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B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

August 2024 Supplementary Examinations

Programme: B.E. **Semester: VI**
Branch: Aerospace Engineering **Duration: 3 hrs.**
Course Code: 20AE6DEEDO **Max Marks: 100**
Course: Engineering Design and Optimization

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

			CO	PO	Marks
		UNIT - I			
1	a)	Define the following with an example for each for engineering design: (i) Synthesis, (ii) Creativity (iii) Adaptive design, (iv) Innovation.	*CO 1*	*PO1*	**8**
	b)	Briefly explain the comparison between the scientific method and the design method.	*CO 1*	*PO 1*	**6**
	c)	Explain the design paradox with a neat sketch.	*CO 1*	*PO 1*	**6**
		UNIT - II			
2	a)	What are the engineering characteristics of a product? How to establish them?	*CO 1*	*PO 1*	**6**
	b)	Explain briefly the classification of customer requirements with the Kano diagram.	*CO 1*	*PO 1*	**7**
	c)	Construct a Gantt chart for timing and scheduling for a design and development of an aerospace product.	*CO 3*	*PO 3* *PO 11*	**7**
		UNIT - III			
3	a)	List and explain briefly the systematic methods for mechanical conceptual design generation.	*CO 1*	*PO 1*	**7**
	b)	What is functional decomposition and synthesis strategy? Explain the function structure of a mechanical pencil.	*CO 3*	*PO 1* *PO 2*	**7**
	c)	Explain the various evaluation methods for concept selection.	*CO 1*	*PO 1*	**6**
		UNIT - IV			
4	a)	Explain the modular and integral product architecture.	*CO 1*	*PO 1*	**7**
	b)	List and briefly explain the guidelines for designing mechanical systems.	*CO 1*	*PO 1*	**6**
	c)	Explain with the sketch the effect of various manufacturing methods on the possible configuration of features on the right-angle bracket.	*CO 3*	*PO 1* *PO 2*	**7**

			OR			
	5	a)	What is meant by Design For Excellence (DFX) and list its types.	*CO 1*	*PO 1*	**6**
		b)	What is parametric design? List systematic steps in parametric design.	*CO 1*	*PO 1*	**7**
			Draw the schematic diagram of the shot-buddy example by showing flows to establish the product architecture.	*CO 3*	*PO 1* *PO 2*	**7**
			UNIT - V			
	6	a)	Classify the optimization problems and specify the application for each.	*CO2*	*PO 1*	**10**
		b)	A manufacturer makes two models A and B of a product. Each model is processed by two machines. To complete one unit of model A, machines I and II must work 1 hour and 3 hours respectively. To complete one unit of model B, machines I and II must work 2 hours and 1 hour respectively. Machine I may not operate for more than 8 hours per day, and machine II for not more than 9 hours per day. If profits on models A and B per unit are Rs. 300 and Rs. 350 respectively, then how many units of each model should be produced, per day, to maximize the profits? Formulate the design optimization problem and solve it graphically to find the optimal solution.	*CO2*	*PO 1* *PO 2*	**10**
			OR			
	7	a)	Explain the objective function, design variables, design constraints, constraint surface, and contours of the objective function with a neat sketch of hypothetical two dimensional design space.	*CO 2*	*PO 1*	**10**
		b)	For a uniform column of the tubular section, with hinge joints at both ends, to carry a compressive load $P = 2500\ kgf$ for minimum cost. The column is made up of a material that has a yield stress (σ_y) of $500\ kgf/cm^2$, modulus of elasticity (E) of $0.85 \times 10^6\ kgf/cm^2$, and weight density ($\rho$) of $0.0025\ kgf/cm^3$. The length of the column is $250\ cm$. The stress-induced ($P/\pi dt$) in the column should be less than the buckling stress ($\frac{\pi^2 EI/l^2}{\pi dt}$) as well as the yield stress. The mean diameter of column d is restricted to lie between 2 and $14\ cm$, and columns with thicknesses t outside the range $0.2–0.8\ cm$ are not available in the market. The cost of the column includes material and construction costs and can be taken as $5W + 2d$, where W is the weight in kilograms force ($\rho l \pi dt$) and d is the mean diameter of the column in centimeters. Formulate the design optimization problem and determine the type of programming required to solve it (do not solve it).	*CO 2*	*PO 1* *PO 2*	**10**

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