



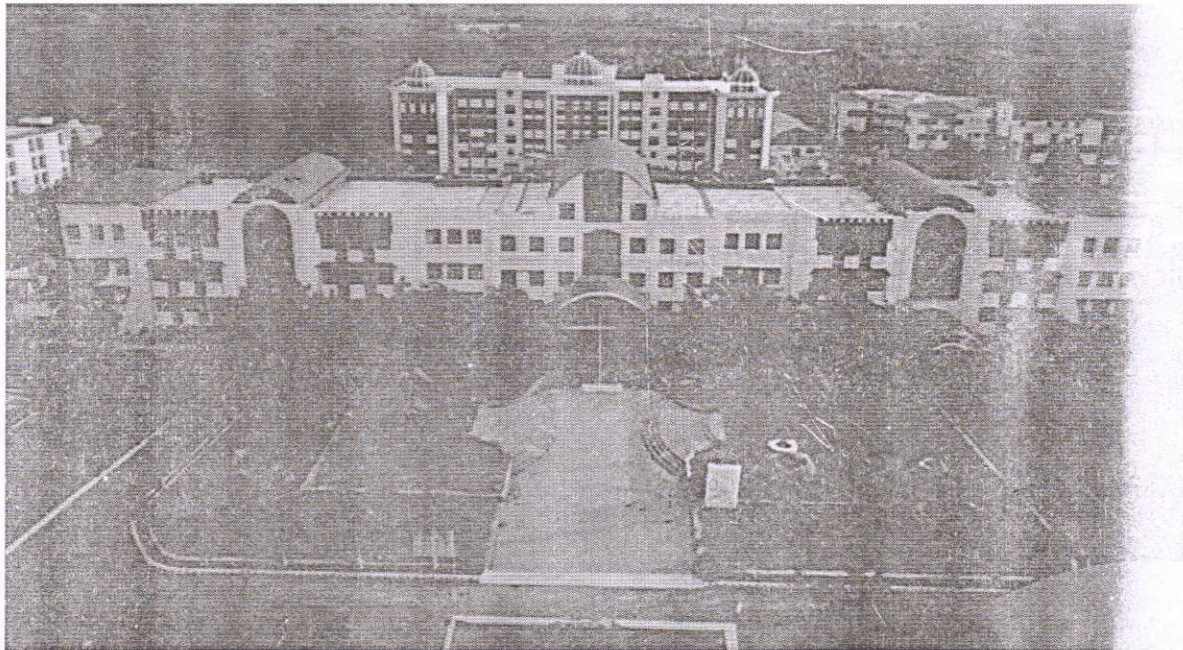
**NEHRU INSTITUTE OF ENGINEERING AND TECHNOLOGY**  
(Autonomous)

An ISO 9001 : 2015 and 14001:2015 Certified Institution, Affiliated to Anna University,  
Chennai

(Approved by AICTE, New Delhi and Recognized by UGC with Section 2(f) and 12(B)  
Re-Accredited by NAAC "A+", NBA Accredited UG Courses : AERO & CSE  
Nehru Gardens, Thirumalayampalayam, Coimbatore-641 105



**DEPARTMENT OF MECHANICAL ENGINEERING**



**SYLLABUS**

**M.E.CAD/CAM**

**REGULATION - 2023**

**DEPARTMENT OF MECHANICAL ENGINEERING****VISION AND MISSION OF THE INSTITUTION****VISION**

Our Vision is to mould the youngsters to acquire sound knowledge in technical and scientific fields to face the future challenges by continuous upgradation of all resources and processes for the benefit of humanity as envisaged by our great leader Pandit Jawaharlal Nehru.

**MISSION**

- To build a strong centre of learning and research in engineering and technology.
- To facilitate the youth to learn and imbibe discipline, culture and spirituality.
- To produce quality engineers, dedicated scientists and leaders.
- To encourage entrepreneurship.
- To face the challenging needs of the global industries.

**VISION AND MISSION OF THE DEPARTMENT****VISION**




- To mould the Mechanical Engineering aspirants into Employable Engineers and Successful Entrepreneurs

**MISSION**

- To be centre of excellence in Mechanical Engineering in providing Quality Education
- To upgrade infrastructure and faculty competency for Continuous Development
- To inculcate a work culture that yields Socio-Economical Engineers and Intellectual Leaders
- To instill leadership qualities to pursue a Professional Career and Entrepreneurship

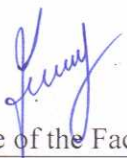
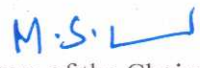

Course Code		Title					
P23CC101		COMPUTER APPLICATIONS IN DESIGN					
Semester: I	L	T	P	Credits	CIA: 40 Marks	ESE: 60 Marks	
	3	0	0	3			
Course pre-requisites		Engineering Design, Engineering Graphics					
Course Objectives							
1	To understand fundamental concepts of computer graphics and its tools in a generic framework.						
2	To impart the parametric fundamentals to create and manipulate geometric models using curves, surfaces and solids.						
3	To impart the parametric fundamentals to create and manipulate geometric models using NURBS and solids.						
4	To provide clear understanding of CAD systems for 3D modeling and viewing.						
5	To create strong skills of assembly modeling and prepare the student to be an effective user of a standards in CAD system						
Course Category		Professional Core Courses (PCC)					
Development Needs		Global / National					
<b>Course Description:</b> This course explores the integration of computer technology in the design process. It covers the fundamentals of computer-aided design (CAD) and computer-aided engineering (CAE), emphasizing their application in various engineering fields.							
Course Content							
Unit	Description						
I	<b>INTRODUCTION TO COMPUTER GRAPHICS FUNDAMENTALS</b> Overview of Graphics systems: Video Display Devices, Raster-Scan System, Random-Scan Systems, Graphics Monitors and Workstations, Input Devices, Hard-Copy Devices, Graphics Software.						
	Output primitives: Line Drawing Algorithm - DDA, Bresenham's and Parallel Line Algorithm. Circle generating algorithm – Midpoint Circle Algorithm. Geometric Transformations: Coordinate Transformations, Windowing and Clipping, 2D Geometric transformations-Translation, Scaling, Shearing, Rotation and Reflection, Composite transformation, 3D transformations.						
						<b>Contact Periods</b>	<b>9</b>
II	<b>CURVES AND SURFACES MODELLING</b> Introduction to curves - Analytical curves: line, circle and conics – synthetic curves: Hermite cubic spline- Bezier curve and B-Spline curve – curve manipulations.						
	Introduction to surfaces - Analytical surfaces: Plane surface, ruled surface, surface of revolution and tabulated cylinder – synthetic surfaces: Hermite bicubic surface- Bezier surface and B-Spline surface- surface manipulations.						
						<b>Contact Periods</b>	<b>9</b>
III	<b>NURBS AND SOLID MODELING</b> NURBS- Basics- curves, lines, arcs, circle and bi linear surface. Regularized Boolean set operations - primitive instancing - sweep representations - boundary representations - constructive solid Geometry - comparison of representations - user interface for solid modeling.						
							<b>Contact Periods</b>

IV	<b>VISUAL REALISM</b> Hidden Line removal, Hidden Surface removal, – Hidden Solid Removal algorithms - Shading – Coloring. Animation - Conventional, Computer animation, Engineering animation - types and techniques.	
	<b>Contact Periods</b>	<b>9</b>
V	<b>ASSEMBLY OF PARTS AND PRODUCT LIFE CYCLE MANAGEMENT</b> Assembly modeling – Design for manufacture – Design for assembly – computer aided DFMA - inferences of positions and orientation - tolerances analysis –Center of Gravity and mass property calculations - mechanism simulation. Graphics and computing standards - Data Exchange standards. Product development and management – new product development –models utilized in various phases of new product development – managing product life cycle.	
	<b>Contact Periods</b>	<b>9</b>
<b>Total Periods</b>		<b>45</b>
<b>Course Outcomes</b>		
<b>Upon Successful Completion of the course, students will be able to:</b>		
<b>CO 1</b>	Solve 2D and 3D transformations for the basic entities like line and circle.	K3
<b>CO 2</b>	Formulate the basic mathematics fundamental to CAD system.	K2
<b>CO 3</b>	Use the different geometric modeling techniques like feature based modeling, surface modeling and solid modeling.	K4
<b>CO 4</b>	Create geometric models through animation and transform them into real world systems	K3
<b>CO 5</b>	Simulate assembly of parts using Computer-Aided Design software	K3
K1: Remembering; K2: Understanding; K3: Applying; K4: Analyzing; K5: Evaluating; K6: Creating		
<b>Text Books</b>	<ol style="list-style-type: none"> <li>1. Boothroyd, G, “Assembly Automation and Product Design” Marcel Dekker, New York, 1997.</li> <li>2. Chitale A.K and Gupta R.C “Product design and manufacturing” PHI learning private limited, 6th Edition, 2015.</li> <li>3. David Rogers, James Alan Adams “Mathematical Elements for Computer Graphics” 2nd Edition, Tata McGraw-Hill edition.2003</li> </ol>	
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Donald D Hearn and M. Pauline Baker “Computer Graphics C Version”, Prentice Hall, Inc., 2nd Edition, 1996.</li> <li>2. Ibrahim Zeid, "Mastering CAD/CAM", McGraw Hill, 2nd Edition, 2006</li> <li>3. William M Newman and Robert F.Sproull “Principles of Interactive Computer Graphics”, McGraw Hill Book Co. 1stEdition, 2001.</li> </ol>	

Tools for Assessment (40 Marks)												
CIA I	CIA II		CIA III			Assignment/ Seminar/ Case study/ Seminar/Case study				Attendance	Total	
10	10		10			5				5	40	
Mapping												
CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	3	2	1	-	-	-	-	-	-
CO2	2	1	1	3	2	1	-	-	-	-	-	-
CO3	2	1	1	3	2	1	-	-	-	-	-	-
CO4	2	1	1	3	2	1	-	-	-	-	-	-
CO5	2	1	1	3	2	1	-	-	-	-	-	-
3-High; 2-Medium; 1-Low												
CO \ PSO		PSO1			PSO2			PSO3				
CO1		3			3			3				
CO2		2			3			3				
CO3		2			3			2				
CO4		3			3			3				
CO5		2			2			2				
Course designed by						Verified by						
 Signature of the Faculty member						 Signature of the Chairperson-BoS						
 Name and Department of the Faculty Member						<b>Dr. M. SANTHOSH</b> Professor and Head Department of Mechanical Engineering Nehru Institute of Engineering and Technology Coimbatore Name and Seal of the Chairperson-BoS						


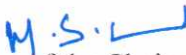
Course Code		Title					
P23CC102		DESIGN FOR SUSTAINABILITY					
Semester: I	L	T	P	Credits	CIA: 40 Marks	ESE: 60 Marks	
	3	0	0	3			
Course pre-requisites		Environmental Science, Engineering Design					
Course Objectives							
1	Selecting the relevant process; applying the general design principles for manufacturability; GD &T.						
2	Applying the design considerations while designing the cast and welded components.						
3	Applying the design considerations while designing the formed and machined components.						
4	Apply design considerations for assembled systems.						
5	Apply design considerations for environmental issues.						
Course Category		Professional Core Courses (PCC)					
Development Needs		Global / National					
Course Description: This course delves into the principles and practices of sustainable design, emphasizing the importance of creating products, systems, and services that minimize environmental impact while maximizing social and economic benefits.							
Course Content							
Unit	Description						
I	<b>INTRODUCTION</b>						
	Introduction - Economics of process selection - General design principles for manufacturability; Geometric Dimensioning & Tolerance (GD&T) – Form tolerancing: straightness, flatness, circularity, cylindricity – Profile tolerancing: profile of a line, and surface – Orientation tolerancing: angularity, perpendicularity, parallelism – Location tolerancing: position, concentricity, symmetry – run out tolerancing: circular and total–Supplementary symbols.						
						<b>Contact Periods</b>	<b>9</b>
II	<b>CAST &amp; WELDED COMPONENTS DESIGN</b>						
	Design considerations for: Sand cast – Die cast – Permanent mold parts. Arc welding – Design considerations for: Cost reduction – Minimizing distortion – Weld strength – Weldment. Resistance welding–Design considerations for: Spot–Seam–Projection–Flash & Upset weldment						
						<b>Contact Periods</b>	<b>9</b>
III	<b>FORMED &amp; MACHINED COMPONENTS DESIGN</b>						
	Design considerations for: Metal extruded parts – Impact/Cold extruded parts – Stamped parts – Forged parts. Design considerations for: Turned parts– Drilled parts – Milled, planned, shaped and slotted parts–Ground parts.						
						<b>Contact Periods</b>	<b>9</b>
IV	<b>DESIGN FOR ASSEMBLY</b>						
	Design for assembly – General assembly recommendations – Minimizing the no. of parts – Design considerations for: Rivets – Screw fasteners – Gasket & Seals – Press fits – Snap fits – Automatic assembly– Computer Application for DFMA.						

		<b>Contact Periods</b>	9
V	<b>DESIGN FOR ENVIRONMENT</b>		
	Introduction– Environmental objectives–Global issues–Regional and local issues–Basic DFE methods–Design guide lines–Example application–Life cycle assessment–Basic method–AT&T’s environmentally responsible product assessment-Weighted sum assessment method–Life cycle assessment method–Techniques to reduce environmental impact–Design to minimize material usage–Design for disassembly–Design for recyclability–Design for manufacture–Design for energy efficiency –Design to regulations and standards		
		<b>Contact Periods</b>	9
		<b>Total Periods</b>	<b>45</b>
<b>Course Outcomes</b>			
Upon Successful Completion of the course, students will be able to:			
<b>CO 1</b>	Select relevant process; apply the general design principles for manufacturability; GD&T.		K1
<b>CO 2</b>	Apply design considerations while designing the cast and welded components.		K3
<b>CO 3</b>	Apply design considerations while designing the formed and machined components.		K2
<b>CO 4</b>	Apply design considerations for assembled systems.		K3
<b>CO 5</b>	Apply design considerations for environmental issues		K3
K1: Remembering; K2: Understanding; K3: Applying; K4: Analyzing; K5: Evaluating; K6: Creating			
<b>Text Books</b>	<ol style="list-style-type: none"> <li>Boothroyd, G, 2nd Edition 2002, “Design for Assembly Automation and Product Design.” New York, Marcel Dekker.</li> <li>Bralla, “Design for Manufacture handbook”, McGrawhill,1999</li> <li>Boothroyd, G, Hartz and Nike, “Product Design for Manufacture”, Marcel Dekker,1994</li> <li>Dickson, John. R, and Corroda Poly, “Engineering Design and Design for Manufacture and Structural Approach”, Field Stone Publisher,USA,1995</li> </ol>		
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>Fixel, J. “Design for the Environment” McGraw Hill., 2nd Edition 2009</li> <li>Graedel T. Allen By. B, “Design for the Environment” Angle Wood Cliff, Prentice Hall. Reason Pub.,1996</li> <li>Kevin Otto and Kristin Wood, “Product Design”. Pearson Publication,(Fourth Impression) 2009</li> <li>Harry Peck, “Designing for manufacture”, Pitman–1973</li> </ol>		

Tools for Assessment (40 Marks)												
CIA I	CIA II	CIA III	Assignment/ Seminar/ Case study				Attendance	Total				
10	10	10	5				5	40				
Mapping												
CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	2	2	1	-	-	-	-	-	-
CO2	1	1	1	2	2	1	-	-	-	-	-	-
CO3	1	1	1	2	2	1	-	-	-	-	-	-
CO4	1	1	1	2	2	1	-	-	-	-	-	-
CO5	1	1	1	2	2	1	-	-	-	-	-	-
3-High; 2-Medium; 1-Low												
CO \ PSO					PSO1	PSO2	PSO3					
CO1					3	2	3					
CO2					3	2	3					
CO3					3	3	3					
CO4					3	3	3					
CO5					2	2	2					
Course designed by						Verified by						
 Signature of the Faculty member						 Signature of the Chairperson-BoS						
 Name and Department of the Faculty Member						<b>Dr. M. SANTHOSH</b> Professor and Head Department of Mechanical Engineering Nehru Institute of Engineering and Technology Coimbatore - 641 105, Tamilnadu, India. Name and Seal of the Chairperson-BoS						


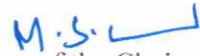
Course Code		Title				
P23CC103		ADVANCED MANUFACTURING PROCESSES				
Semester: I	L	T	P	Credits	CIA: 40 Marks	ESE: 60 Marks
	3	0	0	3		
Course pre-requisites		Manufacturing Processes, Material Science and Engineering				
Course Objectives						
1	To analyze and determine material fabrication processes.					
2	To use laboratory instrument doing routine metrological measurements					
3	To operate regular machine shop equipment such as grinders, drill presses, lathes, milling machines, shapers and etc.					
4	To recognize engine machine tool requirements and be selective in the choice of tools.					
5	To setup and operate machines, index and determine machine speeds, feeds, and depth of cut requirements.					
Course Category		Professional Core Courses (PCC)				
Development Needs		Global / National				
Course Description: This course provides an in-depth study of advanced manufacturing processes, focusing on the latest technologies and methodologies used in the production of complex and high-precision components.						
Course Content						
Unit	Description					
I	<b>SURFACE TREATMENT</b> Scope, Cleaners, Methods of cleaning, Surface coating types, and ceramic and organic methods of coating, economics of coating. Electro forming, Chemical vapour deposition, thermal spraying, Ion implantation, diffusion coating, Diamond coating and cladding.					
						Contact Periods
II	<b>NON-TRADITIONAL MACHINING</b> Introduction, need ,AJM, Parametric Analysis, Process capabilities, USM –Mechanics of cutting, models, Parametric Analysis, WJM –principle, equipment ,process characteristics , performance, EDM – principles, equipment, generators, analysis of R-C circuits, MRR , Surface finish, WEDM.					
						Contact Periods
III	<b>LASER BEAM MACHINING</b> Principle of working, equipment, Material removal rate, Process parameters, performance characterization, Applications. Plasma Arc Machining – Principle of working, equipment, Material removal rate, Process parameters, performance characterization, Applications. Electron Beam Machining - Principle of working, equipment, Material removal rate, Process parameters, performance characterization, Applications. Electro Chemical Machining – Principle of working, equipment, Material removal rate, Process parameters, performance characterization, Applications.					
						Contact Periods

IV	<b>PROCESSING OF CERAMICS</b>	
	Applications, characteristics, classification .Processing of particulate ceramics, Powder preparations, consolidation, Drying, sintering, Hot compaction, Area of application , finishing of ceramics. Processing of Composites: Composite Layers, Particulate and fiber reinforced composites, Elastomers, Reinforced plastics, MMC, CMC, Polymer matrix composites.	
<b>Contact Periods</b>		<b>9</b>
V	<b>FABRICATION OF MICROELECTRONIC DEVICES</b>	
	Crystal growth and wafer preparation, Film Deposition oxidation, lithography, bonding and packaging, reliability and yield, Printed Circuit boards, computer aided design in microelectronics, surface mount technology, Integrated circuit economics. E-Manufacturing. nanotechnology, and micromachining, High speed Machining	
<b>Contact Periods</b>		<b>9</b>
<b>Total Periods</b>		<b>45</b>
<b>Course Outcomes</b>		
<b>Upon Successful Completion of the course, students will be able to:</b>		
<b>CO 1</b>	At the end of the course, the student will be able to understand the working principle of Electron beam, laser beam and laser hybrid welding processes.	K1
<b>CO 2</b>	Able to understand different types of composite material characteristics, types of micro & macro machining processes	K2
<b>CO 3</b>	Understand the e-manufacturing & nano materials	K4
<b>CO 4</b>	To make the students get acquainted with the design for manufacturing, assembly and environment.	K2
<b>CO 5</b>	To make the students understand fabrication of microelectronic devices	K5
K1: Remembering; K2: Understanding; K3: Applying; K4: Analyzing; K5: Evaluating; K6: Creating		
<b>Text Books</b>	<ol style="list-style-type: none"> <li>Boothroyd,G,1997 “Design for Assembly Automation and Product Design”. NewYork, Marcel Dekker.</li> <li>Boothroyd, G, Hartz and Nike, “Product Design for Manufacture”, MarcelDekker, 2nd Edition 2002.</li> <li>Bralla, “Design for Manufacture handbook”, McGrawhill,1999.</li> </ol>	
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>Dickson, John. R, and Corroda Poly, “Engineering Design and Design for Manufacture and Structural Approach”, Field Stone Publisher, USA, 1995.</li> <li>Fixel, J. “Design for the Environment” McGrawHill.1996.</li> <li>Graede IT. Allen By. B, “Design for the Environment” Angle Wood Cliff, Prentice Hall. ReasonPub.,1996.</li> <li>Harry Peck, “Designing for manufacture”,Pitman–1973</li> </ol>	

Tools for Assessment (40 Marks)												
CIA I	CIA II	CIA III	Assignment/ Seminar/ Case study				Attendance	Total				
10	10	10	5				5	40				
Mapping												
CO \ PO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	3	-	-	-	-	-	-	-	-
CO2	2	2	-	2	2	2	-	-	-	-	-	-
CO3	2	-	2	2	2	3	-	-	-	-	-	-
CO4	3	2	2	2	2	3	-	-	-	-	-	-
CO5	3	3	3	3	2	3	-	-	-	-	-	-
3-High; 2-Medium; 1-Low												
CO \ PSO		PSO1			PSO2			PSO3				
CO1		3			3			3				
CO2		2			3			3				
CO3		2			3			2				
CO4		3			3			3				
CO5		2			2			2				
Course designed by						Verified by						
 Signature of the Faculty member						 Signature of the Chairperson-BoS						
Dr. D. SATHISH KUMAR AP / MECHANICAL ENGS.						<b>Dr. M. SANTHOSH</b> Professor and Head Department of Mechanical Engineering Nehru Institute of Engineering and Technology Coimbatore - 641 105, Tamilnadu, India.						
Name and Department of the Faculty Member						Name and Seal of the Chairperson-BoS						




Course Code		Title				
P23CC104		COMPUTER AIDED TOOLS FOR MANUFACTURING				
Semester: I	L	T	P	Credits	CIA: 40 Marks	ESE: 60 Marks
	3	0	0	3		
Course pre-requisites		Manufacturing Processes, Engineering Graphics				
Course Objectives						
1	To prepare the students for computer aided toolsthat can be implemented in various industrial applications					
2	To understand the working of computer aided manufacturing.					
3	To understand different types of computer aided process planning.					
4	To understand the computer aided inspection					
5	To make the students get acquainted with the reverse engineering					
Course Category		Professional Core Courses (PCC)				
Development Needs		Global / National				
<b>Course Description:</b> This course focuses on the use of computer-aided tools to enhance and streamline manufacturing processes. It covers the application of computer-aided design (CAD), computer-aided manufacturing (CAM), and computer-aided engineering (CAE) technologies in modern production environments.						
Course Content						
Unit	Description					
I	<b>COMPUTER AIDED MANUFACTURING</b> Manufacturing Processes – Removing, Forming, Deforming and joining – Integration equipments. Integrating CAD, NC and CAM – Machine tools – Point to point and continuous path machining, NC, CNC and DNC – NC Programming – Basics, Languages, G Code, M Code, APT – Tool path generation and verification – CAD/CAM NC Programming – Production Control – Cellular Manufacturing					
						<b>Contact Periods</b>
II	<b>COMPUTER AIDED PROCESS PLANNING</b> Role of process planning in CAD/CAM Integration – Computer Aided Process Planning – Development, Benefits, Model and Architecture – CAPP Approaches – Variant, Generative and Hybrid – Process and Planning systems – CAM-I, D-CLASS and CMPP – Criteria in selecting a CAPP System.					
						<b>Contact Periods</b>
III	<b>COMPUTER AIDED INSPECTION</b> Engineering Tolerances – Need for Tolerances – Conventional Tolerances – FITS and LIMITS – Tolerance Accumulation and Surface quality – Geometric Tolerances – Tolerances Practices in design, Drafting and manufacturing – Tolerance Analysis – Tolerance synthesis – Computer Aided Quality control – Contact Inspection Methods – Non Contact Inspection Methods - Non optical.					
						<b>Contact Periods</b>

IV	<b>REVERSE ENGINEERING</b>	
	Scope and tasks of Reverse Engineering – Domain Analysis – Process Duplicating – Tools for RE – Developing Technical data – Digitizing techniques – Construction of surface model – Solid part model – Characteristic evaluation – Software’s and its application – CMM and its feature capturing – surface and solid modeling.	
		<b>Contact Periods</b>
		<b>9</b>
V	<b>DATA MANAGEMENT</b>	
	Strategies for Reverse Engineering Data management – Software application – Finding renewable software components – Recycling real time embedded software – Design experiments to evaluate a RE tools – Rule based detection for RE user interface – RE of assembly programs.	
		<b>Contact Periods</b>
		<b>9</b>
		<b>Total Periods</b>
		<b>45</b>
<b>Course Outcomes</b>		
Upon Successful Completion of the course, students will be able to:		
CO 1	At the end of the course, the student will be able to understand the working of computer aided manufacturing.	K1
CO 2	Able to understand different types of computer aided process planning.	K3
CO 3	Understand the computer aided inspection	K4
CO 4	To make the students get acquainted with the reverse engineering	K3
CO 5	To make the students understand the data management.	K3
K1: Remembering; K2: Understanding; K3: Applying; K4: Analyzing; K5: Evaluating; K6: Creating		
<b>Text Books</b>	<ol style="list-style-type: none"> <li>1. Catherine A. Ingle, “Reverse Engineering”, Tata Mc Graw Hill Publication, 1994</li> <li>2. David D. Bedworth, Mark R. Henderson, Philp M. Wolfe, “Computer Integrated Design and manufacturing”, Mc Graw Hill International series, 1991</li> <li>3. Donald R. Honra, “Co-ordinate measurement and reverse Engineering, American GearManufacturers Association.</li> </ol>	
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Ibrahim Zeid and R. Sivasubramanian, “CAD/CAM Theory and Practice”, Revised First special Indian Edition, Tata Mc Graw Hill Publication, 2007</li> <li>2. Ibrahim Zeid, “Mastering CAD/CAM”, special Indian Edition, Tata Mc Graw Hill Publication, 2007</li> <li>3. Linda Wills, “Reverse Engineering” Kluwer Academic Press, 1996</li> </ol>	


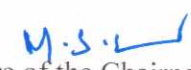
Tools for Assessment (40 Marks)												
CIA I	CIA II		CIA III		Assignment/ Seminar/ Case study				Attendance	Total		
10	10		10		5				5	40		
Mapping												
CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	1	3	2	-	-	-	-	-	-	-
CO2	2	-	1	3	2	-	-	-	-	-	-	-
CO3	2	-	1	3	2	-	-	-	-	-	-	-
CO4	2	-	1	3	2	-	-	-	-	-	-	-
CO5	2	-	1	3	2	-	-	-	-	-	-	-
3-High; 2-Medium; 1-Low												
CO \ PSO		PSO1			PSO2			PSO3				
CO1		3			3			3				
CO2		3			3			3				
CO3		2			3			2				
CO4		3			3			3				
CO5		2			2			2				
Course designed by						Verified by						
												
Signature of the Faculty member						Signature of the Chairperson-BoS						
<b>Dr. D. SATHISH KUMAR</b> <b>AP/MECHANICAL ENGG.</b>						<b>Dr. M. SANTHOSH</b> <b>Professor and Head</b> <b>Department of Mechanical Engineering</b> <b>Nehru Institute of Engineering and Technology</b> <b>Coimbatore - 641 105, Tamilnadu, India.</b>						
Name and Department of the Faculty Member						Name and Seal of the Chairperson-BoS						

Course Code		Title				
P23CC105		RESEARCH METHODOLOGY AND IPR				
Semester: I	L	T	P	Credits	CIA: 40 Marks	ESE: 60 Marks
	2	0	0	2		
Course pre-requisites		Research ethics, Statistics				
Course Objectives						
1	To prepare the students for research design					
2	To understand the working of data collection and sources					
3	To understand different types of data analysis and reporting.					
4	To understand the intellectual property rights					
5	To make the students get acquainted with the patents					
Course Category						
Development Needs		Global / National				
Course Description: This course offers a comprehensive understanding of research methodology and the fundamentals of intellectual property rights (IPR).						
Course Content						
Unit	Description					
I	<b>RESEARCH DESIGN</b>					
	Overview of research process and design, Use of Secondary and exploratory data to answer the research question, Qualitative research, Observation studies, Experiments and Surveys.					
					<b>Contact Periods</b>	<b>6</b>
II	<b>DATA COLLECTION AND SOURCES</b>					
	Measurements, Measurement Scales, Questionnaires and Instruments, Sampling and methods. Data - Preparing, Exploring, examining and displaying.					
					<b>Contact Periods</b>	<b>6</b>
III	<b>DATA ANALYSIS AND REPORTING</b>					
	Overview of Multivariate analysis, Hypotheses testing and Measures of Association. Presenting Insights and findings using written reports and oral presentation.					
					<b>Contact Periods</b>	<b>6</b>
IV	<b>INTELLECTUAL PROPERTY RIGHTS</b>					
	Intellectual Property – The concept of IPR, Evolution and development of concept of IPR, IPR development process, Trade secrets, utility Models, IPR & Bio diversity, Role of WIPO and WTO in IPR establishments, Right of Property, Common rules of IPR practices, Types and Features of IPR Agreement, Trademark, Functions of UNESCO in IPR maintenance.					
					<b>Contact Periods</b>	<b>6</b>
V	<b>PATENTS</b>					
	Patents – objectives and benefits of patent, Concept, features of patent, Inventive step, Specification, Types of patent application, process E-filing, Examination of patent, Grant of patent, Revocation, Equitable Assignment/ Seminar/ Case studys, Licences, Licensing of related patents, patent agents, Registration of patent agents.					

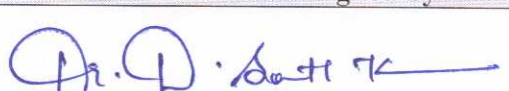

		<b>Contact Periods</b>	<b>6</b>
		<b>Total Periods</b>	<b>30</b>
<b>Course Outcomes Upon Successful Completion of the course, students will be able to:</b>			
<b>CO 1</b>	To prepare the students for research design		K1
<b>CO 2</b>	To understand the working of data collection and sources		K3
<b>CO 3</b>	To understand different types of data analysis and reporting.		K2
<b>CO 4</b>	To understand the intellectual property rights		K3
<b>CO 5</b>	To make the students get acquainted with the patents		K4
K1: Remembering; K2: Understanding; K3: Applying; K4: Analyzing; K5: Evaluating; K6: Creating			
<b>Text Books</b>	<ol style="list-style-type: none"> <li>1. Catherine J. Holland, "Intellectual property: Patents, Trademarks, Copyrights, Trade Secrets", Entrepreneur Press, 2007.</li> <li>2. David Hunt, Long Nguyen, Matthew Rodgers, "Patent searching: tools &amp; techniques", Wiley, 2007.</li> </ol>		
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Cooper Donald R, Schindler Pamela S and Sharma JK, "Business Research Methods", Tata McGrawHill Education, 11e (2012).</li> <li>2. The Institute of Company Secretaries of India, Statutory body under an Act of parliament, "Professional Programme Intellectual Property Rights, Law and practice", September 2013.</li> </ol>		

Tools for Assessment (40 Marks)												
CIA I	CIA II		CIA III		Assignment/ Seminar/ Case study				Attendance	Total		
10	10		10		5				5	40		
Mapping												
CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	1	3	2	-	-	-	-	-	-	-
CO2	2	-	1	3	2	-	-	-	-	-	-	-
CO3	2	-	1	3	2	-	-	-	-	-	-	-
CO4	2	-	1	3	2	-	-	-	-	-	-	-
CO5	2	-	1	3	2	-	-	-	-	-	-	-
3-High; 2-Medium; 1-Low												
CO \ PSO		PSO1			PSO2			PSO3				
CO1		3			3			3				
CO2		3			3			3				
CO3		2			2			2				
CO4		3			3			3				
CO5		2			2			2				
Course designed by						Verified by						
 Signature of the Faculty member						 Signature of the Chairperson-BoS						
 Name and Department of the Faculty Member						<b>Dr. M. SANTHOSH</b> Professor and Head Department of Mechanical Engineering Nehru Institute of Engineering and Technology Name and Seal of the Chairperson-BoS <small>Coimbatore - 641 105, Tamil Nadu, India</small>						

Course Code		Title				
P23CC115		COMPUTER AIDED DESIGN LABORATORY				
Semester: I	L	T	P	Credits	CIA: 40 Marks	ESE: 60 Marks
	0	0	4	2		
Course pre-requisites		Engineering Graphics				
Course Objectives						
1	To impart knowledge on how to prepare drawings for various mechanical components using any commercially available 3D modeling software's					
Course Category		Professional Core Courses (PCC)				
Development Needs		Global / National				
<b>Course Description:</b> This hands-on laboratory course provides practical experience with computer-aided design (CAD) software, focusing on the creation and manipulation of digital models for engineering applications.						
Course Content						
Unit	Description					
	<b>CAD INTRODUCTION</b> <ul style="list-style-type: none"> <li>• <b>Sketcher</b></li> <li>• <b>Solid modeling</b> – Extrude, Revolve, Sweep and variational sweep, Loft</li> <li>• <b>Surface modeling</b> – Extrude, Sweep, Trim and Mesh of curves, Freeform.</li> <li>• <b>Feature manipulation</b> – Copy, Edit, Pattern, Suppress, History operations etc.</li> <li>• <b>Assembly</b> - Constraints, Exploded Views, Interference check</li> <li>• <b>Drafting</b> - Layouts, Standard &amp; Sectional Views, Detailing &amp; Plotting.</li> </ul> <p>Exercises in modeling and drafting of mechanical components-assembly using parametric and feature-based packages like PRO-E/SOLIDWORKS /CATIA/NX</p>					
<b>Total Periods</b>						<b>60</b>
<b>Course Outcomes Upon Successful Completion of the course, students will be able to:</b>						
<b>CO1</b>	Use the modern engineering tools necessary for engineering practice					K1
<b>CO2</b>	Draw 2D part drawings, sectional views, and assembly drawings as per standards.					K3
<b>CO3</b>	Create 3D Model on any CAD software.					K4
<b>CO4</b>	Convert 3D solid models into 2D drawings and prepare different views, sections, and dimensioning of part models.					K3
<b>CO5</b>	Examine interference to ensure that parts will not interfere.					K3
K1: Remembering; K2: Understanding; K3: Applying; K4:Analyzing; K5:Evaluating; K6: Creating						


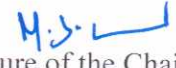
Tools for Assessment (40 Marks)												
CIA I	CIA II		CIA III		Assignment/ Seminar/ Case study				Attendance	Total		
10	10		10		5				5	40		
Mapping												
CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	3	2	2	-	-	-	-	-	-	-
CO2	1	3	3	2	2	-	-	-	-	-	-	-
CO3	1	3	3	2	2	-	-	-	-	-	-	-
CO4	1	3	3	2	2	-	-	-	-	-	-	-
CO5	1	3	3	2	2	-	-	-	-	-	-	-
3-High; 2-Medium; 1-Low												
CO \ PSO		PSO1			PSO2			PSO3				
CO1		3			2			3				
CO2		3			2			3				
CO3		2			2			2				
CO4		3			3			3				
CO5		2			2			2				
Course designed by						Verified by						
 Signature of the Faculty member						 Signature of the Chairperson-BoS						
Dr. S. JEEVANANTHAM ASP/MECH						<b>Dr. M. SANTHOSH</b> Professor and Head Department of Mechanical Engineering Nehru Institute of Engineering and Technology Coimbatore-641 105 Tamilnadu, India						
Name and Department of the Faculty Member						Name and Seal of the Chairperson-BoS						

Course Code	Title					
P23CC116	COMPUTER AIDED MANUFACTURING LABORATORY					
Semester: I	L	T	P	Credits	CIA: 40 Marks	ESE: 60 Marks
	0	0	4	2		
Course pre-requisites		Manufacturing processes, CNC				
Course Objectives						
1	To familiarize students with manual CNC part programming for milling and turning machines.					
2	To generate part programs using CAM packages for milling and turning machines.					
3	To train students with dimensional and geometric measurements for machined features using video measuring system and coordinate measuring machine.					
4	To get hands on knowledge on programming logic controller - ladder programming and robot programming.					
5	To introduce the concept of printing parts using additive manufacturing and to introduce Relational database management system in Material requirements planning.					
Course Category		Professional Core Courses (PCC)				
Development Needs		Global / National				
<b>Course Description:</b> This laboratory course provides practical experience with computer-aided manufacturing (CAM) technologies, focusing on the use of software and hardware tools to plan, manage, and optimize manufacturing processes.						
Course Content						
Unit	Description					
	1. Programming and simulation for various operations using canned cycle for CNC turning Centre. 2. Programming and simulation for machining of internal surfaces in CNC turning Centre 3. Programming and simulation for profile milling operations 4. Programming and simulation for circular and rectangular pocket milling 5. Programming and simulation using canned cycle for CNC Milling such as peck drilling and tapping cycle 6. CNC code generation using CAM software packages – Milling 7. CNC code generation using CAM software packages – Turning 8. Dimensional and geometric measurement of machined features using VMS and CMM 9. PLC ladder logic programming. 10. Robot programming for Material handling applications. 11. Study on RDBMS and its application in problems like inventory control MRP. Design and fabrication of a component using extrusion based additive manufacturing					
<b>Total Periods</b>						<b>60</b>

Course Outcomes												
Upon Successful Completion of the course, students will be able to:												
CO 1	Explain the manual CNC part programming for milling and turning machines.											K1
CO 2	Create part programs using CAM packages for milling and turning Machines.											K2
CO 3	Appraise dimensional and geometric measurements of machined features using video measuring system and coordinate measuring machine.											K4
CO 4	Construct PLC ladder programming and robot programming.											K3
CO 5	Relate the concept of printing parts using additive manufacturing and appreciate the application RDBMS in MRP.											K3
K1: Remembering; K2: Understanding; K3: Applying; K4:Analyzing; K5:Evaluating; K6: Creating												
Tools for Assessment (40 Marks)												
CIA I	CIA II	CIA III	Assignment/ Seminar/ Case study				Attendance	Total				
10	10	10	5				5	40				
Mapping												
CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	3	2	-	-	-	-	-	-	-	-
CO2	1	-	3	2	-	-	-	-	-	-	-	-
CO3	1	-	3	2	-	-	-	-	-	-	-	-
CO4	1	-	3	2	-	-	-	-	-	-	-	-
CO5	1	-	3	2	-	-	-	-	-	-	-	-
3-High; 2-Medium; 1-Low												
CO \ PSO				PSO1			PSO2			PSO3		
CO1				3			3			3		
CO2				3			3			3		
CO3				2			2			2		
CO4				3			3			3		
CO5				2			2			2		
Course designed by						Verified by						
 Signature of the Faculty member						 Signature of the Chairperson-BoS						
<b>Dr. D. SATHISH KUMAR</b> <b>AP   MECHANICAL ENGG.</b> Name and Department of the Faculty Member						<b>Dr. M. SANTHOSH</b> <b>Professor and Head</b> <b>Department of Mechanical Engineering</b> <b>Nehru Institute of Engineering and Technology</b> <b>Coimbatore - 641 105, Tamilnadu, India.</b> Name and Seal of the Chairperson-BoS						




Course Code		Title				
P23CC201		PRODUCT LIFECYCLE MANAGEMENT				
Semester: II	L	T	P	Credits	CIA: 40 Marks	ESE: 60 Marks
	3	0	0	3		
Course pre-requisites		Production processes				
Course Objectives						
1	To understand history, concepts and terminology of PLM					
2	To understand functions and features of PLM/PDM					
3	To understand different modules offered in commercial PLM/PDM tools					
4	To demonstrate PLM/PDM approaches for industrial applications					
5	To Use PLM/PDM with legacy data bases, CAx & ERP systems					
Course Category		Professional Core Courses (PCC)				
Development Needs		Global / National				
Course Description: This course covers the principles and practices of Product Lifecycle Management (PLM), a strategic approach to managing a product's lifecycle from inception through design, manufacturing, service, and disposal.						
Course Content						
Unit	Description					
I	<b>HISTORY, CONCEPTS AND TERMINOLOGY OF PLM</b> Introduction to PLM, Need for PLM, opportunities of PLM, Different views of PLM Engineering Data Management (EDM), Product Data Management (PDM), Collaborative Product Definition Management (cPDM), Collaborative Product Commerce (CPC), Product Lifecycle Management (PLM). PLM/PDM Infrastructure – Network and Communications, Data Management, Heterogeneous data sources and applications.					
	Contact Periods					9
II	<b>PLM/PDM FUNCTIONS AND FEATURES</b> User Functions – Data Vault and Document Management, Workflow and Process Management, Product Structure Management, Product Classification and Programme Management. Utility Functions – Communication and Notification, data transport, data translation, image services, system administration and application integration.					
	Contact Periods					9
III	<b>DETAILS OF MODULES IN APDM/PLM SOFTWARE</b> Case studies based on top few commercial PLM/PDM tools					
	Contact Periods					9
IV	<b>ROLE OF PLM IN INDUSTRIES</b> Case studies on PLM selection and implementation (like auto, aero, electronic) other possible sectors, PLM visioning, PLM strategy, PLM feasibility study, change management for PLM, financial justification of PLM, barriers to PLM implementation, ten step approach to PLM, benefits of PLM for– business, organization, users, product or service, process performance.					
	Contact Periods					9

V	<b>BASICS ON CUSTOMISATION/INTEGRATION OF PDM/PLM SOFTWARE</b> PLM Customization, use of EAI technology (Middleware), Integration with legacy data base, CAD, SLM and ERP.	
		<b>Contact Periods</b>
		<b>9</b>
		<b>Total Periods</b>
		<b>45</b>
<b>Course Outcomes</b>		
<b>Upon Successful Completion of the course, students will be able to:</b>		
<b>CO 1</b>	Summarize the history, concepts and terminology of PLM	K1
<b>CO 2</b>	Use the functions and features of PLM/PDM	K3
<b>CO 3</b>	Use different modules offered in commercial PLM/PDM tools.	K4
<b>CO 4</b>	Implement PLM/PDM approaches for industrial applications.	K3
<b>CO 5</b>	Integrate PLM/PDM with legacy data bases, CAx& ERP systems.	K3
K1: Remembering; K2: Understanding; K3: Applying; K4: Analyzing; K5: Evaluating; K6: Creating		
<b>Text Books</b>	<ol style="list-style-type: none"> <li>1. Antti Saaksvuori and Anselmi Immonen, "Product Lifecycle Management", SpringerPublisher, 2008 (3rd Edition).</li> <li>2. International Journal of Product Lifecycle Management, Inderscience Publishers</li> <li>3. Ivica Crnkovic, Ulf Asklund and Annita Persson Dahlqvist, "Implementing andIntegrating Product Data Management and Software Configuration Management", Artech House Publishers, 2003.</li> </ol>	
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. John Stark, "Global Product: Strategy, Product Lifecycle Management and the Billion Customer Question", Springer Publisher, 2007.</li> <li>2. John Stark, "Product Lifecycle Management: 21st Century Paradigm for Product Realisation", Springer Publisher, 2011 (2nd Edition).</li> <li>3. Michael Grieves, "Product Life Cycle Management", Tata McGraw Hill, 2006.</li> </ol>	

Tools for Assessment (40 Marks)												
CIA I	CIA II		CIA III		Assignment/ Seminar/ Case study				Attendance	Total		
10	10		10		5				5	40		
Mapping												
CO \ PO	PO1	PO2	PO3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2	1	-	-	-	-	-	-	-	-
CO2	2	2	2	1	-	-	-	-	-	-	-	-
CO3	2	1	2	1	-	-	-	-	-	-	-	-
CO4	1	1	3	1	-	-	-	-	-	-	-	-
CO5	1	1	1	1	-	-	-	-	-	-	-	-
3-High; 2-Medium; 1-Low												
CO \ PSO		PSO1			PSO2			PSO3				
CO1		3			3			3				
CO2		3			3			3				
CO3		2			2			2				
CO4		3			3			3				
CO5		2			2			2				
Course designed by						Verified by						
 Signature of the Faculty member						 Signature of the Chairperson-BoS						
<b>Dr. D. SATHISH KUMAR</b> <b>AP/MECHANICAL ENGG</b> Name and Department of the Faculty Member						<b>Dr. M. SANTHOSH</b> <b>Professor and Head</b> <b>Department of Mechanical Engineering</b> <b>Nehru Institute of Engineering and Technology</b> <b>Coimbatore - 641 105, Tamilnadu, India.</b> Name and Seal of the Chairperson-BoS						

Course Code		Title				
P23CC202		FINITE ELEMENT METHODS IN MECHANICAL DESIGN				
Semester: II	L	T	P	Credits	CIA: 40 Marks	ESE: 60 Marks
	3	1	0	4		
Course pre-requisites		Engineering mechanics				
Course Objectives						
1	To learn mathematical models for one dimensional problems and their numerical solutions					
2	To learn two dimensional scalar and vector variable problems to determine field variables					
3	To learn Iso parametric transformation and numerical integration for evaluation of element matrices					
4	To study various solution techniques to solve Eigen value problems					
5	To learn solution techniques to solve non-linear problems					
Course Category		Professional Core Courses (PCC)				
Development Needs		Global / National				
Course Description: This course provides an in-depth understanding of the Finite Element Method (FEM) and its application in mechanical design and analysis.						
Course Content						
Unit	Description					
I	<b>FINITE ELEMENT ANALYSIS OF ONE DIMENSIONAL PROBLEMS</b> Historical Background – Weighted Residual Methods - Basic Concept of FEM – Variational Formulation of B.V.P. – Ritz Method – Finite Element Modelling – Element Equations – Linear and Higher order Shape functions – Bar, Beam Elements – Applications to Heat Transfer problems.					
						Contact Periods
II	<b>FINITE ELEMENT ANALYSIS OF TWO DIMENSIONAL PROBLEMS</b> Basic Boundary Value Problems in two-dimensions – Linear and higher order Triangular, quadrilateral elements – Poisson's and Laplace's Equation – Weak Formulation – Element Matrices and Vectors – Application to scalar variable problems - Introduction to Theory of Elasticity – Plane Stress – Plane Strain and Axisymmetric Formulation – Principle of virtual work – Element matrices using energy approach					
						Contact Periods
III	<b>ISO-PARAMETRIC FORMULATION</b> Natural Co-ordinate Systems – Lagrangian Interpolation Polynomials – Iso parametric Elements – Formulation – Shape functions -one dimensional, two dimensional triangular and quadrilateral elements -Serendipity elements- Jacobian transformation - Numerical Integration – Gauss quadrature – one, two and three point integration					
						Contact Periods
IV	<b>EIGEN VALUE PROBLEMS</b> Dynamic Analysis – Equations of Motion – Consistent and lumped mass matrices – Free Vibration analysis – Natural frequencies of Longitudinal, Transverse and torsional vibration – Solution of Eigenvalue problems - Introduction to transient field problems					



		<b>Contact Periods</b>	<b>9+3</b>
<b>V</b>	<b>NON-LINEAR ANALYSIS</b> Introduction to Non-linear problems - some solution techniques- computational procedure- material non-linearity-Plasticity and visco plasticity, stress stiffening, contact interfaces- problems of gaps and contact - geometric non-linearity - modeling considerations - Free and Mapped meshing -Mesh quality- Error estimate		
		<b>Contact Periods</b>	<b>9+3</b>
		<b>Total Periods</b>	<b>60</b>
<b>Course Outcomes Upon Successful Completion of the course, students will be able to:</b>			
<b>CO 1</b>	Develop mathematical models for one dimensional problems and their numerical solutions		K2
<b>CO 2</b>	Determine field variables for two dimensional scalar and vector variable problems		K3
<b>CO 3</b>	Apply Isoparametric transformation and numerical integration for evaluation of element matrices		K1
<b>CO 4</b>	Apply various solution techniques to solve Eigen value problems		K3
<b>CO 5</b>	Formulate solution techniques to solve non-linear problems		K3
K1: Remembering; K2: Understanding; K3: Applying; K4: Analyzing; K5: Evaluating; K6: Creating			
<b>Text Books</b>	<ol style="list-style-type: none"> <li>1. Bathe K.J., "Finite Element Procedures in Engineering Analysis", Prentice Hall, 1990</li> <li>2. David Hutton, "Fundamentals of Finite Element Analysis", Tata McGrawHill, 2005</li> <li>3. Rao, S.S., "The Finite Element Method in Engineering", 6th Edition, Butterworth- Heinemann, 2018.</li> </ol>		
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Reddy, J.N. "Introduction to the Finite Element Method", 4th Edition, Tata McGraw Hill, 2018</li> <li>2. Seshu, P., "Text Book of Finite Element Analysis", PHI Learning Pvt. Ltd., New Delhi, 2012.</li> <li>3. Tirupathi R. Chandrupatla and Ashok D. Belegundu, "Introduction to Finite Elements in Engineering", International Edition, Pearson Education Limited, 2014.</li> </ol>		

Tools for Assessment (40 Marks)												
CIA I	CIA II		CIA III		Assignment/ Seminar/ Case study				Attendance	Total		
10	10		10		5				5	40		
Mapping												
CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	3	-	-	-	-	-	-	-
CO2	3	2	2	2	3	-	-	-	-	-	-	-
CO3	3	2	2	2	3	-	-	-	-	-	-	-
CO4	3	2	2	2	3	-	-	-	-	-	-	-
CO5	3	2	2	2	3	-	-	-	-	-	-	-
3-High; 2-Medium; 1-Low												
CO \ PSO		PSO1			PSO2			PSO3				
CO1		3			3			3				
CO2		3			3			3				
CO3		2			2			2				
CO4		3			3			3				
CO5		2			2			2				
Course designed by						Verified by						
 Signature of the Faculty member						 Signature of the Chairperson-BoS						
 Name and Department of the Faculty Member						<b>Dr. M. SANTHOSH</b> Professor and Head Department of Mechanical Engineering Nehru Institute of Engineering and Technology Coimbatore - 641 105, Tamilnadu, India. Name and Seal of the Chairperson-BoS						

Course Code		Title				
P23CC203		SOLID FREEFORM MANUFACTURING				
Semester: II	L	T	P	Credits	CIA: 40 Marks	ESE: 60 Marks
	3	0	0	3		
Course pre-requisites		Manufacturing processes				
Course Objectives						
1	To acquaint the students with evolution of Solid Freeform Manufacturing (SFM) / Additive Manufacturing (AM), proliferation into various fields and its effects on supply chain.					
2	To gain knowledge on Design for Additive Manufacturing (DFAM) and its importance in quality improvement of fabricated parts.					
3	To acquaint with polymerization and sheet lamination processes and their applications.					
4	To acquaint with material extrusion and powder bed fusion processes.					
5	To gain knowledge on jetting and direct energy deposition processes and their applications.					
Course Category		Professional Core Courses (PCC)				
Development Needs		Global / National				
Course Description: This course explores the principles and applications of Solid Freeform Manufacturing (SFM), also known as additive manufacturing or 3D printing.						
Course Content						
Unit	Description					
I	<b>INTRODUCTION</b> Need - Development of SFM systems – Hierarchical structure of SFM - SFM process chain – Classification – Applications. Case studies: Bio printing- Food Printing- Electronics printing – Rapid Tooling - Building printing. AM Supply chain. Economics aspect: Strategic aspect- Operative aspect.					
						<b>Contact Periods</b>
II	<b>DESIGN FOR ADDITIVE MANUFACTURING</b> Concepts and Objectives - AM Unique Capabilities - Part Consolidation - Topology Optimization - Lightweight Structures - DFAM for Part Quality Improvement - CAD Modeling - Model Reconstruction - Data Processing for AM - Data Formats - Data Interfacing - Part Orientation - Support Structure Design and Support Structure Generation - Model Slicing - Tool Path Generation. Design Requirements of Additive Manufacturing: For Part Production, For Mass Production, For Series Production. Case Studies.					
						<b>Contact Periods</b>
III	<b>VAT POLYMERIZATION AND SHEET LAMINATION PROCESSES</b> Stereolithography Apparatus (SLA): Principles – Photo Polymerization of SL Resins - Pre Build Process – Part-Building and Post-Build Processes - Part Quality and Process					


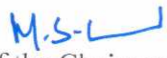
	Planning, Recoating Issues - Materials - Advantages - Limitations and Applications. Digital Light Processing (DLP) - Materials - Process - Advantages and Applications. Laminated Object Manufacturing (LOM): Working Principles - Process - Materials, Advantages, Limitations and Applications. Ultrasonic Additive Manufacturing (UAM) - Process - Parameters - Applications. Case Studies.	
<b>Contact Periods</b>		<b>9</b>
<b>IV</b>	<p><b>MATERIAL EXTRUSION AND POWDER BED FUSION PROCESSES</b></p> <p>Fused deposition Modeling (FDM): Working Principles - Process - Materials and Applications. Design Rules for FDM.</p> <p>Selective Laser Sintering (SLS): Principles - Process - Indirect and Direct SLS - Powder Structure – Materials - Surface Deviation and Accuracy - Applications. Multijet Fusion.</p> <p>Selective Laser Melting (SLM) and Electron Beam Melting (EBM): Principles – Processes – Materials – Advantages - Limitations and Applications. Case Studies.</p>	
<b>Contact Periods</b>		<b>9</b>
<b>V</b>	<p><b>JETTING AND DIRECT ENERGY DEPOSITION PROCESSES</b></p> <p>Binder Jetting: Three dimensional Printing (3DP): Principles – Process - Physics of 3DP - Types of printing: Continuous mode – Drop on Demand mode - Process – Materials - Advantages - Limitations - Applications.</p> <p>Material Jetting: Multi Jet Modelling (MJM) - Principles - Process - Materials - Advantages and Limitations.</p> <p>Laser Engineered Net Shaping (LENS): Processes- Materials- Advantages - Limitations and Applications. Case Studies.</p>	
<b>Contact Periods</b>		<b>9</b>
<b>Total Periods</b>		<b>45</b>
<b>Course Outcomes</b>		
<b>Upon Successful Completion of the course, students will be able to:</b>		
<b>CO 1</b>	Relate the importance in the evolution of SFM/AM, proliferation into the various fields and its effects on supply chain.	K2
<b>CO 2</b>	Analyze the design for AM and its importance in the quality of fabricated parts.	K3
<b>CO 3</b>	Build knowledge on principles and applications of polymerization and sheet lamination processes with case studies.	K4
<b>CO 4</b>	Explain the principles of material extrusion and powder bed fusion processes and design guidelines.	K3
<b>CO 5</b>	Elaborate jetting and direct energy deposition processes and their applications	K3
K1: Remembering; K2: Understanding; K3: Applying; K4: Analyzing; K5: Evaluating; K6: Creating		

<b>Text Books</b>	<ol style="list-style-type: none"><li>1. Andreas Gebhardt and Jan-Steffen Hotter, "Additive Manufacturing: 3D Printing for Prototyping and Manufacturing", Hanser publications Munchen, Germany, 2016. ISBN:978-1-56990-582-1.</li><li>2. Ben Redwood, Brian Garret, FilemonSchöffner, and Tony Fadel, "The 3D Printing Handbook: Technologies, Design and Applications", 3D Hubs B.V., Netherland, 2017. ISBN-13: 978- 9082748505.</li><li>3. Ian Gibson, David W. Rosen and Brent Stucker, "Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing" Springer - New York, USA, 2nd Edition, 2015. ISBN-13: 978-1493921126.</li></ol>
<b>Reference Books</b>	<ol style="list-style-type: none"><li>1. Liou, L.W. and Liou, F.W., "Rapid Prototyping and Engineering applications: A tool box for prototype development", CRC Press, 1st Edition, 2007 FL, USA. ISBN- 9780849334092.</li><li>2. Milan Brandt., "Laser Additive Manufacturing 1st Edition Materials. Design, Technologies, and Applications", Woodhead Publishing, UK, 2016. ISBN- 9780081004333</li></ol>

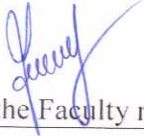

Tools for Assessment (40 Marks)												
CIA I	CIA II		CIA III			Assignment/ Seminar/ Case study				Attendance	Total	
10	10		10			5				5	40	
Mapping												
CO \ PO	PO1	PO 2	PO 3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	1	3	2	-	-	-	-	-	-	-
CO2	3	2	3	3	2	-	-	-	-	-	-	-
CO3	3	3	2	3	1	-	-	-	-	-	-	-
CO4	3	3	2	3	1	-	-	-	-	-	-	-
CO5	3	3	2	3	1	-	-	-	-	-	-	-
CO \ PSO				PSO1			PSO2			PSO3		
CO1				3			2			3		
CO2				3			3			3		
CO3				2			2			2		
CO4				3			3			3		
CO5				2			2			2		
3-High; 2-Medium; 1-Low												
Course designed by						Verified by						
 Signature of the Faculty member						 Signature of the Chairperson-BoS						
<b>Dr. D. SATHISH KUMAR</b> <b>AP/ MECHANICAL ENGG.</b> Name and Department of the Faculty Member						<b>Dr. M. SANTHOSH</b> <b>Professor and Head</b> <b>Department of Mechanical Engineering</b> <b>Nehru Institute of Engineering and Technology</b> Name and Seal of the Chairperson-BoS						

Course Code		Title				
P23CC204		INDUSTRY 4.0				
Semester: II	L	T	P	Credits	CIA: 40 Marks	ESE: 60 Marks
	3	0	0	3		
Course pre-requisites		Manufacturing processes, Engineering Design				
Course Objectives						
1	Understand Industry 4.0					
2	Apply IoT and IIoT for Industry 4.0					
3	Understand CPS for Industry 4.0					
4	Understand role of data					
5	Understand role of IIoT					
Course Category		Professional Core Courses (PCC)				
Development Needs		Global / National				
Course Description: This course provides an in-depth exploration of Industry 4.0, the fourth industrial revolution characterized by the integration of digital technologies into manufacturing and industrial processes.						
Course Content						
Unit	Description					
I	Introduction to Industry 4.0 The Various Industrial Revolutions - Digitalisation and the Networked Economy - Drivers, Enablers, Compelling Forces and Challenges for Industry 4.0 - Comparison of Industry 4.0 Factory and Today's Factory - Trends of Industrial Big Data and Predictive Analytics for Smart Business Transformation					
Contact Periods						9
II	Road to Industry 4.0 - Internet of Things (IoT) & Industrial Internet of Things (IIoT) & Internet of Services - Smart Manufacturing - Smart Devices and Products - Smart Logistics - Smart Cities - Predictive Analytics					
Contact Periods						9
III	System, Technologies for enabling Industry 4.0–Cyber Physical Systems - Robotic Automation and Collaborative Robots - Support System for Industry 4.0 - Mobile Computing - Cyber Security					
Contact Periods						9
IV	Role of data, information, knowledge and collaboration in future organizations - Resource- based view of a firm - Data as a new resource for organizations - Harnessing and sharing knowledge in organizations - Cloud Computing Basics -Cloud Computing and Industry 4.0					
Contact Periods						9
V	Industry 4.0 IIoT case studies - Opportunities and Challenges - Future of Works and Skills for Workers in the Industry 4.0 Era - Strategies for competing in an Industry 4.0 world – Society 5.0TOTAL					
Contact Periods						9
Total Periods						45


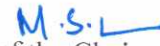
<b>Course Outcomes</b>		
<b>Upon Successful Completion of the course, students will be able to:</b>		
<b>CO 1</b>	To use Industry 4.0 for Industrial Applications	K1
<b>CO 2</b>	To use IoT and IIoT for Industry 4.0	K3
<b>CO 3</b>	To apply smart devices Industrial Applications	K4
<b>CO 4</b>	To understand role of data	K3
<b>CO 5</b>	To understand role of IIoT	K3
K1: Remembering; K2: Understanding; K3: Applying; K4: Analyzing; K5: Evaluating; K6: Creating		
<b>Text Books</b>	1. Alasdair Gilchrist, Industry 4.0: The Industrial Internet of Things 2. Arsheep Bahga, Internet of Things: A Hands-On Approach	
<b>Reference Books</b>	1. Arsheep Bahga, Internet of Things: A Hands-On Approach	

Tools for Assessment (40 Marks)												
CIA I		CIA II		CIA III		Assignment/ Seminar/ Case study				Attendance	Total	
10		10		10		5				5	40	
Mapping												
CO \ PO	PO1	PO 2	PO 3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	1	3	2	-	-	-	-	-	-	-
CO2	3	2	3	3	2	-	-	-	-	-	-	-
CO3	3	3	2	3	1	-	-	-	-	-	-	-
CO4	3	3	2	3	1	-	-	-	-	-	-	-
CO5	3	3	2	3	1	-	-	-	-	-	-	-
CO \ PSO				PSO1			PSO2			PSO3		
CO1				3			2			3		
CO2				2			3			3		
CO3				2			2			2		
CO4				3			3			3		
CO5				2			2			2		
3-High; 2-Medium; 1-Low												
Course designed by						Verified by						
 Signature of the Faculty member						 Signature of the Chairperson-BoS						
<b>Dr. D. SATHISH KUMAR</b> <b>AP/ MECHANICAL ENGG.</b> Name and Department of the Faculty Member						<b>Dr. M. SANTHOSH</b> <b>Professor and Head</b> <b>Department of Mechanical Engineering</b> <b>Nehru Institute of Engineering and Technology</b> <b>Coimbatore - 641 016, Tamil Nadu, India</b> Name and Seal of the Chairperson-BoS						

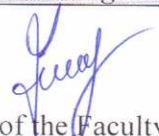
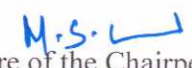
Course Code		Title					
P23CC215		RAPID PROTOTYPING LABORATORY					
Semester: II	L	T	P	Credits	CIA: 40 Marks	ESE: 60 Marks	
	0	0	4	2			
Course pre-requisites		CAD, CAM					
Course Objectives							
1	Optimize the process parameters of FDM machine to improve the quality of the parts produced.						
2	Build complex engineering assemblies in plastic material with less process planning.						
3	Improve surface finish of fabricated plastic components for the engineering applications.						
4	Design and fabricate working models for the conceptual testing applications.						
5	To Demonstrating Creative Working Models						
Course Category		Professional Core Courses (PCC)					
Development Needs		Global / National					
Course Description: This laboratory course provides hands-on experience with rapid prototyping technologies, focusing on the creation of physical models and prototypes directly from digital designs.							
Course Content							
Unit	Description						
	<ol style="list-style-type: none"> <li>1. Review of CAD Modeling Techniques and Introduction to RP</li> <li>2. Forming Groups &amp; Assigning Creative Idea</li> <li>3. Generating STL files from the CAD Models &amp; Working on STL files</li> <li>4. Modeling Creative Designs in CAD Software</li> <li>5. Assembling Creative Designs in CAD Software</li> <li>6. Processing the CAD data in Catalyst software (Selection of Orientation, Supports generation, Slicing, Tool path generation)</li> <li>7. Sending the tool path data to FDM RP machine</li> <li>8. Removing the supports &amp; post processing (cleaning the surfaces)</li> <li>9. Demonstrating Creative Working Models</li> </ol>						
<b>Total Periods</b>						<b>60</b>	
<b>Course Outcomes Upon Successful Completion of the course, students will be able to:</b>							
<b>CO 1</b>	Optimize the process parameters of FDM machine to improve the quality of the parts produced					K3	
<b>CO 2</b>	Build complex engineering assemblies in plastic material with less process planning.					K3	
<b>CO 3</b>	Improve surface finish of fabricated plastic components for the engineering applications.					K4	
<b>CO 4</b>	Design and fabricate working models for the conceptual testing applications.					K3	
<b>CO 5</b>	To Demonstrating Creative Working Models					K3	
K1: Remembering; K2: Understanding; K3: Applying; K4: Analyzing; K5: Evaluating; K6: Creating							

Tools for Assessment (40 Marks)												
CIA I		CIA II		CIA III		Assignment/ Seminar/ Case study			Attendance		Total	
10		10		10		5			5		40	
Mapping												
CO \ PO	PO1	PO 2	PO 3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	3	2	3	3	2	-	-	-	-	-
CO2	1	3	3	2	3	3	2	-	-	-	-	-
CO3	1	3	3	2	3	3	2	-	-	-	-	-
CO4	1	3	3	2	3	3	2	-	-	-	-	-
CO5	1	3	3	2	3	3	2	-	-	-	-	-
CO \ PSO		PSO1			PSO2			PSO3				
CO1		3			3			3				
CO2		3			3			3				
CO3		3			2			2				
CO4		3			3			3				
CO5		2			2			2				
3-High; 2-Medium; 1-Low												
Course designed by						Verified by						
 Signature of the Faculty member						 Signature of the Chairperson-BoS						
Dr. S. JEEYANANTHAN ASP/MECH Name and Department of the Faculty Member						<b>Dr. M. SANTHOSH</b> Professor and Head Department of Mechanical Engineering Nehru Institute of Engineering and Technology Coimbatore-641 095, Tamil Nadu Name and Seal of the Chairperson-BoS						

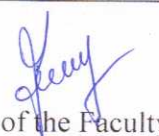
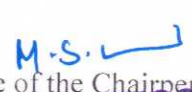
Course Code		Title				
P23CC216		SIMULATION AND ANALYSIS LABORATORY				
Semester: II	L	T	P	Credits	CIA: 40 Marks	ESE: 60 Marks
	0	0	4	2		
Course pre-requisites		CAD, CAM				
Course Objectives						
1	Solve engineering problems numerically using Computer Aided Finite Element Analysis packages					
2	Analyze the force, stress, deflection in mechanical component					
3	Analyze thermal stress and heat transfer in mechanical components.					
4	Analyze the vibration of mechanical components.					
5	Analyze the modal, harmonic, transient and spectrum concepts in mechanical components.					
Course Category		Professional Core Courses (PCC)				
Development Needs		Global / National				
<b>Course Description:</b> This laboratory course provides practical experience with simulation and analysis tools used in mechanical engineering and design.						
Course Content						
Unit	Description					
	<ol style="list-style-type: none"> <li>1. Force and Stress analysis using link elements in Trusses.</li> <li>2. Stress and deflection analysis in beams with different support conditions.</li> <li>3. Stress analysis of flat plates.</li> <li>4. Stress analysis of axi-symmetric components.</li> <li>5. Thermal stress and heat transfer analysis of plates.</li> <li>6. Thermal stress analysis of cylindrical shells.</li> <li>7. Vibration analysis of spring-mass systems.</li> <li>8. Modal analysis of Beams.</li> <li>9. Harmonic, transient and spectrum analysis of simple systems.</li> <li>10. Analysis of machine elements under dynamic loads</li> <li>11. Analysis of non-linear systems</li> </ol>					
					Total Periods	60
<b>Course Outcomes Upon Successful Completion of the course, students will be able to:</b>						
CO 1	Solve engineering problems numerically using Computer Aided Finite Element Analysis packages					K1
CO 2	Analyze the force, stress, deflection in mechanical component					K3
CO 3	Analyze thermal stress and heat transfer in mechanical components.					K1
CO 4	Analyze the vibration of mechanical components.					K3
CO 5	Analyze the modal, harmonic, transient and spectrum concepts in mechanical components.					K3
K1: Remembering; K2: Understanding; K3: Applying; K4: Analyzing; K5: Evaluating; K6: Creating						

Tools for Assessment (40 Marks)												
CIA I		CIA II		CIA III		Assignment/ Seminar/ Case study			Attendance		Total	
10		10		10		5			5		40	
Mapping												
CO \ PO	PO1	PO 2	PO 3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	2	3	3	2	-	-	-	-	-
CO2	2	3	3	2	3	3	2	-	-	-	-	-
CO3	2	3	3	3	3	3	2	-	-	-	-	-
CO4	2	3	3		3	2	2	-	-	-	-	-
CO5	2	3	3	3	3	3	2	-	-	-	-	-
CO \ PSO		PSO1			PSO2			PSO3				
CO1		3			3			3				
CO2		3			3			3				
CO3		3			3			3				
CO4		3			3			3				
CO5		2			2			2				
3-High; 2-Medium; 1-Low												
Course designed by						Verified by						
 Signature of the Faculty member						 Signature of the Chairperson-BoS						
Dr. S. JEEVANANTHAM ASP/MEW Name and Department of the Faculty Member						<b>Dr. M. SANTHOSH</b> Professor and Head Department of Mechanical Engineering Vohru Institute of Engineering and Technology Name and Department of the Chairperson-BoS Bangalore-601 105, Tamilnadu, India.						

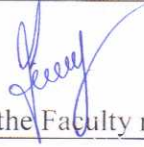
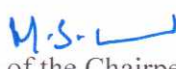

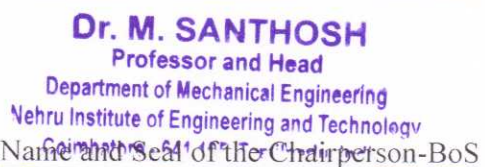
Course Code		Title				
P23CC311		TECHNICAL SEMINAR				
Semester: III	L	T	P	Credits	CIA: 40 Marks	ESE: 60 Marks
	0	0	2	1		
Course pre-requisites		TECHNICAL ENGLISH				
Course Objectives						
1	To work on a specific technical topic in Engineering design related topics in order to acquire the skills of oral presentation					
2	To acquire technical writing abilities for seminars and conferences					
Course Category		Professional Core Courses (PCC)				
Development Needs		Global / National				
Course Description: This course involves presenting and discussing advanced topics and current research in various engineering disciplines through a series of seminars.						
Course Content						
Unit	Description					
	<p>The students will work for two hours per week guided by a group of staff members. They will be asked to talk on any topic of their choice related to Engineering design topics and to engage in dialogue with the audience. A brief copy of their talk also should be submitted. Similarly, the students will have to present a seminar of not less than fifteen minutes and not more than thirty minutes on the technical topic. They will also answer the queries on the topic. The students as audience also should interact. Evaluation will be based on the technical presentation and the report and also on the interaction during the seminar.</p>					
					Total Periods	30
Course Outcomes Upon Successful Completion of the course, students will be able to:						
CO 1	Students comprehend concepts and methods adequate to understand inductive and deductive reasoning, and increase their general problem solving skills.					K1
CO 2	Students develop communicative skills(e.g. speaking, listening, reading, and/or writing					K3
K1: Remembering; K2: Understanding; K3: Applying; K4: Analyzing; K5: Evaluating; K6: Creating						

Tools for Assessment (40 Marks)												
CIA I		CIA II		CIA III		Assignment/ Seminar/ Case study				Attendance		Total
10		10		10		5				5		40
Mapping												
CO \ PO	PO1	PO 2	PO 3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	3	2	2	2	-	-	-	-	-	-
CO2	1	3	3	2	2	2	-	-	-	-	-	-
CO3	1	3	3	2	2	2	-	-	-	-	-	-
CO4	1	3	3		2	2	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-
CO \ PSO		PSO1				PSO2			PSO3			
CO1		3				3			3			
CO2		3				3			3			
CO3		3				3			3			
CO4		3				3			3			
CO5		2				2			2			
3-High; 2-Medium; 1-Low												
Course designed by						Verified by						
 Signature of the Faculty member						 Signature of the Chairperson-BoS						
Dr. S. JEEVANANTHAM ASP/Mech						<b>Dr. M. SANTHOSH</b> Professor and Head Department of Mechanical Engineering Nehru Institute of Engineering and Technology Coimbatore - 641 105, Tamilnadu, India.						
Name and Department of the Faculty Member						Name and Seal of the Chairperson-BoS						

Course Code		Title				
P23CC312		PROJECT WORK I				
Semester: III	L	T	P	Credits	CIA: 40 Marks	ESE: 60 Marks
	0	0	12	6		
Course pre-requisites		Core Engineering Courses				
Course Objectives						
1	To identify a specific problem for the current need of the society and collecting information related to the same through detailed review of literature.					
2	To acquire technical writing abilities for seminars and conferences					
3	To train the students in preparing project reports and to face reviews and viva -voce examination					
Course Category		Professional Core Courses (PCC)				
Development Needs		Global / National				
Course Description: This course is designed to provide students with hands-on experience in executing a significant engineering project.						
Course Content						
Unit	Description					
	<p>The student individually works on a specific topic approved by the head of the division under the guidance of a faculty member who is familiar in this area of interest. The student can select any topic which is relevant to the area of engineering design and manufacturing applications. The topic may be theoretical or case studies. At the end of the semester, a detailed report on the work done should be submitted which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work. The students will be evaluated through a viva-voce examination by a panel of examiners including one external examiner.</p>					
<b>Total Periods</b>						30
<b>Course Outcomes Upon Successful Completion of the course, students will be able to:</b>						
<b>CO 1</b>	Demonstrate a sound technical knowledge of their selected project topic.					K1
<b>CO 2</b>	Undertake problem identification, formulation and solution.					K3
<b>CO 3</b>	Design and manufacturing engineering solutions to complex problems utilizing a systems approach					K4
<b>CO 4</b>	The students will have a clear idea of their area of work and they will be in a position to carry out the remaining phase II work in a systematic way.					K3
K1: Remembering; K2: Understanding; K3: Applying; K4: Analyzing; K5: Evaluating; K6: Creating						

Tools for Assessment (40 Marks)												
Review I		Review II		Review III		Assignment/ Seminar/ Case study				Attendance		Total
10		10		10		5				5		40
Mapping												
CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	2	2	2	-	-	-	-	-	-
CO2	2	2	3	2	2	2	-	-	-	-	-	-
CO3	2	2	3	2	2	2	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-
3-High; 2-Medium; 1-Low												
CO \ PSO		PSO1			PSO2			PSO3				
CO1		3			3			3				
CO2		3			3			3				
CO3		3			3			3				
CO4		3			3			3				
CO5		2			2			2				
Course designed by						Verified by						
 Signature of the Faculty member						 Signature of the Chairperson-BoS						
Dr. SOJEEVAN BANTHAM ASP/meet						<b>Dr. M. SANTHOSH</b> Professor and Head Department of Mechanical Engineering Nehru Institute of Engineering and Technology Coimbatore - 641 105, Tamilnadu, India.						
Name and Department of the Faculty Member						Name and Seal of the Chairperson-BoS						

Course Code		Title				
P23CC411		PROJECT WORK II				
Semester: III	L	T	P	Credits	CIA: 40 Marks	ESE: 60 Marks
	3	0	0	3		
Course pre-requisites		Core Engineering Courses:				
Course Objectives						
1	To solve the identified problem based on the formulated methodology					
2	To develop skills to analyze and discuss the test results, and make conclusions					
Course Category		Professional Core Courses (PCC)				
Development Needs		Global / National				
Course Description: This course is designed to provide students with hands-on experience in executing a significant engineering project.						
Course Content						
Unit	Description					
	The student should continue the phase I work on the selected topic as per the formulated methodology under the same supervisor. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report should be prepared and submitted to the head of the department. The students will be evaluated based on the report submitted and the viva-voce examination by a panel of examiners including one external examiner.					
<b>Total Periods</b>						<b>360</b>
Course Outcomes						
Upon Successful Completion of the course, students will be able to:						
CO 1	Demonstrate a sound technical knowledge of their selected project topic.					K1
CO 2	Undertake problem identification, formulation and solution.					K3
CO 3	Design engineering solutions to complex problems utilizing a systems approach					K4
CO 4	Demonstrate the knowledge, skills and attitudes of a professional engineer to take up any challenging practical problem in the field of engineering design and manufacturing engineering and find better solutions to it.					K3
K1: Remembering; K2: Understanding; K3: Applying; K4: Analyzing; K5: Evaluating; K6: Creating						




Tools for Assessment (40 Marks)												
Review I		Review II		Review III		Assignment/ Seminar/ Case study				Attendance		Total
10		10		10		5				5		40
Mapping												
CO \ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	2	3	2	-	-	-	-	-	-
CO2	2	3	3	2	3	2	-	-	-	-	-	-
CO3	2	3	3	2	3	2	-	-	-	-	-	-
CO4	2	3	3		3	2	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-
3-High; 2-Medium; 1-Low												
CO \ PSO		PSO1			PSO2			PSO3				
CO1		3			3			3				
CO2		3			3			3				
CO3		3			3			2				
CO4		3			3			3				
CO5		2			2			2				
Course designed by						Verified by						
 Signature of the Faculty member						 Signature of the Chairperson-BoS						
 Name and Department of the Faculty Member						 Name and Seal of the Chairperson-BoS						

## ELECTIVES

Course Code		Title				
P23CC11		INTEGRATED PRODUCT DEVELOPMENT				
Semester: I	L	T	P	Credits	CIA: 40 Marks	ESE: 60 Marks
	3	0	0	3		
Course pre-requisites		Engineering Design, CAD				
Course Objectives						
1	To Understand the principles of generic development process; product planning; customer need analysis for new product design and development.					
2	To enhance the understanding of setting product specifications and generate, select, screen, and test concepts for new product design and development.					
3	To apply the principles of product architecture and the importance of industrial design principles and DFM principles for new product development.					
4	To expose the different Prototyping techniques, Design of Experiment principles to develop a robust design and importance to patent a developed new product.					
5	Applying the concepts of economics principles; project management practices in development of new product.					
Course Category		Professional Core Courses (PCC)				
Development Needs		Global / National				
Course Description: Integrated Product Development (IPD) is a comprehensive course that provides students with the knowledge and skills necessary to manage the entire product development process from concept to market.						
Course Content						
Unit	Description					
I	<b>INTRODUCTION TO PRODUCT DESIGN</b>					
	Characteristics of Successful Product development –Duration and Cost of Product Development – Challenges of Product Development - Product Development Processes and Organizations – Product Planning Process - Process of Identifying Customer Needs					
					<b>Contact Periods</b>	<b>9</b>
II	<b>PRODUCT SPECIFICATIONS, CONCEPT GENERATION, SELECTION AND TESTING</b>					
	Establish Target and Final product specifications – Activities of Concept Generation - Concept Screening and Scoring - Concept Testing Methodologies.					
					<b>Contact Periods</b>	<b>9</b>
III	<b>PRODUCT ARCHITECTURE AND INDUSTRIAL DESIGN</b>					
	Product Architecture – Implications and establishing the architecture – Delayed Differentiation – Platform Planning – Related system level design issues - Need and					

	impact of industrial design - Industrial design process - management of the industrial design process - assessing the quality of industrial design	
		<b>Contact Periods</b> 9
<b>IV</b>	<b>DESIGN FOR MANUFACTURE, PROTOTYPING AND ROBUST DESIGN</b> DFM Definition - Estimation of Manufacturing cost- Reducing the component costs, costs of supporting function and assembly costs – Impact of DFM decision on other factors - Prototype basics - Principles of prototyping – Prototyping technologies - Planning for prototypes - Robust design –Robust Design Process	
		<b>Contact Periods</b> 9
<b>V</b>	<b>PRODUCT DEVELOPMENT ECONOMICS AND MANAGING PROJECTS</b> Economic Analysis – Elements of Economic Analysis - Understanding and representing tasks- Baseline Project Planning - Accelerating the project - Project execution – Postmortem project evaluation.	
		<b>Contact Periods</b> 9
		<b>Total Periods</b> 45
<b>Course Outcomes</b>		
Upon Successful Completion of the course, students will be able to:		
<b>CO 1</b>	Apply the principles of generic development process; product planning; customer need analysis for new product design and development.	
<b>CO 2</b>	Set product specifications and generate, select, screen, test concepts for new product design and development.	
<b>CO 3</b>	Apply the principles of product architecture, industrial design and design for manufacturing principles in new product development.	
<b>CO 4</b>	Apply the adopt Prototyping techniques	
<b>CO 5</b>	Design of Experiment principles to develop a robust design and document a new product for patent.	
<b>Text Books</b>	<ol style="list-style-type: none"> <li>1. Karl T.Ulrich, Steven D.Eppinger, Anita Goyal, "Product Design and Development", McGraw –Hill Education (India) Pvt. Ltd, 4th Edition, 2012.</li> <li>2. Kenneth Crow, "Concurrent Engineering/Integrated Product Development". DRM Associates, 6/3, Via Olivera, Palos Verdes, CA 90274(310) 377-569, Workshop Book</li> <li>3. Kevin N Otto, Kristin L Wood, "Product Design – Techniques in Reverse Engineering and New Product Development", Pearson Education, Inc, 2016</li> </ol>	



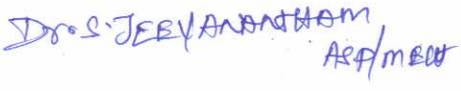
Reference Books	<ol style="list-style-type: none"> <li>1. Stephen Rosenthal, "Effective Product Design and Development", Business One OrwinHomewood, 1992</li> <li>2. Stuart Pugh, "Total Design — Integrated Methods for successful Product Engineering", AddisonWesley Publishing, Neyourk, NY, 1991.</li> </ol>
-----------------	--

Tools for Assessment (40 Marks)												
CIA I	CIA II		CIA III			Assignment/ Seminar/ Case study				Attendance	Total	
10	10		10			5				5	40	
Mapping												
CO \ PO	PO1	PO 2	PO 3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	-	-	-	-	-	-	-
CO2	3	3	3	3	3	-	-	-	-	-	-	-
CO3	3	3	3	3	3	-	-	-	-	-	-	-
CO4	3	3	3	3	3	-	-	-	-	-	-	-
CO5	3	3	3	3	3	-	-	-	-	-	-	-
3-High; 2-Medium; 1-Low												
Course designed by						Verified by						
 Signature of the Faculty member						 Signature of the Chairperson-BoS						
 Name and Department of the Faculty Member						<b>Dr. M. SANTHOSH</b> Professor and Head Department of Mechanical Engineering Nehru Institute of Engineering and Technology Coimbatore, 641 095, Tamilnadu, India Name and Seal of the Chairperson-BoS						

Course Code		Title				
P23CC12		COMPOSITE MATERIALS AND MECHANICS				
Semester: I	L	T	P	Credits	CIA: 40 Marks	ESE: 60 Marks
	3	0	0	3		
Course pre-requisites		Material science				
Course Objectives						
1	Study of different composite materials and finding its mechanical strength					
2	Fabrication of FRP and other composites by different manufacturing methods					
3	Stress analysis of fiber reinforced Laminates for different combinations of plies with different orientations of the fiber.					
4	Calculation of stresses in the lamina of the laminate using different failure theories					
5	Calculation of residual stresses in different types of laminates under thermo-mechanical load using the Classical Laminate Theory.					
Course Category		Professional Core Courses (PCC)				
Development Needs		Global / National				
Course Description: Composite Materials and Mechanics is a course focusing on the study of composite materials and their mechanical behavior.						
Course Content						
Unit	Description					
I	<b>INTRODUCTION TO COMPOSITE MATERIALS</b>					
	Definition-Matrix materials-polymers-metals-ceramics - Reinforcements: Particles, whiskers, inorganic fibers, metal filaments-ceramic fibers-fiber fabrication-natural composite wood, Jute- Advantages and drawbacks of composites over monolithic materials. Mechanical properties and applications of composites, Particulate-Reinforced composite Materials, Dispersion-Strengthened composite, Fiber-reinforced composites Rule of mixtures-Characteristics of fiber-Reinforced composites, Manufacturing fiber and composites					
					<b>Contact Periods</b>	<b>9</b>
II	<b>MANUFACTURING OF COMPOSITES</b>					
	Manufacturing of Polymer Matrix Composites (PMCs)-handlay-up, spray technique, filament winding, Pultrusion, Resin Transfer Moulding (RTM)-,bag moulding, injection moulding, Sandwich Mould Composites (SMC) - Manufacturing of Metal Matrix Composites (MMCs) - Solid state, liquid state, vapour state processing, Manufacturing of Ceramic Matrix Composites (CMCs)-hot pressing- reaction bonding process-infiltration technique, directoxidation-interfaces					
					<b>Contact Periods</b>	<b>9</b>



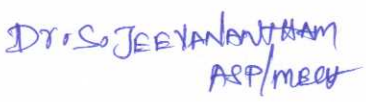
<b>LAMINA CONSTITUTIVE EQUATIONS</b>	
<b>III</b>	<p>Lamina Constitutive Equations: Lamina Assumptions–Macroscopic Viewpoint. Generalized Hooke’s Law. Reduction to Homogeneous Orthotropic Lamina – Isotropic limit case, Orthotropic Stiffness matrix (<math>Q_{ij}</math>), Definition of stress and Moment Resultants. Strain Displacement relations. Basic Assumptions of Laminated anisotropic plates. Laminate Constitutive Equations – Coupling Interactions, Balanced Laminates, Symmetric Laminates, Angle Ply Laminates, CrossPly Laminates. Laminate Structural Moduli. Evaluation of Lamina Properties from Laminate Tests. Quasi-Isotropic Laminates. Determination of Lamina stresses within Laminates.</p>
<b>Contact Periods</b>	
<b>9</b>	
<b>LAMINA STRENGTH ANALYSIS AND ANALYSIS OF LAMINATED FLAT PLATES</b>	
<b>IV</b>	<p>Introduction- Maximum Stress and Strain Criteria. Von-Misses Yield criterion for Isotropic Materials. Generalized Hill’s Criterion for Anisotropic materials. Tsai-Hill’s Failure Criterion for Composites. Tensor Polynomial(Tsai-Wu) Failure criterion. Prediction of laminate Failure Equilibrium Equations of Motion. Energy Formulations. Static Bending Analysis. Buckling Analysis. Free Vibrations– Natural Frequencies</p>
<b>Contact Periods</b>	
<b>9</b>	
<b>THERMO-STRUCURAL ANALYSIS</b>	
<b>V</b>	<p>Fabrication stresses / Residual stresses in FRP laminated composites-Co-efficient of Thermal Expansion (C.T.E.) - Modification of Hooke’s Law. Modification of Laminate Constitutive Equations. Orthotropic Lamina C.T.E’s -Stress and Moment Resultants due cooling of the laminates during fabrication-Calculations for thermo-mechanical stresses in FRP laminates Case studies: Implementation of CLT for evaluating residual stresses in the components made with different isotropic layers such as electronic packages etc.</p>
<b>Contact Periods</b>	
<b>9</b>	
<b>Total Periods</b>	
<b>45</b>	
<b>Course Outcomes Upon Successful Completion of the course, students will be able to:</b>	
<b>CO 1</b>	Calculate for mechanical strength of the composite material
<b>CO 2</b>	Fabricate the FRP and other composites by different manufacturing methods

CO 3	Analyze fiber reinforced Laminates for different combinations of plies with different orientations of the fiber.
CO 4	Evaluate the stresses in the lamina of the laminate using different failure theories
CO 5	Analyze thermo-mechanical behavior and evaluate residual stresses in different types of laminates using the Classical Laminate Theory.
Text Books	<ol style="list-style-type: none"> <li>1. Agarwal BD and Broutman LJ, "Analysis and Performance of Fiber Composites", John Wiley and Sons, New York, 1990.</li> <li>2. Gibson RF, Principles of Composite Material Mechanics, CRC press, 4<sup>th</sup> Edition, 2015.</li> <li>3. Hyer MW and Scott R White, "Stress Analysis of Fiber — Reinforced Composite Materials", McGraw-Hill, 1998</li> </ol>
Reference Books	<ol style="list-style-type: none"> <li>1. Issac M Daniel and OriIshai, "Engineering Mechanics of Composite Materials", Oxford University Press- 2006, First Indian Edition-2007</li> <li>2. Madhujit Mukhopadhyay, "Mechanics of Composite Materials and</li> <li>3. Mallick PK, Fiber – Reinforced Composites: Materials, Manufacturing and Design, CRC Press, 3<sup>rd</sup> Edition, 2007.</li> </ol>

Tools for Assessment (40 Marks)												
CIA I	CIA II		CIA III		Assignment/ Seminar/ Case study				Attendance	Total		
10	10		10		5				5	40		
Mapping												
CO \ PO	PO1	PO 2	PO 3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	3	2	2	2	-	-	-	-	-	-
CO2	1	1	3	2	2	2	-	-	-	-	-	-
CO3	1	1	3	2	2	2	-	-	-	-	-	-
CO4	1	1	3	2	2	2	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-
3-High; 2-Medium; 1-Low												
Course designed by						Verified by						
 Signature of the Faculty member						 Signature of the Chairperson-BoS						
 Name and Department of the Faculty Member						<b>Dr. M. SANTHOSH</b> Professor and Head Department of Mechanical Engineering Nehru Institute of Engineering and Technology Coimbatore - 641 105, Tamilnadu, India. Name and Seal of the Chairperson-BoS						


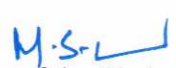
Course Code		Title				
P23CC13		COMPUTER CONTROL IN PROCESS PLANNING				
Semester: I	L	T	P	Credits	CIA: 40 Marks	ESE: 60 Marks
	3	0	0	3		
Course pre-requisites		Process Planning, Production Planning				
Course Objectives						
1	To understand the need of process planning in manufacturing					
2	To know handle the computer aided process planning tool					
3	To apply the knowledge of Expert systems, Group technology and part representation for various applications					
4	To interpret the use of computer aided process planning for CAD/CAM Systems					
5	To analyse the computer aided planning systems for various industrial applications					
Course Category		Professional Core Courses (PCC)				
Development Needs		Global / National				
Course Description: Computer Control in Process Planning is a course designed to explore the integration of computer-based technologies in manufacturing process planning.						
Course Content						
Unit	Description					
I	<b>INTRODUCTION</b> The Place of Process Planning in the Manufacturing cycle - Process Planning and Production Planning – Process Planning and Concurrent Engineering, CAPP, Group Technology					
						<b>Contact Periods</b>
II	<b>PART DESIGN REPRESENTATION</b> Design Drafting - Dimensioning - Conventional tolerance - Geometric tolerance - CAD – input/output devices - topology- Geometric transformation- Perspective transformation – Data structure - Geometric modelling for process planning- GT coding - The optiz system - The MICLASS system.					
						<b>Contact Periods</b>
III	<b>PROCESS ENGINEERING AND PROCESS PLANNING</b> Experienced, based planning - Decision table and decision trees - Process capability analysis - Process Planning - Variant process planning - Generative approach - Forward and Backward planning, Input format, AI.					
						<b>Contact Periods</b>
IV	<b>COMPUTER AIDED PROCESS PLANNING SYSTEMS</b> Logical Design of a Process Planning - Implementation considerations - manufacturing system components, production Volume, No. of production families - CAM-I, CAPP, MIPLAN, APPAS, AUTOPLAN and PRO, CPPP.					
						<b>Contact Periods</b>

V	<b>AN INTERGRADED PROCESS PLANNING SYSTEMS</b>	
	Totally integrated process planning systems - An Overview - Modulus structure - Data Structure, operation –Report Generation, Expert process planning.	
	Contact Periods	9
	Total Periods	45
<b>Course Outcomes Upon Successful Completion of the course, students will be able to:</b>		
<b>CO 1</b>	To understand the need of process planning in manufacturing	
<b>CO 2</b>	To know handle the computer aided process planning tool	
<b>CO 3</b>	To apply the knowledge of Expert systems, Group technology and part representation forvarious applications	
<b>CO 4</b>	To interpret the use of computer aided process panning for CAD/CAM Systems	
<b>CO 5</b>	To analyse the computer aided planning systems for various industrial applications	
<b>Text Books</b>	<ol style="list-style-type: none"> <li>1. Chang, T.C., "An Expert Process Planning System", Prentice Hall,1985.</li> <li>2. Gideon Halevi and Roland D.Weill, "Principles of Process Planning", A logical approach, Chapman &amp; Hall,1995.</li> <li>3. Nanua Singh,"Systems Approachto Computer Integrated Design and Manufacturing", JohnWiley &amp; Sons, 1996.</li> </ol>	
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Rao, "Computer Aided Manufacturing", Tata Mc Graw Hill Publishing Co.,2000.</li> <li>2. Tien-Chien Chang, Richard A. Wysk, "An Introduction to automated process planningsystems", Prentice Hall,1985.</li> </ol>	

Tools for Assessment (40 Marks)												
CIA I	CIA II		CIA III			Assignment/ Seminar/ Case study				Attendance	Total	
10	10		10			5				5	40	
Mapping												
CO \ PO	PO1	PO 2	PO 3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	3	2	2	2	-	-	-	-	-	-
CO2	1	2	3	2	2	2	-	-	-	-	-	-
CO3	1	2	3	2	2	2	-	-	-	-	-	-
CO4	1	2	3	2	2	2	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-
3-High; 2-Medium; 1-Low												
Course designed by						Verified by						
 Signature of the Faculty member						 Signature of the Chairperson-BoS						
 Name and Department of the Faculty Member						<b>Dr. M. SANTHOSH</b> Professor and Head Department of Mechanical Engineering Nehru Institute of Engineering and Technology Coimbatore - 641 105, Tamil Nadu, India Name and Seal of the Chairperson-BoS						

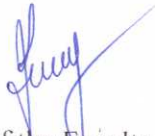
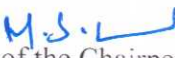
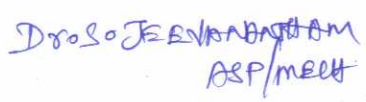
Course Code	Title					
P23CC21	ADVANCED FINITE ELEMENT ANALYSIS					
Semester: II	L	T	P	Credits	CIA: 40 Marks	ESE: 60 Marks
	3	0	0	3		
Course pre-requisites		Finite Element Analysis				
Course Objectives						
1	To study concept of Finite Element Analysis to solve problems involving plate and shell elements					
2	To learn concept of Finite Element Analysis to solve problems involving geometric and material non linearity					
3	To study solution techniques to solve dynamic problems					
4	To study the concepts of Finite Element Analysis to solve fluid mechanics and heat transfer problems					
5	To study error norms, convergence rates and refinement					
Course Category		Professional Core Courses (PCC)				
Development Needs		Global / National				
<b>Course Description:</b> Advanced Finite Element Analysis (FEA) is an intensive course that dives deeper into the theory, methods, and applications of finite element analysis in engineering.						
Course Content						
Unit	Description					
I	<b>BENDING OF PLATES AND SHELLS</b> Review of Elasticity Equations – Bending of Plates and Shells – Finite Element Formulation of Plate and Shell Elements - Conforming and Non-Conforming Elements – C0 and C1 Continuity Elements –Degenerated shell elements-Application and Examples.					
	Contact Periods					9
II	<b>NON-LINEAR PROBLEMS</b> Introduction – Iterative Techniques – Material non-linearity – Elasto Plasticity – Plasticity – Visco Plasticity – Geometric Non linearity – large displacement Formulation –Solution procedure- Application in Metal Forming Process and Contact Problems.					
	Contact Periods					9
III	<b>DYNAMIC PROBLEM</b> Direct Formulation – Free, Transient and Forced Response – Solution Procedures – Eigen solution-Sub space Iterative Technique – Response analysis - Houbolt, Wilson, Newmark– Methods – Explicit & Implicit Methods-Lanchzos, Reduced method for large size system equations.					
	Contact Periods					9

FLUID MECHANICS AND HEAT TRANSFER	
IV	Governing Equations of Fluid Mechanics – Solid structure interaction - Inviscid and Incompressible Flow – Potential Formulations – Slow Non-Newtonian Flow – Metal and Polymer Forming–Navier Stokes Equation–Steady and Transient Solution.
<b>Contact Periods</b>	
<b>9</b>	
ERROR ESTIMATES AND ADAPTIVE REFINEMENT	
V	Error norms and Convergence rates–h-refinement with adaptivity–Adaptive refinement.
<b>Contact Periods</b>	
<b>9</b>	
<b>Total Periods</b>	
<b>45</b>	
Course Outcomes Upon Successful Completion of the course, students will be able to:	
<b>CO 1</b>	To study concept of Finite Element Analysis to solve problems involving plate and shells
<b>CO 2</b>	To learn concept of Finite Element Analysis to solve problems involving geometric and material non linearity
<b>CO 3</b>	To study solution techniques to solve dynamic problems
<b>CO 4</b>	To study the concepts of Finite Element Analysis to solve fluid mechanics and heat transfer problems
<b>CO 5</b>	To study error norms, convergence rates and refinement
<b>Text Books</b>	<ol style="list-style-type: none"> <li>1. Bathe K.J., “Finite Element Procedures in Engineering Analysis”, Prentice Hall, 1990</li> <li>2. Logan. D. L., “A first course in Finite Element Method”, Cengage Learning, 2012</li> <li>3. Reddy, J.N. “An Introduction to Non linear Finite Element Analysis”, 2nd Edition, Oxford, 2015</li> <li>4. Robert D.Cook, David S.Malkus, Michael E.Plesha, Robert J.Witt, “Concepts and Applications of Finite Element Analysis”, 4th Edition, Wiley Student Edition, 2004.</li> </ol>
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Tirupathi R. Chandrupatla and Ashok D.Belegundu, “Introduction to Finite Elements in Engineering”, International Edition, Pearson Education Limited, 2014.</li> <li>2. Zienkiewicz, O. C., Taylor, R. L. and Zhu. J. Z. , “The Finite Element Method: Its Basis and Fundamentals”, 7th Edition, Butterworth-Heinemann, 2013.</li> </ol>

Tools for Assessment (40 Marks)												
CIA I	CIA II		CIA III			Assignment/ Seminar/ Case study				Attendance	Total	
10	10		10			5				5	40	
Mapping												
CO \ PO	PO1	PO 2	PO 3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	3	2	2	1	-	-	-	-	-	-
CO2	2	1	3	2	2	1	-	-	-	-	-	-
CO3	2	1	3	2	2	1	-	-	-	-	-	-
CO4	2	1	3	2	2	1	-	-	-	-	-	-
CO5	2	1	3	2	2	1	-	-	-	-	-	-
3-High; 2-Medium; 1-Low												
Course designed by						Verified by						
 Signature of the Faculty member						 Signature of the Chairperson-BoS						
DR. S. JEEVANANTHAM ASP/MECH						<b>Dr. M. SANTHOSH</b> Professor and Head Department of Mechanical Engineering Nehru Institute of Engineering and Technology Coimbatore, India						
Name and Department of the Faculty Member						Name and Department of the Chairperson-BoS						




Course Code		Title				
P23CC22		OPTIMIZATION TECHNIQUES IN DESIGN				
Semester: II	L	T	P	Credits	CIA: 40 Marks	ESE: 60 Marks
	3	0	0	3		
Course pre-requisites			Computer aided design			
Course Objectives						
1	To understand the basic concepts of unconstrained optimization techniques.					
2	To understand the basic concepts of constrained optimization techniques.					
3	To provide the mathematical foundation of artificial neural networks and swarm intelligence for design problems.					
4	To implement optimization approaches and to select appropriate solution for design application.					
5	To demonstrate selected optimization algorithms commonly used in static and dynamic applications.					
Course Category			Professional Core Courses (PCC)			
Development Needs			Global / National			
Course Description: Optimization Techniques in Design is a specialized course focused on enhancing engineering design processes through mathematical optimization methods.						
Course Content						
Unit	Description					
I	<b>UNCONSTRAINED OPTIMIZATION TECHNIQUES</b> Introduction to optimum design - General principles of optimization – Problem formulation & their classifications- Single variable and multivariable optimization, Techniques of unconstrained minimization – Golden section, Random, pattern and gradient search methods – Interpolation methods.					
	Contact Periods					9
II	<b>CONSTRAINED OPTIMIZATION TECHNIQUES</b> Optimization with equality and inequality constraints-Direct methods-Indirect methods using penalty functions, Lagrange multipliers-Geometric programming.					
	Contact Periods					9
III	<b>ARTIFICIAL NEURAL NETWORKS AND SWARM INTELLIGENCE</b> Introduction-Activation functions, types of activation functions, neural network architectures, Single layer feed forward network, multi layer feed forward network, Neural network applications. Swarm intelligence-Variations of animal behaviors, Ant Colony optimization, Particle Swarm optimization.					
	Contact Periods					9
IV	<b>ADVANCED OPTIMIZATION TECHNIQUES</b> Multistage optimization-dynamic programming, stochastic programming Multi objective optimization Genetic algorithms and Simulated Annealing technique.					
	Contact Periods					9

V	<b>STATIC AND DYNAMIC APPLICATIONS</b> Structural applications – Design of simple truss members – Design of simple axial, transverse loaded members for minimum cost, weight – Design of shafts and torsionally loaded members – Design of springs. Dynamic Applications – Optimum design of single, two degree of freedom systems, vibration absorbers. Application in Mechanisms – Optimum design of simple linkage mechanisms.	
	<b>Contact Periods</b>	9
		<b>Total Periods</b>
		45
<b>Course Outcomes</b>		
Upon Successful Completion of the course, students will be able to:		
<b>CO 1</b>	Formulate unconstrained optimization techniques in engineering design application.	
<b>CO 2</b>	Formulate constrained optimization techniques for various applications.	
<b>CO 3</b>	Implement neural network technique to real world design problems.	
<b>CO 4</b>	Apply genetic algorithms to combinatorial optimization problems.	
<b>CO 5</b>	Evaluate solutions by various optimization approaches for a design problem.	
<b>Text Books</b>	<ol style="list-style-type: none"> <li>1. Goldberg, David. E, "Genetic Algorithms in Search, Optimization and Machine Learning", Pearson, 2009.</li> <li>2. Jang, J. S.R, Sun, C. T and Mizutani E., "Neuro - Fuzzy and Soft Computing", Pearson Education.2015,</li> <li>3. Johnson Ray,C., "Optimum design of mechanical elements", Wiley, 2nd Edition 1980.</li> <li>4. Kalyanmoy Deb, "Optimization for Engineering Design : Algorithms and Examples", PHI Learning Private Limited, 2nd Edition, 2012.</li> </ol>	
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Rao Singiresu S., "Engineering Optimization – Theory and Practice", New Age International Limited, New Delhi, 3rd Edition, 2013.</li> <li>2. Rajasekaran S and Vijayalakshmi Pai, G.A, "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI, 2011</li> </ol>	

Tools for Assessment (40 Marks)												
CIA I	CIA II		CIA III		Assignment/ Seminar/ Case study				Attendance	Total		
10	10		10		5				5	40		
Mapping												
CO \ PO	PO1	PO 2	PO 3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	-	-	1	-	-	-	-	-	-
CO2	3	2	2	-	2	-	-	-	-	-	-	-
CO3	3	2	3	-	2	-	-	-	-	-	-	-
CO4	3	3	3	-	2	-	-	-	-	-	-	-
CO5	3	3	3	3	2	1	-	-	-	-	-	-
3-High; 2-Medium; 1-Low												
Course designed by						Verified by						
 Signature of the Faculty member						 Signature of the Chairperson-BoS						
 Name and Department of the Faculty Member						<b>Dr. M. SANTHOSH</b> Professor and Head Department of Mechanical Engineering Nehru Institute of Engineering and Technology Name and Seal of the Chairperson-BoS						




Course Code		Title				
P23CC23		ADVANCED MACHINE TOOL DESIGN				
Semester: II	L	T	P	Credits	CIA: 40 Marks	ESE: 60 Marks
	3	0	0	3		
Course pre-requisites		CAD				
Course Objectives						
1	Selecting the different machine tool mechanisms.					
2	Designing the Multi speed Gear Box and feed drives.					
3	Designing the machine tool structures.					
4	Designing the guideways and power screws.					
5	Designing the spindles and bearings					
Course Category		Professional Core Courses (PCC)				
Development Needs		Global / National				
Course Description: Advanced Machine Tool Design is an in-depth course focusing on the design and analysis of precision machine tools used in manufacturing processes.						
Course Content						
Unit	Description					
I	<b>INTRODUCTION TO MACHINE TOOL DESIGN</b>					
	Introduction to Machine Tool Drives and Mechanisms, Auxiliary Motions in Machine Tools, Kinematics of Machine Tools, Motion Transmission					
					Contact Periods	9
II	<b>REGULATION OF SPEEDS AND FEEDS</b>					
	Aim of Speed and Feed Regulation, Stepped Regulation of Speeds, Multiple Speed Motors, Ray Diagrams and Design Considerations, Design of Speed Gear Boxes, Feed Drives, Feed Box Design					
					Contact Periods	9
III	<b>DESIGN OF MACHINE TOOL STRUCTURES</b>					
	Functions of Machine Tool Structures and their Requirements, Design for Strength, Design for Rigidity, Materials for Machine Tool Structures, Machine Tool Constructional Features, Beds and Housings, Columns and Tables, Saddles and Carriage.					
					Contact Periods	9
IV	<b>DESIGN OF GUIDEWAYS AND POWER SCREWS</b>					
	Functions and Types of Guideways, Design of Guideways, Design of Aerostatic Slide ways, Design of Anti-Friction Guideways, Combination Guideways, Design of Power Screws					
					Contact Periods	9

V	<b>DESIGN OF SPINDLES AND SPINDLE SUPPORT</b>	
	Functions of Spindles and Requirements. Effect of Machine Tool Compliance on Machining Accuracy, Design of Spindles. Antifriction Bearings. Dynamics of Machine Tools: Machine Tool Elastic System, Static and Dynamic Stiffness	
		<b>Contact Periods</b>
		9
		<b>Total Periods</b>
		45
<b>Course Outcomes Upon Successful Completion of the course, students will be able to:</b>		
<b>CO 1</b>	Select the different machine tool mechanisms.	
<b>CO 2</b>	Design the Multi speed Gear Box and feed drives.	
<b>CO 3</b>	Design the machine tool structures.	
<b>CO 4</b>	Design the guide ways and power screws.	
<b>CO 5</b>	Design the spindles and bearings	
<b>Text Books</b>	<ol style="list-style-type: none"> <li>1. N.K. Mehta, "Machine Tool Design and Numerical Control", TMH, New Delhi, 3rd edition 2012</li> <li>2. G.C. Sen and A. Bhattacharya, "Principles of Machine Tools", New Central Book Agency, 2015</li> <li>3. K Pal, S. K. Basu, "Design of Machine Tools", 6th Edition. Oxford IBH, 2014</li> <li>4. N. S. Acherkhan, "Machine Tool Design", Volume 2 University Press of the Pacific, 2000</li> </ol>	
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. F. Koenigsberger, "Design Principles of Metal-Cutting Machine Tools", Pergamon Press, 1964</li> <li>2. F. Koenigsberger, "Machine Tool Structures", Pergamon Press, 1970.</li> </ol>	

Tools for Assessment (40 Marks)												
CIA I		CIA II		CIA III		Assignment/ Seminar/ Case study				Attendance		Total
10		10		10		5				5		40
Mapping												
CO \ PO	PO1	PO 2	PO 3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	3	3	-	-	-	-	-	-
CO2	3	3	3	2	3	3	-	-	-	-	-	-
CO3	3	3	3	2	3	3	-	-	-	-	-	-
CO4	3	3	3	2	3	3	-	-	-	-	-	-
CO5	3	3	3	2	3	3	-	-	-	-	-	-
3-High; 2-Medium; 1-Low												
Course designed by						Verified by						
 Signature of the Faculty member						 Signature of the Chairperson-BoS						
 Name and Department of the Faculty Member						<b>Dr. M. SANTHOSH</b> Professor and Head Department of Mechanical Engineering Nehru Institute of Engineering and Technology Coimbatore - 641 105, Tamilnadu, India. Name and Seal of the Chairperson-BoS						




Course Code	Title						
P23CC24	REVERSE ENGINEERING						
Semester: II	L	T	P	Credits	CIA: 40 Marks	ESE: 60 Marks	
	3	0	0	3			
Course pre-requisites		Engineering Materials and Methodology					
Course Objectives							
1	Applying the fundamental concepts and principles of reverse engineering in product design and development.						
2	Applying the concept and principles material characteristics, part durability and life limitation in reverse engineering of product design and development.						
3	Applying the concept and principles of material identification and process verification in reverse engineering of product design and development.						
4	Applying the concept and principles of data processing, part performance and system compatibility in reverse engineering of product design and development.						
5	Analyzing the various legal aspect and applications of reverse engineering in product design and development.						
Course Category		Professional Core Courses (PCC)					
Development Needs		Global / National					
Course Description: Reverse Engineering is a specialized course that delves into the process of extracting design information from existing products to understand their structure, function, and behavior.							
Course Content							
Unit	Description						
I	<b>INTRODUCTION TO REVERSE ENGINEERING &amp; GEOMETRIC FORM</b> Definition – Uses – The Generic Process – Phases – Computer Aided Reverse Engineering - Surface and Solid Model Reconstruction – Dimensional Measurement – Prototyping.						
						<b>Contact Periods</b>	<b>9</b>
II	<b>MATERIAL CHARACTERISTICS, PART DURABILITY AND LIFE LIMITATION</b> Alloy Structure Equivalency – Phase Formation and Identification – Mechanical Strength – Hardness – Part Failure Analysis – Fatigue – Creep and Stress Rupture – Environmentally Induced Failure						
						<b>Contact Periods</b>	<b>9</b>
III	<b>MATERIAL IDENTIFICATION AND PROCESS de VERIFICATION</b> Material Specification - Composition Determination - Microstructure Analysis - Manufacturing Process Verification.						
						<b>Contact Periods</b>	<b>9</b>

IV	<b>DATA PROCESSING, PART PERFORMANCE AND SYSTEM COMPATIBILITY</b> Statistical Analysis – Data Analysis – Reliability and the Theory of Interference – Weibull Analysis – Data Conformity and Acceptance – Data Report – Performance Criteria – Methodology of Performance Evaluation – System Compatibility	<b>Contact Periods</b>	<b>9</b>
V	<b>ACCEPTANCE, LEGALITY AND INDUSTRIAL APPLICATIONS OF RE</b> Legality of Reverse Engineering – Patent – Copyrights – Trade Secret – Third-Party Materials – Reverse Engineering in the Automotive Industry; Aerospace Industry; Medical Device Industry.	<b>Contact Periods</b>	<b>9</b>
		<b>Total Periods</b>	<b>45</b>
<b>Course Outcomes Upon Successful Completion of the course, students will be able to:</b>			
<b>CO 1</b>	Apply the fundamental concepts and principles of reverse engineering in product design and development.		
<b>CO 2</b>	Apply the concept and principles material characteristics, part durability and life limitation in reverse engineering of product design and development.		
<b>CO 3</b>	Apply the concept and principles of material identification and process verification in reverse engineering of product design and development.		
<b>CO 4</b>	Apply the concept and principles of data processing, part performance and system compatibility in reverse engineering of product design and development.		
<b>CO 5</b>	Analyze the various legal aspect and applications of reverse engineering in product design and development		
<b>Text Books</b>	<ol style="list-style-type: none"> <li>1. “Co-ordinate Measurement and reverse engineering”, Donald R. Honsa, ISBN 1555897, American Gear Manufacturers Association</li> <li>2. “Data Reverse Engineering”, Aiken, Peter, McGraw-Hill, 1996</li> <li>3. “Design Recovery for Maintenance and Reuse”, T J Biggerstaff, IEEE Corpn. July 1991</li> <li>4. “Reverse Engineering”, Katheryn, A. Ingle, McGraw-Hill, 1994</li> </ol>		
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Reverse Engineering, Linda Wills, Kluiver Academic Publishers, 1996</li> <li>2. White paper on RE, S. Rugaban, Technical Report, Georgia Instt. of Technology, 1994</li> </ol>		

Tools for Assessment (40 Marks)												
CIA I		CIA II		CIA III		Assignment/ Seminar/ Case study				Attendance		Total
10		10		10		5				5		40
Mapping												
CO \ PO	PO1	PO 2	PO 3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	-	-	-	-	-	-	-	-
CO2	3	3	1	2	-	-	-	-	-	-	-	-
CO3	3	3	1	2	-	1	-	-	-	-	-	-
CO4	3	3	1	2	-	1	-	-	-	-	-	-
CO5	1	2	1	1	-	1	-	-	-	-	-	-
3-High; 2-Medium; 1-Low												
Course designed by						Verified by						
 Signature of the Faculty member						 Signature of the Chairperson-BoS						
 Name and Department of the Faculty Member						<b>Dr. M. SANTHOSH</b> Professor and Head Department of Mechanical Engineering Nehru Institute of Engineering and Technology Coimbatore- 641 105, Tamilnadu, India. Name and Seal of the Chairperson-BoS						

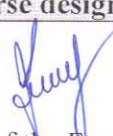
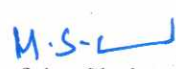

Course Code		Title				
P23CC31		INDUSTRIAL SAFETY MANAGEMENT				
Semester: II	L	T	P	Credits	CIA: 40 Marks	ESE: 60 Marks
	3	0	0	3		
Course pre-requisites		Manufacturing processes				
Course Objectives						
1	To understand the functions and activities of safety engineering department.					
2	To carry out a safety audit and prepare a report for the audit.					
3	To prepare an accident investigation report.					
4	To estimate the accident cost using supervisors report and data.					
5	To evaluate the safety performance of an organization from accident records.					
Course Category		Professional Core Courses (PCC)				
Development Needs		Global / National				
Course Description: Industrial Safety Management is a comprehensive course focusing on the principles, practices, and regulations governing occupational safety and health in industrial environments.						
Course Content						
Unit	Description					
I	<b>SAFETY MANAGEMENT</b>					
	Evaluation of modern safety concepts- Safety management functions- safety organization, safety department-safety committee, safety audit-performance measurements and motivation-employee participation in safety-safety and productivity.					
					<b>Contact Periods</b>	<b>9</b>
II	<b>OPERATIONAL SAFETY</b>					
	Hot metal Operation-Boiler, pressure vessels- heat treatment shop- gas furnace operation- electroplating-hot bending pipes - Safety in welding and cutting. Cold-metal Operation - Safety in Machine shop-Cold bending and chamfering of pipes-metal cutting-shot blasting, grinding, painting-power press and other machines.					
					<b>Contact Periods</b>	<b>9</b>
III	<b>SAFETY MEASURES</b>					
	Layout design and material handling – Use of electricity – Management of toxic gases and chemicals - Industrial fires and prevention - Road safety - highway and urban safety - Safety of sewage disposal and cleaning - Control of environmental pollution - Managing emergencies in Industries- planning, security and risk assessments, on-site and offsite. Control of major industrial hazards.					
					<b>Contact Periods</b>	<b>9</b>
IV	<b>ACCIDENT PREVENTION</b>					
	Human side of safety - personal protective equipment - Causes and cost of accidents. Accident prevention programmes - Specific hazard control strategies - HAZOP - Training and development of employees-First Aid-Fire fighting devices-Accident reporting,					

	investigation.
	<b>Contact Periods</b>
	<b>9</b>
<b>V</b>	<b>SAFETY, HEALTH, WELFARE &amp; LAWS</b> Safety and health standards - Industrial hygiene - occupational diseases prevention – Welfare facilities-History of legislations related to Safety-pressure vessel act-Indian boileract-The environmental protection act-Electricity act-Explosive act.
	<b>Contact Periods</b>
	<b>9</b>
	<b>Total Periods</b>
	<b>45</b>
<b>Course Outcomes</b>	
<b>Upon Successful Completion of the course, students will be able to:</b>	
<b>CO 1</b>	To understand the functions and activities of safety engineering department.
<b>CO 2</b>	To carry out a safety audit and prepare a report for the audit.
<b>CO 3</b>	To prepare an accident investigation report.
<b>CO 4</b>	To estimate the accident cost using supervisors report and data.
<b>CO 5</b>	To evaluate the safety performance of an organization from accident records.
<b>Text Books</b>	<ol style="list-style-type: none"> <li>1. Ray Asfahl. C “Industrial Safety and Health Management” Pearson Prentice Hall, 2003.</li> <li>2. Blake R.B., “Industrial Safety” Prentice Hall, Inc., New Jersey, 1973.</li> <li>3. John V.Grimaldi and Rollin H. Simonds, “Safety Management”, Richard D Irwin, 1994.</li> <li>4. Dan Petersen, “Techniques of Safety Management”, McGraw-Hill Company, Tokyo, 1981.</li> <li>5. Philip Hagan, “Accident Prevention Manual for Business and Industry”, N.S.C.Chicago, 13th edition, 2009.</li> <li>6. Lees, F.P &amp; M. Sam Mannan, “Loss Prevention in Process Industries: Hazard Identification, Assessment and Control”, Butterworth-Heinemann publications, London, 4th edition, 2012.</li> </ol>
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. John Ridley, “Safety at Work”, Butterworth and Co., London, 1983.</li> <li>2. Subramanian.V., “The Factories Act 1948 with Tamilnadu factories rules 1950”, Madras Book Agency, 21st ed., Chennai, 2000.</li> <li>3. Heinrich H.W. “Industrial Accident Prevention” McGraw-Hill Company, New York, 1980.</li> <li>4. Krishnan N.V. “Safety Management in Industry” Jaico Publishing House, Bombay, 1997</li> </ol>

Tools for Assessment (40 Marks)												
CIA I	CIA II		CIA III			Assignment/ Seminar/ Case study				Attendance	Total	
10	10		10			5				5	40	
Mapping												
CO \ PO	PO1	PO 2	PO 3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	3	2	3	3						
CO2	1	3	3	2	3	3						
CO3	1	3	3	2	3	3						
CO4	1	3	3	2	3	3						
CO5	1	3	3	2	3	3						
3-High; 2-Medium; 1-Low												
Course designed by						Verified by						
 Signature of the Faculty member						 Signature of the Chairperson-BoS						
 Name and Department of the Faculty Member						<b>Dr. M. SANTHOSH</b> Professor and Head Department of Mechanical Engineering Nehru Institute of Engineering and Technology Coimbatore-441014, India Name and Seal of the Chairperson-BoS						

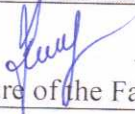
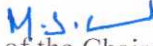
Course Code		Title				
P23CC32		MECHANICAL MEASUREMENTS AND ANALYSIS				
Semester: II	L	T	P	Credits	CIA: 40 Marks	ESE: 60 Marks
	3	0	0	3		
Course pre-requisites		Metrology and Measurements				
Course Objectives						
1	The student will understand the principle of force and strain measurement.					
2	The student will understand the vibration measurement and their applications.					
3	To impart knowledge on the principle behind acoustics and wind flow measurements.					
4	To familiarize with the distress measurements					
5	To realize the non destructive testing principle and application					
Course Category		Professional Core Courses (PCC)				
Development Needs		Global / National				
Course Description: Mechanical Measurements and Analysis is a foundational course that explores the principles, techniques, and instruments used to measure and analyze mechanical quantities and properties.						
Course Content						
Unit	Description					
I	<b>FORCES AND STRAIN MEASUREMENT</b> Strain gauge, principle, types, performance and uses. Photo elasticity–Principle and applications - Moire Fringe-Hydraulic jacks and pressure gauges–Electronic load cells– Proving Rings– Calibration of Testing Machines.					
	Contact Periods					9
II	<b>VIBRATION MEASUREMENTS</b> Characteristics of Structural Vibrations–Linear Variable Differential Transformer(LVDT)– Transducers for velocity and acceleration measurements. Vibration meter– Seismographs – Vibration Analyzer – Display and recording of signals – Cathode Ray Oscilloscope – XY Plotter – Chart Plotters–Digital data Acquisition systems.					
	Contact Periods					9
III	<b>ACOUSTICS AND WIND FLOW MEASUREMENTS</b> Principles of Pressure and flow measurements–pressure transducers–sound level meter– venturimeter and flow meters–wind tunnel and its use in structural analysis–structural modelling – direct and indirect model analysis					
	Contact Periods					9
IV	<b>DISTRESS MEASUREMENTS</b> Diagnosis of distress in structures–crack observation and measurements–corrosion of reinforcement in concrete – Half-cell, construction and use – damage assessment – controlled blasting for demolition.					
	Contact Periods					9

V	<b>NON DESTRUCTIVE TESTING METHODS</b>	
	Load testing on structures, buildings ,bridges and towers–Rebound Hammer –acoustice mission –ultrasonic testing principles and application–Holography–use of laser for structural testing– Brittle coating	
		<b>Contact Periods</b>
		<b>9</b>
		<b>Total Periods</b>
		<b>45</b>
<b>Course Outcomes Upon Successful Completion of the course, students will be able to:</b>		
<b>CO 1</b>	Measure physical quantities such as forces and strains.	
<b>CO 2</b>	Apply different vibration measurements techniques.	
<b>CO 3</b>	Measure physical quantities such as pressure and flow.	
<b>CO 4</b>	Apply techniques involved in crack measurement.	
<b>CO 5</b>	Select the appropriate non-destructive testing methods for various engineering applications.	
<b>Text Books</b>	<ol style="list-style-type: none"> <li>1. Bray DonE and Stanley, R.K., "Non-destructive Evaluation", McGraw Hill Publishing Company, N.Y.1989</li> <li>2. Garas,F.K.,Clarke,J. Land Armer GST, "Structural assessment", Butterworths,London,1987</li> </ol>	
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. James W. Dally and William Franklin Riley, "Experimental Stress Analysis", McGraw Hill , 3rdEdition,1991</li> <li>2. Sadhu Singh, Experimental Stress Analysis, Khanna Publishers, New Delhi,2009.</li> <li>3. Srinath LS, Raghavan Mr, Lingaiah K, Gargesha G, Pant Band Ramachandra, K, "Experimental Stress Analysis",Tata McGraw Hill Company, New Delhi,1984</li> <li>4. Sirohi,R.S.and Radhakrishna, H.C,"Mechanical Measurements",New Age International (P) Ltd, 3<sup>rd</sup> Edition 1997</li> </ol>	

Tools for Assessment (40 Marks)												
CIA I		CIA II		CIA III		Assignment/ Seminar/ Case study				Attendance		Total
10		10		10		5				5		40
Mapping												
CO \ PO	PO1	PO 2	PO 3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	3	2	2	3	-	-	-	-	-	-
CO2	1	2	3	2	2	3	-	-	-	-	-	-
CO3	1	2	3	2	2	3	-	-	-	-	-	-
CO4	1	2	3	2	2	3	-	-	-	-	-	-
CO5	1	2	3	2	2	3	-	-	-	-	-	-
3-High; 2-Medium; 1-Low												
Course designed by						Verified by						
 Signature of the Faculty member						 Signature of the Chairperson-BoS						
 Name and Department of the Faculty Member						<b>Dr. M. SANTHOSH</b> Professor and Head Department of Mechanical Engineering Nehru Institute of Engineering and Technology Coimbatore - 641 105, Tamilnadu, India Name and Seal of the Chairperson-BoS						

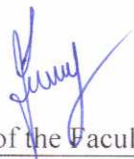


Course Code		Title				
P23CC33		RELIABILITY IN ENGINEERING SYSTEMS				
Semester: II	L	T	P	Credits	CIA: 40 Marks	ESE: 60 Marks
	3	0	0	3		
Course pre-requisites		Manufacturing processes				
Course Objectives						
1	The ability to use statistical tools to characterize the reliability of an item;					
2	The working knowledge to determine the reliability of a system a					
3	To suggest approaches to enhancing system reliability;					
4	The ability to select appropriate reliability validation methods					
5	The ability to use statistical tools to characterize the reliability of an item;					
Course Category		Professional Core Courses (PCC)				
Development Needs		Global / National				
Course Description: Reliability in Engineering Systems is an advanced course that examines the principles and methodologies for assessing and ensuring the reliability of engineering systems.						
Course Content						
Unit	Description					
I	<b>RELIABILITY CONCEPT</b> Reliability definition – Quality and Reliability– Reliability mathematics – Reliability functions – Hazard rate–Measures of Reliability–Design life–A prior and posterior probabilities– Mortality of a component–Bath tub curve–Useful life.					
	Contact Periods					9
II	<b>FAILURE DATA ANALYSIS</b> Data collection –Empirical methods: Ungrouped/Grouped, Complete/Censored data – Time to failure distributions: Exponential, Weibull– Hazardplotting– Goodnessoffittests					
	Contact Periods					9
III	<b>RELIABILITYASSESSMENT</b> Different configurations–Redundancy–m/n system–Complex systems: RBD–Baye’s method– Cut and tiesets–Fault Tree Analysis–Stand by system.					
	Contact Periods					9
IV	<b>RELIABILITY MONITORING</b> Life testing methods: Failure terminated – Time terminated – Sequential Testing – Reliabilitygrowthmonitoring–Reliabilityallocation–Softwarereliability.					
	Contact Periods					9
V	<b>RELIABILITY IMPROVEMENT</b> Analysis of downtime – Repair time distribution – System MTTR – Maintainability prediction – Measures of maintainability–System Availability–Replacement theory.					
	Contact Periods					9

	<b>Contact Periods</b>	<b>9</b>
	<b>Total Periods</b>	<b>45</b>
<b>Course Outcomes</b>		
<b>Upon Successful Completion of the course, students will be able to:</b>		
<b>CO 1</b>	The ability to use statistical tools to characterize the reliability of an item;	
<b>CO 2</b>	The working knowledge to determine the reliability of a system a	
<b>CO 3</b>	To suggest approaches to enhancing system reliability;	
<b>CO 4</b>	The ability to select appropriate reliability validation methods	
<b>CO 5</b>	Apply the appropriate methodologies and tools for enhancing the inherent and actual reliability of components and systems	
<b>Text Books</b>	<ol style="list-style-type: none"> <li>1. Charles E.Ebeling, "An introduction to Reliability and Maintain ability engineering",TMH , 2000.</li> <li>2. Roy Billington and Ronald N. Allan, "Reliability Evaluation of Engineering Systems", Springer,2007.</li> </ol>	
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Alessandro Birolini, Reliability Engineering: Theory and Practice 8th ed. 2017 Edition</li> <li>2. Mohammad Modarres, Mark P. Kaminskiy, Vasiliy Krivtsov "Reliability Engineering and Risk Analysis: A Practical Guide", Third Edition 3rd EditionBahga, Internet of Things: A Hands-On Approach</li> </ol>	

Tools for Assessment (40 Marks)												
CIA I	CIA II		CIA III			Assignment/ Seminar/ Case study				Attendance	Total	
10	10		10			5				5	40	
Mapping												
CO \ PO	PO1	PO 2	PO 3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	3	2	3	3	-	-	-	-	-	-
CO2	2	3	3	2	3	3	-	-	-	-	-	-
CO3	2	3	3	2	3	3	-	-	-	-	-	-
CO4	2	3	3	2	3	3	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-
3-High; 2-Medium; 1-Low												
Course designed by						Verified by						
 Signature of the Faculty member						 Signature of the Chairperson-BoS						
Dr. S. JEEVANANTHAM AEP/MECH						<b>Dr. M. SANTHOSH</b> Professor and Head Department of Mechanical Engineering Nehru Institute of Engineering and Technology Coimbatore - 641 105, Tamilnadu, India.						
Name and Department of the Faculty Member						Name and Seal of the Chairperson-BoS						

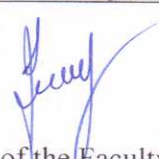
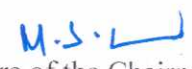
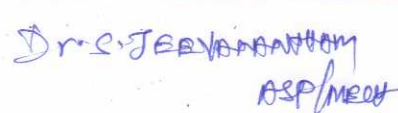
Course Code		Title				
P23CC41		PERFORMANCE MODELING AND ANALYSIS OF MANUFACTURING SYSTEMS				
Semester: III	L	T	P	Credits	CIA: 40 Marks	ESE: 60 Marks
	3	0	0	3		
Course pre-requisites		Computer aided design				
Course Objectives						
1	To develop an understanding of the use and benefits of modeling and simulation in manufacturing systems design and operation.					
2	To develop an understanding of techniques to assess factory performance and identify areas for improvement.					
3	To develop an understanding of techniques to assess and manufacturing performance.					
4	To develop an understanding of techniques to enable responsive manufacturing systems.					
5	To provide the students with knowledge of a set of tools to enable them to assess the performance of a manufacturing facility					
Course Category		Professional Core Courses (PCC)				
Development Needs		Global / National				
<b>Course Description:</b> Performance Modeling and Analysis of Manufacturing Systems is an advanced course focusing on the quantitative analysis of manufacturing processes and systems to optimize performance and efficiency.						
Course Content						
Unit	Description					
I	<b>MANUFACTURING SYSTEMS &amp; CONTROL</b> Automated Manufacturing Systems- Modelling- Role of performance modelling – simulation models- Analytical models. Product cycle - Manufacturing automation - Economics of scale and scope - input/output model- plant configurations. Performance measures-Manufacturing lead time - Work in process- Machine utilization-Throughput-Capacity-Flexibility- performability - Quality. Control Systems - Control system architecture - Factory communications - Local area networks-Factory networks – Open systems interconnection model – Network to network interconnections – Manufacturing automation protocol – Database management system.					
						<b>Contact Periods</b>
II	<b>MANUFACTURING PROCESSES</b> Examples of stochastic processes – Poisson process Discrete time Markov chain models- Definition and notation-Sojourn times in states-Examples of DTMCs in manufacturing- Chapman-Kolmogorov equation-Steady-state analysis. Continuous Time Markov Chain Models Definitions and notation – Sojourn times in states – examples of CTMCs in manufacturing-Equations for CTMC evolution- Markov model of a transfer line. Birth and Death Processes in Manufacturing- Steady state analysis of BD Processes-Typical BD processes in manufacturing.					
						<b>Contact Periods</b>

<b>III</b>	<p><b>QUEUING MODELS</b></p> <p>Notation for queues - Examples of queues in manufacturing systems - Performance measures - Little's result-Steady state analysis of M/M/m queue, queues with general distributions and queues with breakdowns-Analysis of a flexible machine center.</p>
<b>Contact Periods</b>	
<b>9</b>	
<b>IV</b>	<p><b>QUEUING NETWORKS</b></p> <p>Examples of QN models in manufacturing - Little's law in queuing networks - Tandem queue – An open queuing network with feedback- An open central server model for FMS- Closed transfer line- Closed server model-Garden Newell networks.</p>
<b>Contact Periods</b>	
<b>9</b>	
<b>V</b>	<p><b>PETRINETS</b></p> <p>Classical Petri Nets - Definitions - Transition firing and reachability - Representational power - properties-Manufacturing models. Stochastic PetriNets- Exponential timed Petri Nets-Generalized Stochastic Petri Nets- modeling of KANBAN systems-Manufacturing models.</p>
<b>Contact Periods</b>	
<b>9</b>	
<b>Total Periods</b>	
<b>45</b>	
<b>Course Outcomes</b>	
<b>Upon Successful Completion of the course, students will be able to:</b>	
<b>CO 1</b>	Develop an understanding of the use and benefits of modeling and simulation in manufacturing systems design and operation.
<b>CO 2</b>	Develop an understanding of techniques to assess factory performance and identify areas for improvement.
<b>CO 3</b>	Develop an understanding of techniques to assess and manufacturing performance.
<b>CO 4</b>	Develop an understanding of techniques to enable responsive manufacturing systems.
<b>CO 5</b>	Provide the students with knowledge of a set of tools to enable them to assess the performance of a manufacturing facility
<b>Text Books</b>	<ol style="list-style-type: none"> <li>1. Gupta S.C., &amp; Kapoor V. K., "Fundamentals of Mathematical Statistics",3rd Edition, Sultan Chand and Sons, New Delhi,1988.</li> <li>2. Trivedi, K.S., "Probability and Statistics with Reliability, Queuing and Computer Science Applications", Prentice Hall, NewJersey,1982.</li> </ol>
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Viswatham, N and Narahari, Y. "Performance Modeling of Automated Manufacturing Systems", Prentice Hall of India, New Delhi,1994.</li> </ol>

Tools for Assessment (40 Marks)												
CIA I	CIA II		CIA III			Assignment/ Seminar/ Case study				Attendance	Total	
10	10		10			5				5	40	
Mapping												
CO \ PO	PO1	PO 2	PO 3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	2	2	2	1	-	-	-	-	-	-
CO2	1	3	2	2	2	1	-	-	-	-	-	-
CO3	1	3	2	2	2	1	-	-	-	-	-	-
CO4	1	3	2	2	2	1	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-
3-High; 2-Medium; 1-Low												
Course designed by						Verified by						
 Signature of the Faculty member						 Signature of the Chairperson-BoS						
 Name and Department of the Faculty Member						<b>Dr. M. SANTHOSH</b> Professor and Head Department of Mechanical Engineering Nehru Institute of Engineering and Technology Name and Department of the Chairperson-BoS						


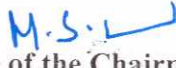
Course Code		Title				
P23CC42		CREATIVITY AND INNOVATION				
Semester: III	L	T	P	Credits	CIA: 40 Marks	ESE: 60 Marks
	3	0	0	3		
Course pre-requisites		Engineering graphics				
Course Objectives						
1	Applying the principles of essential theory of creativity in new product design and development.					
2	Applying the principles of various methods and tools for creativity in new product design and development.					
3	Applying the design principles of creativity in new product design and development.					
4	Applying the various innovation principles and practices in new product design and development.					
5	Applying the principles of innovation management in new product design and development.					
Course Category		Professional Core Courses (PCC)				
Development Needs		Global / National				
<b>Course Description:</b> Creativity and Innovation is a dynamic course designed to foster creative thinking and innovative problem-solving skills.						
Course Content						
Unit	Description					
I	<b>INTRODUCTION TO ESSENTIAL THEORY OF CREATIVITY</b> Directed creativity: The Need for Creative Thinking in the Pursuit of Quality -Essential Theory for Directed Creativity: Definitions and the Theory of the Mechanics of Mind; Heuristics and Models: Attitudes, Approaches, and Actions That Support Creative Thinking.					
						<b>Contact Periods</b>
II	<b>METHODS AND TOOLS FOR CREATIVITY</b> Three basic principles behind the tools of directed creativity – Tools that prepare the mind for creative thought – Tools that stimulate the imagination for new idea – Development and action: the bridge between mere creativity and the rewards of innovation - ICEDIP: Inspiration, Clarification, Distillation, Perspiration, Evaluation and Incubation – Creativity and Motivation					
						<b>Contact Periods</b>
III	<b>DESIGN AND APPLICATION OF CREATIVITY</b> Three levels of emotional design: Visceral, Behavioral and Reflective – Process design, reengineering, and creativity – Creativity and customer needs analysis – Innovative product and service design – Creative problem solving and incremental improvement.					
						<b>Contact Periods</b>

<b>IV</b>		<b>INNOVATION PRINCIPLES &amp; PRACTICES</b> Methods of Creativity Activation: Morphological Box – Requirements for Inventive Problem Solving – Altshuller’s Engineering Parameters– Altshuller’s Inventive Principles– Altshuller’s Contradiction Matrix Algorithm
		<b>Contact Periods</b>
		<b>9</b>
<b>V</b>		<b>INNOVATION MANAGEMENT</b> Disruptive Innovation Model – Two Types of Disruption – Three Approaches to Creating New- Growth Businesses – New Market Disruptions: Three Case Histories – Product Architectures and Integration – Process of commoditization and de-commoditization – Two Processes of Strategy Formulation – Role of senior executive in leading new growth: The Disruptive Growth Engine
		<b>Contact Periods</b>
		<b>9</b>
		<b>Total Periods</b>
		<b>45</b>
<b>Course Outcomes Upon Successful Completion of the course, students will be able to:</b>		
<b>CO 1</b>	Apply the principles of essential theory of creativity in new product design and development.	
<b>CO 2</b>	Apply the principles of various methods and tools for creativity in new product design and development.	
<b>CO 3</b>	Apply the design principles of creativity in new product design and development.	
<b>CO 4</b>	Apply the various innovation principles and practices in new product design and development.	
<b>CO 5</b>	Apply the principles of innovation management in new product design and development	
<b>Text Books</b>	<ol style="list-style-type: none"> <li>1. Clayton M. Christensen Michael E. Raynor, "The Innovator’s Solution", Harvard Business School Press Boston, USA, 2013</li> <li>2. Donald A. Norman, "Emotional Design", Perseus Books Group New York , 2004.</li> </ol>	
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Geoffrey Petty, "How to be better at Creativity", The Industrial Society 1999</li> <li>2. Rousing Creativity: Think New Now Floyd Hurr, ISBN 1560525479, Crisp Publications Inc. 1999</li> <li>3. Semyon D. Savransky, "Engineering of Creativity – TRIZ", CRC Press New York USA 2003.</li> </ol>	

Tools for Assessment (40 Marks)												
CIA I		CIA II		CIA III		Assignment/ Seminar/ Case study				Attendance		Total
10		10		10		5				5		40
Mapping												
CO \ PO	PO1	PO 2	PO 3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	3	2	3	-	-	-	-	-	-
CO2	2	2	2	3	2	3	-	-	-	-	-	-
CO3	2	2	2	3	2	3	-	-	-	-	-	-
CO4	2	2	2	3	2	3	-	-	-	-	-	-
CO5	2	2	2	3	2	3	-	-	-	-	-	-
3-High; 2-Medium; 1-Low												
Course designed by						Verified by						
 Signature of the Faculty member						 Signature of the Chairperson-BoS						
 Name and Department of the Faculty Member						<b>Dr. M. SANTHOSH</b> Professor and Head Department of Mechanical Engineering Nehru Institute of Engineering and Technology Coimbatore - 641 195, Tamilnad, India Name and Seal of the Chairperson-BoS						

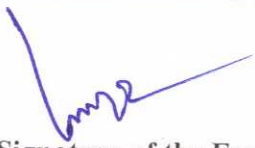
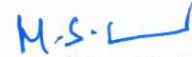
Course Code		Title					
P23CC43		INDUSTRIAL ROBOTICS AND EXPERT SYSTEMS					
Semester: III	L	T	P	Credits	CIA: 40 Marks	ESE: 60 Marks	
	3	0	0	3			
Course pre-requisites			Robotics				
Course Objectives							
1	To appreciate the need and scope for robotics and to understand the principles of robot kinematics						
2	To design the drive systems and its control						
3	To understand the principles of sensors and vision systems						
4	To envision the industrial applications of robots and its safety						
5	To gain knowledge on artificial intelligence and expert systems						
Course Category		Professional Core Courses (PCC)					
Development Needs		Global / National					
<b>Course Description:</b> Industrial Robotics and Expert Systems is an advanced course focusing on the theory, design, and application of robotic systems and artificial intelligence techniques in industrial settings.							
Course Content							
Unit	Description						
I	<b>INTRODUCTION AND ROBOT KINEMATICS</b> Definition need and scope of Industrial robots– Robot anatomy – Work volume – Precision movement – End effectors – Sensors. Robot Kinematics – Direct and inverse kinematics – Robot trajectories – Control of robot manipulators – Robot dynamics – Methods for orientation and location of objects						
						<b>Contact Periods</b>	<b>9</b>
II	<b>ROBOT DRIVES AND CONTROL</b> Controlling the Robot motion – Position and velocity sensing devices – Design of drive systems – Hydraulic and Pneumatic drives – Linear and rotary actuators and control valves Electro hydraulic servo valves, electric drives – Motors – Designing of end effectors – Vacuum, magnetic and air operated grippers.						
						<b>Contact Periods</b>	<b>9</b>
III	<b>ROBOT SENSORS</b> Transducers and Sensors – Tactile sensor – Proximity and range sensors – Sensing joint forces – Robotic vision system – Image Representation - Image Grabbing –Image processing and analysis – Edge Enhancement – Contrast Stretching – Band Rationing - Image segmentation – Pattern recognition – Training of vision system.						
						<b>Contact Periods</b>	<b>9</b>

IV	<b>ROBOT CELL DESIGN AND APPLICATION</b> Robot work cell design and control – Safety in Robotics – Robot cell layouts – Multiple Robots and machine interference – Robot cycle time analysis. Industrial application of robots.	<b>Contact Periods</b>	<b>9</b>
V	<b>ROBOT PROGRAMMING, ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS</b> Methods of Robot Programming – Characteristics of task level languages lead through programming methods – Motion interpolation. Artificial intelligence – Basics – Goals of artificial intelligence – AI techniques–problem representation in AI – Problem reduction and solution techniques - Application of AI and KBES in Robots.	<b>Contact Periods</b>	<b>9</b>
		<b>Total Periods</b>	<b>45</b>
<b>Course Outcomes</b>			
Upon Successful Completion of the course, students will be able to:			
<b>CO 1</b>	Understand robot kinematics		
<b>CO 2</b>	Incorporate mechanical components and concepts in robotics		
<b>CO 3</b>	Understand the basics of various sensors to effectively design a robot		
<b>CO 4</b>	Design suitable robots for specific applications		
<b>CO 5</b>	Optimize the robots using Artificial Intelligence		
<b>Text Books</b>	<ol style="list-style-type: none"> <li>1. K.S.Fu, Gonzalez, R.C. and Lee, C.S.G., “Robotics Control, Sensing, Vision and Intelligence”, McGraw Hill, 1987</li> <li>2. Koren, Y., “Robotics for Engineers”, McGraw-Hill, 1987</li> </ol>		
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Kozyrey, Yu. “Industrial Robots”, MIR Publishers Moscow, 1985.</li> <li>2. Klafter, R.D., Chmielewski, T.A. and Negin, M., “Robotics Engineering – An Integrated Approach”, Prentice-Hall of India Pvt. Ltd., 1984</li> <li>3. Deb, S.R. “Robotics Technology and Flexible Automation”, Tata McGraw-Hill, 1994</li> <li>4. Groover, M.P., Weis, M., Nagel, R.N. and Odrey, N.G., “Industrial Robotics Technology, Programming and Applications”, McGraw-Hill, Int., 1986</li> <li>5. Jordanides, T. and Torby, B.J., “Expert Systems and Robotics”, Springer – Verlag, New York, May 1991</li> </ol>		

Tools for Assessment (40 Marks)												
CIA I		CIA II		CIA III		Assignment/ Seminar/ Case study				Attendance	Total	
10		10		10		5				5	40	
Mapping												
CO \ PO	PO1	PO 2	PO 3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	3	-	2	1	-	-	-	-	-	-
CO2	1	3	3	-	2	1	-	-	-	-	-	-
CO3	1	3	3	-	2	1	-	-	-	-	-	-
CO4	1	3	3	-	2	1	-	-	-	-	-	-
CO5	1	3	3	-	2	1	-	-	-	-	-	-
3-High; 2-Medium; 1-Low												
Course designed by						Verified by						
 Signature of the Faculty member						 Signature of the Chairperson-BoS						
<b>RVINOTHKUMAR</b> <b>AP / Mechanical Engineering</b> Name and Department of the Faculty Member						<b>Dr. M. SANTHOSH</b> <b>Professor and Head</b> <b>Department of Mechanical Engineering</b> <b>Nehru Institute of Engineering and Technology</b> <b>Coimbatore - 641 011, India</b> Name and Seal of the Chairperson-BoS						

Course Code		Title				
P23CC44		DESIGN FOR CELLULAR MANUFACTURING SYSTEMS				
Semester: III	L	T	P	Credits	CIA: 40 Marks	ESE: 60 Marks
	3	0	0	3		
Course pre-requisites		Manufacturing processes				
Course Objectives						
1	At the end of this course the student should be able to understand					
2	Concepts and applications of Cellular manufacturing systems					
3	Traditional and non-traditional approaches of Problem solving Performance measurement					
4	Human and economical aspects of CMS.					
5	To understand the economics of GT/CMS					
Course Category		Professional Core Courses (PCC)				
Development Needs		Global / National				
Course Description: Design for Cellular Manufacturing Systems is an advanced course focusing on the principles, methodologies, and techniques for designing efficient and flexible manufacturing systems based on cellular manufacturing concepts.						
Course Content						
Unit	Description					
I	<b>INTRODUCTION</b>					
	Introduction to Group Technology, Limitations of traditional manufacturing systems, characteristics and design of groups, benefits of GT and issues in GT.					
					Contact Periods	9
II	<b>CMS PLANNING AND DESIGN</b>					
	Problems in GT/CMS - Design of CMS - Models, traditional approaches and non-traditional approaches -Genetic Algorithms, Simulated Annealing, Neural networks.					
					Contact Periods	9
III	<b>IMPLEMENTATION OF GT/CMS</b>					
	Inter and Intra cell layout, cost and non-cost based models, establishing a team approach, Managerial structure and groups, batch sequencing and sizing, life cycle issues in GT/CMS.					
					Contact Periods	9
IV	<b>PERFORMANCE MEASUREMENT AND CONTROL</b>					
	Measuring CMS performance - Parametric analysis - PBC in GT/CMS, cell loading, GT and MRP – framework.					
					Contact Periods	9

V	<b>ECONOMICS OF GT/CMS:</b>	
	Conventional Vs group use of computer models in GT/CMS, Human aspects of GT/CMS - cases.	
		<b>Contact Periods</b>
		<b>9</b>
		<b>Total Periods</b>
		<b>45</b>
<b>Course Outcomes</b>		
<b>Upon Successful Completion of the course, students will be able to:</b>		
<b>CO 1</b>	To impart knowledge on group technology, optimization algorithms	
<b>CO 2</b>	To learn the aspects of cellular manufacturing and its design	
<b>CO 3</b>	To know the implementation of GT/CMS	
<b>CO 4</b>	To understand Performance measurements of CMS.	
<b>CO 5</b>	To understand the economics of GT/CMS	
<b>Text Books</b>	<ol style="list-style-type: none"> <li>1. Askin, R.G. and Vakharia, A.J., G.T " Planning and Operation, in The automated factory- Hand</li> <li>2. Book: Technology and Management ", Cleland.D.I. and Bidananda, B (Eds), TAB Books , NY, 1991.</li> </ol>	
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Burbidge, J.L. Group "Technology in Engineering Industry ", Mechanical Engineering pub.London, 1979.</li> <li>2. Irani, S.A. " Cellular Manufacturing Systems ", Hand Book Kamrani, A.K, Parsaei, H.R and Liles, D.H. (Eds), " Planning, design and analysis of cellular manufacturing systems ", Elsevier, 1999</li> </ol>	

Tools for Assessment (40 Marks)												
CIA I	CIA II		CIA III			Assignment/ Seminar/ Case study				Attendance	Total	
10	10		10			5				5	40	
Mapping												
CO \ PO	PO1	PO 2	PO 3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	3	2	1	1	-	-	-	-	-	-
CO2	2	1	3	2	1	1	-	-	-	-	-	-
CO3	2	1	3	2	1	1	-	-	-	-	-	-
CO4	2	1	3	2	1	1	-	-	-	-	-	-
CO5	2	1	3	2	1	1	-	-	-	-	-	-
3-High; 2-Medium; 1-Low												
Course designed by						Verified by						
 Signature of the Faculty member						 Signature of the Chairperson-BoS						
A C RAMAKUMAR B, AP(Su) Mechanical Engineering Name and Department of the Faculty Member						<b>Dr. M. SANTHOSH</b> Professor and Head Department of Mechanical Engineering Nehru Institute of Engineering and Technology Coimbatore - 641 105, Tamilnadu, India. Name and Seal of the Chairperson-BoS						

Course Code	Title					
P23CC45	ELECTRONICS MANUFACTURING TECHNOLOGY					
Semester: III	L	T	P	Credits	CIA: 40 Marks	ESE: 60 Marks
	3	0	0	3		
Course pre-requisites		BASICS OF ELECTRICAL AND ELECTRONICS				
Course Objectives						
1	To impart knowledge on wafer preparation and PCB fabrication					
2	To introduce Through Hole Technology (THT) and Surface Mount Technology (SMT) with various types of electronic components					
3	To elaborate various steps in Surface Mount Technology (SMT)					
4	To be acquainted with various testing and inspection methods of populated PCBS					
5	To outline repair, rework and quality aspects of Electronic assemblies.					
Course Category		Professional Core Courses (PCC)				
Development Needs		Global / National				
Course Description: Electronics Manufacturing Technology is an advanced course that delves into the principles, processes, and technologies involved in the production of electronic components and devices.						
Course Content						
Unit	Description					
I	<b>INTRODUCTION TO ELECTRONICS MANUFACTURING</b>					
	History, definition, wafer preparation by growing, machining, and polishing, diffusion, microlithography, etching and cleaning, Printed Circuit Boards, types- single sided, double sided, multi layer and flexible printed circuit board, design, materials, manufacturing, inspection. Electronic packaging – Through Hole Technology (THT) and Surface Mount Technology (SMT)					
					<b>Contact Periods</b>	<b>9</b>
II	<b>COMPONENTS AND PACKAGING</b>					
	Through-hole components – axial, radial, multi leaded, odd form. Surface mount components- active, passive. Interconnections - chip to lead interconnection, die bonding, wire bonding, TAB, Flip chip, chip on board, multi chip module, direct chip array module, leaded, leadless, area array and embedded packaging, miniaturization and trends					
					<b>Contact Periods</b>	<b>9</b>
III	<b>SOLDERING AND CLEANING</b>					
	Soldering theory, effect of elemental constituents on wetting, microstructure and soldering, solder paste technology – fluxing reactions, flux chemistry, solder powder, solder paste composition and manufacturing, solder paste rheology, Wave soldering. Adhesive and solder paste application. solder system variables. soldering temperature profile. Reflow					

	soldering - profile generation and control, soldering quality and defects. Post solder cleaning and selection. Measurement of cleanliness levels.	
		<b>Contact Periods</b> 9
<b>IV</b>	<b>SURFACE MOUNT TECHNOLOGY</b> SMT Equipment and Material Handling Systems, Handling of Components and Assemblies - Moisture Sensitivity and ESD, Safety and Precautions Needed, IPC and Other Standards, Stencil Printing Process, solder paste storage and handling, stencils and squeegees, process parameters, quality control - Component Placement, Equipment Type, Chip shooter, IC placer, Flexibility, Accuracy of Placement, Throughput, reflow soldering, adhesive, underfill and encapsulation process, applications, storage and handling, process & parameters	<b>Contact Periods</b> 9
<b>V</b>	<b>INSPECTION, TEST AND REWORK FOR PCB:</b> Inspection Techniques, Equipment and Principle – AOI, X-ray. stencil printing process-defects & corrective action, component placement process - defects & corrective action, Reflow Soldering Process- defects & corrective action, underfill and encapsulation Process- defects & corrective action, Testing of assemblies, In-circuit testing (ICT), functional testing, concept of yield, Rework and Repair, tools, rework criteria and process, Design for - Manufacturability, Assembly, Reworkability, Testing, Reliability and Environment.	<b>Contact Periods</b> 9
		<b>Total Periods</b> 45
<b>Course Outcomes</b>		
<b>Upon Successful Completion of the course, students will be able to:</b>		
<b>CO 1</b>	Realize wafer preparation and PCB fabrication.	
<b>CO 2</b>	Elaborate on through hole and surface mount technology components.	
<b>CO 3</b>	Discuss the steps involved in soldering post solder cleaning and its importance in PCB	
<b>CO 4</b>	Improve knowledge on surface mount technology.	
<b>CO 5</b>	CO5: Locate the required inspections, testing and repair methods used in PCB.	
<b>Text Books</b>	<ol style="list-style-type: none"> <li>1. Coombs, Jr. C.E., "Printed Circuits Handbook" Mc Graw-Hill Hand books Sixth Edition, 2008</li> <li>2. Gurnett, K.W., "Surface Mount Handbook", Newnes Elsevier , 1999</li> </ol>	

**Reference Books**

1. Landers, T.L., "Electronics Manufacturing Processes", Prentice Hall, 1998
2. Lee, N.C., "Reflow Soldering Process and Trouble Shooting – SMT, BGA, CSP and Flip Chip Technologies", Newnes Elsevier, 2001
3. Prasad R.P., "Surface Mount Technology: Principles and Practice", New York: Chapman and Hall, 1997.
4. Seraphim, D., Lasky, R.C. and Che-Yu Li, "Principles of Electronic Packaging" McGraw Hill, 1989.
5. Strauss, R., "SMT Soldering Handbook", Newnes Elsevier, 1998
6. Zant, P.V., "Microchip Fabrication – a practical guide to semiconductor processing" McGraw Hill, 2000


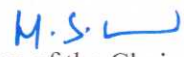
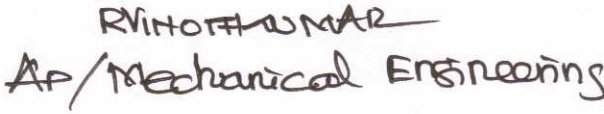
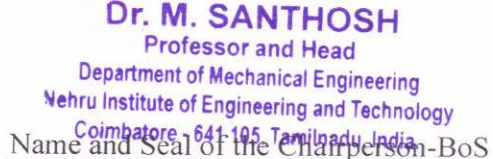
**Tools for Assessment (40 Marks)**

CIA I	CIA II	CIA III	Assignment/ Seminar/ Case study	Attendance	Total
10	10	10	5	5	40

**Mapping**


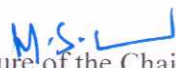
CO \ PO	PO1	PO 2	PO 3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-
CO3	3	-	2	-	-	-	-	-	-	-	-	-
CO4	3	-	2	-	-	-	-	-	-	-	-	-
CO5	3	-	2	-	-	-	-	-	-	-	-	-

3-High; 2-Medium; 1-Low

Course designed by	Verified by
 Signature of the Faculty member	 Signature of the Chairperson-BoS
 Name and Department of the Faculty Member	 Name and Seal of the Chairperson-BoS

Course Code		Title				
P23CC51		QUALITY CONCEPTS IN DESIGN				
Semester: III	L	T	P	Credits	CIA: 40 Marks	ESE: 60 Marks
	3	0	0	3		
Course pre-requisites		Engineering design				
Course Objectives						
1	To impart knowledge on various concepts in engineering design, material selection and manufacturing methods.					
2	To learn the principles of implementing quality in a product or services using different tools					
3	To enhance the quality of product by use of failure mode effect analysis and implement methods to uphold the status of six sigma					
4	To develop a robust product or service using various strategies of design of experiments					
5	To maintain the quality of the product by use of statistical tools and enforce methods to improve the reliability of a product					
Course Category		Professional Core Courses (PCC)				
Development Needs		Global / National				
Course Description: Quality Concepts in Design is a fundamental course that explores the principles, techniques, and methodologies for ensuring quality in product design and development.						
Course Content						
Unit	Description					
I	<b>DESIGN FUNDAMENTALS, METHODS AND MATERIAL SELECTION</b> Morphology of Design – The Design Process – Computer Aided Engineering – Concurrent Engineering – Competition Bench Marking – Creativity – Theory of Problem solving (TRIZ) – Value Analysis - Design for Manufacture, Design for Assembly – Design for casting, Forging, Metal Forming, Machining and Welding.					
						<b>Contact Periods</b>
II	<b>DESIGN FOR QUALITY</b> Quality Function Deployment -House of Quality-Objectives and functions-Targets-Stakeholders- Measures and Matrices-Design of Experiments –design process- Identification of control factors, noise factors, and performance metrics - developing the experimental plan- experimental design – testing noise factors- Running the experiments – Conducting the analysis-Selecting and conforming factor-Set points-reflecting and repeating.					
						<b>Contact Periods</b>
III	<b>FAILURE MODE EFFECTS ANALYSIS AND DESIGN FOR SIX SIGMA</b> Basic methods: Refining geometry and layout, general process of product embodiment - Embodiment checklist- Advanced methods: systems modeling, mechanical embodiment principles-FMEA method- linking fault states to systems modeling - Basis of SIX SIGMA – Project selection for SIX SIGMA- SIX SIGMA problem solving- SIX SIGMA in service and small organizations - SIX SIGMA and lean production –Lean SIX SIGMA and services.					
						<b>Contact Periods</b>


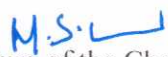
<b>DESIGN OF EXPERIMENTS</b>	
IV	Importance of Experiments. Experimental Strategies, Basic principles of Design, Terminology, ANOVA, Steps in Experimentation, Sample size, Single Factor experiments – Completely Randomized design, Randomized Block design, Statistical Analysis, Multifactor experiments - Two and three factor full Factorial experiments, 2K factorial Experiments, Confounding and Blocking designs, Fractional factorial design, Taguchi's approach - Steps in experimentation, Design using Orthogonal Arrays, Data Analysis, Robust Design- Control and Noise factors, S/N ratios
<b>Contact Periods</b>	
<b>9</b>	
<b>STATISTICAL CONSIDERATION AND RELIABILITY</b>	
V	Frequency distributions and Histograms- Run charts –stem and leaf plots- Pareto diagrams- Cause and Effect diagrams-Box plots- Probability distribution-Statistical Process control–Scatter diagrams –Multivariable charts –Matrix plots and 3-D plots.-Reliability-Survival and Failure- Series and parallel systems-Mean time between failure-Weibull distribution.
<b>Contact Periods</b>	
<b>9</b>	
<b>Total Periods</b>	
<b>45</b>	
<b>Course Outcomes</b>	
<b>Upon Successful Completion of the course, students will be able to:</b>	
<b>CO 1</b>	Apply fundamentals of design process and material selection for developing a quality product
<b>CO 2</b>	Apply the quality concepts to develop a robust product
<b>CO 3</b>	Perform Failure Mode Effect Analysis on a product and use six sigma principles to enhance its quality
<b>CO 4</b>	Apply different experimental design methods in product development
<b>CO 5</b>	Implement various statistical tools to improve its quality and reliability
<b>Text Books</b>	<ol style="list-style-type: none"> <li>1. Amitava Mitra, "Fundamentals of Quality control and improvement", John Wiley &amp; Sons, 2016</li> <li>2. George E. Dieter, Linda C. Schmidt, "Engineering Design", McGraw Hill Education Pvt. Ltd., 2013</li> </ol>
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Karl T. Ulrich, Steven D. Eppinger, "Product Design And Development, ,Tata Mcgraw-Hill Education, 2015</li> <li>2. Kevin N. Otto and Kristin L. Wood, "Product Design: Techniques in Reverse Engineering and New Product Development", Prentice Hall, 2001</li> <li>3. Montgomery, D.C., "Design and Analysis of experiments", John Wiley and Sons, 2017.</li> <li>4. Phillip J. Ross, "Taguchi techniques for quality engineering", Tata McGraw Hill, 2005.</li> </ol>

Tools for Assessment (40 Marks)												
CIA I		CIA II		CIA III		Assignment/ Seminar/ Case study				Attendance		Total
10		10		10		5				5		40
Mapping												
CO \ PO	PO1	PO 2	PO 3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	3	2	2	2	-	-	-	-	-	-
CO2	1	1	3	2	2	2	-	-	-	-	-	-
CO3	1	1	3	2	2	2	-	-	-	-	-	-
CO4	1	1	3	2	2	2	-	-	-	-	-	-
CO5	1	1	3	2	2	2	-	-	-	-	-	-
3-High; 2-Medium; 1-Low												
Course designed by						Verified by						
 Signature of the Faculty member						 Signature of the Chairperson-BoS						
<b>A.C RAMKUMAR, AP(Sr)</b> <b>mechanical Engineering</b> Name and Department of the Faculty Member						<b>Dr. M. SANTHOSH</b> Professor and Head Department of Mechanical Engineering Nehru Institute of Engineering and Technology Coimbatore - 641 105, Tamilnadu, India. Name and Seal of the Chairperson-BoS						

Course Code		Title				
P23CC52		NON-DESTRUCTIVE TESTING				
Semester: III	L	T	P	Credits	CIA: 40 Marks	ESE: 60 Marks
	3	0	0	3		
Course pre-requisites		Manufacturing processes				
Course Objectives						
1	To stress the importance of NDT in Engineering.					
2	To select the appropriate NDT Technique					
3	To familiarize with different NDT Technique					
4	To impart various knowledge to check the weld quality of various structures, pressure vessels					
5	Compare the merits of various NDT Techniques					
Course Category		Professional Core Courses (PCC)				
Development Needs		Global / National				
Course Description: Non-Destructive Testing (NDT) is an essential course that focuses on the principles, techniques, and applications of inspecting materials and components without causing damage to them.						
Course Content						
Unit	Description					
I	<b>NON-DESTRUCTIVE TESTING: AN INTRODUCTION, VISUAL INSPECTION &amp; LIQUID PENETRANT TESTING</b>					
	Introduction to various non-destructive methods, Comparison of Destructive and Non-destructive Tests, Visual Inspection, Optical aids used for visual inspection, Applications. Physical principles, procedure for penetrant testing, Penetrant testing materials, Penetrant testing methods-water washable, Post – Emulsification methods, Applications					
<b>Contact Periods</b>						<b>9</b>
II	<b>EDDY CURRENT TESTING &amp; ACOUSTIC EMISSION</b>					
	Principles, Instrumentation for ECT, Absolute, differential probes, Techniques – High sensitivity techniques, Multi frequency, Phased array ECT, Applications. Principle of AET, Instrumentation, Applications - testing of metal pressure vessels, Fatigue crack detection in aerospace structures.					
<b>Contact Periods</b>						<b>9</b>
III	<b>MAGNETIC PARTICLE TESTING &amp; THERMOGRAPHY</b>					
	Principle of MPT, procedure used for testing a component, Equipment used for MPT, Magnetizing techniques, Applications.					


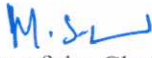
	Principle of Thermography, Infrared Radiometry, Active thermography measurements, Applications – Imaging entrapped water under an epoxy coating, Detection of carbon fiber contaminants	<b>Contact Periods</b>	<b>9</b>
<b>IV</b>	<b>ULTRASONIC TESTING</b> Principle, Ultrasonic transducers, Ultrasonic Flaw detection Equipment, Modes of display A- scan, B- Scan, C- Scan, Applications, Inspection Methods - Normal Incident Pulse-Echo Inspection, Normal Incident Through-transmission Testing, Angle Beam Pulse-Echo testing, TOFD Technique, Applications of Normal Beam Inspection in detecting fatigue cracks, Inclusions, Slag, Porosity and Intergranular cracks - Codes, standards, specification and procedures and case studies in ultrasonics test.	<b>Contact Periods</b>	<b>9</b>
<b>V</b>	<b>RADIOGRAPHY</b> Principle of Radiography, x-ray and gamma ray sources- safety procedures and standards, Effect of radiation on Film, Radiographic imaging, Inspection Techniques – Single wall single image, Double wall Penetration, Multiwall Penetration technique, Real Time Radiography - Codes, standards, specification and procedures and case studies in Radiography test. Case studies on defects in cast, rolled, extruded, welded and heat-treated components - Comparison and selection of various NDT techniques	<b>Contact Periods</b>	<b>9</b>
<b>Total Periods</b>			<b>45</b>
<b>Course Outcomes</b>			
<b>Upon Successful Completion of the course, students will be able to:</b>			
<b>CO 1</b>	Realize the importance of various NDT Techniques		
<b>CO 2</b>	Are expected to have hands on experience on all types of NDT techniques		
<b>CO 3</b>	Will choose appropriate technique for testing		
<b>CO 4</b>	Will Compare the merits of various NDT Techniques		
<b>CO 5</b>	Characterize the flaws and defects and provide solutions		
<b>Text Books</b>	<ol style="list-style-type: none"> <li>Baldev Raj, Jeyakumar,T., Thavasimuthu,M., “Practical Non Destructive Testing” Narosa publishing house, New Delhi, 2002</li> <li>Krautkramer. J., “Ultra Sonic Testing of Materials”, 1st Edition, Springer – Verlag Publication, New York, 1996.</li> </ol>		

<b>Reference Books</b>	1. Peter J. Shull "Non-Destructive Evaluation: Theory, Techniques and Application" Marcel Dekker, Inc., New York, 2002 www.ndt.net
------------------------	--

Tools for Assessment (40 Marks)												
CIA I		CIA II		CIA III		Assignment/ Seminar/ Case study				Attendance		Total
10		10		10		5				5		40
Mapping												
CO \ PO	PO1	PO 2	PO 3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	3	-	-	1	-	-	-	-	-	-
CO3	-	-	-	2	-	-	-	-	-	-	-	-
CO4	-	-	-	-	1	-	-	-	-	-	-	-
CO5	1	-	-	2	-	1	-	-	-	-	-	-
3-High; 2-Medium; 1-Low												
Course designed by						Verified by						
 Signature of the Faculty member						 Signature of the Chairperson-BoS						
<b>RVINOTHKUMAR</b> <b>AP / Mechanical Engg.</b> Name and Department of the Faculty Member						<b>Dr. M. SANTHOSH</b> <b>Professor and Head</b> <b>Department of Mechanical Engineering</b> <b>Nehru Institute of Engineering and Technology</b> <b>Coimbatore, 641 105, Tamilnadu, India</b> Name and Seal of the Chairperson-BoS						


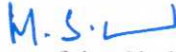
Course Code		Title				
P23CC53		DESIGN OF HYBRID AND ELECTRIC VEHICLES				
Semester: III	L	T	P	Credits	CIA: 40 Marks	ESE: 60 Marks
	3	0	0	3		
Course pre-requisites		COMPUTER AIDED DESIGN				
Course Objectives						
1	Fundamental concepts of electric and hybrid vehicle operation and architectures.					
2	Understand the properties of batteries and its types.					
3	Provide knowledge about design of series hybrid electric vehicles.					
4	Provide knowledge about design of parallel hybrid electric vehicles.					
5	Understand of electric vehicle drive train.					
Course Category		Professional Core Courses (PCC)				
Development Needs		Global / National				
Course Description: Design of Hybrid and Electric Vehicles is an advanced course focusing on the principles, methodologies, and technologies involved in the development of hybrid and electric vehicles (HEVs).						
Course Content						
Unit	Description					
I	<b>INTRODUCTION TO ELECTRIC VEHICLES</b> Electric Vehicles (EV) system- EV History – EV advantages – EV market – vehicle mechanics: roadway fundamentals- law of motion-vehicle kinetics- dynamics of vehicle motion – propulsion power–velocity and acceleration-propulsion system design.					
	Contact Periods					9
II	<b>ENERGY SOURCE</b> Battery basics-lead acid battery–alternative batteries–battery parameters-technical characteristics– battery power–alternative energy sources: Fuel cells-Fuel Cell characteristics-Fuel cell types.					
	Contact Periods					9
III	<b>SERIES HYBRID ELECTRIC DRIVE TRAIN DESIGN</b> Operation Patterns- Control Strategies-Sizing of the Major Components -Design of peaking power source- Traction Motor Size - Design of the Gear Ratio-Verification of Acceleration Performance- .Verification of grade ability-- Design of Engine/Generator Size - Design of the Power Capacity-Design of the Energy Capacity –Fuel Consumption.					
	Contact Periods					9
IV	<b>PARALLEL HYBRID ELECTRIC DRIVE TRAIN DESIGN</b> Control Strategies of ParallelHybridDriveTrain-DriveTrainParameters-EnginePowerCapacity- Electric Motor Drive Power Capacity-Transmission Design- Energy Storage Design					
	Contact Periods					9

V	<b>ELECTRIC VEHICLE DRIVE TRAIN</b>	
	EV Transmission configurations–Transmission components–Ideal gear box– Gearratio–torque–speed characteristics–EV motor sizing–initial acceleration–rated vehicle velocity–maximum velocity – maximum gradability	
		<b>Contact Periods</b>
		<b>9</b>
		<b>Total Periods</b>
		<b>45</b>
<b>Course Outcomes</b>		
Upon Successful Completion of the course, students will be able to:		
<b>CO 1</b>	Explain how a hybrid vehicle works and describe its main components and their function.	
<b>CO 2</b>	Choose proper energy storage systems for vehicle applications	
<b>CO 3</b>	Design series hybrid electric vehicles.	
<b>CO 4</b>	Design parallel hybrid electric vehicles.	
<b>CO 5</b>	Describe the transmission components and their configurations for electric vehicles	
<b>Text Books</b>	1. Ehsani,M, “Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design”, CRC Press,2005	
<b>Reference Books</b>	1. “Hybrid Electric Vehicle Technology Assessment: Methodology, Analytical Issues, and Interim Results,”CenterforTransportationResearchArgonneNationalLaboratory,United States Department of Energy. 2. Energy. 3. Iqbal Hussain, “Electric & Hybrid Vehicles– Design Fundamentals”, Second Edition, CRC Press,2011. 4. James Larminie, “Electric Vehicle Technology Explained”, John Wiley & Sons, 2003.	

Tools for Assessment (40 Marks)												
CIA I	CIA II		CIA III			Assignment/ Seminar/ Case study				Attendance	Total	
10	10		10			5				5	40	
Mapping												
CO \ PO	PO1	PO 2	PO 3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C01	2	1	3	2	2	3	-	-	-	-	-	-
C02	2	1	3	2	2	3	-	-	-	-	-	-
C03	2	1	3	2	2	3	-	-	-	-	-	-
C04	2	1	3	2	2	3	-	-	-	-	-	-
C05	2	1	3	2	2	3	-	-	-	-	-	-
3-High; 2-Medium; 1-Low												
Course designed by						Verified by						
 Signature of the Faculty member						 Signature of the Chairperson-BoS						
<b>A.C RAMKUMAR B, AP(Sy)</b> <b>Mechanical Engineering</b> Name and Department of the Faculty Member						<b>Dr. M. SANTHOSH</b> Professor and Head Department of Mechanical Engineering Nehru Institute of Engineering and Technology Coimbatore - 641 105, Tamil Nadu Name and Seal of the Chairperson-BoS						

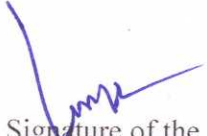
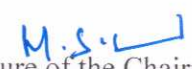
Course Code		Title				
P23CC54		MATERIAL HANDLING SYSTEMS AND DESIGN				
Semester: III	L	T	P	Credits	CIA: 40 Marks	ESE: 60 Marks
	3	0	0	3		
Course pre-requisites		Manufacturing processes				
Course Objectives						
1	Fundamental concepts related to material handling.					
2	Design of various hoisting gears for different material handling applications					
3	Development of conveyer systems for material flow in different industrial production systems.					
4	Design of elevators for various manufacturing and service applications.					
5	Integrated mechanical system design for machine tools, power transmission and engine parts					
Course Category		Professional Core Courses (PCC)				
Development Needs		Global / National				
Course Description: Material Handling Systems and Design is a comprehensive course focusing on the principles, methodologies, and technologies involved in the design and optimization of material handling systems.						
Course Content						
Unit	Description					
I	<b>INTRODUCTIONS AND DESIGN OF HOISTS</b> Types, selection and applications, Design of hoisting elements: Welded and roller chains- Hemp and wire ropes - Design of ropes, pulleys, pulley systems, sprockets and drums, Load handling attachments. Design of forged hooks and eye hooks – crane grabs - lifting magnets –Grabbing attachments-Design of arresting gear -Brakes: shoe, band and cone types					
	<b>Contact Periods</b>					<b>9</b>
II	<b>DRIVES OF HOISTING GEAR</b> Hand and power drives - Traveling gear - Rail traveling mechanism - cantilever and monorail cranes-slewing, and gear-cog wheel drive- selecting the motor ratings					
	<b>Contact Periods</b>					<b>9</b>
III	<b>CONVEYORS</b> Types-description-design and applications of Belt conveyors, apron conveyors and escalators Pneumatic conveyors, Screw conveyors and vibratory conveyors.					
	<b>Contact Periods</b>					<b>9</b>
IV	<b>ELEVATORS</b> Bucket elevators: design - loading and bucket arrangements - Cage elevators - shaft way, guides, counter weights, hoisting machine, safety devices-Design of fork lift trucks.					
	<b>Contact Periods</b>					<b>9</b>

		<b>Contact Periods</b>	<b>9</b>
<b>V</b>	<b>INTEGRATED DESIGN</b>		
	Integrated Design of systems - Valve Gear Mechanisms, Portable Air Compressor, Hay-Balelifter, Cam Testing Machine, Power Screws, Gear Box Design more than six speed.		
		<b>Contact Periods</b>	<b>9</b>
		<b>Total Periods</b>	<b>45</b>
<b>Course Outcomes</b>			
Upon Successful Completion of the course, students will be able to:			
<b>CO 1</b>	Design hoists and brakes used in any handling applications.		
<b>CO 2</b>	Design drive mechanisms and hoisting gear for different handling applications.		
<b>CO 3</b>	Design different conveyor systems for material handling applications.		
<b>CO 4</b>	Design bucket, cage and fork lift elevators for to and fro transportation of materials in vertical direction.		
<b>CO 5</b>	Design of integrated mechanical system for machine tools, power transmission and engine parts		
<b>Text Books</b>	<ol style="list-style-type: none"> <li>Alexandrov, M., Materials Handling Equipments, MIR Publishers, 1981.</li> <li>Boltzharol, A., Materials Handling Handbook, The Ronald Press Company, 1958</li> </ol>		
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>Norton. L Robert. "Machine Design–An Integrated Approach" Pearson Education, 2nd Edition, 2005.</li> <li>Rudenko, N., Materials handling equipment, ELnvee Publishers, 1970.</li> <li>Spivakovsy, A.O. and Dyachkov, V.K., Conveying Machines, Volumes I and II, MIR Publishers, 1985.</li> </ol>		

Tools for Assessment (40 Marks)												
CIA I	CIA II		CIA III			Assignment/ Seminar/ Case study				Attendance	Total	
10	10		10			5				5	40	
Mapping												
CO \ PO	PO1	PO 2	PO 3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	3	2	2	1	-	-	-	-	-	-
CO2	2	1	3	2	2	1	-	-	-	-	-	-
CO3	2	1	3	2	2	1	-	-	-	-	-	-
CO4	2	1	3	2	2	1	-	-	-	-	-	-
CO5	2	1	3	2	2	1	-	-	-	-	-	-
3-High; 2-Medium; 1-Low												
Course designed by						Verified by						
 Signature of the Faculty member						 Signature of the Chairperson-BoS						
A. CRAMIKUMAR, AP(S4) Mechanical Engineering Name and Department of the Faculty Member						<b>Dr. M. SANTHOSH</b> Professor and Head Department of Mechanical Engineering Nehru Institute of Engineering and Technology Coimbatore - 641 105, Tamilnadu, India. Name and Seal of the Chairperson-BoS						

Course Code		Title					
P23CC55		DESIGNING WITH ADVANCED MATERIALS					
Semester: III	L	T	P	Credits	CIA: 40 Marks	ESE: 60 Marks	
	3	0	0	3			
Course pre-requisites		Engineering design					
Course Objectives							
1	Analyzing the different strengthening and failure mechanism of the metals						
2	Applying the effects of metallurgical parameters in the materials design						
3	Analyzing the relationship between the selection of materials and processing						
4	Developing the novel material through understanding the properties of the existing metallic materials						
5	Analyzing the different materials used in the engineering applications.						
Course Category		Professional Core Courses (PCC)					
Development Needs		Global / National					
Course Description: Designing with Advanced Materials is an advanced course focusing on the principles, techniques, and applications of advanced materials in engineering design.							
Course Content							
Unit	Description						
I	<b>INTRODUCTION TO REVERSE ENGINEERING &amp; GEOMETRIC FORM</b>						
	Definition – Uses – The Generic Process – Phases – Computer Aided Reverse Engineering - Surface and Solid Model Reconstruction – Dimensional Measurement – Prototyping.						
						<b>Contact Periods</b>	<b>9</b>
II	<b>MATERIAL CHARACTERISTICS, PART DURABILITY AND LIFE LIMITATION</b>						
	Alloy Structure Equivalency – Phase Formation and Identification – Mechanical Strength – Hardness – Part Failure Analysis – Fatigue – Creep and Stress Rupture – Environmentally Induced Failure						
						<b>Contact Periods</b>	<b>9</b>
III	<b>MATERIAL IDENTIFICATION AND PROCESS VERIFICATION</b>						
	Material Specification - Composition Determination - Microstructure Analysis - Manufacturing Process Verification.						
						<b>Contact Periods</b>	<b>9</b>
IV	<b>DATA PROCESSING, PART PERFORMANCE AND SYSTEM COMPATIBILITY</b>						
	Statistical Analysis – Data Analysis – Reliability and the Theory of Interference – Weibull Analysis – Data Conformity and Acceptance – Data Report – Performance Criteria – Methodology of Performance Evaluation – System Compatibility.						
						<b>Contact Periods</b>	<b>9</b>



V	<b>ACCEPTANCE, LEGALITY AND INDUSTRIAL APPLICATIONS OF RE</b> Legality of Reverse Engineering – Patent – Copyrights – Trade Secret – Third-Party Materials – Reverse Engineering in the Automotive Industry; Aerospace Industry; Medical Device Industry.	
		<b>Contact Periods</b> 9
		<b>Total Periods</b> 45
<b>Course Outcomes</b>		
Upon Successful Completion of the course, students will be able to:		
<b>CO 1</b>	Analyze the different strengthening and failure mechanism of the metals	
<b>CO 2</b>	Apply the effects of metallurgical parameters in the materials design	
<b>CO 3</b>	Analyze the relationship between the selection of materials and processing	
<b>CO 4</b>	Develop the novel material through understanding the properties of the existing metallic materials	
<b>CO 5</b>	Analyze the different materials used in the engineering applications	
<b>Text Books</b>	<ol style="list-style-type: none"> <li>1. George E. Dieter, Mechanical Metallurgy, McGraw Hill, 1988</li> <li>2. Thomas H. Courtney, Mechanical Behavior of Materials, (2nd edition), McGraw Hill, 2000</li> </ol>	
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. William D. Callister Jr. and David G. Rethwisch, Callister's Materials Science and Engineering, (2nd edition) Wiley Editorial, 2018</li> <li>2. Charles, J.A., Crane, F.A.A. and Fumess, J.A.G., Selection and use of engineering materials, (34d edition), Butterworth-Heinemann, 1997</li> <li>3. Flinn, R.A., and Trojan, P.K., Engineering Materials and their Applications, (4th Edition) Jaico, 1999</li> <li>4. Metals Hand book, Vol.10, Failure Analysis and Prevention, (10th Edition), Jaico, 1999</li> <li>5. Ashby M.F., materials selection in Mechanical Design 2nd Edition, Butter worth 1999, <a href="http://www.astm.org/labs/pages/131350.htm">www.astm.org/labs/pages/131350.htm</a></li> </ol>	

Tools for Assessment (40 Marks)												
CIA I	CIA II		CIA III			Assignment/ Seminar/ Case study				Attendance	Total	
10	10		10			5				5	40	
Mapping												
CO \ PO	PO1	PO 2	PO 3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	3	1	1	2	-	-	-	-	-	-
CO2	3	-	3	1	1	2	-	-	-	-	-	-
CO3	3	-	3	1	1	2	-	-	-	-	-	-
CO4	3	-	3	1	1	2	-	-	-	-	-	-
CO5	3	-	3	1	1	2	-	-	-	-	-	-
3-High; 2-Medium; 1-Low												
Course designed by						Verified by						
 Signature of the Faculty member						 Signature of the Chairperson-BoS						
<b>A.C RAMAKUMAR, AP (Sr)</b> <b>Mechanical Engineering</b> Name and Department of the Faculty Member						<b>Dr. M. SANTHOSH</b> <b>Professor and Head</b> <b>Department of Mechanical Engineering</b> <b>Nehru Institute of Engineering and Technology</b> <b>Coimbatore - 641 105, Tamilnadu, India</b> Name and Seal of the Chairperson-BoS						

## AUDIT COURSES


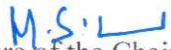
Course Code		Title				
P23MC01		English for Research Paper Writing				
Semester: III	L	T	P	Credits	CIA: 40 Marks	ESE: 60 Marks
	3	0	0	3		
Course pre-requisites		Technical English				
Course Objectives						
1	Teach how to improve writing skills and level of readability					
2	Tell about what to write 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					
Course Category		Professional Core Courses (PCC)				
Development Needs		Global / National				
Course Description: English for Research Paper Writing is a specialized course designed to enhance students' academic writing skills for research purposes.						
Course Content						
Unit	Description					
I	<b>INTRODUCTION TO RESEARCH PAPER WRITING</b>					
	Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness					
					Contact Periods	9
II	<b>PRESENTATION SKILLS</b>					
	Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction					
					Contact Periods	9
III	<b>TITLE WRITING SKILLS</b>					
	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					
					Contact Periods	9
IV	<b>RESULT WRITING SKILLS</b>					
	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					

		<b>Contact Periods</b>	<b>9</b>
<b>V</b>	<b>VERIFICATION SKILLS</b>		
	Useful phrases, checking Plagiarism, how to ensure paper is as good as it could possibly be the first- time submission		
		<b>Contact Periods</b>	<b>9</b>
		<b>Total Periods</b>	<b>45</b>
<b>Course Outcomes</b>			
Upon Successful Completion of the course, students will be able to:			
<b>CO 1</b>	Understand that how to improve your writing skills and level of readability CO2 – Learn about what to write in each section		
<b>CO 2</b>	Understand the skills needed when writing a Title		
<b>CO 3</b>	Understand the skills needed when writing the Conclusion CO5 – Ensure the good quality of paper at very first-time submission		
<b>CO 4</b>	Understand that how to improve your writing skills and level of readability CO2 – Learn about what to write in each section		
<b>CO 5</b>	Understand the skills needed when writing a Title		
<b>Text Books</b>	1. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011		
<b>Reference Books</b>	1. Day R How to Write and Publish a Scientific Paper, Cambridge University Press 2006 2. Goldbort R Writing for Science, Yale University Press (available on Google Books) 2006 3. Highman N, Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book 1998.		

Tools for Assessment (40 Marks)												
CIA I		CIA II		CIA III		Assignment/ Seminar/ Case study				Attendance		Total
10		10		10		5				5		40
Mapping												
CO \ PO	PO1	PO 2	PO 3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	3	1	1	2	-	-	-	-	-	-
CO2	3	-	3	1	1	2	-	-	-	-	-	-
CO3	3	-	3	1	1	2	-	-	-	-	-	-
CO4	3	-	3	1	1	2	-	-	-	-	-	-
CO5	3	-	3	1	1	2	-	-	-	-	-	-
3-High; 2-Medium; 1-Low												
Course designed by						Verified by						
 Signature of the Faculty member						 Signature of the Chairperson-BoS						
<b>R. VINOOTAKUMAR</b> <b>Ap/Mechanical Engineering</b> Name and Department of the Faculty Member						<b>Dr. M. SANTHOSH</b> Professor and Head Department of Mechanical Engineering Nehru Institute of Engineering and Technology Coimbatore - 641 105, Tamilnadu, India. Name and Seal of the Chairperson-BoS						



Course Code	Title					
P23MG01	DISASTER MANAGEMENT					
Semester: III	L	T	P	Credits	CIA: 40 Marks	ESE: 60 Marks
	3	0	0	3		
Course pre-requisites		Engineering disasters				
Course Objectives						
1	Summarize basics of disaster					
2	Explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.					
3	Illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.					
4	Describe an understanding of standards of humanitarian response and practical relevance inspecific types of disasters and conflict situations.					
5	Develop the strengths and weaknesses of disaster management approaches					
Course Category		Professional Core Courses (PCC)				
Development Needs		Global / National				
Course Description: Disaster Management is a comprehensive course that examines the principles, strategies, and practices for mitigating, preparing for, responding to, and recovering from disasters.						
Course Content						
Unit	Description					
I	<b>INTRODUCTION</b> Disaster: Definition, Factors and Significance; Difference between Hazard And Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude					
						<b>Contact Periods</b>
II	<b>REPERCUSSIONS OF DISASTERS AND HAZARDS</b> 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.					
						<b>Contact Periods</b>
III	<b>DISASTER PRONE AREAS IN INDIA</b> 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					
						<b>Contact Periods</b>

IV	<b>DISASTER PREPAREDNESS AND MANAGEMENT</b>	
	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 Community Preparedness.	
		<b>Contact Periods</b>
		<b>9</b>
V	<b>RISK ASSESSMENT</b>	
	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	
		<b>Contact Periods</b>
		<b>9</b>
		<b>Total Periods</b>
		<b>45</b>
<b>Course Outcomes</b>		
Upon Successful Completion of the course, students will be able to:		
<b>CO 1</b>	Ability to summarize basics of disaster	
<b>CO 2</b>	Ability to explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.	
<b>CO 3</b>	Ability to illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.	
<b>CO 4</b>	Ability to describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.	
<b>CO 5</b>	Ability to develop the strengths and weaknesses of disaster management approaches	
<b>Text Books</b>	1. Goel S. L., Disaster Administration And Management Text And Case Studies", Deep & Deep Publication Pvt. Ltd., New Delhi, 2009.	
<b>Reference Books</b>	1. Nishitha Rai, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "New Royal book Company, 2007. 2. Sahni, Pardeep Et. Al. ," Disaster Mitigation Experiences And Reflections", Prentice Hall of India, New Delhi, 2001.	

Tools for Assessment (40 Marks)												
CIA I		CIA II		CIA III		Assignment/ Seminar/ Case study				Attendance	Total	
10		10		10		5				5	40	
Mapping												
CO \ PO	PO1	PO 2	PO 3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	3	1	1	2	-	-	-	-	-	-
CO2	3	-	3	1	1	2	-	-	-	-	-	-
CO3	3	-	3	1	1	2	-	-	-	-	-	-
CO4	3	-	3	1	1	2	-	-	-	-	-	-
CO5	3	-	3	1	1	2	-	-	-	-	-	-
3-High; 2-Medium; 1-Low												
Course designed by						Verified by						
 Signature of the Faculty member						 Signature of the Chairperson-BoS						
<b>R VINOTHKUMAR</b> <b>AP / Mechanical Engineering</b> Name and Department of the Faculty Member						<b>Dr. M. SANTHOSH</b> <b>Professor and Head</b> <b>Department of Mechanical Engineering</b> <b>Nehru Institute of Engineering and Technology</b> <b>Coimbatore - 641 105, Tamil Nadu</b> Name and Seal of the Chairperson-BoS						

Course Code		Title				
P23MC03		CONSTITUTION OF INDIA				
Semester: III	L	T	P	Credits	CIA: 40 Marks	ESE: 60 Marks
	3	0	0	3		
Course pre-requisites		INDIAN CIVIL RIGHTS				
Course Objectives						
1	Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.					
2	To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional Role and entitlement to civil and economic rights as well as the emergence nation hood in the early years of Indian nationalism.					
3	To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.					
Course Category		Professional Core Courses (PCC)				
Development Needs		Global / National				
Course Description: The Constitution of India course offers an in-depth study of the fundamental principles, structures, and provisions of the Indian Constitution.						
Course Content						
Unit	Description					
I	<b>HISTORY OF MAKING OF THE INDIAN CONSTITUTION</b> History, Drafting Committee, (Composition & Working)					
					Contact Periods	9
II	<b>PHILOSOPHY OF THE INDIAN CONSTITUTION</b> Preamble, Salient Features					
					Contact Periods	9
III	<b>CONTOURS OF CONSTITUTIONAL RIGHTS AND DUTIES</b> Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.					
					Contact Periods	9
IV	<b>ORGANS OF GOVERNANCE</b> Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.					
					Contact Periods	9

V	<p><b>LOCAL ADMINISTRATION</b></p> <p>District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO, Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy(Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.</p>
VI	<p><b>ELECTION COMMISSION</b></p> <p>Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners - Institute and Bodies for the welfare of SC/ST/OBC and women.</p>
<b>Contact Periods</b>	
9	
<b>Total Periods</b>	
30	
<b>Course Outcomes</b>	
<b>Upon Successful Completion of the course, students will be able to:</b>	
<b>CO 1</b>	Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
<b>CO 2</b>	Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
<b>CO 3</b>	Discuss the conceptualization of social reforms leading to revolution in India.
<b>CO 4</b>	Discuss the circumstances surrounding the foundation of the Congress Socialist Party[CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
<b>CO 5</b>	Discuss the passage of the Hindu Code Bill of 1956.
<b>Text Books</b>	<ol style="list-style-type: none"> <li>1. The Constitution of India, 1950(Bare Act), Government Publication.</li> <li>2. Dr.S.N.Busi, Dr.B. R.Ambedkar framing of Indian Constitution, 1st Edition, 2015.</li> </ol>
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. M.P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.</li> <li>2. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.</li> </ol>



Tools for Assessment (40 Marks)												
CIA I	CIA II		CIA III			Assignment/ Seminar/ Case study				Attendance	Total	
10	10		10			5				5	40	
Mapping												
CO \ PO	PO1	PO 2	PO 3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	1	2	2	-	-	-	-	-	-
CO2	3	3	1	1	2	2	-	-	-	-	-	-
CO3	3	3	1	1	2	2	-	-	-	-	-	-
CO4	3	3	1	1	2	2	-	-	-	-	-	-
CO5	3	3	1	1	2	2	-	-	-	-	-	-
3-High; 2-Medium; 1-Low												
Course designed by						Verified by						
 Signature of the Faculty member						 Signature of the Chairperson-BoS						
<b>R VINOTHKUMAR</b> <b>AP / Mechanical Engineering</b> Name and Department of the Faculty Member						<b>Dr. M. SANTHOSH</b> <b>Professor and Head</b> <b>Department of Mechanical Engineering</b> <b>Nehru Institute of Engineering and Technology</b> <b>Coimbatore - 641 105, Tamilnadu, India.</b> Name and Seal of the Chairperson-BoS						

Course Code	Title						
P23MC04	நற் றமிழ் இலக்கியம்						
Semester: III	L	T	P	Credits	CIA: 40 Marks	ESE: 60 Marks	
	3	0	0	3			
Course pre-requisites	Tamil						
Course Category	Professional Core Courses (PCC)						
Development Needs	Global / National						
Course Description:	This course describes about Tamil Literature.						
Course Content							
Unit	Description						
I	சங்க இலக்கியம்						
	1. தமிழின் துவக்க நூல் ததொல்கொப்பியம் – எழுத்து, த ால், தபொருள் 2. அகநொனூறு (82) - இயற்கக இன்னிக அரங்கம் 3. குறிஞ்சிப் பொட்டின் மலரக் ்கொட்சி 4. புறநொனூறு (95,195) - பபொகர நிறுத்திய ஒளகவயொர						
						Contact Periods	6
II	அறநநறித் தமிழ்						
	1. அறநநறி வகுத்த திருவள்ளுவர் - அறம் வலியுறுத்தல், அன்புகடகம, ஒப்புரவறிதல், ஈகக, புகழ் 2. பிற அறநூல்கள் - இலக்கிய மருந்து – ஏலொதி, சிறுபஞ் மூலம், திரிகடுகம், ஆ ாரக்பகொகவ (தூய்கமகய வலியுறுத்தும் நூல் )						
						Contact Periods	6

III	<p><b>இரட்டடக் காப்பியங்கள்</b></p> <p>1. கண்ணகியின் புரட்சி</p> <p>- சிலப்பதிகார வழக்குகர கொகத</p> <p>முகப கவ இலக்கியம் மணிபமககல</p> <p>- சிகறக்பகொட்டம் அறக்பகொட்டமொகிய கொகத</p>
Contact Periods	
6	
IV	<p><b>அருள்நநறித் தமிழ்</b></p> <p>1. சிறுபொணொற்றுப்பகட</p> <p>- பொரி முல்கலக்குத் பதர்த் தகொடுத்தது, பபகன் மயிலுக்குத் பபொரக் வ</p> <p>தகொடுத்தது, அதியமொன் ஒளகவக்கு தநல்லிக்கனி தகொடுத்தது, அரர்த் பண் புகள்</p> <p>2. நற்றிகண</p> <p>- அன்கனக்குரிய புன்கன சிறப்பு</p> <p>3. திருமந்திரம் (617, 618)</p> <p>- இயமம் நியமம் விதிகள்</p> <p>4. தரம்த் ாகலகய நிறுவிய வள்ளலொர்த்</p> <p>5. புறநொனூறு</p> <p>- சிறுவபன வள்ளலொனொன்</p> <p>6. அகநொனூறு (4) - வண் டு</p> <p>நற்றிகண (11) - நண் டு</p> <p>கலித்ததொகக (11) - யொகன, புறொ</p> <p>ஐந்திகண 50 (27) - மொன்</p> <p>ஆகியகவ பற்றிய தய்திகள்</p>

		Contact Periods	9
V	நவீன தமிழ் இலக்கியம்		
	1. உகரநகடத் தமிழ்,		
	- தமிழின் முதல் புதினம்,		
	- தமிழின் முதல் சிறுகதை,		
	- கட்டுகர இலக்கியம்,		
	- பயண இலக்கியம்,		
	- நொடகம்,		
2. நொட்டு விடுதகல பபொரொட்டமும் தமிழ் இலக்கியமும்,			
3. முதொய விடுதகலயும் தமிழ் இலக்கியமும்,			
4. தபண் விடுதகலயும் விளிம்பு நிகலயினரின் பமம்பொட்டில் தமிழ் இலக்கியமும்,			
5. அறிவியல் தமிழ்,			
6. இகணயத்தில் தமிழ்,			
7. சுற்று தீழல் பமம்பொட்டில் தமிழ் இலக்கியம்			
		Contact Periods	9
		Total Periods	45
<b>Course Outcomes</b>			
Upon Successful Completion of the course, students will be able to:			
Text Books	1. தமிழ் இகணய கல்விக்கழகம் (Tamil Virtual University) - <a href="http://www.tamilvu.org">www.tamilvu.org</a> 2. தமிழ் விக்கிப்பீடியொ (Tamil Wikipedia) - <a href="https://ta.wikipedia.org">https://ta.wikipedia.org</a> தரம் புர ஆதீன தவளியீடு 3. வெழ்வியல் களஞ்சியம் - தமிழ்ப் பல்கலக்கழகம் , தஞ்செர் ொவூர		



Reference Books	1. தமிழ்க்கலக் களஞ்சியம் - தமிழ் வளர்ச்சித் துகற (thamilvalarchithurai.com) அறிவியல் களஞ்சியம் - தமிழ்ப் பல்கலைக்கழகம், தஞ்சை
-----------------	---

Tools for Assessment (40 Marks)												
CIA I	CIA II		CIA III			Assignment/ Seminar/ Case study				Attendance	Total	
10	10		10			5				5	40	
Mapping												
CO \ PO	PO1	PO 2	PO 3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	1	2	2	-	-	-	-	-	-
CO2	3	3	1	1	2	2	-	-	-	-	-	-
CO3	3	3	1	1	2	2	-	-	-	-	-	-
CO4	3	3	1	1	2	2	-	-	-	-	-	-
CO5	3	3	1	1	2	2	-	-	-	-	-	-
3-High; 2-Medium; 1-Low												
Course designed by						Verified by						
 Signature of the Faculty member						 Signature of the Chairperson-BoS						
A.C RAMKUMAR, (Asst) Mechanical Engineering Name and Department of the Faculty Member						<b>Dr. M. SANTHOSH</b> Professor and Head Department of Mechanical Engineering Nehru Institute of Engineering and Technology Coimbatore - 641 105, Tamilnadu, India. Name and Seal of the Chairperson-BoS						

## Open Electives

Course Code		Title				
P23CCO01		SUSTAINABLE MANAGEMENT				
	L	T	P	Credits	CIA: 40 Marks	ESE: 60 Marks
	3	0	0	3		
Course pre-requisites		Engineering design				
Course Objectives						
1	An understanding of sustainability management as an approach to aid in evaluating and minimizing environmental impacts while achieving the expected social impact.					
2	An understanding of corporate sustainability and responsible Business Practices					
3	Knowledge and skills to understand, to measure and interpret sustainability performances					
4	Knowledge of innovative practices in sustainable business and community management					
5	Deep understanding of sustainable management of resources and commodities					
Course Category		Professional Core Courses (PCC)				
Development Needs		Global / National				
Course Description: Sustainable Management is a comprehensive course that explores the principles, practices, and challenges of sustainable business operations.						
Course Content						
Unit	Description					
I	<b>MANAGEMENT OF SUSTAINABILITY</b> Management of sustainability -rationale and political trends: An introduction to sustainability management, International and European policies on sustainable development, theoretical pillars in sustainability management studies.					
						Contact Periods
II	<b>CORPORATE SUSTAINABILITY AND RESPONSIBILITY</b> Corporate sustainability parameter, corporate sustainability institutional framework, integration of sustainability into strategic planning and regular business practices, fundamentals of stakeholder engagement.					
						Contact Periods
III	<b>SUSTAINABILITY MANAGEMENT: STRATEGIES AND APPROACHES</b> Corporate sustainability management and competitiveness: Sustainability-oriented corporate strategies, markets and competitiveness, Green Management between theory and practice, Sustainable Consumption and Green Marketing strategies, Environmental regulation and strategic postures; Green Management approaches and tools; Green engineering: clean technologies and innovation processes; Sustainable Supply Chain Management and Procurement.					
						Contact Periods


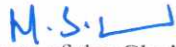
<b>SUSTAINABILITY AND INNOVATION</b>	
IV	Socio-technical transitions and sustainability, Sustainable entrepreneurship, Sustainable pioneers in green market niches, Smart communities and smart specializations.
<b>Contact Periods</b>	
<b>9</b>	
<b>SUSTAINABLE MANAGEMENT OF RESOURCES, COMMODITIES AND COMMONS</b>	
V	Energy management, Water management, Waste management, Wild Life Conservation, Emerging trends in sustainable management, Case Studies.
<b>Contact Periods</b>	
<b>9</b>	
<b>Total Periods</b>	
<b>45</b>	
<b>Course Outcomes</b>	
<b>Upon Successful Completion of the course, students will be able to:</b>	
<b>CO 1</b>	An understanding of sustainability management as an approach to aid in evaluating and minimizing environmental impacts while achieving the expected social impact.
<b>CO 2</b>	An understanding of corporate sustainability and responsible Business Practices
<b>CO 3</b>	Knowledge and skills to understand, to measure and interpret sustainability performances
<b>CO 4</b>	Knowledge of innovative practices in sustainable business and community management
<b>CO 5</b>	Deep understanding of sustainable management of resources and commodities
<b>Text Books</b>	<ol style="list-style-type: none"> <li>1. Daddi, T., Iraldo, F., Testa, Environmental Certification for Organizations and Products: Management, 2015</li> <li>2. Christian N. Madu, Handbook of Sustainability Management 2012</li> </ol>
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Petra Molthan-Hill, The Business Student's Guide to Sustainable Management: Principles and Practice, 2014</li> <li>2. Margaret Robertson, Sustainability Principles and Practice, 2014 Peter Rogers, An Introduction to Sustainable Development, 2006</li> </ol>

Tools for Assessment (40 Marks)												
CIA I		CIA II			CIA III		Assignment/ Seminar/ Case study				Attendance	Total
10		10			10		5				5	40
Mapping												
CO \ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												
3-High; 2-Medium; 1-Low												
Course designed by						Verified by						
 Signature of the Faculty member						 Signature of the Chairperson-BoS						
<b>R VINOTHKUMAR</b> <b>AP / Mechanical Engineering</b> Name and Department of the Faculty Member						<b>Dr. M. SANTHOSH</b> <b>Professor and Head</b> <b>Department of Mechanical Engineering</b> <b>Nehru Institute of Engineering and Technology</b> <b>Coimbatore - 641 105, Tamilnadu, India</b> Name and Seal of the Chairperson-BoS						

Course Code		Title				
P23CCO02		RENEWABLE ENERGY TECHNOLOGY				
	L	T	P	Credits	CIA: 40 Marks	ESE: 60 Marks
	3	0	0	3		
Course pre-requisites		Renewable energy sources				
Course Objectives						
1	To demonstrate the need for renewable energy sources.					
2	To develop a stand-alone photo voltaic system and implement a maximum power point tracking in the PV system.					
3	To design a stand-alone and Grid connected PV system.					
4	To analyse the different configurations of the wind energy conversion systems.					
5	To realize the basic of various available renewable energy sources					
Course Category		Professional Core Courses (PCC)				
Development Needs		Global / National				
Course Description: Renewable Energy Technology is an interdisciplinary course focusing on the principles, applications, and advancements in renewable energy sources and systems.						
Course Content						
Unit	Description					
I	<b>INTRODUCTION</b> 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 - CO2 Emission - importance of renewable energy sources, Potentials – Achievements– Applications.					
						<b>Contact Periods</b>
II	<b>SOLAR PHOTOVOLTAICS</b> 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.					
						<b>Contact Periods</b>
III	<b>PHOTOVOLTAIC SYSTEM DESIGN</b> 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.					
						<b>Contact Periods</b>



WIND ENERGY CONVERSION SYSTEMS	
<b>IV</b>	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.
<b>Contact Periods</b>	
<b>9</b>	
OTHER RENEWABLE ENERGY SOURCES	
<b>V</b>	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.
<b>Contact Periods</b>	
<b>9</b>	
<b>Total Periods</b>	
<b>45</b>	
Course Outcomes Upon Successful Completion of the course, students will be able to:	
<b>CO 1</b>	Demonstrate the need for renewable energy sources.
<b>CO 2</b>	Develop a stand-alone photo voltaic system and implement a maximum power point tracking in the PV system
<b>CO 3</b>	Design a stand-alone and Grid connected PV system.
<b>CO 4</b>	Analyze the different configurations of the wind energy conversion systems.
<b>CO 5</b>	Realize the basic of various available renewable energy sources
<b>Text Books</b>	<ol style="list-style-type: none"> <li>1. S.N.Bhadra, D. Kastha, &amp; S. Banerjee "Wind Electrical Systems", Oxford University Press, 2009.</li> <li>2. Rai. G.D, "Non conventional energy sources", Khanna publishes, 1993.</li> <li>3. Rai. G.D," Solar energy utilization", Khanna publishes, 1993.</li> </ol>
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Chetan Singh Solanki, "Solar Photovoltaics: Fundamentals, Technologies and Applications",</li> <li>2. PHI Learning Private Limited, 2012.</li> <li>3. John Twideu and Tony Weir, "Renewal Energy Resources" BSP Publications, 2006</li> <li>4. Gray, L. Johnson, "Wind energy system", prentice hall of India, 1995. B.H.Khan, " Non-conventional Energy sources", , McGraw-hill, 2nd Edition, 2009.</li> <li>5. Fang Lin Luo Hong Ye, " Renewable Energy systems", Taylor &amp; Francis roup,2013.</li> </ol>

**Tools for Assessment (40 Marks)**

CIA I		CIA II		CIA III		Assignment/ Seminar/ Case study				Attendance	Total	
10		10		10		5				5	40	
Mapping												
CO \ PO	PO1	PO 2	PO 3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	1	2	2	-	-	-	-	-	-
CO2	3	3	1	1	2	2	-	-	-	-	-	-
CO3	3	3	1	1	2	2	-	-	-	-	-	-
CO4	3	3	1	1	2	2	-	-	-	-	-	-
CO5	3	3	1	1	2	2	-	-	-	-	-	-
3-High; 2-Medium; 1-Low												
Course designed by						Verified by						
 Signature of the Faculty member						 Signature of the Chairperson-BoS						
<b>RVINOTHKAR</b> <b>A.P / Mechanical Engineering</b> Name and Department of the Faculty Member						<b>Dr. M. SANTHOSH</b> <b>Professor and Head</b> <b>Department of Mechanical Engineering</b> <b>Yehru Institute of Engineering and Technology</b> <b>Coimbatore - 641 105, Tamil Nadu, India</b> Name and Seal of the Chairperson-BoS						


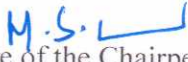
Course Code		Title				
P23CCO03		NANOCOMPOSITE MATERIALS				
	L	T	P	Credits	CIA: 40 Marks	ESE: 60 Marks
	3	0	0	3		
Course pre-requisites		Composite materials				
Course Objectives						
1	To understand the basics of Nanocomposites					
2	To develop knowledge on metal nanocomposites					
3	To design polymer and nanocomposites.					
4	To analyse nanocomposite with biomaterials.					
5	To realize the nanocomposite technology.					
Course Category		Professional Core Courses (PCC)				
Development Needs		Global / National				
Course Description: Nano composite Materials is an advanced course that delves into the synthesis, characterization, and applications of nano composites in materials science and engineering.						
Course Content						
Unit	Description					
I	<b>BASICS OF NANOCOMPOSITES</b> Nomenclature, Properties, features and processing of nano composites. Sample Preparation and Characterization of Structure and Physical properties. Designing, stability and mechanical properties and applications of super hard nano composites.					
						<b>Contact Periods</b>
II	<b>METAL BASED NANOCOMPOSITES</b> Metal-metal nano composites, some simple preparation techniques and their properties. Metal- Oxide or Metal-Ceramic composites, Different aspects of their preparation techniques and their final properties and functionality. Fractal based glass-metal nano composites, its designing and fractal dimension analysis. Core-Shell structured nano composites					
						<b>Contact Periods</b>
III	<b>POLYMER BASED NANOCOMPOSITES</b> Preparation and characterization of di block Copolymer based nano composites; Polymer Carbon nanotubes based composites, their mechanical properties, and industrial possibilities.					
						<b>Contact Periods</b>
IV	<b>NANOCOMPOSITE FROM BIOMATERIALS</b> Natural nano composite systems - spider silk, bones, shells; organic-inorganic nano composite formation through self-assembly. Biomimetic synthesis of nanocomposites					

	material; Use of synthetic nano composites for bone, teeth replacement
	<b>Contact Periods</b> <b>9</b>
<b>V</b>	<p><b>NANOCOMPOSITE TECHNOLOGY</b></p> <p>Nanocomposite membrane structures- Preparation and applications. Nanotechnology in Textiles and Cosmetics-Nano-fillers embedded polypropylene fibers – Soil repellence, Lotus effect - Nano finishing in textiles (UV resistant, anti-bacterial, hydrophilic, self-cleaning, flame retardant finishes), Sun-screen dispersions for UV protection using titanium oxide – Colour cosmetics. Nanotechnology in Food Technology - Nanopackaging for enhanced shelf life - Smart/Intelligent packaging</p>
	<b>Contact Periods</b> <b>9</b>
	<b>Total Periods</b> <b>45</b>
<b>Course Outcomes</b>	
<b>Upon Successful Completion of the course, students will be able to:</b>	
<b>CO 1</b>	Understand the basics of Nanocomposites
<b>CO 2</b>	Develop knowledge on metal nanocomposites
<b>CO 3</b>	Design polymer and nanocomposites.
<b>CO 4</b>	Analyse nanocomposite with biomaterials.
<b>CO 5</b>	Realize the nanocomposite technology.
<b>Text Books</b>	<ol style="list-style-type: none"> <li>1. Introduction to Nanocomposite Materials. Properties, Processing, Characterization-Thomas E.Twardowski. 2007. DEStech Publications. USA.</li> <li>2. Nanocomposites Science and Technology - P. M. Ajayan, L.S. Schadler, P. V.Braun 2006.</li> </ol>
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Physical Properties of Carbon Nanotubes- R. Saito 1998.</li> <li>2. Carbon Nanotubes (Carbon , Vol 33) - M. Endo, S. Iijima, M.S. Dresselhaus 1997.</li> <li>3. The search for novel, superhard materials- Stan Veprjek (Review Article) JVST A, 1999</li> <li>4. Nanometer versus micrometer-sized particles-Christian Brosseau, Jamal BeN Youssef, Philippe</li> <li>5. Talbot, Anne-Marie Konn, (Review Article) J. Appl. Phys, Vol 93, 2003</li> <li>6. Diblock Copolymer, - Aviram (Review Article), Nature, 2002</li> <li>7. Bikramjit Basu, Kantesh Balani Advanced Structural Ceramics, A John Wiley &amp; Sons, Inc.,</li> <li>8. P. Brown and K. Stevens, Nanofibers and Nanotechnology in Textiles, Woodhead publication, London, 2006</li> </ol>

Tools for Assessment (40 Marks)												
CIA I		CIA II		CIA III		Assignment/ Seminar/ Case study				Attendance		Total
10		10		10		5				5		40
Mapping												
CO \ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	2	1	2	2	-	-	-	-	-	-
CO2	3	1	2	1	2	2	-	-	-	-	-	-
CO3	3	1	2	1	2	2	-	-	-	-	-	-
CO4	3	1	2	1	2	2	-	-	-	-	-	-
CO5	3	1	2	1	2	2	-	-	-	-	-	-
3-High; 2-Medium; 1-Low												
Course designed by						Verified by						
 Signature of the Faculty member						 Signature of the Chairperson-BoS						
<b>RVINOTHKUMAR</b> <b>AP / Mechanical Engineering</b> Name and Department of the Faculty Member						<b>Dr. M. SANTHOSH</b> <b>Professor and Head</b> <b>Department of Mechanical Engineering</b> <b>Nehru Institute of Engineering and Technology</b> <b>Coimbatore - 641 406, Tamil Nadu, India</b> Name and Seal of the Chairperson-BoS						

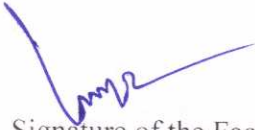

Course Code		Title				
P23CCO04		IPR, BIOSAFETY AND ENTREPRENEURSHIP				
	L	T	P	Credits	CIA: 40 Marks	ESE: 60 Marks
	3	0	0	3		
Course pre-requisites		Basics of Patents				
Course Objectives						
1	To understand the basics of IPR					
2	To develop knowledge on patent filing procedures					
3	To understand biosafety guidelines.					
4	To analyse genetically modified organisms					
5	To realize the entrepreneurship development.					
Course Category		Professional Core Courses (PCC)				
Development Needs		Global / National				
Course Description: IPR, Biosafety, and Entrepreneurship is an interdisciplinary course that explores the intersections of intellectual property rights (IPR), biosafety regulations, and entrepreneurial ventures in the biotechnology and life sciences industries.						
Course Content						
Unit	Description					
I	<b>IPR</b> Intellectual property rights – Origin of the patent regime – Early patents act & Indian pharmaceutical industry – Types of patents – Patent Requirements – Application preparation filing and prosecution – Patentable subject matter – Industrial design, Protection of GMO's IP as a factor in R&D, IP's of relevance to biotechnology and few case studies.					
<b>Contact Periods</b>						9
II	<b>AGREEMENTS, TREATIES AND PATENT FILING PROCEDURES</b> History of GATT Agreement – Madrid Agreement – Hague Agreement – WIPO Treaties – Budapest Treaty – PCT – Ordinary – PCT – Conventional – Divisional and Patent of Addition – Specifications – Provisional and complete – Forms and fees Invention in context of "prior art" – Patent databases – Searching International Databases – Country-wise patent searches (USPTO, espacenet(EPO) – PATENT Scope (WIPO) – IPO, etc National & PCT filing procedure – Time frame and cost – Status of the patent applications filed – Precautions while patenting – disclosure/non-disclosure – Financial assistance for patenting – Introduction to existing schemes Patent licensing and agreement Patent infringement – Meaning, scope, litigation, case studies					
<b>Contact Periods</b>						9
III	<b>BIOSAFETY</b> Introduction – Historical Background – Introduction to Biological Safety Cabinets –					

	Primary Containment for Biohazards – Biosafety Levels – Biosafety Levels of Specific Microorganisms – Recommended Biosafety Levels for Infectious Agents and Infected Animals – Biosafety guidelines – Government of India.	<b>Contact Periods</b>	<b>9</b>
<b>IV</b>	<b>GENETICALLY MODIFIED ORGANISMS</b> Definition of GMOs & LMOs – Roles of Institutional Biosafety Committee – RCGM – GEAC etc. for GMO applications in food and agriculture – Environmental release of GMOs – Risk Analysis – Risk Assessment – Risk management and communication – Overview of National Regulations and relevant International Agreements including Cartagena Protocol.	<b>Contact Periods</b>	<b>9</b>
<b>V</b>	<b>ENTREPRENEURSHIP DEVELOPMENT</b> Introduction – Entrepreneurship Concept – Entrepreneurship as a career – Entrepreneurial personality – Characteristics of successful Entrepreneur – Factors affecting entrepreneurial growth – Entrepreneurial Motivation – Competencies – Mobility – Entrepreneurship Development Programmes (EDP) - Launching Of Small Enterprise - Definition, Characteristics – Relationship between small and large units – Opportunities for an Entrepreneurial career – Role of small enterprise in economic development – Problems of small scale industries – Institutional finance to entrepreneurs - Institutional support to entrepreneurs.	<b>Contact Periods</b>	<b>9</b>
		<b>Total Periods</b>	<b>45</b>
<b>Course Outcomes</b>			
<b>Upon Successful Completion of the course, students will be able to:</b>			
<b>CO 1</b>	Understand the basics of IPR		
<b>CO 2</b>	Develop knowledge on patent filing procedures		
<b>CO 3</b>	Understand biosafety guidelines.		
<b>CO 4</b>	Analyse genetically modified organisms		
<b>CO 5</b>	Realize the entrepreneurship development.		
<b>Text Books</b>	1. Bouchoux, D.E., “Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets for the Paralegal”, 3rd Edition, Delmar Cengage Learning, 2008. 2. Fleming, D.O. and Hunt, D.L., “Biological Safety: Principles and Practices”, 4th Edition, American Society for Microbiology, 2006.		

Reference Books	1. Irish, V., "Intellectual Property Rights for Engineers", 2nd Edition, The Institution of Engineering and Technology, 2005. 2. Mueller, M.J., "Patent Law", 3rd Edition. Wolters Kluwer Law & Business, 2009. 3. Young, T., "Genetically Modified Organisms and Biosafety: A Background Paper for DecisionMakers and Others to Assist in Consideration of GMO Issues" 1st Edition, World Conservation Union, 2004. 4. S.S Khanka, "Entrepreneurial Development", S.Chand & Company LTD, New Delhi, 2007.											
	<b>Tools for Assessment (40 Marks)</b>											
CIA I	CIA II			CIA III		Assignment/ Seminar/ Case study				Attendance	Total	
10	10			10		5				5	40	
<b>Mapping</b>												
CO \ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	2	1	2	-	-	-	-	-	-
CO2	1	2	1	2	1	2	-	-	-	-	-	-
CO3	1	2	1	2	1	2	-	-	-	-	-	-
CO4	1	2	1	2	1	2	-	-	-	-	-	-
CO5	1	2	1	2	1	2	-	-	-	-	-	-
<b>3-High; 2-Medium; 1-Low</b>												
<b>Course designed by</b>						<b>Verified by</b>						
 Signature of the Faculty member						 Signature of the Chairperson-BoS						
<b>R VINOTHKUMAR</b> <b>AP/Mechanical Engineering</b> Name and Department of the Faculty Member						<b>Dr. M. SANTHOSH</b> Professor and Head Department of Mechanical Engineering Nehru Institute of Engineering and Technology Coimbatore - 641 105, Tamilnadu, India Name and Seal of the Chairperson-BoS						

Course Code		Title					
P23CC005		ENVIRONMENTAL SUSTAINABILITY					
	L	T	P	Credits	CIA: 40 Marks	ESE: 60 Marks	
	3	0	0	3			
Course pre-requisites		Sustainability in Engineering					
Course Objectives							
1	To understand the environmental concepts						
2	To develop knowledge on concept of sustainability						
3	To understand biodiversity.						
4	To analyse pollution impacts						
5	To realize the environmental economics.						
Course Category		Professional Core Courses (PCC)					
Development Needs		Global / National					
Course Description: Environmental Sustainability is a multidisciplinary course that examines the principles, challenges, and strategies for achieving sustainability in environmental management and conservation.							
Course Content							
Unit	Description						
I	<b>INTRODUCTION</b>						
	Valuing the Environment: Concepts, Valuing the Environment: Methods, Property Rights, Externalities, and Environmental Problems						
						<b>Contact Periods</b>	<b>9</b>
II	<b>CONCEPT OF SUSTAINABILITY</b>						
	Sustainable Development: Defining the Concept, the Population Problem, Natural Resource Economics: An Overview, Energy, Water, Agriculture						
						<b>Contact Periods</b>	<b>9</b>
III	<b>SIGNIFICANCE OF BIODIVERSITY</b>						
	Biodiversity, Forest Habitat, Commercially Valuable Species, Stationary - Source Local Air Pollution, Acid Rain and Atmospheric Modification, Transportation						
						<b>Contact Periods</b>	<b>9</b>
IV	<b>POLLUTION IMPACTS</b>						
	Water Pollution, Solid Waste and Recycling, Toxic Substances and Hazardous Wastes, Global Warming.						
						<b>Contact Periods</b>	<b>9</b>
V	<b>ENVIRONMENTAL ECONOMICS</b>						
	Development, Poverty, and the Environment, Visions of the Future, Environmental economics and policy by Tom Tietenberg, Environmental Economics						

		<b>Contact Periods</b>	<b>9</b>
		<b>Total Periods</b>	<b>45</b>
<b>Course Outcomes</b>			
<b>Upon Successful Completion of the course, students will be able to:</b>			
<b>CO 1</b>	Understand the environmental concepts		
<b>CO 2</b>	Develop knowledge on concept of sustainability		
<b>CO 3</b>	Understand biodiversity.		
<b>CO 4</b>	Analyse pollution impacts		
<b>CO 5</b>	Realize the environmental economics.		
<b>Text Books</b>	<ol style="list-style-type: none"> <li>1. Andrew Hoffman, Competitive Environmental Strategy - A Guide for the Changing Business Landscape, Island Press.</li> <li>2. Stephen Doven, Environment and Sustainability Policy: Creation, Implementation, Evaluation, the Federation Press, 2005</li> </ol>		
<b>Reference Books</b>	<ol style="list-style-type: none"> <li>1. Robert Brinkmann., Introduction to Sustainability, Wiley-Blackwell., 2016</li> <li>2. Niko Roorda., Fundamentals of Sustainable Development, 3rd Edn, Routledge, 2020</li> <li>3. Bhavik R Bakshi., Sustainable Engineering: Principles and Practice, Cambridge University Press, 2019</li> </ol>		

Tools for Assessment (40 Marks)												
CIA I		CIA II		CIA III		Assignment/ Seminar/ Case study				Attendance		Total
10		10		10		5				5		40
Mapping												
CO \ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	2	1	2	1	-	2	-	-	-	-	-
CO2	-	2	1	2	1	-	2	-	-	-	-	-
CO3	-	2	1	2	1	-	2	-	-	-	-	-
CO4	-	2	1	2	1	-	2	-	-	-	-	-
CO5	-	2	1	2	1	-	2	-	-	-	-	-
3-High; 2-Medium; 1-Low												
Course designed by						Verified by						
 Signature of the Faculty member						 Signature of the Chairperson-BoS						
<b>A. C. RAMKUMAR, AD (G)</b> <b>Mechanical Engineering</b> Name and Department of the Faculty Member						<b>Dr. M. SANTHOSH</b> <b>Professor and Head</b> <b>Department of Mechanical Engineering</b> <b>Nehru Institute of Engineering and Technology</b> <b>Coimbatore - 641 105</b> Name and Seal of the Chairperson-BoS						