INDIAN INSTITUTE OF INFORMATION TECHNOLOGY
DESIGN AND MANUFACTURING (IIITDM) KANCHEEPURAM

<table>
<tr><td>Course Title</td><td colspan="2">Surface Modification Technologies</td><td>Course Code</td><td colspan="4">MEXXXX</td></tr>
<tr><td>Dept./
Specialization</td><td colspan="2">Mechanical Engineering</td><td>Structure (LTPC)</td><td>3</td><td>1</td><td>0</td><td>4</td></tr>
<tr><td>To be offered for</td><td colspan="2">UG / PG</td><td>Status</td><td colspan="2">Core ☐</td><td colspan="2">Elective ■</td></tr>
<tr><td>Faculty Proposing the course</td><td colspan="2">Dr. S. Gowthaman</td><td>Type</td><td colspan="2">New ☐</td><td colspan="2">Modification ■</td></tr>
<tr><td colspan="3">Recommendation from the DAC - Yes</td><td>Date of DAC</td><td colspan="4">01 – 06 – 2021</td></tr>
<tr><td>External Expert(s)</td><td colspan="6">Prof. M. Duraiselvam, NIT Trichy</td></tr>
<tr><td>Pre-requisite</td><td colspan="2">Materials for Engineers</td><td colspan="2">Submitted for approval</td><td colspan="2">46th Senate</td></tr>
<tr><td>Learning Objectives</td><td colspan="6">● To provide knowledge on various surface degradation mechanisms, modification and characterization techniques
● To explore the materials, process parameters and design guidelines used in surface engineering of materials</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">After the completion of the course, students will be able:
● To explain various types of surface degradation mechanisms, surface modification and characterization techniques
● To understand various materials requirements, process parameters and design guidelines so as to select appropriate surface modification technique for a given application</td></tr>
<tr><td>Contents of the course
(With approximate break-up of hours for L/T/P)</td><td colspan="6">Fundamentals of surface engineering: Surface dependent properties and failures, mechanism of surface degradation, importance and necessity of surface engineering, surface energy, general principles of surface engineering, analysis of surface roughness, classification and scope of surface engineering in metals, ceramics, polymers and composites, tailoring of surfaces of advanced materials. (L10+T4)

Conventional surface modification methods: Changing surface metallurgy - flame hardening, induction hardening, shot peening; changing surface chemistry – aluminum anodizing, oxidation treatments, diffusion coatings such as carburizing, nitriding and cyaniding; adding a surface layer or coating – organic coatings, ceramic coating and linings, hot dip coatings, electrochemical deposition; weld overlay coatings, scope and applications of conventional surface modification methods in engineering materials, advantages and limitations of conventional surface modification methods. (L10+T3)

Advanced surface modification methods: changing the surface metallurgy - high-energy beam hardening with ion, electron and laser beams, severe plastic deformation; changing the surface chemistry – ion implantation, laser alloying; adding a surface layer or coating – thermal spray coatings, plasma spray coating, cladding, chemical vapor deposition, physical vapor deposition, thermoreactive deposition/diffusion process, functional and nanostructured coatings and their</td></tr>
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	applications in photovoltaics, bio and chemical sensors, surface coatings on polymers and composites. (L12+T2) **Process comparison and surface characterization methods**: process availability, corrosion resistance, wear resistance, distortion or size change tendencies, coating thickness attainable; measurement of coating thickness, porosity, adhesion, residual stresses and stability; testing and evaluation of surface properties by microstructural and compositional characterization of surfaces, structure-property correlation, economics and energy considerations, designing of surface modification processes. (L10+T5)
Text Book	1. K. G. Budinski, Surface Engineering for Wear Resistance, 1st edition, Englewood Cliffs, New Jersey, Prentice Hass, 1988. ISBN: 0138779376. 2. J. R. Davis, Surface Engineering for Corrosion and Wear Resistance, 1st edition, ASM International, 2001, ISBN: 978-0-87170-700-0.
Reference Books	1. A. W. Batchelor, N. L. Loh and M. Chandrasekaran, Materials Degradation and Its Control by Surface Engineering, 3rd edition, World Scientific, 2011, ISBN: 978-1- 84816-501-4 2. M. Ohring, Materials Science of Thin Films – Deposition & Structure, 2nd edition, Academic Presss, 2002. ISBN-13: 978-0125249751.