2101MF101 - PROBABILITY AND STATISTICS IN MANUFACTURING

L T P C
3 1 0 4

OBJECTIVES:

- To understand the basics of random variables with emphasis on the standard discrete and continuous distributions.
- To introduce the concepts of sampling distributions and the test statistics.
- To provide an understanding of the statistical methods and concepts by which real life problemsare analyzed.
- To analyze various data using statistical techniques.
- To train the students in design experiments and use these concepts for research.

MODULE I PROBABILITY THEORY 12

Random variables – probability density and distribution functions-moment generating and characteristic functions – Binomial, Poisson, Normal distributions and their applications in manufacturing.

MODULE II SAMPLING THEORY 12

Sampling distributions – Standard error – t, F, Chi square distributions – applications in manufacturing.

MODULE III ESTIMATION THEORY 12

Interval estimation for population mean, standard deviation, difference in means, preparation ratio ofstandard deviations and variances- applications in manufacturing.

MODULE IV TESTING OF HYPOTHESIS AND ANOVA 12

Hypothesis testing – Small samples – Tests concerning proportion, means, standard deviations –Tests based on chi square – and Redistribution test -Design of experiments - applications in manufacturing.

MODULE V ANOVA 12

Design of experiments – One, Two factor Models- applications in manufacturing

TOTAL: 60 PERIODS

OUTCOMES: Employability.

At the end of the course, the student will be

- Able to analyze the performance in terms of probabilities and distributions achieved by thedetermined solution.
- Aware of various test statistics for the samples.
- Able to develop an ability to apply statistical tests in experiments as well as to analyze and interpret data.
- Able to use the statistical tools for their project and future research.
- Able to use the concepts in design of experiments in manufacturing problems.

REFERENCES:

1. Gupta and Kapoor, "Fundamentals of Applied Statistics", Sultan Chand and sons, 4th Edition, NewDelhi, 2019.
2. Hooda, "Statistics for Business and Economics", Macmillan, 3rd Edition, India, 2003.
3. John.E.Freunds, "Mathematical statistics with applications", Pearson Education, 8th Edition, NewDelhi, 2013.
4. Levin and Rubin, "Statistics for Management", Pearson Education India, 7th Edition, New Delhi,2013.

ATTESTED
Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

2102MF102	MODERN MANUFACTURING PROCESSES	L T P C 3 0 0 3

OBJECTIVES:

- To create awareness on Abrasive aided machining
- To understand electrical and electrochemical machining processes.
- To analyse the principles of high energy aided machining.
- To study the surface and bulk machining processes of silicon wafer.
- To introduce students to the major manufacture steps in electronic circuit boards.

MODULE I ABRASIVE AIDED MACHINING PROCESSES **9**

Abrasive machining – water jet machining - ultrasonic machining –Abrasive flow machining- Magnetorheological Abrasive flow machining- construction working principle – steps - types – process parameters – derivations – problems, merits, demerits and applications .

MODULE II ELECTRICAL AND CHEMICAL AIDED MACHINING PROCESSES **9**

Wire cut EDM - Electric discharge machining – Electrochemical machining – chemical machining – Maskants - Electrochemical grinding - construction – principle – types – control - circuits – tool design – merits, demerits and applications. Hybrid Machining.

MODULE III HIGH ENERGY AIDED MACHINING PROCESSES **9**

Laser beam machining – Electron beam machining – Plasma arc machining – Ion beam machining – construction working principle types – process parameter – derivations – problems, merits, demerits and applications.

MODULE IV FABRICATION OF MICRO DEVICES **9**

Semiconductors – Si wafer - planarization – Oxidation - diffusion – ion implantation – etching – metallization – bonding – surface and bulk machining – LIGA Process

MODULE V MICROFABRICATION TECHNOLOGY **9**

Moulding – PCB board hybrid and MCM technology – programmable devices and ASIC – electronic material and processing– stereolithography – Solid free form fabrication -SAW devices, Surface Mount Technology

TOTAL: 45 PERIODS

OUTCOMES : Employability.

Students will be able to

CO1 : Understand and grasp the significance of modern machining process and its applications.
CO2 : Identify the selection of machining process and its parameters.
CO3 : Express and appreciate the cutting edge technologies and apply the same for researchpurposes.
CO4 : Measure the stages involved in fabrication of micro devices.
CO5 : Create new devices involved in micro fabrication and recent technology.

REFERENCES:

1. Brahem T. Smith, Advanced Machining I.F.S. UK 2016.
2. Jaeger R.C., Introduction to Microelectronic Fabrication Addison Wesley, 2nd Edition, 1998.
3. Jain V K, Micromanufacturing Processes, CRC Press, 2012.
4. Julian W. Gardner, Vijay K Varadan and Osama O Awadelkarim, Microsensors MEMS andSmart devices, John Willey, 2013.
5. Pandey P.C. and Shan HS Modern Machining Processes, Standard Publishing Co.,1st Edition,1980.
6. Serope Kalpakjian and Steven R. Schmid- Manufacturing Process for Engineering Material – Pearson Education, 6th Edition, 201

ATTESTED
Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

2103MF001 - THEORY OF METAL FORMING

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OBJECTIVES:

- To provide knowledge on the mechanism involved in plastic deformation and parameter representation.
- Enable students to understand various bulk forming process and its recent technology.
- To provide overview of various sheet metal forming process
- To study the powder metallurgy techniques and Special metal forming processes.
- To introduce the significance of surface treatment and industrial application of metal forming

MODULE I THEORY OF PLASTICITY **9**

Theory of plastic deformation – Yield criteria – Tresca and Von-Mises – Distortion energy – Stress- strain relation – Mohr's circle representation of a state of stress – cylindrical and spherical co-ordinate system – upper and lower bound solution methods – Overview of FEM applications in Metal Forming analysis.

MODULE II THEORY AND PRACTICE OF BULK FORMING PROCESSES **9**

Analysis of plastic deformation in Forging, Rolling, Extrusion, rod/wire drawing and tube drawing – Effect of friction – calculation of forces, work done – Process parameters, equipment used – Defects – applications – Recent advances in Forging, Rolling, Extrusion and Drawing processes – Design consideration in forming.

MODULE III SHEET METAL FORMING **9**

Formability studies – Conventional processes – High energy rate forming (**HERF**) techniques – Superplastic forming techniques – Hydro forming – Stretch forming – Water hammer forming – Principles and process parameters – Advantage, Limitations and application – Incremental forming.

MODULE IV POWDER METALLURGY AND SPECIAL FORMING PROCESSES **9**

Overview of P/M technique – Advantages – applications – Powder preform forging – powder rolling – Tooling, process parameters and applications. - Orbital forging – Isothermal forging – Hot and cold isostatic pressing – High speed extrusion – Rubber pad forming – Fine blanking – LASER beam forming

MODULE V SURFACE TREATMENT AND METAL FORMING APPLICATIONS **9**

Experiment techniques of evaluation of friction in metal forming selection – influence of temperature and gliding velocity – Friction heat generation – Friction between metallic layers – Lubrication carrier layer – Surface treatment for drawing, sheet metal forming, Extrusion, hot and cold forging. Processing of thin Al tapes – Cladding of Al alloys – Duplex and triplex steel rolling – Thermo mechanical regimesof Ti and Al alloys during deformation – Formability of welded blank sheet – Laser structured steel sheet - Formability of laminated sheet.

TOTAL: 45 PERIODS

OUTCOMES:

Employability

Students will able to

CO1 : Understand the state of stress in metal forming process.
CO2 : To identify the appropriate bulk forming process based on the application.
CO3 : Understand the conventional sheet metal forming process and various high energy rateforming techniques.
CO4 : Understand the powder metallurgy forming technique.
CO5 : Select appropriate surface heat treatment technique.

ATTESTED
Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

2103MF007 **ADVANCED WELDING TECHNOLOGY** L T P C
3 0 0 3

OBJECTIVES:

- To provide overview of different arc and gas welding processes.
- To know various solid state and special welding processes.
- To introduce to metallurgy of welding.
- To design the weldments for various materials.
- To gain knowledge on various welding defects and inspection methods.

MODULE I ARC AND GAS WELDING PROCESSES 9

Fundamental Principles – Air Acetylene Welding, Oxyacetylene Welding, Carbon Arc Welding, Shielded Metal Arc Welding, Submerged Arc Welding, TIG and MIG Welding, Plasma Arc Welding and Electroslag Welding Processes – Advantages, Limitations and Applications - Spot Welding, Seam Welding, Projection Welding, Resistance Butt Welding, Flash Butt Welding, Percussion Welding and High Frequency Resistance Welding Processes – Advantages, Limitations and Applications – RoboticWelding

MODULE II SOLID STATE AND SPECIAL WELDING PROCESSES 9

Cold Welding, Diffusion Bonding, Explosive Welding, Ultrasonic Welding, Friction Welding, Friction Stir Welding - Forge Welding, Roll Welding and Hot Pressure Welding Processes – Advantages, Limitations and Applications - Thermit Welding, Atomic Hydrogen Welding, Electron Beam Welding, Laser Beam Welding, Friction Stir Welding, Under Water Welding, Welding Automation In Aerospace, Nuclear and Surface Transport Vehicles.

MODULE III WELDING METALLURGY 9

geometry, plate thickness, preheat, significance of thermal severity number, Epitaxial growth - weld metal solidification - columnar structures and growth morphology effect of welding parameters - absorption of gases - gas/metal and slag/metal reactions, Phase transformations- weld CCT diagrams

- carbon equivalent-preheating and post heating weldability of low alloy steels, welding of stainless steels use of Schaffler and Delong diagrams, welding of cast irons - Welding of Cu, Al, Ti and Ni alloys – processes, difficulties, microstructures, defects andremedial measures, Origin - types - process induced defects, - significance - remedial measures, Hot cracking - cold cracking -lamellar tearing - reheat cracking - weldability tests - effect ofmetallurgical parameters,.

MODULE IV DESIGN OF WELDMENTS 9

Type of joints, joint efficiency, factor of safety, symbols, selection of edge preparation, design considerations, types of loading, Permissible stress, allowable defects, computation of stresses in welds, weld size calculation, code requirement for statically loaded structures - Design for fluctuating and impact loading - dynamic behaviour of joints – stress, concentrations - fatigue analysis

- fatigue improvement techniques - permissible stress- life prediction, Concept of stress intensity factors - LEFM and EPFM concepts - brittle fracture- transition, temperature approach - fracture toughness testing, application of fracture mechanics to fatigue Welding residual stresses - causes, occurrence, effects and measurements - thermal and mechanical relieving; types of distortion - factorsaffecting distortion, distortion control methods - prediction - correction, jigs, fixtures and positioners.

ATTESTED

Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

MODULE VWELDING DEFECTS AND INSPECTION 9

Classification of weld defects- General sources of weld defects- Arc welding defects- Weld defects in other than Arc welding processes. Resistance welding defects- Defects in Friction welding- Defects in friction stir welding - Defects in welds of other welding processes-Visual Inspection-Liquid Penetrant Inspection- Magnetic particle inspection- Ultra sonic testing(UT) Radiography testing (RT) - Eddy current testing –Thermography- Optical and Acoustical holography.

TOTAL : 45 PERIODS

OUTCOMES: Employability / Entrepreneurship.

Students will be able to

CO1 : Understand the different arc and gas welding processes. **CO2 :** Know and perform solid state and special welding process. **CO3 :** Understand and analyze the material structures after welding. **CO4 :** Design the weldments for various materials.

CO5 : Attain the knowledge about various welding defects and inspection methods.

REFRENCES:

1. Baldev Raj, Practical Non – Destructive Testing, Narosa Publishing House,2009.
2. Lancaster J.F, Metallurgy of Welding, Abington Publishing,6th Edition, 1999.
3. Linnert G. E.,'Welding Metallurgy', Volume I and II, AWS,4thEdition, 1994
4. Mishra. R.S and Mahoney. M.W, Friction Stir Welding and Processing, ASM, 2007
5. Parmer R.S., "Welding Engineering and Technology", Khanna Publishers,1stEdition New Delhi,2008.
6. Welding Handbook, Volume 2, 7thEdition, American Welding Society

ATTESTED

Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

2101RMX01 **RESEARCH METHODOLOGY AND IPR**

COURSE OBJECTIVES:

To impart knowledge and skills required for research and IPR:

- Problem formulation, analysis and solutions.
- Technical paper writing / presentation without violating professional ethics
- Patent drafting and filing patents.

MODULE I RESEARCH PROBLEM FORMULATION **9**

Meaning of research problem- Sources of research problem, criteria characteristics of a good research problem, errors in selecting a research problem, scope and objectives of researchproblem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, necessary instrumentations

MODULE II LITERATURE REVIEW **9**

Effective literature studies approaches, analysis, plagiarism, and research ethics.

MODULE IIITECHNICALWRITING /PRESENTATION **9**

Effective technical writing, how to write report, paper, developing a research proposal, format of research proposal, a presentation and assessment by a review committee.

MODULE IV INTRODUCTION TO INTELLECTUAL PROPERTY RIGHTS (IPR) **9**

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

MODULE V INTELLECTUAL PROPERTY RIGHTS (IPR) **9**

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. New Developments in IPR: Administration of Patent System, IPR of Biological Systems, Computer Software etc.
Traditional knowledge Case Studies, IPR and IITs.

TOTAL: 45 PERIODS

COURCE OUTCOMES: Employability | Skill Development

1. Ability to formulate research problem
2. Ability to carry out research analysis
3. Ability to follow research ethics
4. Ability to understand that today's world is controlled by Computer, Information Technology, buttomorrow world will be ruled by ideas, concept, and creativity
5. Ability to understand about IPR and filing patents in R & D.

ATTESTED
Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Nagapattinam (Dt) Tamil Nadu.

REFERENCES:

1. Asimov, "Introduction to Design", Prentice Hall, 1962.
2. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
3. Mayall, "Industrial Design", McGraw Hill, 1992.
4. Niebel, "Product Design", McGraw Hill, 1974.
5. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guidefor beginners" 2010

AUDIT COURSES

2101AU001	ENGLISH FOR RESEARCH PAPER WRITING	L	T	P	C
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COURSE OBJECTIVES:

1. Teach how to improve writing skills and level of readability
2. Tell about what to write in each section
3. Summarize the skills needed when writing a Title
4. Infer the skills needed when writing the Conclusion
5. Ensure the quality of paper at very first-time submission

MODULE I	INTRODUCTION TO RESEARCH PAPER WRITING	6 Hours
Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness		
MODULE II	PRESENTATION SKILLS	6 Hours
Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction		
MODULE III	TITLE WRITING SKILLS	6 Hours
Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check		
MODULE IV	RESULT WRITING SKILLS	6 Hours
Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions		
MODULE V	VERIFICATION SKILLS	6 Hours
Useful phrases, checking Plagiarism, how to ensure paper is as good as it could possibly be the first- time submission		
	Total:	30 Hours

FURTHER READING:

COURSE OUTCOMES: Skill Development

CO1	Understand that how to improve your writing skills and level of readability
CO2	Learn about what to write in each section
CO3	Understand the skills needed when writing a Title
CO4	Understand the skills needed when writing the Conclusion
CO5	Ensure the good quality of paper at very first-time submission

References:

1. R. Nadarajan, Sangam Ali, "Disaster Management in India: Perspectives, issues and strategies" New Royal book Company
2. Sahni, Pardeep Et. Al. (Eds.)" Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi
3. Goel S. L., Disaster Administration And Management Text And Case Studies" ,Deep &Deep Publication Pvt. Ltd., New Delhi

ATTESTED

Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

2102MF103 - COMPUTER AIDED MANUFACTURING LAB **L T P C**
0 0 4 2

AIM:

To impart the knowledge on training the students in the area of CAM
To teach the students about programming of CNC machines
To train them to use the various sensors

EXPERIMENTS:

Exercise on CNC Lathe: Plain Turning, Step turning, Taper turning, Threading, Grooving& canned cycle
Exercise on CNC Milling Machine: Profile Milling, Mirroring, Scaling & canned cycle.
Study of Sensors, Transducers & PLC: Hall-effect sensor, Pressure sensors, Strain gauge, PLC, LVDT, Load cell, Angular potentiometer, Torque, Temperature & Optical Transducers.

TOTAL: 60 PERIODS

OUTCOMES: Employability | Entrepreneurship.

Students will be able to
CO1 : Understand and grasp the significance of modern machining process and its applications through hands-on experience.
CO2 : Identify the selection of machining processes and its process parameters.
CO3 : Express and perform project related works.

ATTESTED
Dr. S. RAMABALAN, M.E., Ph.D.
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

2102MF104 - METAL FORMING AND METAL TESTING LABORATORY

L T P C
0 0 4 2

AIM

- To impart practical knowledge on bulk metal forming and sheet metal forming processes

OBJECTIVE

- To train the students to have an hands on having the basic concepts of metal forming processes and to determine some metal forming parameters for a given shape.

EXPERIMENTS

1. Determination of strain hardening exponent
2. Determination of strain rate sensitivity index
3. Determination of efficiency in water hammer forming
4. Determination of interface friction factor
5. Study on rolling process
6. Determination of torque and force measurement in rolling mill.
7. Analysis of cutting forces on a lathe.
8. Measurement of torque on milling machine.

TOTAL: 60 PERIODS

OUTCOMES: Employability.

Students will be able to

1. **CO1 :** Understand and grasp the significance of modern machining process and itsapplications through hands-on experience.
2. **CO2 :** Identify the selection of machining processes and its process parameters.
3. **CO3 :** Express and perform project related works.

ATTESTED

Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

2102MF201	INDUSTRIAL AUTOMATION AND MECHATRONICS	L T P C
		3 0 0 3

OBJECTIVES:

This syllabus is formed to create 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.

MODULE I INDUSTRIAL AUTOMATION **8**

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.

MODULE II INTRODUCTION TO MECHATRONICS **8**

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

MODULE III SENSORS AND TRANSDUCERS **12**

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.

MODULE IV ACTUATORS 8

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 – Piezo electric actuators.

MODULE V MECHATRONIC SYSTEMS **9**

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

TOTAL: 45 PERIODS

OUTCOMES : Employability.

Students will be able to

CO1 : Understand and grasp the significance of modern machining process and its applications.
CO2 : Identify the selection of machining process and its parameters.
CO3 : Express and appreciate the cutting edge technologies and apply the same for researchpurposes.
CO4 : Measure the stages involved in fabrication of micro devices.
CO5 : Create new devices involved in micro fabrication and recent technology.

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 Microcontroller and embedded systems,2002
4. Devadasshetty, Richard A. Kolk, -Mechatronics System Design, PWS Publishing Company, 2001.

ATTESTED

Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

2102MF202 - ROBOT DESIGN AND PROGRAMMING **L T P C**
3 0 0 3

OBJECTIVES:

- To gain knowledge on growth of robots since origin based on the application.
- To study the kinematics of robot.
- To study the dynamics of robot.
- To expose the students in the various programming techniques in robot and illuminate the curiosity over recent AI techniques.
- To familiarize the sensors and actuators involved in the robot based the application.

MODULE I INTRODUCTION **9**

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.

MODULE II ROBOT KINEMATICS **9**

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:

MODULE III ROBOT DYNAMICS AND TRAJECTORY PLANNING **9**

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

MODULE IV ROBOT PROGRAMMING AND AI TECHNIQUES **9**

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

MODULE V ROBOT SENSORS AND ACTUATORS **9**

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 PERIODS

OUTCOMES: Employability

Students will able to

CO1 : Apply their knowledge on calculation of end effector coordinate position and angle based onthe application.

CO2 : Calculate force involved in the robot while under operation (i.e. gripping force). **CO3 :** Compute the trajectory of robot based on both joint space and Cartesian space.**CO4 :** Understand the traditional programming in robot and Modern AI Techniques.

CO5 : Identify appropriate sensors and actuators based on the application.

REFERENCES:

1. Fu K S, Gonzalez, Lee C S G, Robotics: Control, Sensing, Vision and Intelligence, McGraw-Hill *Book* Company, 1987.
2. Gordon Mair, 'Industrial Robotics', Prentice Hall U.K, 1998.
3. Groover.M.P. Industrial Robotics, McGraw – Hill International edition, 2012.
4. John J. Craig, Introduction to Robotics: Mechanics and Control, Pearson, 3rd edition, 2004.
5. Saeed.B.Niku, 'Introduction to Robotics, Analysis, system, Applications', Pearson education,2010.
6. Wesley E Snyder R, 'Industrial Robots, Computer Interfacing and Control', Prentice HallInternational

ATTESTED
Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

2102MF203 - MATERIALS TECHNOLOGY **L T P C**
3 0 0 3

OBJECTIVES:

- To understand the elastic and plastic behaviour of materials.
- To impart knowledge on fracture analysis.
- To familiarize on modern metallic materials.
- To review on polymeric and ceramics materials and their applications.
- To enable student to select material for specific applications.

MODULE I ELASTIC AND PLASTIC BEHAVIOR **10**

Elasticity in metals and polymers Anelastic and visco-elastic behaviour – Mechanism of plastic deformation shear strength of perfect and real crystals – Strengthening mechanisms, work hardening, solid solutioning, grain boundary strengthening, poly phase mixture, precipitation, particle, fibre, dispersion and texture strengthening. Effect of temperature, strain and strain rate on plastic behaviour – Super plasticity – Deformation of polymeric, ceramic and non-crystalline materials.

MODULE II FRACTURE BEHAVIOUR **10**

Griffith's theory, stress intensity factor, J-Integral and fracture toughness – Toughening mechanisms – Ductile, brittle transition in steel – High temperature fracture, creep – Larson Miller parameter – Deformation and fracture mechanism maps – Fatigue, low and high cycle fatigue test, crack initiation and propagation mechanisms and Paris law. Effect of surface and metallurgical parameters on fatigue – Fracture in ceramics and polymers – Failure analysis, sources of failure, procedure of failure analysis.

MODULE III MODERN METALLIC MATERIALS **8**

Dual phase steels, High strength low alloy (HSLA) steel, Transformation induced plasticity (TRIP) Steel, Maraging steel, Nitrogen steel, Super alloys –Intermetallics, Ni and Ti aluminides – smart materials, shape memory alloys – Metallic glass nano crystalline materials and composite materials.

MODULE IV NON METALLIC MATERIALS **7**

Polymeric materials – Formation of polymer structure – Production techniques of fibres, foams, adhesives and coating – structure, properties and applications of Commodity and engineering polymers – Advanced structural ceramics, WC, TIC, TaC, Al_2O_3, SiC, Si_3N_4 CBN and diamond – properties, applications as abrasives and cutting tool- Properties and applications of CNT – Graphene based Material

MODULE V SELECTION OF MATERIALS **10**

Selection for mechanical properties, strength, toughness, fatigue and creep – Selection for Atmospheric, water, Soil and chemical, corrosion Selection for adhesive and abrasive wear resistance – Relationship between materials selection and processing – Case studies in materials selection with relevance to aero, auto, marine, machinery, chemical and nuclear applications.

TOTAL: 45 PERIODS

OUTCOMES: Employability.

Students will be able to

CO1 : Get knowledge of mechanism of failure of materials and methods.

CO2 : Fully appreciate modification of material property to suit the specific requirements.

CO3 : Express and appreciate the existing materials and development of upcoming new materials. **CO4 :** Have the knowledge to select the various non-metallic materials to suit required applications**CO5 :** Identify and select suitable material for relevant application.

REFERENCES:

1. Ashby M.F., Material Selection in Mechanical Design, 5th Edition, Butter Worth 2017.
2. ASM Hand book, Vol.11, Failure Analysis and Prevention, 10th Edition, ASM, 2002.

2103MF012 PRODUCTION AND OPERATIONS MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:

- To familiarize with various forecasting models.
- To impress upon the importance of sequencing problem in industries.
- To design and develop inventory control models for a given industry.
- To familiarize with project management techniques such as CPM and PERT.
- To train on plant engineering techniques such as plant location, plant layout, materials handling and work study.

MODULE I FORECASTING **9**

Forecasts-Types-Purpose- opinion and judgmental method-Time series methods – moving average - weighted moving average – method of least squares – Exponential smoothing method- Regression and correlation methods – simple and multiple regression – Linear and Nonlinear regression.

MODULE II SCHEDULING AND SEQUENCING
9

Scheduling – Single Criterion rules –Sequencing –n job 2 machine problem – Johnson's algorithm – 3 machine problem – M machine problem – Graphical method for 2 jobs M machine problems – Heuristic methods.

MODULE III INVENTORY
9

Inventory – purpose of inventory – Basic EOQ Model –Quantity discount model – Reorder level – Fixed order quantity inventory system – Periodic review system – ABC analysis – Materials requirement planning – EOQ models under constraints – Purchasing management – Stores management – Just In Time inventory system – Vendor evaluation - Inventory pricing –Supply chain Management – Aggregate planning.

MODULE IV PROJECT MANAGEMENT
9

Project network analysis – Activities – Events- critical path method – Method based on time estimates – Programme Evaluation Review Technique –Optimistic, pessimistic time, most likely time - Probability of completion of projects – Time crashing of Projects –Optimum duration and cost.

MODULE VPLANT ENGINEERING AND WORK STUDY **9**

Plant location – Factors affecting plant location – Break even analysis- Factors weighted ratingmethod – Plant layout- Types- Selection – Plant layout Techniques – Travel chart method – Line balancing method– Work study – method study – Principles of Motion economy – steps in methods study - Charts – Micromotion study-memo motion study – multiple activity charts- therbligs – work measurement – stop watch time study – Production studies – PMTS – Work sampling – Materials handling – Principles – Selection.

TOTAL : 45 PERIODS

OUTCOMES: Employability.

Students will be able to

CO1 : Select an appropriate forecasting method for a given industry. **CO2 :** Obtain optimal solutions for sequencing problem in industry. **CO3 :** Design a suitable inventory system for any particular industry.

CO4 : Use the project management techniques to minimize the project time.

CO5 : Design plant layout and materials handling systems and can make use of the concepts of workstudy for work design.

ATTESTED
Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

2103MF013 PROCESSING OF POLYMERS AND COMPOSITES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the various processing methods of polymers.
- To enlighten the students about the different types of fibres and matrix materials.
- To analyse the different polymer matrix composites processing methods and their applications.
- To expose the students to the various metal matrix composite processing methods.
- To analyse the various processing techniques of various ceramic matrix composites.

MODULE I PROCESSING OF POLYMERS **9**

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.

MODULE II FIBRES AND MATRIX MATERIALS **9**

Fibres – Fabrication, Structure, properties and applications – Glass fibre, Boron fibre, carbon fibre, organic fibre, ceramic and metallic fibres - whiskers–Fabrication of Matrix materials – polymers, metalsand ceramics and their properties – interfaces – Wettability – Types of bonding at the interface – Testsfor measuring interfacial strength - Physical and chemical properties.

MODULE III PROCESSING OF POLYMER MATRIX COMPOSITES **9**

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 of PMCs.

MODULE IV PROCESSING OF METAL MATRIX COMPOSITES 9

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.

MODULE V PROCESSING OF CERAMIC MATRIX COMPOSITES AND CARBON-CARBON COMPOSITES **9**

Processing of CMCs: cold pressing, sintering, reaction bonding, liquid infiltration, lanxide process – insitu 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 PERIODS

OUTCOMES: Employability.

Students will be able to

CO1 : Get knowledge on various processing methods of polymers.
CO2 : Get knowledge about various types of fibres and matrix materials.
CO3 : Understand the various polymer matrix composites processing methods.
CO4 : Analyse the various processing methods of metal matrix composites.
CO5 : Analyse the various processing techniques of ceramic matrix composites.

ATTESTED
Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

2101AU002	DISASTER MANAGEMENT	L T P C 2 0 0 0

COURSE OBJECTIVES

- Summarize basics of disaster
- Explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- Describe an understanding of standards of humanitarian response and practical relevance inspecific types of disasters and conflict situations.
- Develop the strengths and weaknesses of disaster management approaches

MODULE I INTRODUCTION **6**

Disaster: Definition, Factors and Significance; Difference between Hazard And Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

MODULE II REPERCUSSIONS OF DISASTERS AND HAZARDS 6

Economic Damage, Loss of Human and Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

MODULE III DISASTER PRONE AREAS IN INDIA 6

Study of Seismic Zones; Areas Prone To Floods and Droughts, Landslides And Avalanches; Areas Prone To Cyclonic and Coastal Hazards with Special Reference To Tsunami; Post-Disaster Diseases and Epidemics

MODULE IV DISASTER PREPAREDNESS AND MANAGEMENT 6

Preparedness: Monitoring Of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological And Other Agencies, Media Reports: Governmental and CommMODULEy Preparedness.

MODULE VRISK ASSESSMENT 6

Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival

TOTAL : 30 PERIODS

OUTCOMES

Employability

CO1: Ability to summarize basics of disaster
CO2: Ability to explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
CO3: Ability to illustrate disaster risk reduction and humanitarian response policy and practicefrom multiple perspectives.
CO4: Ability to describe an understanding of standards of humanitarian response and practicalrelevance in specific types of disasters and conflict situations.
CO5: Ability to develop the strengths and weaknesses of disaster management approaches

REFERENCES

1. Goel S. L., Disaster Administration And Management Text And Case Studies",Deep & Deep Publication Pvt. Ltd., New Delhi,2009.
2. NishithaRai, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'NewRoyal book Company,2007.
3. Sahni, PardeepEt.Al. ," Disaster Mitigation Experiences And Reflections", Prentice HallOfIndia, New

2102MF204 - INDUSTRIAL AUTOMATION AND MECHATRONICS LAB

L T P C
0 0 4 2

OBJECTIVE:

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

EXPERIMENTS

1. Simulation of single and double acting cylinder circuits
2. Simulation of Hydraulic circuits
3. Simulation of electro pneumatic circuits
4. Simulation of electro hydraulic circuits
5. Simulation of PLC circuits
6. Software simulation of fluid power circuits using a software package.
7. Simulation of various Mechatronics systems using hardware components

TOTAL: 60 PERIODS

OUTCOMES: Employability.

Students will be able to

CO1 : Understand and grasp the significance of modern machining process and its applications through hands-on experience.

CO2 : Identify the selection of machining processes and its process parameters.

CO3 : Express and perform project related works.

ATTESTED
Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

2102MF205 - MODELLING AND SIMULATION LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

- To study the fundamentals of finite element analysis from classical method to nodal approximation method in various fields of manufacturing applications.
- To make the students to design an element by Finite element analysis.
- To develop the knowledge related to modelling and simulation in field of manufacturing.

LIST OF EXERCISES

1. One Dimensional FEA Problem like beam, Truss etc.
2. Two Dimensional FEA Problems like plane stress, plane strain, axisymmetric andvibration.
3. Three Dimensional FEA Problems like shell and contact.
4. FEA Application in metal forming like superplastic forming, deep drawing etc
5. FEA Application in Metal cutting
6. FEA Application in Casting process
7. 3D Modelling and Assemble of Engine
8. Modelling of Crack Shaft
9. Modelling of Connecting Rod
10. Modelling of Cotter Joint
11. Modelling of Plummer Block and Coupling

(Any 10 for Conduct of end semester examination)

OUTCOMES: Employability.

Students will be able to

CO1 : Apply the principles of Finite Element Analysis to solve problems in the field ofproduction engineering.

CO2 : design and analyse various problems in field of manufacturing

CO3 : identify the problems and simulate using Finite element analysis

CO4 : Relate to Finite element analysis in various manufacturing applications.

CO5 : Develop skills in field of design and simulation using FEA.

ATTESTED

Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

AUDIT COURSES (AC)

2101AU001 **ENGLISH FOR RESEARCH PAPER WRITING** **L T P C**

2 0 0 0

COURSE OBJECTIVES

- Teach how to improve writing skills and level of readability
- Tell about what to write in each section
- Summarize the skills needed when writing a Title
- Infer the skills needed when writing the Conclusion
- Ensure the quality of paper at very first-time submission

MODULE I **INTRODUCTION TO RESEARCH PAPER WRITING** **6**

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs andSentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

MODULE II **PRESENTATION SKILLS** **6**

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing andPlagiarism, Sections of a Paper, Abstracts, Introduction

MODULE III **TITLE WRITING SKILLS** **6**

Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check

MODULE IV **RESULT WRITING SKILLS** **6**

Skills are needed when writing the Methods, skills needed when writing the Results, skills areneeded when writing the Discussion, skills are needed when writing the Conclusions

MODULE V **VERIFICATION SKILLS** **6**

Useful phrases, checking Plagiarism, how to ensure paper is as good as it could possibly be thefirst- time submission

TOTAL: 30 PERIODS

OUTCOMES

Skill Development

CO1 –Understand that how to improve your writing skills and level of readabilityCO2 – Learn about what to write in each section
CO3 – Understand the skills needed when writing a Title
CO4 – Understand the skills needed when writing the Conclusion CO5 – Ensure the good quality of paper at very first-time submission

REFERENCES

1. Adrian Wallwork, English for Writing Research Papers, Springer New York DordrechtHeidelberg London, 2011
2. Day R How to Write and Publish a Scientific Paper, Cambridge University Press 2006
3. Goldbort R Writing for Science, Yale University Press (available on Google Books) 2006
4. Highman N, Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book 1998.

ATTESTED
Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

2104MF206	MINI PROJECT WITH SEMINAR	L T P C 0 0 2 1

OBJECTIVES

- To prepare students to identify a problem for study.
- To do literature review of a problem.
- To enable to comprehend information in form of presentation both written and oral, to develop technical communication skills.
- To carry out modelling/ conduct experiments beyond regular laboratory exercises indeveloping solution to the identified problem.
- To cultivate spirit of team work in working as a group.

A student has to choose a problem and carry out scientific systematic investigation experimentally/ theoretically in suggesting a viable solution. At the end of the semester, each group of students have to submit a report for evaluation.

TOTAL: 30 PERIODS

OUTCOMES

Employability | Entrepreneurship | Skill Development

Students at the end of course will be

- To critically observe the world around and identify a problem that can be solved.
- To develop skills of read and comprehensively analysing the facts.
- To exhibit skill of presentation both orally and in written form.
- To get hands on experience to doing experimental/ theoretical analysis in synthesis of solution to the problem
- Able to appreciate the importance of team work

ATTESTED
Dr. S. RAMABALAN, M.E., Ph.D.
PRINCIPAL
E.G.S. Pillay Engineering College,
...thi, Nagore - 611 002.
...tinam (Dt) Tamil Nadu.

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.

Employability.

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.

ATTESTED

Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

17I5MF016	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.

employability.

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.

ATTESTED
Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

17MEV017	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, Electrodialysis & 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

Employability.

REFERENCES:

1. Industrial wastewater management, treatment & disposal, Water Environment
2. Lawrence K.Wang, Yung . Tse Hung, Howard H.Lo and Constantine Yapijakis, " Handbook 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.

ATTESTED

Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

1704MF301	Project Work – Phase I	L T P C 0 0 12 6

OBJECTIVES:

- To enable students to select and define a problem/need for analysis in the field of manufacturing engineering.
- To review and analyse literature/ data of selected problem for study and proposeobjective and scope of dissertation work.
- To develop hypothesis and identify methodology based on ethical, scientific andsystematic application of knowledge in the field of problem
- To design, model and experiment/develop optimal solution for problem beinginvestigated
- To analysis and interpretation of data, and synthesis of the information to provide valid conclusions and submit dissertation.

EVALUATION:

- A project topic may be selected based on the literature survey and the creative ideas of the students themselves in consultation with their project supervisor. The topic should be so chosen that it will improve and develop the skills to design, fabricate, analyse, test and research. Literature survey and a part of the project work be carried out in dissertation I.
- The project work is evaluated jointly by external and internal examiners constituted by the Head of the Department based on oral presentation and the project report.
- A project report for dissertation I is to be submitted at the end.
- Project work evaluation is based on the Regulations of the Credit system for the Post graduate programmes of EGSPEC.

TOTAL: 90 PERIODS

OUTCOMES: Employability | Entrepreneurship | Skill development

CO1 : The students would apply the knowledge gained from theoretical and practical coursesin solving problems, so as to give confidence to the students to be creative and get trained in planning, organizing and coordination various components of dissertation work.

ATTESTED
Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.

1704MF401	Project Work – Phase II	L T P C
		0 0 28 14

OBJECTIVES:

- Based on practical experience in dissertation-I work, the students will be able to proposeand define a problem/need for analysis in the field of manufacturing engineering.
- To comprehensively review and analyse literature/ data to develop hypothesis andidentify methodology based on ethical, scientific and systematic application of knowledge in the field of problem
- To design experiments, develop model and conduct experiments/ simulations for development of sustainable and economical solution for problem being investigated
- To analyse and interpret data, and synthesize of the factual information's to arrive at valid conclusions
- To enable students to communicate technical information in form of oral presentation and technical report in form of dissertation

EVALUATION:

- The progress of the project is evaluated based on a minimum of three reviews.
- The review committee may be constituted by the Head of the Department.
- A project report is required at the end of the semester. The project work is evaluated jointly by external and internal examiners constituted by the Head of the Department based on oral presentation and the project report
- Project work evaluation is based on the Regulations of the Credit system for Post graduate programmes of EGSPEC.

OUTCOMES:

Employability / Entrepreneurship / Skill Development

CO1 : The students' would apply the knowledge gained from theoretical and practical courses in solving problems, so as to give confidence to the students to be creative, well planned, organized, coordinated project outcome of the aimed work.

ATTESTED
Dr. S. RAMABALAN, M.E., Ph.D.,
PRINCIPAL
E.G.S. Pillay Engineering College,
Thethi, Nagore - 611 002.
Nagapattinam (Dt) Tamil Nadu.