ANNA UNIVERSITY, CHENNAI
UNIVERSITY DEPARTMENTS
R -2015

LIST OF OPEN ELECTIVES
TO BE OFFERED IN THE EVEN SEMESTER (MIT CAMPUS)

SL. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
FACULTY OF MECHANICAL ENGINEERING								
DEPARTMENT OF PRODUCTION TECHNOLOGY								
B.E. Production Engineering								
1.	PR7891	Surface Engineering	OE	3	3	0	0	3
2.	PR7892	Corrosion Engineering	OE	3	3	0	0	3
FACULTY OF INFORMATION AND COMMUNICATION ENGINEERING								
DEPARTMENT OF ELECTRONICS ENGINEERING								
B.E. Electronics and Communication Engineering								
3.	EC7891	Microcontroller Programming for Industrial Applications	OE	3	3	0	0	3

PR7891   **SURFACE ENGINEERING**   **L T P C**
                                                                          3 0 0 3

OBJECTIVES
- To enable the Engineering students about the value of surface engineering
- To make the engineering students to understand the importance of surface & its interactions with its environment
- To equip the students to understand the various & Advanced surface modification techniques
- To develop the skill among the students to evaluate and inspect the surface modified materials for various industrial usages.

UNIT- I   BASICS OF SURFACE PROPERTIES
Introduction – Tribology – surface degradation – wear – types of wear – adhesive – abrasive – oxidative –corrosive – erosive and fretting wear – roles of friction and lubrication – corrosion – types – passivity – mechanism of growth and break down of passive film – corrosion control.

UNIT – II   SURFACE CLEANING
Introduction – surface pretreatment of metallic and electronic materials – mechanical cleaning-polishing – chemical cleaning – acid, alkaline, acetone and carbon tetra chloride cleaning – alumina and diamond polishing – degreasing – ultrasonic cleaning

UNIT – III   SURFACE COATING TECHNIQUES
Introduction – principle – parameters of electrodeposition –Faraday's laws of electrodeposition-electrodeposition of copper, nickel, chromium and gold for industrial practices – organic coatings-paints-requirements of good paints-constituents of paints-function-formulation of durable paint-enamel coatings-special paints-heat resistant and fire retardant paints-electroless coatings-conversion coatings.

UNIT – IV   ADVANCED SURFACE MODIFICATION PROCESS
Introduction –physical vapor deposition-chemical vapor deposition- ion beam process – ion beam assisted vapour deposition – ion implantation – reactive ion sputtering coating – electron beam process – electron beam assisted vapour deposition – laser assisted surface modification – laser alloying – laser melting – laser ablation – laser sprayed deposit – direct metal deposition by laser

UNIT - V   STANDARDS FOR SURFACE ENGINEERING MEASUREMENTS
Introduction – Terminology – laboratory accredation – sampling – surface finish evaluation – bare and coated materials – product quality standards for specific coating process – conversion coatings – galvanized coatings – electrodeposited coatings – vapor deposited coatings – standards & ASTM Standards for measurement of surface treated materials – depth – thickness – hardness and friction co-efficient.

                                                             TOTAL: 45 PERIODS
TEXT BOOKS
1. Ramnarayan chattopadhyay, advanced thermally assisted surface engineering processes, kluwer academic publishers, 2004
2. Sudarshan T S, Surface modification technologies – an engineer's guide; Marcel Dekkar, Newyork, 1989.

REFERENCES
1. Varghese C D, Electroplating and other surface treatments – a practical guide, TMH, 1993.
2. Adamson A W and Gast A P, Physical chemistry of surfaces, 6th Ed., John Willey & Sons 1997.
3. Stanley J.Dapkunas, Surface Engineering Measurement Standards for inorganic materials,National institute of standards & technology (special publication,960-9)

PR7892   **CORROSION ENGINEERING**   **L T P C**
                                                                                 3 0 0 3

OBJECTIVES
- To enlighten the engineering students about the scope and cost of corrosion
- To make the engineering students to understand the various types of corrosion under normal to severe corrosive environments in manufacturing industrial sectors.
- To develop the skills among the students about corrosion testing of materials and devices of Aerospace, Automobile, refinaries and electronic equipments.
- To familiarize the students in selection of materials, corrosion monitoring and prevention, developing the specialized skills in manufacturing the durable materials for various industries for long term application.

UNIT I   INTRODUCTION AND CORROSION PRINCIPLES   9
Introduction-Definition-Corrosion engineering-Scope in industries-Cost of corrosion-corrosion damage-Classification of corrosion (wet & dry)-electrochemical corrosion-electrochemical reactions-effects of oxidizers-velocity-temperature-concentration-Galvanic coupling (Dissimilar materials coupling) - metallurgical aspects-metallic properties-economic considerations-importance of corrosion inspection-new instruments.

UNIT – II   FORMS OF CORROSION ON ENGINEERING DEVICES   9
Introduction-two metal Corrosion-emf-Galvanic series-Distance area principle, characteristics, mechanism, velocity of pitting corrosion (autocatalytic, shape and growth)-Intergrannular corrosion (weld decay, knife line attack)-Selective leaching (dezincification and graphitation)-erosion corrosion-surface film-turbulence-impingement-stress corrosion-cracking-crack-morphology-stress effect-time to cracking-Hydrogen embrittlement-fracture mechanism-prevention.

**UNIT-III   CORROSION TESTING OF ENGINEERING MATERIALS AND
                  DEVICES   9**
Introduction-classification-purpose-sample preparation-Exposure testing-Duration-planned interval tests for erosion corrosion-crevice-pitting-intergrannular-pitting and stress corrosion cracking-NACE test methods-Slow strain rate-linear polarization-cyclic voltametry-electronic instrumentation-AC impedance-in sea water testing-in vivo-testing-Huey and Streicher tests for stainless steel and sensitized steels-corrosion of plastics and elastomers-summerizing data-interpretations of data.

**UNIT-IV   EFFECTS OF CORROSIVE ENVIRONMENTS AND AGEING STUDIES OF
                  ENGINEERING MATERIALS AND DEVICES   9**
Introduction-atmosphere-seawater-fresh water-soils-corrosion of aerospace-automobile-electronic equipments-nuclear-thermal solar power plants-Ageing studies of Class1-class2-class 3 materials in ambient, medium and severe corrosive environments & manufacturing industries- case studies.

UNIT-V   MODERN APPROACHES FOR CORROSION PREVENTION   9
Introduction- selection of materials-alternate environments- proper design rules-metallic coatings-anodic and cathodic-applications-galvanizing of steel sheet-metal cladding-electroplating-objectives-theory-procedures on metals and non metals-electroplating of nickel and chromium for automobile and other industries –cleaning methods of samples before and after electro plating-metals spray coatings- corrosion control standards.

                                                                    TOTAL: 45 PERIODS
TEXT BOOKS
1. Mars G.Fontana Corrosion Engineering (Third edition) McGraw Hill Education (India) private Limited. Chennai , India
2. P.C.Jain & Monika Jain Engineering Chemistry, Dhanpat Rai & Sons, Delhi, India.

REFERENCES.
1. Pierre R. Roberge Handbook of corrosion Engineering, McGraw Hill Professional (1999)
2. Volkan Cicek, Corrosion Engineering, John Wiley & Sons (2014)
3. Volkan Cicek, Bayan Al-Numan,Corrosion Chemistry, John Wiley & sons (2011)

EC7891   **MICROCONTROLLER PROGRAMMING FOR**   **L T P C**
                    INDUSTRIAL APPLICATIONS   **3 0 0 3**

OBJECTIVES
- To study different microcontroller architectures and interfaces
- To program the microcontroller for real time applications
- To architect a microcontroller system for different hardware and software.

UNIT I   INTRODUCTION TO 8051 MICRO CONTROLLER   9
Overview of 8051 Micro Controller, Architecture, I/O ports and Memory Organization, Interrupts, Timer/Counter and Serial Communication.

UNIT II   PIC MICROCONTROLLER   9
PIC microcontroller Architecture - Memory - Parallel ports - Interrupts - Timers/Counters - UART-A/D converter - PWM.

UNIT III   PROGRAMMING WITH C   9
Introduction to C - Microchip MPLAB IDE - CCS PCM C compiler - Proteus VSM - Microchip PICDEM Mechatronics board.

UNIT IV   HUMAN AND PHYSICAL INTERFACES   9
Human interface from switches to keypads - LED displays - LCD - interfacing to the physical world-simple sensors: micro switch, Light-dependent resistors, Optical object sensing, opto-sensor applied as a shaft encoder, Ultrasonic object sensor - Actuators: DC and stepper motors - Interfacing to actuators.

UNIT V   APPLICATIONS OF 8051 AND PIC MICROCONTROLLERS   9
LED Chasing circuit - Four digit LED Display interface, Interrupt driven event counter with 4-digit LED display - Simple Buzzer interface, Speaker interface - Electronic Siren - Interfacing Digital temperature sensor - Analog temperature sensor IC with A/D converter .

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course, the student will be able to:
- Select a microcontroller suitable for industrial applications.
- Design hardware of microcontroller system.
- Find effective solutions to a wide range of real-world microcontroller applications.

TEXT BOOKS:
1. Muhammad Ali Mazidi and Janice GilliMazidi, The 8051 Micro Controller and Embedded Systems', Pearson Education, 5th Indian reprint, 2003.
2. Dogan Ibrahim, Microcontroller Projects in C for the 8051, Newnes, 2000.
3. Martin P.Bates, Programming 8-bit PIC Microcontrollers in C with interactive hardware simulation, Newnes Press, 2008.

REFERENCES:
1. Tim Wilmshurst, Designing Embedded Systems with PIC Microcontrollers Principles and applications, Newnes, Elsevier, 2007.
2. Milan Verle, PIC Microcontrollers – Programming In C, Mikro Elektronika, 2009.