M.Tech. Mechanical Engineering Design CBCS Pattern Semester-I

MED12 - Advanced Mechanics of Solids

P. Pages : 2 **GUG/W/23/14187**

Time : Three Hours Max. Marks : 70

Notes :
1. All questions carry equal marks.
2. Answer **any five** questions.
3. Due credit will be given to neatness and adequate dimensions.
4. Assume suitable data wherever necessary.
5. Diagrams and Chemical equation should be given wherever necessary.
6. Illustrate your answers wherever necessary with the help of neat sketches.
7. Use of slide rule, Logarithmic tables, Steam tables, Mollier's chart, Drawing instruments, Thermodynamic tables for moist air, Psychrometric charts and Refrigeration charts is permitted. Use of non programmable calculator is permitted.

1. a) Define and discuss shear center in bending symmetrical and nonsymmetrical bending. **7**

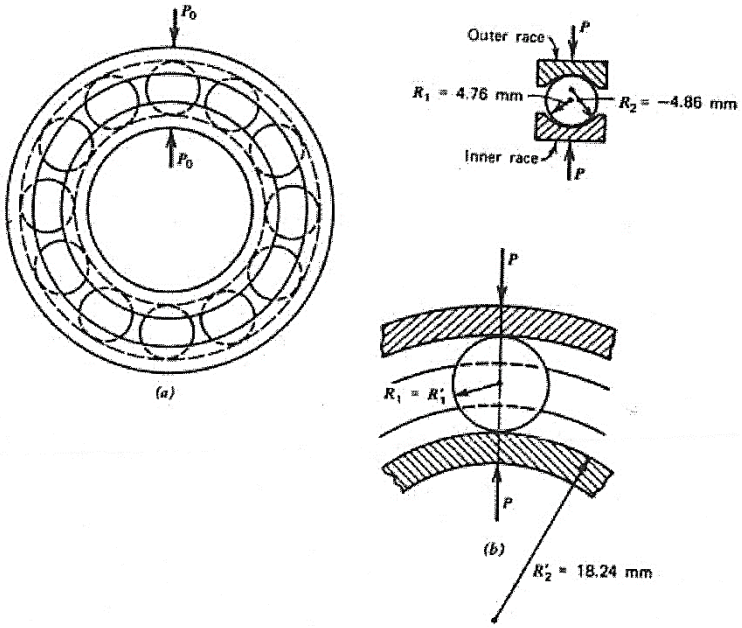
b) What is Saint-Venant's principle? What is its significance? **7**

2. Derive the equation for deflections of straight beams subjected to nonsymmetrical bending. **14**

3. A steel ball bearing consisting of an inner race, an outer race, and 12 balls is shown in figure, E = 200 GPa, ν = 0.29, and Y = 1600 Mpa. A rated load of $P_0 = 4.2\,kN$ is given in a manufacturer's handbook for this bearing when operated at 3000 rpm. An empirical relation Allen 1945 is used to determine the load P on the topmost ball that bears the largest portion of the load; $P = 5P_0 / n = 1.75\,kN$ in which n is the number of balls. Use ball designation as shown in the figure. **14**

i) At the region of contact between the inner race and topmost ball, determine the maximum principal stress, maximum shear stress, maximum octahedral shear stress, dimensions of the area of contact, maximum orthogonal shear stress, and distance from the point of contact of the point where these stresses occur.

ii) What is the factor of safety against initiation of yielding based on the octahedral shear stress criterion of failure?



4.	a)	Derive the equation for linear elastic solution for elliptical cross section.	**7**
	b)	Derive the equation for linear elastic solution for rectangular cross section.	**7**
5.		Derive the Stress-Strain-temperature relations for isotropic elastic plates.	**14**
6.		Discuss strain displacement relations for flat plates.	**14**
7.		Describe the method of computing principal stresses and maximum shear stresses.	**14**
8.		Explain the assumptions on which the solution of the problem of contact stresses is based.	**14**

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