

Government College of Engineering, Aurangabad

(An Autonomous Institute of Government of Maharashtra)

M.E. Mechanical Design (Part Time) Old

End Semester Examination Nov- 2016 - Semester I

ME 503: Design Engineering

Time: Three Hours

2 DEC 2016

Max. Marks: 60

“Verify the course code and check whether you have got the correct question paper”

N.B.: -

1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Assume suitable data if necessary and state it clearly.
4. Use of Non-programmable Calculator is allowed.

Q.1 Attempt any One 12

- i) The load of 5kN acting against pressing two roller of diameter 50 mm and length 1m, Find maximum principal stress, Maximum shear stress, and Maximum octahedral shear stress? If one of the rollers is replaced by the flat medium carbon steel plate under the same force find the maximum octahedral stress? (Substantiate your answer with diagrams and mathematical equation)
- ii) Explain octahedral stress, principal strain, tri-axial state of stress, Mohr's circle for tri-axial stresses from first principal? (Substantiate your answer with diagrams and mathematical equation)

Q.2 Attempt any One 12

- i) Explain mechanism of fracture? Explain J Integral and R curves for lower strength ductile material, explain crack tip opening displacement? (Support your answer with the mathematical expression and neat diagrams)?
- ii) A continuous beam ABC is simply supported at A&C and is continuous over B, AB= 5m, BC=8m. The span AB is loaded with UDL 25kN/m. The point load of 60 kN is acting at 3m left of 'C'. If all loads are Ultimate find plastic moment and B.M.D at collapse assume same M_p throughout.

Q.3 Attempt any One 12

- i) Explain fatigue phenomena, Micro mechanism of fatigue with neat diagrams. Explain the effect of stress concentration, corrosion, mean stress, surface finish, size, plating on fatigue failure (support your answer with one examples and mathematical equation)?
- ii) A rolling mill roller is made of 1040 steel having ultimate tensile strength 550 Mpa and endurance limit 450 Mpa. Stress concentration factor is 1.5 at point of expected failure. For short time test for this part the service stress of 315Mpa was applied for 15000 reversal. Then stress of 450 Mpa was applied after 17000 additional reversals the part failed, find the expected life of the component. The strength of material under reversible loading is 90% of Ultimate strength for 10^3 cycles of reversals.

Q.4 **Attempt any One** **12**
i) Prove that shape factor for annular ring of thickness 'T' and outside diameter D is 1.27?

ii) A steel plate with a through thickness crack of length $2a=50$ mm is subjected to a stress of 500 Mpa normal to the crack. If yield strength of the plate material is 600 Mpa, What is the plastic zone size and the stress intensity factor of the crack? (Assume the plate is infinitely wide) use Dugdale model of plastic zone.

Q.5 **Attempt any One** **12**

i) A long thin wall pipe constrained by end fittings made of polyvinyl chloride is subjected to a steady internal pressure of 0.6 Mpa at 30 degree if tensile stress of 17.5 Mpa is not to be exceeded and internal radius is 120 mm, Determine the suitable wall thickness. What will be increase in diameter after 1000 hours? The main creep concentration ratio is 0.5 and tensile creep curve provide the following values

Strength (Mpa)	6.9	13.8	20.7	27.6	34.5
Strain%	0.2	0.48	0.97	1.72	3.38

ii) **Write detail note on (any Two)**

1. Phenomenon of Creep & Effect of temperature and time on creep
2. Fatigue under multi-axial cyclic stresses
3. Ductile and brittle fracture
4. Plastic bending, shape factor and plastic hinges
5. Cyclic plastic strain and fatigue life