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ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. / B. Tech / B. Arch (Full Time) - END SEMESTER EXAMINATIONS, APRIL / MAY 2024

B.E. MATERIALS SCIENCE AND ENGINEERING
Semester 06
ML5602 Materials Selection and Design
(Regulation 2019)

Time: 3hrs Max.Marks: 100

CO 1 Identify criteria and apply the Ashby charts during materials selection.
CO 2 Recognize the different manufacturing process and diagnose their role in design.
CO 3 Elucidate the manufacturing considerations in design.
CO 4 Analyze the influence of material properties and the nature of loading on design.
CO 5 Develop a design procedure for various types of failures.

BL – Bloom's Taxonomy Levels
(L1 - Remembering, L2 - Understanding, L3 - Applying, L4 - Analyzing, L5 - Evaluating, L6 - Creating)

PART- A (10 x 2 = 20 Marks)
(Answer all Questions)

Q. No	Questions	Marks	CO	BL
1	Write the significance of using Ashby charts for the material selection of the product development.	2	CO1	L2
2	List any four criteria for selecting the materials to produce a product.	2	CO1	L2
3	Differentiate between batch and job shop production systems.	2	CO2	L2
4	What are the disadvantages of copper alloys from design considerations ?	2	CO2	L2
5	What are the implications of surface finish in the manufacturing?	2	CO3	L2
6	Why it is necessary to give tolerance on engineering dimension?	2	CO3	L2
7	State the assumptions made in deriving the torsion equation.	2	CO4	L2
8	Distinguish clearly between direct stress and bending stress.	2	CO4	L2
9	Comment on the criteria Infinite life design under design failure.	2	CO5	L2
10	Give the reasons of formation of the crevice corrosion.	2	CO5	L2

PART- B (5 x 13 = 65 Marks)

Q. No	Questions	Marks	CO	BL
11 (a)	Illustrate the steps in materials selection at the embodiment design phase.	13	CO1	L3
	OR			
11 (b)	Illustrate the steps involved in the materials selection for the substitution design.	13	CO1	L3
12 (a)	i. Suggest the various factors influencing the selection of a manufacturing process to make a part.	6	CO2	L5
	ii. Evaluate any four guidelines for design for manufacturability with the necessary sketches.	7		
	OR			

12 (b)	Analyze and evaluate any three guidelines for each of the following: i. Design for welding ii. Design for casting	6 7	CO2	L5
13 (a)	Elucidate the manufacturing considerations for the following: i. Surface finish ii. Interchangeable assembly	6 7	CO3	L3
	OR			
13 (b)	i. The dimensions of the mating parts, according to basic hole system, are given as follows: **Hole:** 25.00 mm **Shaft** : 24.97 mm 25.02 mm 24.95 mm Find the hole tolerance, shaft tolerance and allowance. ii. Evaluate the need of tolerances in the design and manufacturing.	7 6	CO3	L3
14 (a)	i. A hollow shaft is required to transmit 600 kW at 110 r.p.m., the maximum torque being 20% greater than the mean. The shear stress is not to exceed 63 MPa and twist in a length of 3 metres not to exceed 1.4 degrees. Find the external diameter of the shaft, if the internal diameter to the external diameter is 3/8. Take modulus of rigidity as 84 GPa. Consider both the cases of design for strength and design for rigidity. ii. A hollow shaft of 40 mm outer diameter and 25 mm inner diameter is subjected to a twisting moment of 120 N-m, simultaneously, it is subjected to an axial thrust of 10 kN and a bending moment of 80 N-m. Calculate the maximum compressive and shear stresses.	7 6	CO4	L3
	OR			
14 (b)	A mild steel shaft of 50 mm diameter is subjected to a bending moment of 2000 N-m and a torque T. If the yield point of the steel in tension is 200 MPa, find the maximum value of this torque without causing yielding of the shaft according to 1. the maximum principal stress 2. the maximum shear stress 3. the maximum distortion strain energy theory of yielding.	13	CO4	L3
15 (a)	Analyze a case study on material selection and design for Fatigue Failure. How do you select materials to reduce the fatigue for the design members?	13	CO5	L4
	OR			
15 (b)	Analyze a case study on material selection and design against wear? How do you select materials to reduce the wear in the materials during the manufacturing process?	13	CO5	L4

PART- C (1 x 15 = 15 Marks)

(Q.No.16 is compulsory)

Q. No	Questions	Marks	CO	BL
16.	Develop and evaluate a case study on material selection and design requirements for the biomedical applications.	15	CO1 CO2 CO3 CO4 CO5	L6