

**APJ ABDULKALAM TECHNOLOGICAL UNIVERSITY**  
**08 PALAKKAD CLUSTER**

Q. P. Code :MD0819012-I

(Pages:3)

Name: .....

Reg. No:.....

**SECOND SEMESTER M.TECH. DEGREE EXAMINATION APRIL 2019**

**Branch: Mechanical Engineering    Specialization: Machine Design**

**08ME6012ADVANCED MACHINE DESIGN**

**Time:3 hours**

**Max.marks: 60**

**Answer all six questions.**

**Modules 1 to 6:**Part 'a' of each question is compulsory and answer either part 'b' or part 'c' of each question.

(Add any other instruction specific to course here like the use of IS codes/design tables etc.)

<b>Q.no.</b>	<b>Module 1</b>	<b>Marks</b>
<b>1.a</b>	Explain the different theories of failure	<b>3</b>
<b>Answer b or c</b>		
<b>b</b>	Explain the failure prevention analysis in mechanical design and explain the various mechanical failure modes?	<b>6</b>
<b>c</b>	A steel member is subjected to a 3 dimensional stress system and the resulting principal stresses are 120 N/mm <sup>2</sup> tension, 80 N/mm <sup>2</sup> and 40 N/mm <sup>2</sup> compression. If the proportional limit of the material in simple tension is 280 N/mm <sup>2</sup> and its poisson's ratio is 0.3. Estimate the factor of safety according to (a) Maximum principal stress theory (b) Maximum principal strain theory and (c) Maximum shear stress theory.	<b>6</b>
<b>Q.no.</b>	<b>Module 2</b>	<b>Marks</b>
<b>2.a</b>	Define the followings;  (a) Fatigue failure (b) Low Cycle Fatigue and (c) High Cycle Fatigue	<b>3</b>
<b>Answer b or c</b>		
<b>b</b>	Explain in details about fatigue design criteria	<b>6</b>
<b>c</b>	Discuss in detail on various fatigue testing and fatigue testing machines	<b>6</b>

<b>Q.no.</b>	<b>Module 3</b>	<b>Marks</b>
<b>3.a</b>	Write a short note on different factors influencing S-N behaviour	<b>3</b>

**Answer b or c**

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|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| <b>b</b> | An automobile engine part rotates, and in each rotation stress varies from $S_{\max}=20,000$ psi to $S_{\min}=1,000$ psi. The material has $S_u=80,000$ psi, $S_{yp}=60,000$ psi, $S_e=28,000$ psi. Assume $K=K_f=1$ . Find $N_{fs}$ , with (i) Soderberg's, (ii) Goodman's and (iii) Modified Goodman's equations. | <b>6</b> |
| <b>c</b> | Discuss in detail about the followings;<br>(i) Stress-Life (S-N) Curves, (ii) Mean stress effects on S-N behaviour                                                                                                                                                                                                  | <b>6</b> |

<b>Q.no.</b>	<b>Module 4</b>	<b>Marks</b>
<b>4.a</b>	Write a short note on (i) LEFM concepts (ii) Fracture toughness	<b>3</b>

**Answer b or c**

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|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| <b>b</b> | Explain in details about the followings; (i) Stochastic variable and Sample in definitions and quantification of data scatter (ii) The Weibull distribution parameter function which is most frequently used in fatigue design and testing (iii) Reliability distributions for service loading and fatigue strength.                                                                                                                                                 | <b>6</b> |
| <b>c</b> | A durability test on 10 units resulted in failures at 140, 90, 190, 220, 270, 200, 115, 170, 260, and 330 hours. Assume the life distribution to be a two-parameter Weibull. Determine (i) The slope, $b$ , and Characteristic life, $\theta$ , for the distribution, (ii) The median and $B_{10}$ lives, (iii) The percentage of the population that would be expected to fail in 300 hours with 50 percent confidence, and (iv) The 90 percent tolerance interval. | <b>6</b> |

<b>Q.no.</b>	<b>Module 5</b>	<b>Marks</b>
<b>5.a</b>	Define the terms (i) Cumulative Damage (ii) Spectrum Load	<b>4</b>

**Answer b or c**

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|----------|-------------------------------------------------------|----------|
| <b>b</b> | Discuss in detail about the cumulative damage theory  | <b>8</b> |
| <b>c</b> | Explain the concept behind the cycle counting methods | <b>8</b> |

<b>Q.no.</b>	<b>Module 6</b>	<b>Marks</b>
<b>6.a</b>	Write a short note on surface failures and surface geometry	<b>4</b>

**Answer b or c**

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|----------|----------------------------------------------------------------------|----------|
| <b>b</b> | Discuss about the stresses developed when two spheres are in contact | <b>8</b> |
| <b>c</b> | Explain in details about Adhesive, Abrasive and Corrosive wear       | <b>8</b> |