MATERIALS AND PROCESS SELECTION FOR ENGINEERING DESIGN

CourseCode	20ME6405	Year	II	Semester	II
Course Category	HONORS	Branch	ME	Course Type	Theory
Credits	4	L – T – P	3 – 1 – 0	Prerequisites	IEM
Continuous Internal Evaluation	30	Semester End Evaluation	70	Total Marks	100

Course Outcomes: Upon successful completion of the course, the student will be able to

	Statement	Skill	BTL	Units
CO1	Understand the material selection, process information, Economics and Environmental aspects for Engineering Applications	Understand	L2	1,2,3,4,5
CO2	Describe the Material Selection and Substitution for candidate materials	Describe	L2	1,3,4
CO3	Explain the basics of design-oriented materials selection for engineering applications	Explain	L2	4
CO4	Analyze materials selection case studies for which either single or multiple constraints are active.	Analyze	L4	1,2,4

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:High, 2: Medium, 1:Low)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2		3	1		1	1	1	1	3	1
CO2	3	2	1	2		2	1		1	1	1	1	3	1
CO3	3	2	3	2		3	3		1		2	1	3	1
CO4	3	2	3	2		3	3		1			1	3	1

Syllabus

UNIT	Contents	Mapped COs
I	**Materials Selection Process:** Introduction, Nature of the Selection Process, Analysis of the Material Performance Requirements and Creating Alternative Solutions, Functional Requirements, Processability Requirements, Cost, Reliability Requirements, Resistance to Service Conditions, Creating Alternative Solutions.	CO1
II	**Strategic thinking:** Matching material to design- The design process- Original design, Redesign, Devices to open corked bottles, **Material and process information for design the strategy:** translation, screening, ranking and documentation, Examples of translation.	CO2
III	**Economics and Environmental impact of materials and Processes:** Introduction, elements of the cost of materials, cost of ore preparation, cost of extraction from the ore, cost of purity and alloying, cost of conversion to semifinished products, cost of conversion to finished products, factors affecting material prices-general inflation and price fluctuations, supply and demand, order size, standardization of grades and sizes, cost extras for special quality geographic location, Comparison of materials on cost basis.	CO3

	Environmental impact assessment of materials and processes: Environmental considerations, energy content of materials, Case study: comparing the energy content in drink containers.	
IV	**Case Studies in Material Selection and Substitution:** Introduction, Design and Selection of Materials for Surgical Implants-Main Dimensions and External Forces, Fatigue-Loading Considerations, Wear Considerations, Analysis of Implant Material Requirements-Tissue Tolerance-CorrosionResistance-MechanicalBehaviour-ElasticCompatibility-Weight-Cost, Classification of Materials and Manufacturing Processes for the Prosthesis Pin, Evaluation of Candidate Materials. **Analysis of The Requirements and Substitution of Materials for Tennis Rackets:** Introduction-Analysis of the Functional Requirements of the Tennis Racket, Design Considerations, classification of Racket Materials-Material Substitution, Ranking of Alternative Substitutes-Conclusion	**CO4**
V	**Planning for Retirement of The Product and Environmental Considerations-** Recycling of Materials, Sources of Materials for Recycling, infrastructure for Recycling Packaging Materials, Sorting, Scrap Processing, Recyclability of Materials.	**CO5**

Learning Resources
Text books
1.Farag, Mahmoud M. Materials and process selection for engineering design. CRC Press, 2020. 2.Ashby, Michael F., Hugh Shercliff, and David Cebon. Materials: engineering, science, processing and design. Butterworth-Heinemann, 2018.
Reference books
1.Ashby, M. F. (2016). Materials Selection in Mechanical Design. United Kingdom: Elsevier Science. 2.Johnson, K., Ashby, M. F. (2013). Materials and Design: The Art and Science of Material Selection in Product Design. Netherlands: Elsevier Science.
E- Resources & other digital material
1.https://nptel.ac.in/courses/112/104/112104122/ 2.https://ocw.mit.edu/courses/materials-science-and-engineering/3-080-economic-environmental- issues-in-materials-selection-fall-2005/ 3.https://ocw.mit.edu/courses/materials-science-and-engineering/3-080-economic-environmental-issues-in-materials-selection-fall-2005/lecture-notes/lec_ms1.pdf 4.https://ocw.mit.edu/courses/materials-science-and-engineering/3-080-economic-environmental-issues-in-materials-selection-fall-2005/lecture-notes/lec_ms2.pdf 5.https://ocw.mit.edu/courses/materials-science-and-engineering/3-080-economic-environmental-issues-in-materials-selection-fall-2005/lecture-notes/lec_ms3.pdf 6.https://ocw.mit.edu/courses/materials-science-and-engineering/3-080-economic-environmental-issues-in-materials-selection-fall-2005/lecture-notes/