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Total Pages : 07

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May 2025

B.Tech. (ME) (Fourth Semester)

Strength of Materials-II (PCC-ME-404/21)

Time : 3 Hours] [*Maximum Marks : 75*

Note : It is compulsory to answer all the questions (1.5 marks each) of Part A in short. Answer any *four* questions from Part B in detail. Different sub-parts of a question are to be attempted adjacent to each other. Assume suitable data any if missing.

Part A

1. (a) Define the generalized Hook's law. **1.5**

(b) What do you mean by strain invariant ? **1.5**

(c) State the distortion strain energy theory of failure. 1.5

(d) Define the proof resilience. 1.5

(e) Differentiate the gradually applied load and suddenly applied load. 1.5

(f) What do you mean by slenderness ratio ? 1.5

(g) What is meant by effective length of column ? 1.5

(h) What do you understand by a rotating disc of constant strength ? 1.5

(i) What do you mean by curved beam ? 1.5

(j) State the Winker-batch theory. 1.5

Part B

2. (a) A bolt is designed to take up direct tensile load of 30 kN and a shear load of 16 kN with a factor of safety of 4. The yield strength of the material used is 400 MPa. Calculate the size of the bolt based on various theories of failure. Take a Poisson ratio = 0.3. 10

(b) Compare graphically all the theories of failure. 5

3. (a) A disc of uniform thickness with 40 mm diameter has a central hole of 10 cm diameter. The disc turns 6000 rev/min about

its axis. Set up a relation for variation in circumferential stress and radial stress along the disc radius and compute the values of theses stresses at 15 cm radius.

Also find out the maximum value of circumferential, radial and shear stresses in the disc ?

For the disc material take $\rho = 7500$ kg/m^3 and $\mu = 0.3$. **10**

(b) Draw the graph showing the variation of hoop stresses and radial stresses in a rotating disc of constant thickness when : **5**

(i) the disc is solid

(ii) the disc has a central hole.

4. (a) Derive an expression for Euler's crippling load for along column with end condition of both ends are hinged. **8**

(b) Explain the middle third and middle quarter rule related to eccentric compression. 7

5. (a) Find the strain energy stored by the structure as shown in the figure below and hence determine the vertical deflection of end A. Assume that members are of uniform cross-section throughout : **8**