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

Second Year – Third Semester

Course Code	Course Name	L	T	P	C	Maximum Marks		
						CA	ES	Total
Theory Course								
1703MF011	**Elective III** - Rapid Prototyping	3	0	0	3	40	60	100
1703MF016	**Elective IV** - Heat Treatment	3	0	0	3	40	60	100
1703EV017	**Elective V** - Industrial Waste Management	3	0	0	3	40	60	100
Laboratory Course								
1704MF301	Project Work Phase-I	0	0	12	6	50	50	100
Open Electives								
1703MF021	Project Management	3	0	0	3	40	60	100
1703MF022	Product Life Cycle Management	3	0	0	3	40	60	100
1703MF023	Research Methodology	3	0	0	3	40	60	100
1703MF024	Modeling and Simulation	3	0	0	3	40	60	100
1703MF025	Sustainable Manufacturing	3	0	0	3	40	60	100

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

1703MF011	RAPID PROTOTYPING	L	T	P	C
		3	0	0	3

PREREQUISITE :

1. Manufacturing Technology – I
2. Manufacturing Technology – II

COURSE OBJECTIVES:

1. To make the students to understand the importance of time compression technologies
2. To make the students to understand the Selection of appropriate technology for the application
3. To make the students to have knowledge on Exposure to RP software packages

UNIT I INTRODUCTION **9 Hours**

Introduction- Need for the compression in product development, History of RP systems, Survey of applications, Growth of RP industry, Classification of RP systems.

UNIT II RP PROCESS-1 **9 Hours**

Principle, process parameters, process details and applications of various RP processes - Stereo lithography systems, Laser Sintering, Fused Deposition Modeling, Laminated Object.

UNIT III RP PROCESS-2 **9 Hours**

Manufacturing, Solid Ground Curing, Laser Engineered Net Shaping, 3D Printing, Laser Melting, Cladding.

UNIT IV RAPID TOOLING **9 Hours**

Rapid Tooling: Indirect rapid tooling Direct rapid tooling , soft tooling Vs hard tooling, Rapid Manufacturing Process Optimization- Factors influencing accuracy, data preparation errors, part building errors, errors in finishing, influence of part build orientation.

UNIT V RP SOFTWARES **9 Hours**

Software for RP: STL files, overview of solid view, magics, mimics, magics communicator, etc., internet based softwares, collaboration tools. RP Technology selection, Decision Making, Life Cycle Assessment of RP processes, Sustainability issues.

TOTAL: 45 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :

1. 3-D Printing
2. Sustainable Manufacturing
3. Advanced Rapid prototyping software

COURSE OUTCOMES:

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

CO1 Understand the importance of time compression technologies
CO2 Selection of appropriate technology for the application
CO3 Exposure to RP software packages
CO4 Understand the different rapid tooling process.
CO5 Analyze the rapid prototyping using relevant software.

REFERENCES:

1. Pham D T and Dimov S S, "Rapid Manufacturing", Verlag, 2001.
2. Paul F Jacobs, "Stereo lithography and other RP&M Technologies", SME,1996.
3. Terry Wohlers, "Wohlers Report 2001", Wohlers Associates, 2008.
4. Prasad H and Badrinarayanan, K S, “Rapid Prototyping and Tooling”, SPI-Pageturners, Bangalore, India, 2013.

1703MF016	HEAT TREATMENT	L	T	P	C
		3	0	0	3

PREREQUISITE :

Engineering Materials and Metallurgy

COURSE OBJECTIVES:

1. To make the students to have knowledge on identify the effect of heat treatment in alloying elements
2. To make the students to have knowledge on apply surface modification techniques
3. To make the students to have knowledge on find the defects occurring in heat treated parts

UNIT I INTRODUCTION **9 Hours**

Iron - Carbon Equilibrium Diagram: Effect of alloying element on properties of steel and heat treatments. Types and application of heat treatments in manufacturing Industries.

UNIT II TTT PROCESS **9 Hours**

TTT & CCT diagram for steels-Various heating media used for heat treatment, furnaces, Temperature and atmosphere control- Selection of furnace for heat treatment.

UNIT III HEAT TREATMENT PROCESS **9 Hours**

Heat Treatment Processes: Annealing – Normalising, Hardenability studies, Jominy end quench test, Grossman's experiments - Tempering, Austempering and Martempering. Thermomechanical treatments.

UNIT IV SURFACE MODIFICATION TECHNIQUES **9 Hours**

Surface Modification Techniques: Induction hardening, flame hardening, electron beam hardening and Laser beam hardening. Carburising, nitriding, carbonitriding, CVD and PVD processes, Ion implantation.

UNIT V DESIGN FOR HEAT TREATMENT **9 Hours**

Heat Treatment of Non-Ferrous Metals and Specific Alloy steels: Heat treatment of gray irons, white irons (malleabilising) and S.G.irons. Austempering of S.G.Iron. Defects: Defects in heat treated parts, causes and remedy Design for heat treatment.

TOTAL: 45 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :

1. Heat treatment for metal matrix composite.
2. Heat treatment for high temperature application metal.
3. Design for smart material heat treatment.

COURSE OUTCOMES:

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

CO1 Identify the effect of heat treatment in alloying elements
CO2 Apply surface modification techniques
CO3 Find the defects occurring in heat treated parts
CO4 Understand the different surface modification techniques.
CO5 Design heat treatment for different metals.

REFERENCES:

1. Rajan and Sharma "Heat Treatment Principles and Techniques" – Prentice Hall of India (P) Ltd, New Delhi, 2004.
2. Prabhudev, K H., "Handbook of Heat Treatment of Steels", Tata - McGraw Hill Publishing Co., New Delhi, 2000.
3. VijendraSingh,"Heat Treatment of Metals", Standard Publishers Distributors, Delhi, First edition 1998.
4. American Society for Metals, "Metals Handbook Vol.4", ASM Metals Parks, Ohio, USA, 2001.
5. Karl-Erik Thelning, "Steel and its Heat Treatment", Butterworths London, second edition 1984.
6. Novikov I, "Theory of Heat Treatment of Metals", MIR Publishers, Moscow, 1978.

1703EV017	INDUSTRIAL WASTE MANAGEMENT	L	T	P	C
		3	0	0	3

PREREQUISITE :

Knowledge on waste water and treatment

COURSE OBJECTIVES:

1. To impart knowledge on the concept and application of Industrial pollution prevention
2. To impart knowledge on the cleaner technologies
3. To educate about the industrial wastewater treatment and residue management.

UNIT I INTRODUCTION 8 Hours

Industrial scenario in India– Industrial activity and Environment - Uses of Water by industry – Sources and types of industrial wastewater – Nature and Origin of Pollutants - Industrial wastewater and environmental impacts – Regulatory requirements for treatment of industrial wastewater – Industrial waste survey – Industrial wastewater monitoring and sampling -generation rates, characterization and variables –Toxicity of industrial effluents and Bioassay tests – Major issues on water quality management.

UNIT II INDUSTRIAL POLLUTION PREVENTION & WASTE MINIMISATION 8 Hours

Prevention vis a vis Control of Industrial Pollution – Benefits and Barriers – Waste management Hierarchy - Source reduction techniques – Periodic Waste Minimisation Assessments – Evaluation of Pollution Prevention Options – Cost benefit analysis – Pay-back period – Implementing & Promoting Pollution Prevention Programs in Industries.

UNIT III INDUSTRIAL WASTEWATER TREATMENT 10 Hours

Flow and Load Equalisation – Solids Separation – Removal of Fats, Oil & Grease- Neutralisation – Removal of Inorganic Constituents – Precipitation, Heavy metal removal , Nitrogen & Phosphorous removal, Ion exchange, Adsorption, Membrane Filtration, Eletrodialysis & Evaporation – Removal of Organic Constituents – Biological treatment Processes, Chemical Oxidation Processes, Advanced Oxidation processes – Treatability Studies.

UNIT IV WASTEWATER REUSE AND RESIDUAL MANAGEMENT 9 Hours

Individual and Common Effluent Treatment Plants – Joint treatment of industrial and domestic wastewater - Zero effluent discharge systems - Quality requirements for Wastewater reuse – Industrial reuse , Present status and issues - Disposal on water and land – Residuals of industrial wastewater treatment – Quantification and characteristics of Sludge – Thickening, digestion, conditioning, dewatering and disposal of sludge – Management of RO rejects.

UNIT V CASE STUDIES 10 Hours

Industrial manufacturing process description, wastewater characteristics, source reduction options and waste treatment flow sheet for Textiles – Tanneries – Pulp and paper – metal finishing – Oil Refining – Pharmaceuticals – Sugar and Distilleries

TOTAL: 45 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :

1. Recent industrial waste management methodologies
2. Advanced treatment techniques

COURSE OUTCOMES:

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

CO1 Understand the wastewater monitoring and treatment requirements
CO2 Define the Principles of pollution prevention and mechanism of oxidation processes.
CO3 Suggest the suitable technologies for the treatment of wastewater.
CO4 Discuss about the wastewater characteristics
CO5 Design the treatment systems

REFERENCES:

1. Industrial wastewater management, treatment & disposal, Water Environment
2. Lawrance K.Wang, Yung . Tse Hung, Howard H.Lo and Constantine Yapijakis, " handlook of Industrial and Hazardous waste Treatment", Second Edition, 2004.
3. Metcalf & Eddy/ AECOM, water reuse Issues, Technologies and Applications, The Mc Graw- Hill companies, 2007.
4. Nelson Leonard Nemerow, "industrial waste Treatment", Elsevier, 2007.
5. W.Wesley Eckenfelder, "Industrial Water Pollution Control", Second Edition, Mc Graw Hill, 1989.
6. Paul L. Bishop, „Pollution Prevention: - Fundamentals and Practice", Mc-Graw Hill International, Boston, 2000.