ADVANCED MECHANICAL ENGINEERING DESIGN

UnitI

Design philosophy: Design process, Problem formation, Introduction to product design,Various design models-Shigley model, Asimov model and Norton model, Need analysis,Strengthconsiderations-standardization.Creativity,Creativetechniques,Materialselections,Notchesandstressconcentration,design forsafetyandReliability

UnitII

ProductDesign:Productstrategies,Productvalue,Productplanning,productspecifications,conceptgeneration,conceptselection,concepttesting.

Designformanufacturing:Forgingdesign,Castingdesign,Designprocessfornonmetallicparts,Plastics,Rubber,Ceramic,Wood,Glassparts.Materialselectioninmachinedesign

UnitIII

Failure theories: Static failure theories: Distortion energy theory, Maximum shear stresstheory,Coulomb-Mohr's theory, Modified Mohr's theory- Fracture mechanics theory: Griffith's theory and its modification.Fatigue mechanisms- Fatigue failure models- Design for fatigue strength and life-Typesofstressvariation,designforfluctuatingstresses,designforlimitedcycles,multiplestress cycles,Fatiguefailuretheories, cumulativefatiguedamage,thermalfatigueandshock,harmfulandbeneficialresidualstresses, Yieldingandtransformation- **creep:** Phenomenology, Creep curves, Creep properties, Multi-axial creep, Creep-fatigueinteraction,Creepintegrals

UnitIV

Surface failures: Surface geometry, mating surfaces, oil film and their effects, designvalues and procedures, adhesive wear, abrasivewear, corrosion wear, surface fatigue,differentcontacts,dynamiccontactstresses,surfacefatiguefailures,surfacefatiguestrength,

UnitV

Economic factors influencing design: Economic analysis, Break-even analysis, Humanengineering considerations, Ergonomics, Design of controls, Design of displays. Valueengineering, Material and process selection in value engineering, Modern approaches indesign.

REFERENCES:

1. MachineDesignAnIntegratedApproachbyRobertL.Norton,Prentice-HallNewJersey,USA.
2. MechanicalEngineeringDesignbyJ.E.ShigleyandL.D.MitchellpublishedbyMcGraw-Hill International BookCompany,NewDelhi.
3. Fundamentals of machine elements by Hamrock,SchmidandJacobian,2ndedition,McGraw-HillInternationaledition.
4. ProductdesignanddevelopmentbyKarlT.UlrichandStevenD.Eppinger.3rdedition,Tata McGrawHill.
5. ProductDesignandManufacturingbyA.K.ChitaleandR.C.Gupta,PrenticeHall

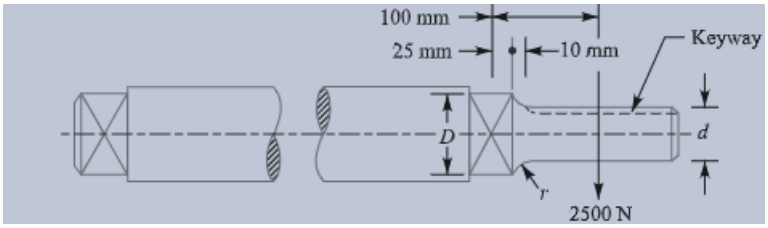
MODEL QUESTION PAPER
ADVANCED MECHANICAL ENGINEERING DESIGN

Time: 3 Hours **Max. Marks: 100**

Answer Any **FIVE** questions only

All Questions Carry Equal Marks

1	a) What is the design process of a product and explain various design models?	10
	b) What do you mean by factor of safety? Explain the design for safety and reliability?	10
2	a) Define stress concertation and explain the factors effecting stress concentration	10
	b)What are the factors to be considered for the selection of materials in machinedesign? Discuss?	10
3	a) Explain the product design strategies with suitable examples according to product specifications?	10
	b) Describe the design process for forging and casting operations?	10
4	a) A cylindrical shaft made of steel of yield strength 700 MPa is subjected to static loads consisting of bending moment 10 kN-m and a torsional moment 30 kN-m. Determine the diameterof the shaft using different static theories of failure, and assuming a factor of safety of 2. Take E = 210GPa and poisson's ratio = 0.25	10
	b) Define creep and explain about the creep curves?	10
5	a) A centrifugal blower rotates at 600 r.p.m. A belt drive is used to connect the blower to a 15 kW and 1750 r.p.m. electric motor. The belt forces a torque of 250 N-m and a force of2500 N on the shaft. Figure shows the location of bearings, the steps in the shaft and the plane inwhich the resultant belt force and torque act. The ratio of the journal diameter to the overhung shaftdiameter is 1.2 and the radius of the fillet is 1/10th of overhung shaft diameter. Find the shaft diameter, journal diameter and radius of fillet to have a factor of safety 3. The blower shaft is to be machinedfrom hot rolled steel having the following values of stresses: Endurance limit = 180 MPa; Yield point stress = 300 MPa; Ultimate tensile stress = 450 MPa.	10



	b)What is fracture mechanics? Describe the Griffith's theory and its modification?	10
6	a) Explain the different types wear models with neat diagrams?	10
	b) What are the considerations in human engineering? Explain?	10
7	a) What is the importance of Ergonomics in engineering design? Explain?	10
	b) Explain the importance of economic analysis in design?	10
8	a) Explain the modern approaches in design?	10
	b) What is role of value engineering in product design?	10