GUJARAT TECHNOLOGICAL UNIVERSITY
BE – SEMESTER – V(OLD)- EXAMINATION – WINTER 2017

Subject Code: 152503   **Date:08/11/17**
**Subject Name: Design of M/c Elements - I**
**Time:10:30 AM TO 01:00 PM**   **Total Marks: 70**
Instructions:
1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Define: **07**
Stress concentration, Fatigue Failure, Endurance limit, Size factor, Notch sensitivity, Surface finish factor.

(b) A cantilever beam of cold drawn steel 40C8 (S_{ut} = 600 N/mm^2 and S_{yt} = 380   **07**
N/mm^2) is shown in fig below. The force P acting at the free end varies from   -50 N to +150 N. the expected reliability is 90% and the factor of safety is 2. The notch sensitivity factor at the fillet is 0.9. Determine the diameter'd' of the beam at the fillet cross section.
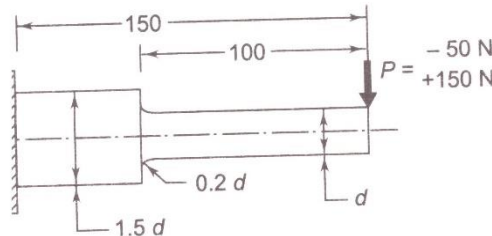
Q.2 **(a)** Explain: Single plate clutch, self locking block brake, Differential band brake   **07**

(b) The block type hand brake shown in fig. has a face width of 45 mm. The friction   **07**
Material permits a maximum pressure of 0.6 MPa and a coefficient of friction of 0.24. Determine;1. Effort F, 2. Maximum torque, 3. Heat generated if the speed of the drum is 100 rpm and the brake is applied for 5 sec. at full capacity to bring the shaft to stop.
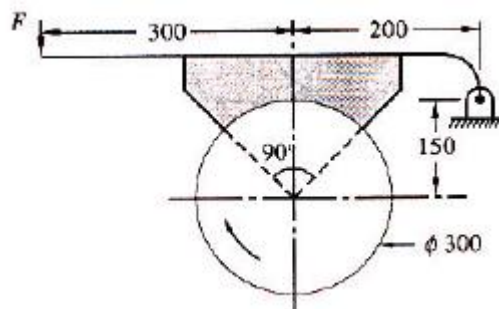
OR

(b) A single plate friction clutch of both sides effective has 300 mm outer diameter   **07**
and 160 mm inner diameter. The coefficient of friction o.2 and it runs at 1000 rpm. Find the power transmitted for uniform wear and uniform pressure distributions cases if allowable maximum pressure is 0.08 Mpa.

Q.3 **(a)** Explain function of flywheel along with the application. State why Flywheel are used in Presses? **07**

(b) It is required to select a V-Belt drive to connect a 15kW, 2880 rpm normal torque A.C. motor to a centrifugal pump, running at approximately 2400 rpm, for a service of 18 hours per day. The centre distance should be approximately 400 mm. Assume that the pitch diameter of the driving pulley is 125 mm. Take correction factor according to service Fa = 1.2, Correction factor for belt pitch length Fc = 0.87.Consider the cross section of V-belt is B. Pitch Length of belt is 1210 mm. Power Rating of Single V-belt Pr = 4.46kW. **07**

OR

Q.3 **(a)** Derive an expression of length of cross belt drive. **07**

(b) Explain the basic difference between the Function of Flywheel and Governor. **07**

Q.4 **(a)** Explain the design procedure of Piston rod. **07**

(b) A pair of spur gears with 20^0 full depth involute teeth consist of a 20 teeth pinion meshing with a 41 teeth gear. The module is 3 mm while the face width is 40 mm. The material for pinion as well as gear is steel with an ultimate tensile strength of 600 N/mm^2. The gears are heat treated to a surface hardness of 400 BHN. The pinion rotates at 1450 rpm and the service factor for the application is 1.75. Assume that velocity factor accounts for dynamic load and the factor of safety is 1.5

Determine the rated power that the gears can transmit. **07**

OR

Q.4 **(a)** Explain Johnson's formula for Columns. Describe the use of Johnson's formula and Euler's formula. **07**

(b) A helical compression spring made of circular wire is subjected to an axial force, which varies from 2.5 kN to 3.5 kN. Deflection is 5 mm. Spring index is 5. The spring has round and square ends. The spring is made from material having ultimate tensile strength of 1050 N/mm^2 and modulus of Rigidity 81370 N/mm^2. The permissible shear stress can be taken as 50% of ultimate tensile strength. Calculate: wire diameter, mean coil diameter, number of active coils, total number of coils, Solid and free length. **07**

Q.5 **(a)** Name the methods used to design thick cylinder to withstand internal pressure equal to or greater the allowable working stress.
Also show the stress distribution across the wall thickness due to shrinkage fitting and internal fluid pressure. **07**

(b) The piston rod of hydraulic cylinder exerts an operating force of 10 kN. The friction due to piston packing and stuffing box is equivalent to 10% of operating force. The pressure in the cylinder is 10 MPa. The cylinder is made of cast iron FG200 and factor of safety is 5. Determine the diameter and thickness of the cylinder. **07**

OR

Q.5 **(a)** Define: through bolt, machine bolt, automobile bolt, tap bolt, stud **07**

(b) Explain the terminology of Screw thread. **07**

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