Seat No.: ____

Enrolment No.__

Date:19/11/2016

Total Marks: 70

14

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GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-V(New) • EXAMINATION - WINTER 2016

Subject Code:2152508

Subject Name: Design of Machine Elements

Time:10:30 AM to 01:00 PM

Instructions:

- 1. Attempt all questions.
- 2. Make suitable assumptions wherever necessary.
- 3. Figures to the right indicate full marks.

Q.1 Answer the following Short Questions

- **1** Explain endurance limit.
- 2 What information do you obtain from soderberg diagram?
- **3** Give characteristics of material for friction surfaces of clutch.
- 4 What are the materials used for brake linings.
- 5 What is self energizing brake?
- 6 Explain creep of belt.
- 7 Why the face of pulley is crowned?
- 8 Sketch the cross section of v-belt and label its important parts.
- 9 What is main function of a flywheel in an engine?
- **10** Define co efficient of fluctuation of speed.
- **11** What is function of a spring?
- 12 Explain spring index.
- 13 How do you distinguish between a thick and thin cylinder?
- **14** Draw stress distribution diagram of thick cylinder.
- **Q.2** (a) Define brake. Explain factors to be considered for brake design.
 - (b) Name different types of clutches. Explain principle of centrifugal04 clutch with neat sketch.
 - (c) A machine component is subjected to a flexural stress which fluctuates between + 300 MN/m^2 and -150 MN/m^2 . Determine the value of minimum ultimate strength according to 1. Gerber relation; 2. Modified Goodman relation; and 3. Soderberg relation. Take yield strength = 0.55 Ultimate strength; Endurance strength = 0.5 Ultimate strength; and factor of safety = 2.

OR

- (c) What is stress concentration? Explain methods of reducing stress 07 concentration. Q.3 Explain Band and Block brake. 03 (a) Explain types of belt drive. Discuss factors to be considered for **(b)** 04 selection of belt drive. (c) Explain design procedure of cast iron pulley. 07 OR Discuss the design of flywheel arms. **Q.3** 03 (a) Derive the relation $\Delta E = mR^2 \omega^2 C_s$ for energy stored in flywheel. **(b)** 04
 - (c) The intercepted areas between the output torque curve and the mean resistance line of a turning moment diagram for a multicylinder engine, taken in order from one end are as follows:

 $-35, +410, -285, +325, -335, +260, -365, +285, -260 \text{ mm}^2$. The diagram has been drawn to a scale of 1 mm = 70 N-m and 1 $mm = 4.5^{\circ}$. The engine speed is 900 r.p.m. and the fluctuation in speed is not to exceed 2% of the mean speed. Find the mass and cross-section of the flywheel rim having 650 mm mean diameter. The density of the material of the flywheel may be taken as 7200 kg / m³. The rim is rectangular with the width 2 times the thickness. Neglect effect of arms, etc.

Explain torsion spring and leaf spring with one application. 0.4 (a) Explain terms used in compression spring.

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Design a helical compression spring for a maximum load of 1000 (c) 07 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 modulus of rigidity is 84 kN/mm².

Take Whal's factor K=
$$\begin{array}{c} 4C - 1 & 0.615 \\ -----+ & ------ \\ 4C - 4 & C \\ OR \end{array}$$

0.4 (a) Explain types of screw thread used for power screw. 03 Explain over hauling and self locking screw. Show that efficiency **(b)** 04

- of self locking screw is less than 50 %. (c) The lead screw of a lathe has Acme threads of 50 mm outside 07
- diameter and 8 mm pitch. The screw must exert an axial pressure of 2500 N in order to drive the tool carriage. The thrust is carried on a collar 110 mm outside diameter and 55 mm inside diameter and the lead screw rotates at 30 r.p.m. Determine (a) the power required to drive the screw; and (b) the efficiency of the lead screw. Assume a coefficient of friction of 0.15 for the screw and 0.12 for the collar.
- **Q.5** Give classification of pressure vessel. (a)

(b)

- What is an autofrattage? Explain various methods of an **(b)** 04 autofrattage.
- A cast iron pipe of internal diameter 200 mm and thickness 50 mm (c) 07 carries water under a pressure of 5 N/mm². Calculate the tangential and radial stresses at radius (r) = 100 mm; 110 mm; 120 mm; 130 mm; $130 \text{$ mm; 140 mm and 150 mm. Sketch the stress distribution curves.

OR

Q.5 Give classification of bevel gear. **(a)**

strength.

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Write advantages and disadvantages of gear drive. 04 **(b)** A bronze spur pinion rotating at 600 r.p.m. drives a cast iron spur 07 (c) gear at a transmission ratio of 4 : 1. The allowable static stresses for the bronze pinion and cast iron gear are 84 MPa and 105 MPa respectively. The pinion has 16 standard 20° full depth involute teeth of module 8 mm. The face width of both the gears is 90 mm. Find the power that can be transmitted from the standpoint of
