CBCS Scheme

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16/17MDE22

# Second Semester M.Tech. Degree Examination, June/July 2018
## Advanced Machine Design

Time: 3 hrs. Max. Marks: 80

***Note:*** **1.** ***Answer any FIVE full questions, choosing one full question from each module.***
**2.** ***Use of machine design data hand book is permitted.***
**3.** ***Missing Data can be suitably assumed.***





### Module-1

1 a. A machine part has a combined state of stress $\sigma_x$ = 50 MPa, $\sigma_y$ = -30 MPa, $\tau_{xy}$ = 30 MPa. The ultimate strength of material in tension $\sigma_{ut}$ = 140 MPa, ultimate strength in compression $\sigma_{uc}$ = 560 MPa. Using modified theory find effective stress and FOS against static failure. **(08 Marks)**

b. Draw the schematic diagram of a computer controlled closed loop fatigue testing machine and explain in brief. **(08 Marks)**

**OR**

2 a. A differential element is subjected to the following state of stress $\sigma_x$ = 100 MPa, $\sigma_y$ = -50 MPa, $\tau_{xy}$ = 50 MPa, material used in ductile steel with $\sigma_{ij}$ = 250 MPa. Determine FOS as per modified Mohr's theory. **(08 Marks)**

b. Write a note on:
i) High cycle fatigue and low cycle fatigue
ii) Explain even and uneven material with Mohr circle diagram. **(08 Marks)**

### Module-2

3 a. An un notched circular rod with a diameter of 10 mm each subjected to constant amplitude bending at room temperature with $s_m$ is equal to 200 MPa. The material is 4340 quenched and tempered alloy steel with $s_u$ = 1240 MPa, $s_y$ = 1170 MPa and $s_{y'}$ = 1000 MPa, with the rod is commercially polished estimate the value of $S_a$, $S_{max}$, $S_{min}$ and 'R' for a median fatigue life of 50000 cycles and no yielding. Take correction factor = 0.87. **(08 Marks)**

b. Write a note on surface finish and other factor influencing strain-life approach. **(08 Marks)**

**OR**

4 a. Write notes on:
i) General S-N behavior
ii) Fatigue crack nucleation, growth and final fracture. **(08 Marks)**

b. Explain strain based ($\in$ – N) approach to life estimation. **(04 Marks)**

c. Explain stress-strain curve of engineering stress and true stress-strain behavior. **(04 Marks)**

### Module-3

5 a. Explain with a neat sketch of crack tip plastic zone with strip model. **(08 Marks)**

b. Explain mean stress effect and Haigh's diagram for 7075 – $T_6$ wrought Aluminum alloy. **(08 Marks)**

**OR**

6 a. Explain Fatigue crack growth, $\frac{da}{dN} - \Delta K$. **(08 Marks)**

b. Sketch and explain the Haigh's diagram and modified Goodman's diagram for Notch part. **(08 Marks)**

## Module-4

7 a. Explain level crossing method. **(08 Marks)**

b. Explain Glinka's rule applied to notch stress-strain analysis. **(08 Marks)**

OR

8 a. Explain peak counting method. **(08 Marks)**

b. Explain application of fracture mechanics to crack growth at notches. **(08 Marks)**

## Module-5

9 a. Write notes on:
i) Surface geometry
ii) Mating surface
iii) Friction **(08 Marks)**

b. Derive an expression for the pressure distribution in cylindrical contact and show the pressure distribution schematically. **(08 Marks)**

OR

10 a. An overhead crane wheel runs slowly on a steel rail. What is the size of the contact patch between wheel and rail and what are the stresses? What is the depth of maximum shear stress? The wheel is 250 mm diameter and 20 mm thick and the rail is flat. Both parts are steel, the radial load is 18000 N Poisson's ratio is 0.28 and $E = 2.1 \times 10^5$ N/mm$^2$. **(08 Marks)**

b. Explain with neat sketch of geometric stress concentration and show the stress distribution under varying load levels. **(08 Marks)**

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