Roll No.

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

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

Material Science and Engineering
VI Semester
ML5602- MATERIAL SELECTION AND DESIGN

(Regulation 2019)

Time: 3hrs

Max.Marks: 100

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

Q. No	Questions	Marks
1	Define Adaptive design.	2
2	What is material performance index?	2
3	List out the types of manufacturing processes.	2
4	What is DFMA?	2
5	What are the advantages of selective assembly?	2
6	What are unilateral and bilateral tolerance?	2
7	What is factor of safety?	2
8	What is stress concentration factor?	2
9	What are ways to improve the fatigue properties?	2
10	Name the friction materials used in clutches and brakes.	2

PART- B (5 x 13 = 65 Marks)
(Restrict to a maximum of 2 subdivisions)

Q. No	Questions	Marks
11 (a)	Describe how material selection enters each stage of the design process with neat sketch.	13
	Or	
11 (b)	Explain the material selection by using Ashby charts for the selection of materials.	13
12 (a)	Explain with an example, the relationship between material selection and material shaping of a product.	13
	Or	
12 (b)	Explain with examples the several guidelines that are adopted for design for assembly (DFM)	13
13 (a)	Write a short note on the following with examples: i. Clearance fit ii. Interference fit.	 6 7
	Or	
13 (b)	Write a short note on the following: i. Preferred numbers ii. Geometric tolerance	 6 7

14 (a)	A transmission shaft of cold drawn steel 27Mn2 (σ_{ut} =550 N/mm^2 and σ_{yt} =350 N/mm^2) is subjected to a fluctuating torque which varies from -150 N-m to +450 N-m. The factor of safety is 1.5 and the expected reliability is 90%. Neglecting the effect of stress concentration. Determine the diameter of the shaft. Assume the distortion energy theory of failure.	**13**
	Or	
14 (b)	It is required to design a helical compression spring subjected to a maximum force of 1250 N. The deflection of the spring corresponding to the maximum force should be approximately 30 mm. The spring index can be taken as 6. The spring is made of patented and cold – drawn steel wire. The ultimate tensile strength and modulus of rigidity of the spring material are 1090 N/mm^2 and 81370 N/mm^2 respectively. The permissible shear stress for the spring should be taken as 50% of the ultimate tensile strength. Design the spring and calculate: (i) Wire diameter, (ii). Mean coil diameter, (iii). Number of active coils, (iv). Total number of coils, (v). Free length of the spring, and (vi). Pitch of the coil	**13**
15 (a)	Explain the procedure to conduct a fatigue test and draw S-N curve for aluminum material.	**13**
	Or	
15 (b)	Write a short note on the following: i. Abrasive wear and Adhesive wear ii. Corrosive wear and Fatigue wear	 **6** **7**

PART- C (1 x 15 = 15 Marks)

(Q.No.16 is compulsory)

Q. No	Questions	Marks
16.	A shaft is supported by two bearings placed 1 m apart. A 600 mm diameter pulley is mounted at a distance of 300 mm to the right of left hand bearing and this drives a pulley directly below it with the help of belt having maximum tension of 2.25 kN. Another pulley 400 mm diameter is placed 200 mm to the left of right hand bearing and is driven with the help of electric motor and belt, which is placed horizontally to the right. The angle of contact for both the pulleys is 180° and μ = 0.24. Determine the suitable diameter for a solid shaft, allowing working stress of 63 MPa in tension and 42 MPa in shear for the material of shaft. Assume that the torque on one pulley is equal to that on the other pulley.	**15**