E.G.S. PILLAY ENGINEERING COLLEGE

(Autonomous)

Approved by AICTE, New Delhi | Affiliated to Anna University, Chennai

Accredited by NAAC with 'A' Grade | Accredited by NBA (CSE, EEE, MECH)

NAGAPATTINAM – 611 002

M.E. MANUFACTURING ENGINEERING

Full Time Curriculum and Syllabus

First Year – First Semester

Course Code	Course Name	L	T	P	C	Maximum Marks		
						CA	ES	Total
Theory Course								
1701MF101	Advanced Optimization Techniques	2	2	0	3	40	60	100
1702MF102	Polymers and Composite Materials	3	0	0	3	40	60	100
1702MF103	Materials Testing and Mechanical Characterization	3	0	0	3	40	60	100
1702MF104	Industrial Automation and Mechatronics	3	0	0	3	40	60	100
1702MF105	Robot Design and Programming	3	0	0	3	40	60	100
	Elective-I	3	0	0	3	40	60	100
Laboratory Course								
1704MF106	CAD/CAM Lab	0	0	4	2	50	50	100
1704MF107	Automation and Mechatronics Lab	0	0	2	1	50	50	100
1704MF108	Communication Skills Lab I	0	0	2	1	100	0	100

L – Lecture | T – Tutorial | P – Practical | C – Credit | CA – Continuous Assessment | ES – End Semester

1701MF101	ADVANCED OPTIMIZATION TECHNIQUES	L	T	P	C
		2	2	0	3

COURSE OBJECTIVES:

To introduce the various advanced optimization techniques and their advancements.

UNIT I INTRODUCTION 7 Hours

Optimization – Historical Development – Engineering applications of optimization – Statement of an Optimization problem – classification of optimization problems.Classical optimization Techniques – Linear Programming, Non-linear Programming, Integer Programming and Dynamic Programming.

UNIT II FUZZY SYSTEMS 9 Hours

Basic definition and terminology, set-theoretic operations, Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions, Fuzzy Rules & Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making; Neuro-fuzzy modeling- Adaptive Neuro-Fuzzy Inference Systems, Coactive Neuro-Fuzzy Modeling, Classification and Regression Trees, Data Clustering Algorithms, Rulebase Structure Identification and Neuro-Fuzzy Control , Applications of neuro-fuzzy modeling

UNIT III ARTIFICIAL NEURAL NETWORKS 10 Hours

Introduction – Fundamental concept – Evolution of Neural Networks – Basic Models of Artificial Neural Networks – Important Terminologies of ANNs – McCulloch-Pitts Neuron – Linear Separability – Hebb Network. SupervisedLearning Network: Perceptron Networks – Adaline – Multiple Adaptive Linear Neurons – Back-Propagation Network – Radial BasisFunction Network.Applications of ANN.

UNIT IV GENETIC ALGORITHM 10 Hours

Introduction to Genetic Algorithms (GA), Representation, Operators in GA, Fitness function, population, building block hypothesis and schema theorem.; Genetic algorithms operators- methods of selection, crossover and mutation, simple GA(SGA), other types of GA, generation gap, steady state GA, Applications of GA

UNIT V SWARM INTELLIGENCE 9 Hours

Swarm intelligence, Various animal behaviors, Ant Colony optimization, swarm intelligence in bees, flocks of birds, shoals of fish, ant-based routing, Particle Swarm optimization

TOTAL: 45 HOURS

REFERENCES:

1. S.S. Rao, "Engineering Optimization: Theory and Practice", New Age International P)Ltd.,New Delhi, 2000.
2. S. Rajasekaran and G.A.V.Pai, Neural Networks, Fuzzy Logic and Genetic Algorithms, PHI, 2003.
3. Timothy J.Ross, Fuzzy Logic with Engineering Applications, McGraw-Hill, 1997.
4. J.S.R.Jang, C.T.Sun and E.Mizutani, Neuro-Fuzzy and Soft Computing, PHI, 2004, Pearson Education.
5. S.N. Sivanandan and S.N. Deepa, Principles of Soft Computing, Wiley India, 2007. ISBN: 10: 81-265-1075-7

1702MF102 POLYMERS AND COMPOSITE MATERIALS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. To study matrix material, reinforcements of polymer matrix composites, MMC and ceramic matrix composites.
2. To develop knowledge on processing, interfacial properties and application ofcomposites.

UNIT I PROCESSING OF POLYMERS 9 Hours

Chemistry and Classification of Polymers – Properties of Thermo plastics – Properties of Thermosetting Plastics - Extrusion – Injection Moulding – Blow Moulding – Compression and Transfer Moulding – Casting – Thermo Forming. General Machining properties of Plastics – Machining Parameters and their effect – Joining of Plastics – Thermal bonding – Applications.

UNIT II FIBERS AND MATRIX MATERIALS 9 Hours

Fibers – Fabrication, Structure, properties and applications – Glass fiber, Boron fiber, carbon fiber, organic fiber, ceramic and metallic fibers - whiskers–Fabrication of Matrix materials – polymers, metals and ceramics and their properties – interfaces – Wettability – Types of bonding at theinterface– Tests for measuring interfacial strength - Physical and chemical properties.

UNIT III PROCESSING OF POLYMER MATRIX COMPOSITES 9 Hours

Thermoset matrix composites: hand layup, spray, filament winding, Pultrusion, resin transfer moulding, autoclave moulding - bag moulding, compression moulding with Bulk Moulding Compound and sheet Moulding Compound – thermoplastic matrix composites – film stacking, diaphragm forming, thermoplastic tape laying, injection moulding – interfaces in PMCs - structure, properties and application of PMCs –recycling ofPMCs.

UNIT IV PROCESSING OF METAL MATRIX COMPOSITES 9 Hours

Metallic matrices: aluminium, titanium, magnesium, copper alloys – processing of MMCs: liquid state, Solid state, in situ fabrication techniques – diffusion bonding – powder metallurgy techniques- interfaces in MMCs – mechanical properties – machining of MMCs – Applications.

UNIT V PROCESSING OF CERAMIC MATRIX COMPOSITES AND CARBON-CARBON COMPOSITES 9 Hours

Processing of CMCs: cold pressing, sintering, reaction bonding, liquid infiltration, lanxide process – in situ chemical reaction techniques: chemical vapour deposition, chemical vapour impregnation,sol-gel– interfaces in CMCs – mechanical properties and applications of CMCs – Carbon-carbon Composites –applications.

TOTAL: 45 HOURS

REFERENCES:

1. Krishnan K Chawla, Composite Materials: Science and Engineering, International Edition, Springer, 2012,ISBN:978-0-387-74364-6.
2. Mallick P.K., Fiber Reinforced Composites: Materials, Manufacturing and Design, CRC press, New Delhi, 2010,ISBN:0849342058.
3. Jamal Y. Sheikh-Ahmad, Machining of Polymer Composites, Springer, USA, 2009. ISBN: 978-0- 387-35539-9.
4. Mallick, P.K. and Newman.S., Composite Materials Technology, Hanser Publishers,2003.
5. Harold Belofsky, Plastics, Product Design and Process Engineering, Hanser Publishers,2002.
6. Seamour, E.B. Modern Plastics Technology, Prentice Hall,2002
7. Said Jahanmir, Ramulu M. and PhilpKoshy, Machining of Ceramics and Composites, Marcel Dekker Inc., New York, 1999, ISBN:0-8247-0178-x.
8. ASM Handbook – Composites, Vol-21, 2001, ISBN: 978-0-87170-703-1.

1702MF103	MATERIALS TESTING AND MECHANICAL CHARACTERIZATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The students are expected to be knowledgeable in microstructure evaluation, crystal structure analysis, electron microscopy, Chemical Thermal Analysis, static and dynamic mechanical testing methods.

UNIT I MICRO AND CRYSTAL STRUCTURE ANALYSIS 9 Hours

Principles of Optical Microscopy – Specimen Preparation Techniques – Polishing and Etching – Polarization Techniques – Quantitative Metallography – Estimation of grain size – ASTM grain size numbers – Microstructure of Engineering Materials - Elements of Crystallography – X- ray Diffraction – Bragg's law – Techniques of X-ray Crystallography – Debye – Scherer camera – Geiger Diffractometer – analysis of Diffraction patterns – Inter planer spacing – Identification of Crystal Structure, Elements of Electron Diffraction.

UNIT II ELECTRON MICROSCOPY 9 Hours

Interaction of Electron Beam with Materials – Transmission Electron Microscopy – Specimen Preparation – Imaging Techniques – BF & DF – SAD – Electron Probe Microanalysis – Scanning Electron Microscopy – Construction & working of SEM – various Imaging Techniques – Applications- Atomic Force Microscopy- Construction & working of AFM - Applications .

UNIT III CHEMICAL ANDTHERMAL ANALYSIS 9 Hours

Basic Principles, Practice and Applications of X-Ray Spectrometry, Wave Dispersive X-Ray Spectrometry, Auger Spectroscopy, Secondary Ion Mass Spectroscopy, Fourier Transform Infra Red Spectroscopy (FTIR)- Proton Induced X-Ray Emission Spectroscopy, Differential Thermal Analysis, Differential Scanning Calorimetry (DSC) And Thermo Gravitymetric Analysis (TGA)

UNIT IV MECHANICAL TESTING –STATIC TESTS 9 Hours

Hardness – Brinell, Vickers, Rockwell and Micro Hardness Test – Tensile Test – Stress – Strain plot – Proof Stress – Torsion Test - Ductility Measurement – Impact Test – Charpy&Izod – DWTT - Fracture Toughness Test, Codes and standards for testing metallic and composite materials.

UNIT V MECHANICAL TESTING –DYNAMIC TESTS 9 Hours

Fatigue – Low & High Cycle Fatigues – Rotating Beam & Plate Bending HCF tests – S-N curve – LCF tests – Crack Growth studies – Creep Tests – LM parameters – AE Tests-modal analysis - Applications of Dynamic Tests.

TOTAL: 45 HOURS

REFERENCES:

1. Culity B.D., Stock S.R& Stock S., Elements of X ray Diffraction, (3rd Edition). Prentice Hall,2001.
2. Dieter G.E., Mechanical Metallurgy, (3rd Edition), ISBN: 0070168938, McGraw Hill,1988.
3. Davis, H.E., Hauck G. &Troxell G.E., The Testing of engineering Materials, (4th Edition), McGraw Hill, College Divn.,1982.
4. Suryanarayana A. V. K., Testing of metallic materials, (2nd Edition), BS publications,2007.
5. Newby J., Metals Hand Book- Metallography & Micro Structures, (9th Edition), ASM International,1989.
6. ASM Hand book-Materials characterization, Vol – 10,2004.

1702MF104	INDUSTRIAL AUTOMATION AND MECHATRONICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

Knowledge in Industrial Automation and Mechatronics systems and impart the source of concepts and techniques, which have recently been applied in practical situation. It gives the frame work of knowledge that allows engineers and technicians to develop an interdisciplinary understanding and integrated approach to engineering

UNIT I INDUSTRIAL AUTOMATION 9 Hours

Role of automation in industries, Benefits of automation –Introduction to fluid power, Advantages of fluid power, Application of fluid power system -Types of fluid power systems -Introduction to automation tools: Low cost automation, PLC, DCS, SCADA -Automation strategy evolution.

UNIT II INTRODUCTION TO MECHATRONICS 9 Hours

Introduction to Mechatronics-systems – Mechatronics approach to modern engineering and design – Need of Mechatronics – Emerging areas of Mechatronics – Classification of Mechatronics – Mechatronics elements.

UNIT III SENSORS AND TRANSDUCERS 9 Hours

Introduction – Performance Terminology – Potentiometers – Strain gauges – LVDT – Eddy current sensor – Hall effect sensor – Capacitance sensors – Digital transducers – Temperature sensors – Optical sensors – Piezo electric sensor-ultrasonic sensors – Proximity sensors – Signal processing techniques.

UNIT IV ACTUATORS 9 Hours

Switching Devices, Classification of actuators – Electrical actuators – Solid state relays, solenoids, D.C. motors, Servo motors, Stepper motors – Interfacing with microcontroller through H-bridge Circuits – Piezoelectric actuators.

UNIT V MECHATRONIC SYSTEMS 9 Hours

Design process-stages of design process – Traditional and Mechatronics design concepts – Case studies – Engine management system, Automatic camera, Automatic wishing machine, Pick and place robots.

TOTAL: 45 HOURS

REFERENCES:

1. R.K.Rajput.A Text Book of Mechatronics, Chand &Co,2007
2. W.Bolton,-Mechatronics‖Pearson Education Limited,2004
3. M.A. Mazidi& J.G. Mazidi, 8051 Micrcontroller and embedded systems,2002
4. Devadasshetty, Richard A. Kolk, -Mechatronics System Design‖, PWS Publishing Company, 2001.

1702MF105	ROBOT DESIGN & PROGRAMMING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. To teach the students about the kinematic arrangement of robots and its applications in the area of manufacturing sectors
2. To expose the students to build a robot for any type of application

UNIT I INTRODUCTION **9 Hours**

Definition, Need Application, Types of robots – Classifications – Configuration, work volume, control loops, controls and intelligence, specifications of robot, degrees of freedoms, end effectors – types, selection applications.

UNIT II ROBOT KINEMATICS **9 Hours**

Introduction – Matrix representation Homogeneous transformation, forward and inverse – Kinematic equations, Denvit – Hartenbers representations – Inverse Kinematic relations. Fundamental problems with D-H representation, differential motion and velocity of frames – Jacobian, Differential Charges between frames:

UNIT III ROBOT DYNAMICS AND TRAJECTORY PLANNING **9 Hours**

Lagrangeon mechanics, dynamic equations for sing, double and multiple DOF robots – static force analysis of robots, Trajectory planning – joint space, Cartesian space description and trajectory planning – third order, fifth order - Polynomial trajectory planning

UNIT IV ROBOT PROGRAMMING & AI TECHNIQUES **9 Hours**

Types of Programming – Teach Pendant programming – Basic concepts in A1 techniques – Concept of knowledge representations – Expert system and its components.

UNIT V ROBOT SENSORS AND ACTUATORS **9 Hours**

Design of Robots – characteristics of actuating systems, comparison, microprocessors control of electric motors, magnetostrictive actuators, shape memory type metals, sensors, position, velocity, force, temperature, pressure sensors – Contact and non contact sensors, infrared sensors, RCC, vision sensors.

TOTAL: 45 HOURS

REFERENCES:

1. Saeed.B.Niku, ‗Introduction to Robotics, Analysis, system, Applications', Pearson educations, 2002
2. Groover.M.P. Industrial Robotics, McGraw – Hill International edition,1996.
3. Wesley E Snyder R, ‗Industrial Robots, Computer Interfacing and Control', Prentice Hall International Edition,1988.
4. Gordon Mair, ‗Industrial Robotics', Prentice Hall (U.K.)1988

1704MF106	CAD / CAM LAB	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

1. To teach the students about the drafting of 3D components and analyzing the same using various CAD packages and programming of CNC machines
2. To train them to use the various sensors

LIST OF EXPERIMENTS:

CAM LABORATORY

1. Exercise on CNC Lathe: Plain Turning
2. Exercise on CNC Milling Machine: Profile Milling
3. Study of Sensors

CAD LABORATORY

2D modeling and 3D modeling of components such as

1. Bearing
2. Couplings
3. Gears
4. Sheet Metal Components
5. Jigs, Fixtures and Die Assemblies.

TOTAL: 45 HOURS

1704MF107	INDUSTRIAL AUTOMATION AND MECHATRONICS LAB	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

To train the students to have a hands on training of the basic concepts of various industrial automation and Mechatronics systems

LIST OF EXPERIMENTS:

1. Simulation of single and double acting cylindercircuits
2. Simulation of Hydrauliccircuits
3. Simulation of electro pneumaticcircuits
4. Simulation of electro hydrauliccircuits
5. Simulation of PLCcircuits
6. Software simulation of fluid power circuits using a software package.
7. Simulation of various Mechatronics systems using hardware components

TOTAL: 60 HOURS

1704MF108	COMMUNICATION SKILLS LAB I (Common to all M.E Progarmmes)	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

1. To acquire skills for using English in workplace effectively.
2. To communicate for essential business needs.
3. To prepare students for taking BEC Vantage level examination which is an International Benchmark for English language proficiency of Cambridge English Language Assessment

LIST OF EXPERIMENTS:

1. GRAMMAR AND VOCABULARY

Forming asking complex questions – expressing purpose and function –modal verbs – impersonal passive voice– Reported speech – cause and effect – relative pronouns – expressions followed by – *ing* forms– acronyms – marketing terms / vocabulary – financial terms – collocations – discourse markers

2. LISTENING

Purposes of listening – features of listening texts – potential barriers to listening – specific listening skills – strategies to use when listening– distinguishing relevant from irrelevant information – gap filling exercise – multiple-choice options – note completion – matching and multiple choice questions – listening for specific information, gist, topic, context and function.

3. SPEAKING

Word and sentence stress – clear individual sounds – turn taking – initiating and responding - intonation patterns – pronunciation – mother tongue intrusion– conversation practice – turn-taking and sustaining the interaction by initiating and responding appropriately- Public Speech – Lectures.

4. READING

Purposes of reading – potential barriers to reading – paraphrasing – identifying facts and ideas – skimming and scanning for information – matching statements with texts– spotting reference words – understanding text structure – understanding the ideas in a text – distinguishing between the correct answer and the distracter – understanding cohesion in a text – deciphering contextual meaning of words and phrases – cloze – proof reading - transcoding.

5. WRITING

Paragraphing a text – using appropriate connectives – editing practice –Longer Documents: writing a proposal & Reports, Agenda – Minutes – Circular

TOTAL: 30 HOURS

ADDITIONAL EXPERIMENTS:

1. Body Language: Kinesics, Proxemics, Para linguistic, Nuances of Speech Delivery
2. Personality Development: Building self esteem
3. Team work

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1: To enable students to get International recognition for work and study.

CO2: To use English confidently in the International business environments.

CO3: To be able to take part in business discussion, read company literature, write formal and informal business correspondences and listen and understand business conversations

REFERENCES:

1. Guy Brook-Hart, "BEC VANTAGE: BUSINESS BENCHMARK Upper-Intermediate – Student's Book", 1st Edition, Cambridge University Press, New Delhi, 2006.
2. Cambridge Examinations Publishing, "Cambridge BEC VANTAGE – Self-study Edition", Cambridge University Press, UK, 2005.
3. Swets, Paul. W. 1983. The Art of Talking So That People Will Listen: Getting
4. The Process of Writing: Planning and Research, Writing, Drafting and Revising