

GUJARAT TECHNOLOGICAL UNIVERSITY
PDDC - SEMESTER-V • EXAMINATION – WINTER • 2014

Subject Code: X 51903**Date: 04-12-2014****Subject Name: Machine Design-I****Time: 10:30 am - 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)** Design and draw a valve spring of a petrol engine for the following operating conditions: **07**
Spring load when the valve is open = 400N
Spring load when the valve is closed = 250N
Max. inside diameter of spring = 25mm
Length of the spring when the valve is open = 40mm
Length of the spring when the valve is closed = 50mm
Max. permissible shear stress = 400N/mm².
- (b)** What is the function of a spring? Classify springs according to their shapes and Draw neat sketches. **07**
- Q.2 (a)** Write and prove Soderberg's equation and state its application to different type of loadings. **07**
- (b)** What is stress concentration? Explain different methods of reducing stress concentration in machine parts. **07**
- OR
- (b)** A machine component is subjected to a flexural stress which fluctuates between +300 N/mm² and -150 N/mm². Determine the value of ultimate strength according to 1. Goodman relation; 2. Soderberg relation. **07**
Take yield strength=0.55 Ultimate strength; Endurance Strength=0.5 Ultimate strength; and factor of safety=2
- Q.3 (a)** Prove the condition for maximum power transmission capacity of belt drive. **07**
- (b)** Two shafts whose centers are 1 m apart are connected by a V-belt drive. The driving pulley is supplied with 100 kW and has an effective diameter of 300mm. It runs at 1000 r.p.m. while the driven pulley runs at 370 r.p.m. The angle of groove on the pulleys is 40°. The permissible tension in 400 mm² cross-sectional area belt is 2.1 MPa. The density of the belt is 1100 kg/m³. The coefficient of friction between the belt and pulley is 0.28. Estimate the number of belts required **07**
- OR
- Q.3 (a)** What do you mean by a self-energizing brake and a self-locking brake? **07**
- (b)** Describe with the help of neat sketch the principle of operation of an internal expanding shoe brake. **07**
- Q.4 (a)** Write the comparison of rolling contact bearing and sliding contact bearing. **07**

- (b) SKF 6306 ball bearing with inner ring rotation has 10 seconds work cycle as follows: **07**

	<u>For 2 sec.</u>	<u>For 8 sec.</u>
Radial load	3640 N	2730 N
Axial load	1820 N	0
RPM	900	1200
Type of load	Light shock Steady load	
For SKF bearing static capacity, $C_o = 14600$ N and dynamic capacity, $C = 22000$ N. Find the expected average life of the bearing.		

OR

- Q.4 (a)** What is Bearing Characteristic number for journal bearing? Explain its dependency on various parameters with graph. **07**
- (b)** A 150 mm diameter shaft supporting a load of 12 KN has a speed of 1400 rpm The shaft run in bearing whose length is 1.5 times the shaft diameter. If the diametral clearance is 0.15mm and the absolute viscosity of oil at the operating temperature is 0.011 kg/m.s, find the power wasted in the friction. **07**

- Q.5 (a)** The multi disc clutch consists of five steel plates and four bronze plates. The inner and the outer diameter of the friction disks are 70 mm and 140 mm respectively. The coefficient of friction is 0.1 and the intensity of pressure on friction lining is limited to 0.3 N/mm^2 Assuming uniform pressure theory calculate (1) required force to engage the clutch (2) power transmitting capacity at 800 rpm. **07**
- (b)** Derive an expression for torque transmitting capacity of single plate clutch considering uniform wear theory **07**

OR

- Q.5 (a)** Prove that the ratio of the driving tensions on the two sides of a pulley is $T_1/T_2 = e^{\mu\theta}$ **07**
- Where, T_1 = Tension in the tight side of the belt,
 T_2 = Tension in the slack side of the belt
 θ = Angle of contact in radians
 μ = coefficient of friction between the belt and pulley.
- (b)** Write a short note on multi-leaf spring. **07**
