

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-V- EXAMINATION – SUMMER 2016****Subject Code: 152503****Date: 09/05/2016****Subject Name: Design of M/c Elements - I****Time: 02:30 PM to 05:00 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) What do you mean by endurance strength of a material? How do the size and surface condition affect such strength? **07**
- (b) Define the following terms: **07**
- (i) Spring Rate, (ii) Free Length, (iii) Solid Length, (iv) Spring Index,
(v) Active and Inactive coil, (vi) Stress factor (vii) Nipping of Spring.
- Q.2** (a) A pair of parallel helical gears consists of a 20 teeth pinion meshing with a 100 teeth gear. The pinion rotates at 720 rpm. The normal pressure angle is 20°, while the helix angle 25°. The face width is 40 mm and the normal module is 4 mm. The pinion as well as the gear are made of steel 40C8 having ultimate tensile strength of 600 N/mm² and heat treated to a surface hardness of 300 BHN. The service factor and the factor of safety are 1.5 and 2 respectively. Assume that the velocity factor accounts for the dynamic load and calculate the power transmitting capacity of gears. **07**
- (b) Explain terms used in Bevel gear with neat sketch. **07**

OR

- (b) Derive an expression for Beam strength of the Spur gear. **07**
- Q.3** (a) Discuss stresses in a thin cylindrical shell due to internal pressure. **07**
- (b) Design a helical compression spring for maximum load of 1000 N for a deflection of 25 mm using the value of spring index as 5. The maximum permissible shear stress for spring wire is 420 MPa and modules of rigidity are 84 kN/mm². **07**

Take Wahl's factor, ,
$$K = \frac{4C - 1}{4C - 4} + \frac{0.615}{C}$$
 where C= Spring Index

OR

- Q.3** (a) Define the spring, Generally how they are classified? Indicate the different types of springs by sketches and give at least two practical applications of each. **07**
- (b) A cast iron cylinder of internal diameter 200 mm and thickness 50 mm is subjected to a pressure of 5 N/mm². Calculate the tangential and radial stresses at the inner, middle(radius= 125 mm) and outer surfaces. **07**
- Q.4** (a) A simple band brake operates on a drum of 600 mm in diameter that is running at 200 rpm. The coefficient of friction is 0.25. The brake band has a contact of 270°, one end is fastened to a fixed pin and the other end to the brake arm 125 mm from the fixed pin. The straight brake arm is 750 mm long and placed perpendicular to the diameter that bisects the angle of contact. **07**
- (a)What is the pull necessary on the end of the brake arm to stop the wheel if 35 KW is being absorbed?
- (b)What width of steel band of 2.5 mm thick is required for this brake if maximum tensile stress is not to exceed 50 MPa?
- (b) Write a design procedure for cast iron Pulleys. **07**

OR

- Q.4** (a) Write a design procedure of Flywheel. **07**
(b) A pulley of 0.9 m diameter revolving at 200 r.p.m. is to transmit 7.5 kW. find **07**
the width of a leather belt if the maximum tension is not to exceed 145 N in 10
mm width. The tension in the tight side is twice that in the slack side. Determine
the diameter of the shaft and the dimensions of the various parts of the pulley,
assuming it to have six arms. Maximum shear stress is not to exceed 63 MPa.
- Q.5** (a) Write a design procedure of Internal Expanding Brake. **07**
(b) Discuss design criterion for V-belt pulley. **07**
- OR**
- Q.5** (a) What is the difference between column and strut? What are the different types of end **07**
conditions based on Eulers' column theory? Define "slenderness ratio".
- (b) Torque requirement for Bolt tightening. **07**
