MF4201 OPTIMIZATION TECHNIQUES IN MANUFACTURING L T P C
3 0 0 3

OBJECTIVES:

1) To make use of the optimization techniques while modelling and solving the engineering problems of different fields.
2) To apply Linear Programming and Dynamic Programming to provide solutions for different problems
3) Learn classical optimization techniques and numerical methods of optimization.
4) Know the basics of different evolutionary algorithms.
5) To understand and differentiate traditional and non-traditional methods of Optimization

UNIT I INTRODUCTION 9

Optimization – Historical Development – Engineering applications of optimization – Statement of an Optimization problem – classification of optimization problems.

UNIT II CLASSIC OPTIMIZATION TECHNIQUES 9

Linear programming - Graphical method – simplex method – dual simplex method – revised simplex method – duality in LP – Parametric Linear programming – Goal Programming.

UNIT III NON-LINEAR PROGRAMMING 9

Introduction – Lagrangeon Method – Kuhn-Tucker conditions – Quadratic programming – Separable programming – Stochastic programming – Geometric programming

UNIT IV INTEGER PROGRAMMING AND DYNAMIC PROGRAMMING AND NETWORK TECHNIQUES 9

Integer programming - Cutting plane algorithm, Branch and bound technique, Zero-one implicit enumeration – Dynamic Programming – Formulation, Various applications using Dynamic Programming. Network Techniques – Shortest Path Model – Minimum Spanning Tree Problem – Maximal flow problem.

UNIT V ADVANCES IN SIMULATION 9

Genetic algorithms – simulated annealing – Neural Network and Fuzzy systems

TOTAL: 45 PERIODS

OUTCOMES:

1) At the end of this course the students will be expected to introduce the various optimization techniques and their advancements.
2) Ability to go in research by applying optimization techniques in problems of Engineering and Technology
3) Use classical optimization techniques and numerical methods of optimization.
4) Describe the basics of different evolutionary algorithms
5) Ability to solve the mathematical results and numerical techniques of optimization theory to concrete Engineering problems by using computer software

REFERENCES:

1. Hamdy A. Taha, Operations Research – An Introduction, Prentice Hall of India, 1997
2. J.K.Sharma, Operations Research – Theory and Applications – Macmillan India Ltd., 1997
3. P.K. Guptha and Man-Mohan, Problems in Operations Research – Sultan chand & Sons, 1994
4. R. Panneerselvam, “Operations Research”, Prentice Hall of India Private Limited, New Delhi 1 – 2005
5. Ravindran, Philips and Solberg, Operations Research Principles and Practice, John Wiley

CO-PO Mapping

CO	PO					
	1	2	3	4	5	6
1	2	-	-	3	2	-
2	1	-	-	2	3	-
3	1	-	-	2	2	-
4	-	2	-	-	-	-
5	1	-	-	3	-	2
Avg.	1.25	2	-	2.5	2.33	2

MF4202 ADVANCES IN METROLOGY AND INSPECTION L T P C
3 0 0 3

OBJECTIVES:

1) To teach the students basic concepts in various methods of engineering measurement techniques and applications
2) To make them understand the importance of measurement and inspection in manufacturing industries.
3) To understand the use of Light rays and Laser beams for measurement and their merits
4) To make the students capable of learning to operate and use advanced metrological devices with ease in industrial environments.
5) To teach the use of computer for measuring and processing of measured quantity

UNIT I CONCEPTS OF METROLOGY 9

Terminologies – Standards of measurement – Errors in measurement – Interchangeability and Selective assembly – Accuracy and Precision – Calibration of instruments – Basics of Dimensional metrology and Form metrology

UNIT II MEASUREMENT OF SURFACE ROUGHNESS 9

Definitions – Types of Surface Texture: Surface Roughness Measurement Methods- Comparison, Contact and Non-Contact type roughness measuring devices, 3D Surface Roughness Measurement, Nano Level Surface Roughness Measurement – Instruments.

UNIT III INTERFEROMETRY 9

Introduction, Principles of light interference – Interferometers – Measurement and Calibration – Laser Interferometry applications - strain –pressure – displacement – vibration

UNIT IV MEASURING MACHINES AND LASER METROLOGY 9

Tool Makers Microscope –height gauges- Coordinate Measuring Machines – Applications – Laser Micrometer, Laser Scanning gauge, Computer Aided Inspection techniques - In-process inspection, Machine Vision system- automated visual inspection -Applications.

UNIT V IMAGE PROCESSING FOR METROLOGY 9

Overview, Computer imaging systems, Image Analysis, Pre-processing, Human vision system, Image model, Image enhancement, grey scale models, histogram models, Image Transforms - Examples.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course the students are expected to

1. Understand the advanced measurement principles with ease.
2. Operate sophisticated and accurate measuring instruments.
3. Understand the various inspection methods and tools
4. Design and develop new measuring methods.
5. Apply computers in Measurement

REFERENCES

1. "ASTE Handbook of Industries Metrology", Prentice Hall of India Ltd., 1992.
2. Bewoor, A.K. and Kulkarni,V.A.,"Metrology and Measurement", Tata Mc Graw-Hill, 2009.
3. Galyer, F.W. and Shotbolt, C.R., "Metrology for engineers", ELBS, 1990.
4. Gupta, I.C., "A Text Book of engineering metrology", Dhanpat Rai and Sons, 1996.
5. Jain ,R.K.,"Engineering Metrology", Khqanna Publishers, 2008.
6. Rajput,R.K., "Engineering Metrology and Instrumentations", Kataria & Sons Publishers, 2001.
7. Smith,G.T., "Industrial Metrology", Springer, 2002
8. Sonka,M., Hlavac,V. and Boyle.R., "Image Processing, Analysis, and Machine Vision", Cengage-Engineering, 2007.
9. Whitehouse,D.J., "Surface and their measurement", Hermes Penton Ltd, 2004.

CO-PO Mapping

CO	PO					
	1	2	3	4	5	6
1	1	-	-	1	1	-
2	1	-	-	1	-	2
3	1	-	3	-	2	1
4	1	-	-	1	2	1
5	-	-	-	1	2	1
Avg.	1	-	3	1	1.75	1.25

MF4203 THEORY OF METAL FORMING L T P C
3 0 0 3

OBJECTIVES:

1) To study the basic concepts of metal forming techniques and to develop force calculation in metal forming process.
2) To study the thermo mechanical regimes and its requirements of metal forming
3) To learn the art of processing and making of powder metallurgy components
4) To learn the effect of friction and lubrication in Metal forming
5) To study the various surface treatment processes

UNIT 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.

UNIT 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 – Equal Chanel Angular Pressing-High Pressure Torsion- Repetitive Corrugation and Straightening- Accumulative Roll bonding.

UNIT III SHEET METAL FORMING 9

Formability studies – Conventional processes – H E R F techniques – Superplastic forming techniques – Hydro forming – Stretch forming – Water hammer forming – Principles and process parameters – Advantages, Limitations and applications

UNIT 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

UNIT 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 regimes of Ti and Al alloys during deformation – Formability of welded blank sheet – Laser structured steel sheet - Formability of laminated sheet.

OUTCOMES:

1) At the end of this course the students are expected to upgrade their knowledge on various metal forming techniques and formability
2) Apply the theory of plasticity for various types of metal forming process.
3) Apply the concept of powder metallurgy to make prismatic components
4) Understand Non-traditional forming processes.
5) Understand the purpose of surface treatment in metal forming applications

TOTAL: 45 PERIODS

REFERENCES:

1. Altan T., Metal forming – Fundamentals and applications – American Society of Metals, Metals park, 2003
2. ALTAN.T, SOO-IK-oh, GEGEL, HL – Metal forming, fundamentals and Applications, American Society of Metals, Metals Park, Ohio, 1995.
3. ASM Hand book, Forming and Forging, Ninth edition, Vol – 14, 2003
4. Dieter G.E., Mechanical Metallurgy (Revised Edition II) McGraw Hill Co., 1988
5. Helmi A Youssef, Hassan A. El-Hofy, Manufacturing Technology: Materials, Processes and Equipment, CRC publication press, 2012.
6. Marciniak,Z., Duncan J.L., Hu S.J., 'Mechanics of Sheet Metal Forming', Butterworth-Heinemann An Imprint of Elsevier, 2006
7. Nagpal G.R., Metal Forming Processes- Khanna publishers, 2005.
8. SAE Transactions, Journal of Materials and Manufacturing Section 5, 1993-2007
9. SHIRO KOBAYASHI, SOO-IK-oh-ALTAN, T, Metal forming and Finite Element Method, Oxford University Press, 2001.
10. Surender Kumar, Technology of Metal Forming Processes, Prentice Hall India Publishers, 2010

CO-PO Mapping

CO	PO					
	1	2	3	4	5	6
1	-	-	-	-	-	-
2	1	-	-	-	-	-
3	1	-	-	2	1	2
4	1	-	2	2	-	-
5	-	-	1	-	2	3
Avg.	1	-	1.5	2	1.5	2.5

MF4204 ADDITIVE MANUFACTURING L T P C
3 0 0 3

OBJECTIVES:

1) To educate students with fundamental and advanced knowledge in the field of Additive manufacturing technology
2) Gain insights on the need, advantages and limitations of additive manufacturing (AM) versus traditional manufacturing
3) Find out the various applications of AM, Deployment levels, Innovative and optimized product design
4) To explore the potential of additive manufacturing in different industrial sectors.
5) To apply 3D printing technology for additive manufacturing.

UNIT I INTRODUCTION 9

Need - Development of AM systems – AM process chain - Impact of AM on Product Development - Virtual Prototyping- Rapid Tooling – RP to AM -Classification of AM processes-Benefits- Applications.

UNIT II REVERSE ENGINEERING AND CAD MODELLING 9

Basic concept- Digitization techniques – Model reconstruction – Data Processing for Rapid Prototyping: CAD model preparation, Data requirements – Geometric modelling techniques: Wire frame, surface and solid modelling – data formats - Data interfacing, Part orientation and support generation, Support structure design, Model Slicing, Tool path generation-Software for AM- Case studies.

UNIT III LIQUID BASED AND SOLID BASED ADDITIVE MANUFACTURING SYSTEMS 9

Stereolithography Apparatus (SLA): Principle, pre-build process, part-building and post-build processes, photo polymerization of SL resins, part quality and process planning, recoating issues, materials, advantages, limitations and applications.

Solid Ground Curing (SGC): working principle, process, strengths, weaknesses and applications. Fused deposition Modelling (FDM): Principle, details of processes, process variables, types, products, materials and applications. Laminated Object Manufacturing (LOM): Working Principles, details of processes, products, materials, advantages, limitations and applications - Case studies.

UNIT IV POWDER BASED ADDITIVE MANUFACTURING SYSTEMS 9

Selective Laser Sintering (SLS): Principle, process, Indirect and direct SLS- powder structures, materials, post processing, surface deviation and accuracy, Applications. Laser Engineered Net Shaping (LENS): Processes, materials, products, advantages, limitations and applications– Case Studies.

UNIT V OTHER ADDITIVE MANUFACTURING SYSTEMS 9

Three-dimensional Printing (3DP): Principle, basic process, Physics of 3DP, types of printing, process capabilities, material system. Solid based, Liquid based and powder based 3DP systems, strength and weakness, Applications and case studies. Shape Deposition Manufacturing (SDM), Ballastic Particle Manufacturing (BPM), Selective Laser Melting, Electron Beam Melting.

TOTAL: 45 PERIODS

OUTCOMES:

1) The students are expected to learn about a variety of Additive Manufacturing (AM) technologies.
2) Describe additive manufacturing and explain its advantages and disadvantages
3) Explain the processes used in additive manufacturing for a range of materials and applications
4) understand the role of additive manufacturing in the design process and their potential to support Design and manufacturing,
5) Case studies relevant to mass customized manufacturing, and some of the important research challenges associated with AM and its data processing tools

REFERENCES:

1. Chua, C.K., Leong K.F. and Lim C.S., “Rapid prototyping: Principles and applications”, second edition, World Scientific Publishers, 2010.
2. Gebhardt, A., “Rapid prototyping”, Hanser Gardener Publications, 2003.
3. Gibson, I., Rosen, D.W. and Stucker, B., “Additive Manufacturing Methodologies: Rapid Prototyping to Direct Digital Manufacturing”, Springer, 2010.
4. Hilton, P.D. and Jacobs, P.F., Rapid Tooling: Technologies and Industrial Applications, CRC press, 2005.
5. Kamrani, A.K. and Nasr, E.A., “Rapid Prototyping: Theory and practice”, Springer, 2006.
6. Liou, L.W. and Liou, F.W., “Rapid Prototyping and Engineering applications: A tool box for prototype development”, CRC Press, 2011.

CO-PO Mapping

CO	PO					
	1	2	3	4	5	6
1	2	-	2	-	-	-
2	1	-	-	-	-	2
3	-	-	3	-	2	-
4	-	-	-	3	-	-
5	-	-	-	-	2	3
Avg.	1.5	-	2.5	3	2	2.5

MF4205 **FLUID POWER AUTOMATION** **L T P C**
3 0 0 3

OBJECTIVES:

1) To make the students to learn the basic concepts of hydraulics and pneumatics and their controlling elements in the area of manufacturing process.
2) To train the students in designing the hydraulic and pneumatic circuits using various design procedures.
3) To understand the concept and principle operation of automation systems and their controls.
4) To provide knowledge levels needed for PLC programming and operating
5) Ability to implement automation systems in Industry

UNIT I INTRODUCTION 9

Need for Automation, Hydraulic & Pneumatic Comparison – ISO symbols for fluid power elements, Hydraulic, pneumatics – Selection criteria.

UNIT II FLUID POWER GENERATING/UTILIZING ELEMENTS 9

Hydraulic pumps and motor gears, vane, piston pumps-motors-selection and specification-Drive characteristics – Linear actuator – Types, mounting details, cushioning – power packs – construction. Reservoir capacity, heat dissipation, accumulators – standard circuit symbols, circuit (flow) analysis.

UNIT III CONTROL AND REGULATION ELEMENTS 9

Direction flow and pressure control valves-Methods of actuation, types, sizing of ports-pressure and temperature compensation, overlapped and underlapped spool valves-operating characteristics-electro hydraulic servo valves, Digital valves -Different types-characteristics and performance.

UNIT IV CIRCUIT DESIGN 9

Typical industrial hydraulic circuits-Design methodology – Ladder diagram-cascade, method-truth table-Karnaugh map method-sequencing circuits-combinational and logic circuit.

UNIT V ELECTRO PNEUMATICS & ELECTRONIC CONTROL OF HYDRAULIC AND PNEUMATIC CIRCUITS 9

Electrical control of pneumatic and hydraulic circuits-use of relays, timers, counters, Ladder diagram. Programmable logic control of Hydraulics Pneumatics circuits, PLC ladder diagram for various circuits, motion controllers, use of field busses in circuits. Electronic drive circuits for various Motors.

TOTAL: 45 PERIODS

OUTCOMES:

1) At the end of this course the students are familiarized in the area of hydraulics, pneumatic and fluid power components and its functions.
2) Recognize the standard symbols used in fluid power circuits and assess the suitable component for a particular application
3) Construct the hydraulic circuits for an industrial application.
4) Build a pneumatic circuit and apply them to real life problems.
5) Design and develop a PLC controlled pneumatic circuit for industrial application

REFERENCES:

1. Antony Esposito, Fluid Power Systems and control Prentice-Hall, 1988
2. Dudbey. A. Peace, Basic Fluid Power, Prentice Hall Inc, 1967.
3. E.C.Fitch and J.B.Suryaatmadyn. Introduction to fluid logic, McGraw Hill, 1978
4. Herbert R. Merritt, Hydraulic control systems, John Wiley & Sons, Newyork, 1967
5. Peter Rohner, Fluid Power Logic Circuit Design, Mcmelan Prem, 1994.

6. Peter Rohner, Fluid Power logic circuit design. The Macmillan Press Ltd.,London, 1979
7. W.Bolton, Mechatronics, Electronic control systems in Mechanical and Electrical Engineering Pearson Education, 2003.

CO-PO Mapping

CO	PO					
	1	2	3	4	5	6
1	1	-	-	-	-	-
2	1	-	3	-	-	2
3	-	-	3	2	-	-
4	1	-	-	2	3	-
5	-	-	-	-	-	3
Avg.	1	-	3	2	3	2.5

MF4001 MICRO MANUFACTURING L T P C
3 0 0 3

OBJECTIVES:

(1) The objective of the course is to acquaint the students with the principles of micro manufacturing
(2) To learn basic machine tools used in micro manufacturing and developments in the micro manufacturing process
(3) To familiarize with the research trends in the area of micro manufacturing process.
(4) To learn various polishing techniques
(5) To study the various measuring techniques used for micro/nano components

UNIT I MECHANICAL MICRO MACHINING 9

Mechanical Micro machining – Ultra Sonic Micro Machining – Abrasive Jet Micro Machining – Water Jet Micro Machining – Abrasive Water Jet Micro Machining – Micro turning – Chemical and Electro Chemical Micro Machining – Electric discharge micro machining.

UNIT II BEAM ENERGY BASED MICRO MACHINING 9

Electron Beam Micro Machining – Laser Beam Micro Machining – Electric Discharge Micro Machining – Ion Beam Micro Machining –Plasma Beam Micro Machining – Hybrid Micro machining – Electro Discharge Grinding – Electro Chemical spark micro machining – Electrolytic in process Dressing.

UNIT III NANO POLISHING 9

Abrasive Flow finishing – Magnetic Abrasive Finishing – Magneto rheological finishing – Magneto Rheological abrasive flow finishing - Magnetic Float polishing – Elastic Emission Machining – chemo-mechanical Polishing.

UNIT IV MICRO FORMING AND WELDING 9

Micro extrusion – Micro and Nano structured surface development by Nano plastic forming and Roller Imprinting – Micro bending with LASER – LASER micro welding – Electron beam for micro welding.

UNIT V RECENT TRENDS AND APPLICATIONS 9

Metrology for micro machined components – Ductile regime machining– AE based tool wear compensation– Machining of Micro gear, micro nozzle, micro pins – Applications.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course the students are well experienced

(1) To impart the principles of various basic micro manufacturing process
(2) To know and perform micro machining
(3) Research various micro machining process to optimize the process variables
(4) Attain knowledge about polishing techniques
(5) Measure and analyse the various parameters of micro machined components

REFERENCES:

1. Bandyopadhyay. A.K., Nano Materials, New age international publishers, New Delhi, 2008, ISBN:8122422578.
2. Bharat Bhushan, Handbook of nanotechnology, springer, Germany, 2010.
3. Jain V.K., 'Introduction to Micro machining' Narosa Publishing House, 2011
4. Jain V.K., Advanced Machining Processes, Allied Publishers, Delhi, 2002
5. Jain V. K., Micro Manufacturing Processes, CRC Press, Taylor & Francis Group, 2012
6. Janocha H., Actuators – Basics and applications, Springer publishers – 2012
7. Mcgeoug.J.A., Micromachining of Engineering Materials, CRC press 2001, ISBN-10:0824706447.
8. www.cmxr.com/industrial/
9. www.sciencemag.org.handbook

CO-PO Mapping

CO	PO					
	1	2	3	4	5	6
1	-	-	3	-	-	-
2	1	-	-	-	2	-
3	3	1	-	-	-	-
4	-	-	-	-	2	2
5	1	-	-	-	2	-
Avg	1.66	1	-	-	2	2

MF4006 POLYMERS AND COMPOSITE MATERIALS L T P C
3 0 0 3

OBJECTIVES:

(1) To impart knowledge on various polymer processing techniques
(2) To learn about various fibre, Matrix materials and their properties
(3) To learn the methods by which Polymer matrix composites are made
(4) To study about the composites used for High temperature applications
(5) To study the behaviour of reinforcements in MMC and PMC

UNIT 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.

UNIT II FIBERS AND MATRIX MATERIALS 9

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

UNIT 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.

UNIT 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.

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

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 PERIODS

OUTCOMES:

At the end of this course the students are expected

- To study matrix material, reinforcements of polymer matrix composites, MMC and ceramic matrix composites.
- To develop knowledge on processing, interfacial properties and application of composites.
- To have ability to develop new fibre or reinforcement materials
- To differentiate between the composites used in room temperature and High temperature applications

REFERENCES:

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

CO-PO Mapping

CO	PO					
	1	**2**	**3**	**4**	**5**	**6**
1	1	-	-	3	-	1
2	-	-	1	2	-	-
3	-	-	3	-	2	-
4	1	-	-	-	2	-
5	-	-	1	3	-	1
Avg.	1	-	1.66	2.66	2	1

PX4012 RENEWABLE ENERGY TECHNOLOGY L T P C
3 0 0 3

OBJECTIVES:

To impart knowledge on

- Different types of renewable energy technologies
- Standalone operation, grid connected operation of renewable energy systems

UNIT I INTRODUCTION 9

Classification of energy sources – Co2 Emission - Features of Renewable energy - Renewable energy scenario in India -Environmental aspects of electric energy conversion: impacts of renewable energy generation on environment Per Capital Consumption - CO_2 Emission - importance of renewable energy sources, Potentials – Achievements– Applications.

UNIT II SOLAR PHOTOVOLTAICS 9

Solar Energy: Sun and Earth-Basic Characteristics of solar radiation- angle of sunrays on solar collector-Estimating Solar Radiation Empirically - Equivalent circuit of PV Cell- Photovoltaic cell-characteristics: P-V and I-V curve of cell-Impact of Temperature and Insolation on I-V characteristics-Shading Impacts on I-V characteristics-Bypass diode -Blocking diode.

UNIT III PHOTOVOLTAIC SYSTEM DESIGN 9

Block diagram of solar photo voltaic system : Line commutated converters (inversion mode) - Boost and buck-boost converters - selection of inverter, battery sizing, array sizing - PV systems classification- standalone PV systems - Grid tied and grid interactive inverters- grid connection issues.

UNIT IV WIND ENERGY CONVERSION SYSTEMS 9

Origin of Winds: Global and Local Winds- Aerodynamics of Wind turbine-Derivation of Betz's limit-Power available in wind-Classification of wind turbine: Horizontal Axis wind turbine and Vertical axis wind turbine- Aerodynamic Efficiency-Tip Speed-Tip Speed Ratio-Solidity-Blade Count-Power curve of wind turbine - Configurations of wind energy conversion systems: Type A, Type B, Type C and Type D Configurations- Grid connection Issues - Grid integrated SCIG and PMSG based WECS.

UNIT V OTHER RENEWABLE ENERGY SOURCES 9

Qualitative study of different renewable energy resources: ocean, Biomass, Hydrogen energy systems, Fuel cells, Ocean Thermal Energy Conversion (OTEC), Tidal and wave energy, Geothermal Energy Resources.

TOTAL : 45 PERIODS

OUTCOMES:

After completion of this course, the student will be able to:

CO1: Demonstrate the need for renewable energy sources.
CO2: Develop a stand-alone photo voltaic system and implement a maximum power point tracking in the PV system.
CO3: Design a stand-alone and Grid connected PV system.
CO4: Analyze the different configurations of the wind energy conversion systems.
CO5: Realize the basic of various available renewable energy sources

REFERENCES:

1. S.N.Bhadra, D. Kastha, & S. Banerjee "Wind Electrical Systems", Oxford UniversityPress, 2009.
2. Rai. G.D, "Non conventional energy sources", Khanna publishes, 1993.
3. Rai. G.D," Solar energy utilization", Khanna publishes, 1993.
4. Chetan Singh Solanki, "Solar Photovoltaics: Fundamentals, Technologies and Applications", PHI Learning Private Limited, 2012.
5. John Twideu and Tony Weir, "Renewal Energy Resources" BSP Publications, 2006
6. Gray, L. Johnson, "Wind energy system", prentice hall of India, 1995.
7. B.H.Khan, " Non-conventional Energy sources", , McGraw-hill, 2nd Edition, 2009.
8. Fang Lin Luo Hong Ye, " Renewable Energy systems", Taylor & Francis Group,2013.

CO-PO MAPPING :

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3		2	2	2	1
CO2	3		2	3	3	3
CO3	3		2	3	3	3
CO4	3		2	3	3	2
CO5	3		2	2	2	2