tolerances?

(ii) What do you understand by the single start and double start threads?

(iii) What are the applications of the cotter joint?

(iv) What is an eccentric loaded welded joint?

(v) What is the necessity of riveted joint?

(vi) What is the effect of keyway cut into the shaft?

(vii) What are the types of shaft coupling?

(viii) What is Kennedy key?

(ix) What do you understand by self-energizing brakes?

(x) Why a positive clutch is used? (2×10=20)