

**GUJARAT TECHNOLOGICAL UNIVERSITY****BE- SEMESTER-V (NEW) EXAMINATION – WINTER 2020****Subject Code:2151907****Date:20/01/2021****Subject Name:Design of Machine Elements****Time:10:30 AM TO 12:30 PM****Total Marks: 56****Instructions:**

1. Attempt any **FOUR** questions out of **EIGHT** questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

	MARKS
<b>Q.1</b> (a) Distinguish between open and cross belt drive.	<b>03</b>
(b) Solve the numbers of R5 basic series from 1 to 10.	<b>04</b>
(c) Decide appropriate manufacturing consideration in design.	<b>07</b>
<b>Q.2</b> (a) Explain stress concentration.	<b>03</b>
(b) Explain factors affecting endurance limit.	<b>04</b>
(c) A machine component is subjected to fluctuating stress that varies from 40 to 100 N/mm <sup>2</sup> . The corrected endurance limit stress for the machine components is 270 N/mm <sup>2</sup> . The ultimate tensile strength and yield strength of the material are 600 and 450 N/mm <sup>2</sup> respectively. Solve the factor of safety using (1) Gerber theory (2) Soderberg line (3) Goodman line.	<b>07</b>
<b>Q.3</b> (a) Design of thin cylinder.	<b>03</b>
(b) Classify types of springs.	<b>04</b>
(c) A semi elliptic multi leaf spring is used for the suspension of the rear axle of a truck. It consists of two extra full length and ten graduated length leaves including the master leaf. The center to centre distance between the spring is 1200 mm and width of leaves is 60 mm. The leaves are made of steel 55Si2Mo90 and $S_{yt}=1500$ N/mm <sup>2</sup> and $E=207$ GPa and factor of safety is 2.5. The spring is to be designed for a maximum force of 30 kN. The leaves are pre stressed so as to equalize stress in all leaves. Solve (1) thickness of the leaves (2) deflection at the end of the spring.	<b>07</b>
<b>Q.4</b> (a) Design of thin spherical vessels.	<b>03</b>
(b) Analyze of stresses in helical spring.	<b>04</b>
(c) It is required to design a helical compression spring subjected to a maximum force of 1.25 KN. The deflection of the spring corresponding to the maximum force should be approximately 30 mm. the spring index can be taken as 6. The spring is made of patented and cold drawn steel wire. The ultimate tensile strength and modulus of rigidity of spring material are 1090 and 81370 N/mm <sup>2</sup> respectively. The permissible shear stress for the spring wire should be taken as 50 % of the	<b>07</b>

ultimate tensile strength. Design the spring and solve (1) wire diameter (2) total number of coils.

- Q.5** (a) Describe creep in belt. **03**  
 (b) List advantages and disadvantage of chain drive. **04**  
 (c) Design an equation for ratio of tensions on tight side to slack side of flat belt drive. **07**
- Q.6** (a) List application of V belt drive. **03**  
 (b) List advantages and disadvantage of belt drive. **04**  
 (c) Design of pulley for flat belt drive. **07**
- Q.7** (a) Define: (1) Pressure vessel (2) thick cylinder (3) thin cylinder **03**  
 (b) The inner diameter of a cylindrical tank for liquefied gas is 250 mm. the gas pressure is limited to 15 MPa. The tank is made of plain carbon steel 10C4 ( $S_{ut}=340 \text{ N/mm}^2$  and  $\mu=0.27$ ) and the factor of safety is 5. Calculate the cylinder wall thickness. **04**  
 (c) Explain principle stresses in thick cylinder. **07**
- Q.8** (a) Describe briefly Autofrettage. **03**  
 (b) A seamless steel pipe of 100 mm internal diameter is subjected to internal pressure of 12 MPa. It is made of steel ( $S_{yt}=230 \text{ N/mm}^2$  and  $\mu=0.27$ ) and the factor of safety is 2.5. Calculate the thickness of the pipe. **04**  
 (c) Explain end closures with neat sketch. **07**

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