Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V (NEW) - EXAMINATION – SUMMER 2018

Subject Code:2151907 **Date:02/05/2018**

Subject Name:Design of Machine Elements

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.**
4. **Design data book is permitted.**

Q.1	**(a)**	Explain the importance of material selection decision in machine elements.	**03**
	(b)	Explain manufacturing considerations in machine design.	**04**
	(c)	What is endurance strength? Explain the factors affecting the endurance limit of a machine component.	**07**
Q.2	**(a)**	Compare among Gerber curve, Soderberg and Goodman lines for fluctuating stresses in machine component.	**03**
	(b)	Explain Miner's rules for Cumulative fatigue Damage.	**04**
	(c)	A solid circular shaft, 15 mm in diameter, is subjected to torsional shear stress, which varies from 0 to 35 N/mm^2 and at the same time, is subjected to an axial stress that varies from –15 to+30 N/mm^2. The frequency of variation of these stresses is equal to the shaft speed. The shaft is made of steel Fe E 400 (S_{ut} = 540 N/mm^2 and S_{yt} = 400 N/mm^2) and the corrected endurance limit of the shaft is 200 N/mm^2. Deter mine the factor of safety	**07**
		OR	
	(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 = 0.55xUltimate strength; Endurance strength = 0.5xUltimate strength; and factor of safety = 2. Compare the results on plot.	**07**
Q.3	**(a)**	Why is factor of safety in spring preferred near to unity?	**03**
	(b)	Explain the stresses induced in compression and tension spring.	**04**
	(c)	A wagon weighing 1530 Kg mass and moving with a speed of 3 km/hr is to be brought to rest by means of a buffer made of two closed helical springs of circular section, on each end of wagon. The spring stiffness is 30 kN/mm and spring index is 6. Maximum permissible shear stress is not to exceed 600 N/mm^2. Find the diameter of wire and number of coils in each spring. Take for spring material G= 8.4×10^4 N/mm^2. Check the design for buckling.	**07**
		OR	
Q.3	**(a)**	Explain the Belleville spring and its applications.	**03**
	(b)	Explain the design steps of semi elliptical laminated multi leaf spring.	**04**
	(c)	A laminated spring of an automobile is to carry a load of 5 kN. The spring is made 1000 mm between the supports. Design the spring. Number of leaves to be taken as 8 with two of them of full length. Distance between U-bolts may be taken as 60 mm.	**07**
Q.4	**(a)**	Explain the difference between belt slip and belt creep.	**03**
	(b)	Explain the design of belt.	**04**

	(c)	Two shafts 1.2 m apart connected by pulley having multiple V-grooves. The system is required to transmit 84 kW power. The driving pulley is running at 900 rpm and has an effective diameter of 240 mm while the driven pulley diameter is 640 mm. groove angle of the pulley is 45^o. The belt used can safely withstand a pull of 1890 N and each has cross section area of 395 $mm^{2.}$ Density of the belt material is 1200 kg / m^3. Coefficient of friction is 0.23. Calculate the number of belts required to accomplish the job.	**07**

OR

Q.4	**(a)**	Explain tooth correction factor for roller chain.	**03**
	(b)	Explain load and power transmitting capacity of chain drive.	**04**
	(c)	Design a chain drive to actuate a compressor from 15 kW electric motor at running 970 rpm and compressor running at 330 rpm. Minimum center distance should be 550 mm. the chain tension may be adjusted by shifting the motor rails. The compressor is to work 16 hr/day.	**07**
Q.5	**(a)**	What are the design criteria and failure modes in pressure vessels?	**03**
	(b)	Explain the design procedure with mathematical formulations for pressure vessels.	**04**
	(c)	A high pressure cylinder consists of an inner cylinder of inner and outer diameters of 200and 300 mm respectively. It is jacketed by an outer cylinder with an outside diameter of 400 mm. The difference between the outer diameter of the inner cylinder and the inner diameter of the jacket before assembly is 0.25 mm (E = 207 kN/mm2). Calculate the shrinkage pressure and the maximum tensile stress induced in any of the cylinders.	**07**

OR

Q.5	**(a)**	Explain pre-stressing of cylinders and its importance in pressure vessels design.	**03**
	(b)	Explain the area compensations method to determine the area of reinforcement for a nozzle opening with neat sketch.	**04**
	(c)	A cylinder of 50 mm inner radius is subjected to an internal pressure P_i. What is the thickness, if the maximum hoop stress calculated by the thick cylinder formula is 10% greater than the value obtained assuming uniform hoop stress across the whole section? By how much does the minimum hoop stress differ?	**07**

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