

**ANNA UNIVERSITY, CHENNAI**  
**NON- AUTONOMOUS COLLEGES AFFILIATED TO ANNA UNIVERSITY**  
**M.E. MANUFACTURING ENGINEERING**  
**REGULATIONS 2021**  
**CHOICE BASED CREDIT SYSTEM**  
**I TO IV SEMESTERS CURRICULA AND I SEMESTER SYLLABUS**

**SEMESTER I**

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
<b>THEORY</b>								
1.	MA4155	Applied Probability and Statistics for Manufacturing Engineering	FC	3	1	0	4	4
2.	MF4101	Advances in Manufacturing Processes	PCC	3	0	0	3	3
3.	MF4102	Advances in Casting and Welding	PCC	3	0	0	3	3
4.	MF4103	Theory of Metal Cutting	PCC	3	0	0	3	3
5.	CM4151	Computer Aided Manufacturing	PCC	3	0	0	3	3
6.	RM4151	Research Methodology and IPR	RMC	2	0	0	2	2
7.		Audit Course – I*	AC	2	0	0	2	0
<b>PRACTICALS</b>								
8.	MF4111	CAD/CAM Laboratory	PCC	0	0	4	4	2
9.	MF4112	Technical Seminar	EEC	0	0	2	2	1
<b>TOTAL</b>				<b>19</b>	<b>1</b>	<b>6</b>	<b>26</b>	<b>21</b>

\* Audit Course is optional

**SEMESTER II**

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
<b>THEORY</b>								
1.	MF4201	Optimization Techniques in Manufacturing	PCC	3	0	0	3	3
2.	MF4202	Advances in Metrology and Inspection	PCC	3	0	0	3	3
3.	MF4203	Theory of Metal Forming	PCC	3	0	0	3	3
4.	MF4204	Additive Manufacturing	PCC	3	0	0	3	3
5.	MF4205	Fluid Power Automation	PCC	3	0	0	3	3
6.		Professional Elective I	PEC	3	0	0	3	3
7.		Professional Elective II	PEC	3	0	0	3	3
8.		Audit Course II*	AC	2	0	0	2	0
<b>PRACTICALS</b>								
9.	MF4211	Automation and Metal Forming Laboratory	PCC	0	0	3	3	1.5
10.	MF4212	Advanced Manufacturing Processes Laboratory	PCC	0	0	3	3	1.5
<b>TOTAL</b>				<b>23</b>	<b>0</b>	<b>6</b>	<b>29</b>	<b>24</b>

\* Audit Course is optional

**SEMESTER III**

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
<b>THEORY</b>								
1.		Professional Elective III	PEC	3	0	0	3	3
2.		Professional Elective IV	PEC	3	0	0	3	3
3.		Professional Elective V	PEC	3	0	0	3	3
4.		Open Elective	OEC	3	0	0	3	3
<b>PRACTICALS</b>								
5.	MF4311	Project Work I	EEC	0	0	12	12	6
<b>TOTAL</b>				<b>12</b>	<b>0</b>	<b>12</b>	<b>24</b>	<b>18</b>

**SEMESTER IV**

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
<b>PRACTICALS</b>								
1.	MF4411	Project Work II	EEC	0	0	24	24	12
<b>TOTAL</b>				<b>0</b>	<b>0</b>	<b>24</b>	<b>24</b>	<b>12</b>

**TOTAL CREDITS TO BE EARNED FOR THE AWARD OF THE DEGREE = 75**

PROGRESS THROUGH KNOWLEDGE

**PROFESSIONAL ELECTIVES FOR M.E. MANUFACTURING ENGINEERING**

**SEMESTER II, ELECTIVES - I & II**

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	MF4071	Design for Manufacture and Assembly	PEC	3	0	0	3	3
2.	MF4001	Micro Manufacturing	PEC	3	0	0	3	3
3.	MF4002	Quality and Reliability Engineering	PEC	3	0	0	3	3
4.	MF4003	Finite Element Methods for Manufacturing Engineering	PEC	3	0	0	3	3
5.	MF4004	Materials Management	PEC	3	0	0	3	3
6.	MF4005	Industrial Ergonomics	PEC	3	0	0	3	3
7.	MF4006	Polymers and Composite Materials	PEC	3	0	0	3	3
8.	AO4074	Non-Destructive Evaluation	PEC	3	0	0	3	3
9.	MF4007	Lean Manufacturing	PEC	3	0	0	3	3
10.	MF4008	Robot Design and Programming	PEC	3	0	0	3	3
11.	MF4009	MEMS and Nanotechnology	PEC	3	0	0	3	3
12.	CM4071	Green Manufacturing	PEC	3	0	0	3	3

**SEMESTER III, ELECTIVES - III, IV & V**

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	MF4010	Computer Aided Product Design	PEC	3	0	0	3	3
2.	MF4011	Process Planning and Cost Estimation	PEC	3	0	0	3	3
3.	MF4073	Manufacturing Management	PEC	3	0	0	3	3
4.	MF4012	Nanotechnology	PEC	3	0	0	3	3
5.	MF4013	Materials Testing and Characterization Techniques	PEC	3	0	0	3	3
6.	MF4014	Mechatronics	PEC	3	0	0	3	3
7.	MR4071	Internet of Things	PEC	3	0	0	3	3
8.	IS4071	Data Analytics	PEC	3	0	0	3	3
9.	CM4072	Manufacturing System Simulation	PEC	3	0	0	3	3

10.	PD4351	Product Lifecycle Management	PEC	3	0	0	3	3
11.	MF4015	Product Design and Development	PEC	3	0	0	3	3
12.	MF4016	Entrepreneurship Development	PEC	3	0	0	3	3
13.	MF4072	Industrial Safety	PEC	3	0	0	3	3
14.	MF4017	Advances in Materials	PEC	3	0	0	3	3
15.	MF4018	Artificial Intelligence	PEC	3	0	0	3	3
16.	MF4019	Smart Manufacturing and Industry 4.0	PEC	3	0	0	3	3



## AUDIT COURSES (AC)

Registration for any of these courses is optional to students

SL. NO	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			CREDITS
			L	T	P	
1.	AX4091	English for Research Paper Writing	2	0	0	0
2.	AX4092	Disaster Management	2	0	0	0
3.	AX4093	Constitution of India	2	0	0	0
4.	AX4094	நற்றமிழ் இலக்கியம்	2	0	0	0



**COURSE OBJECTIVES:**

1. To understand the basics of random variables with emphasis on the standard discrete and continuous distributions.
2. To understand the basic probability concepts with respect to two dimensional random variables along with the relationship between the random variables.
3. To apply the small and large sample tests through test of hypothesis.
4. To understand the basic concepts of sampling distributions and statistical properties of point estimators.
5. To understand the concept of analysis of variance and use it to investigate factorial dependence.

**UNIT I PROBABILITY AND RANDOM VARIABLES 12**

Probability – Axioms of probability – Conditional probability – Baye’s theorem - Random variables - Probability function – Moments – Moment generating functions and their properties – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions – Function of a random variable.

**UNIT II TWO DIMENSIONAL RANDOM VARIABLES 12**

Joint distributions – Marginal and conditional distributions – Functions of two dimensional random variables – Regression curve – Correlation.

**UNIT III TESTING OF HYPOTHESIS 12**

Sampling distributions - Type I and Type II errors - Tests based on Normal, t, Chi square and F distributions for testing of mean, variance and proportions – Tests for independence of attributes and goodness of fit.

**UNIT IV ESTIMATION THEORY 12**

Interval estimation for population mean - Standard deviation - Difference in means, proportion ratio of standard deviations and variances.

**UNIT V DESIGN OF EXPERIMENTS 12**

Completely randomized design – Randomized block design – Latin square design –  $2^2$  Factorial design.

**TOTAL: 60 PERIODS****COURSE OUTCOMES :**

At the end of the course, students will be able to

1. Analyze the performance in terms of probabilities and distributions achieved by the determined solutions.
2. Be familiar with some of the commonly encountered two dimensional random variables and be equipped for a possible extension to multivariate analysis.
3. Apply the basic principles underlying statistical inference(hypothesis testing).
4. Demonstrate knowledge of applicable large sample theory of estimators and tests.
5. Obtain a better understanding of the importance of the methods in modern industrial processes.

**REFERENCES :**

1. Devore, J. L., “Probability and Statistics for Engineering and Sciences”, 8<sup>th</sup> Edition, Cengage Learning, 2014.
2. Gupta S.C. and Kapoor V.K.,” Fundamentals of Mathematical Statistics”, 12<sup>th</sup> Edition, Sultan and Sons, New Delhi, 2020.
3. Johnson, R.A., Miller, I and Freund J., "Miller and Freund’s Probability and Statistics for Engineers", 9<sup>th</sup> Edition, Pearson Education, Asia, 2016.
4. Rice, J. A., "Mathematical Statistics and Data Analysis", 3<sup>rd</sup> Edition, Cengage Learning, 2015.
5. Ross, S. M., "Introduction to Probability and Statistics for Engineers and Scientists", 5<sup>th</sup> Edition, Elsevier, 2014.

**OBJECTIVES:**

1. To inculcate specialized knowledge and skill in advanced manufacturing processes using the principles and methods of engineering analysis and design.
2. To impart knowledge about the significance of controlling process parameters for the optimal performance for newly developed engineering materials used in industries and research organizations.
3. To impart knowledge about principles and criteria of yielding during forming of metals, analysis of different bulk metal forming processes following different analysis approach.
4. To give awareness of different techniques used in Micro and Nano manufacturing.
5. To introduce students the basics of /rapid prototyping and its applications in various fields, reverse engineering techniques

**UNIT I ENERGY ASSISTED MANUFACTURING PROCESSES 9**

Introduction – mechanism of materials removal and operating parameters of: Plasma Arc Machining – Laser Beam Machining – Electron Beam Machining – Electrical Discharge Machining – Ultrasonic Machining – Water Jet Machining – Abrasive water jet Machining – Abrasive jet Machining – Ion Beam Machining.

**UNIT II PRECISION MACHINING 9**

Electro chemical Machining- Ultra Precision turning and grinding- Chemical Mechanical Polishing (CMP) - ELID process – Partial ductile mode grinding-Ultra precision grinding- Binderless wheel – Free form optics. aspherical surface generation Grinding wheel- Design and selection of grinding wheel-High-speed grinding-High-speed milling- Diamond turning.

**UNIT III ADVANCES IN METAL FORMING 9**

Orbital forging, Isothermal forging, Warm forging, Overview of Powder Metal techniques –Hot and Cold isostatic pressing - high speed extrusion, rubber pad forming, Hydroforming, Superplastic forming, Peen forming-micro blanking –Powder rolling – Tooling and process parameters.

**UNIT IV MICRO MACHINING AND NANO FABRICATION 9**

Theory of micromachining – Micromachining Processes – Micro-milling – Micro-drilling – Micro-turning – Micro-grinding – Micro-polishing – Principle of Micro EDM – Micro wire EDM – Planetary Micro EDM – Reverse Micro EDM – Advantages, Challenges. Nano fabrication process - Nano machining techniques – Top / Bottom up Nano fabrication techniques - Sub micron lithographic technique, conventional film growth technique, Chemical etching, Quantum dot fabrication techniques – MOCVD – Epitaxy techniques.

**UNIT V RAPID PROTOTYPING AND SURFACE MODIFICATION TECHNIQUES 9**

Introduction – Classification – Principle advantages limitations and applications- Rapid Prototyping - Rapid Manufacturing - Rapid Tooling and Future Rapid Prototyping Processes -Stereolithography (SLA) – 3D Printing (3DP) – Selective Laser Sintering (SLS) – Laminated Object Manufacturing (LOM) – Fused Deposition Modelling (FDM) Introduction, Process descriptions, Materials, process variations, economic considerations, applications, design aspects and quality issues – CVD – PVD – Electroplating – Hot Dip Coating – Thermal Spraying.

**TOTAL: 45 PERIODS**

## OUTCOMES:

At the end of the course, students will be able to

1. Analyze the processes and evaluate the role of each process parameter during machining of various advanced materials.
2. Understand requirements to achieve maximum material removal rate and best quality of machined surface while machining various industrial engineering materials.
3. Analyze the different bulk metal forming process mechanics using different analysis
4. Acquire the knowledge in mechanical micromachining processes.
5. Demonstrate the knowledge of Additive Manufacturing and Rapid Prototyping Technologies

## REFERENCES

1. Benedict,G.F.,"Non Traditional manufacturing Processes",CRC press,2011
2. Madou, M.J., Fundamentals of Micro fabrication: The Science of Miniaturization, Second Edition, CRC Press (ISBN: 0849308267),2006
3. McGeough,J.A.,"Advanced methods of Machining",Springer,2011
4. Narayanaswamy, R., Theory of Metal Forming Plasticity, Narosa Publishers,2000.
5. Pandey, P.S. and Shah.N., "Modern Manufacturing Processes", Tata McGraw Hill, 2017.
6. Serope Kalpakjian., "Manufacturing Engineering and Technology" Pearson Education,2018

**MF4102**

**ADVANCES IN CASTING AND WELDING**

**L T P C**  
**3 0 0 3**

## COURSE OBJECTIVES:

- To study the metallurgical concepts and applications of casting and welding process.
- To acquire knowledge in CAD of casting and automation of the welding process.
- To know various solid state and special welding processes.
- To introduce metallurgy of welding.
- To design the weldments for various materials. To gain knowledge on various welding defects and inspection methods.

### UNIT I CASTING DESIGN

**9**

Heat transfer between metal and mould — Design considerations in casting – Designing for directional solidification and minimum stresses - principles and design of gating and riser-Melting and casting quality

### UNIT II CASTING METALLURGY

**9**

Solidification of pure metal and alloys – shrinkage in cast metals – progressive and directional solidification — Degasification of the melt-casting defects – Castability of steel , Cast Iron, Al alloys, Babbitt alloy and Cu alloy.

### UNIT III RECENT TRENDS IN CASTING AND FOUNDRY LAYOUT

**9**

Shell moulding, precision investment casting, CO<sub>2</sub> moulding, centrifugal casting, Die casting, Continuous casting, Counter gravity low pressure casting, Squeeze casting and semisolid processes. Layout of mechanized foundry – sand reclamation – material handling in foundry pollution control in foundry — Computer aided design of casting.



**UNIT IV WELDING METALLURGY AND DESIGN 9**

Heat affected Zone and its characteristics – Weldability of steels, cast iron, stainless steel, aluminum, Mg , Cu , Zirconium and titanium alloys – Carbon Equivalent of Plain and alloy steels Hydrogen embrittlement – Lamellar tearing – Residual stress – Distortion and its control . Heat transfer and solidification - Analysis of stresses in welded structures – pre and post welding heat treatments – weld joint design – welding defects – Testing of weldment- welding thermal cycle.

**UNIT V RECENT TRENDS IN WELDING 9**

Friction welding, Friction stir welding – Explosive welding – Diffusion bonding – High frequency induction welding – Ultrasonic welding – Electron beam welding – Laser beam welding –Plasma welding – Electroslag welding- Narrow gap, Hybrid twin wire active TIG – Tandem MIG- Modern brazing and soldering techniques – Induction, Dip resistance, Diffusion processes – Hot gas, Wave and vapour phase soldering. Overview of automation of welding in aerospace, Nuclear, surface transport vehicles and underwater welding.

**COURSE OUTCOMES:**

- At the end of this course the students are expected to impart knowledge on basic concepts and advances in casting and welding processes.
- Know and perform solid state and special welding processes.
- Understand and analyze the material structures after welding.
- Design the weldments for various materials.
- Attain the knowledge about various welding defects and inspection methods.

**TOTAL: 45 PERIODS**

**REFERENCES:**

1. ASM Handbook vol.6, welding Brazing & Soldering, 2010
2. ASM Handbook, Vol 15, Casting, 2008
3. Carry B., Modern Welding Technology, Prentice Hall Pvt Ltd., 2005
4. Cornu.J. Advanced welding systems – Volumes I, II and III, JAICO Publishers, 1994.
5. Heinelooper & Rosenthal, Principles of Metal Casting, Tata McGraw Hill, 2017.
6. Iotrowski – Robotic welding – A guide to selection and application – Society of mechanical Engineers, 1987.
7. Jain P.L., Principles of Foundry Technology, Tata McGraw Hill Publishers, 2003
8. Lancaster.J.F. – Metallurgy of welding – George Alien & Unwin Publishers, 1999.
9. Parmer R.S., Welding Engineering and Technology, Khanna Publishers,2002
10. Schwariz, M.M. – Source book on innovative welding processes – American Society for Metals (OHIO), 1981
11. Srinivasan N.K., Welding Technology, Khanna Tech Publishers, 2002
12. P N Rao Manufacturing Technology , Vol 1, 3<sup>rd</sup> edition ,2011

**MF4103**

**THEORY OF METAL CUTTING**

**L T P C**

**3 0 0 3**

**COURSE OBJECTIVES:**

- To make the students to familiar with the various principles of metal cutting, cutting tool materials and its wear mechanisms during the machining operation.

**UNIT I INTRODUCTION 9**

Need for rational approach to the problem of cutting materials-observation made in the cutting of metals-basic mechanism of chip formation-thin and thick zone modes-types of chips-chip breaker-orthogonal Vs oblique cutting-force velocity relationship for shear plane angle in orthogonal cutting-energy consideration in machining-review of Merchant, Lee and Shafter theories-critical comparison.

- UNIT II SYSTEM OF TOOL NOMENCLATURE 9**  
 Nomenclature of single point cutting tool and nomenclature of multi point cutting tools – Twist Drill – milling cutter -System of tool nomenclature and conversion of rake angles-nomenclature of multi point tools like drills, milling-conventional Vs climb milling, mean cross sectional area of chip in milling-specific cutting pressure.
- UNIT III THERMAL ASPECTS OF MACHINING 9**  
 Heat distribution in machining-effects of various parameters on temperature-methods of temperature measurement in machining-hot machining- Cutting fluid – properties – types of cutting fluids – Selection of cutting fluids.
- UNIT IV TOOL MATERIALS, TOOL LIFE AND TOOL WEAR 9**  
 Essential requirements of tool materials-development of tool materials-ISO specification for inserts and tool holders- Tool geometry - Mechanisms of tool wear – Abrasion – Adhesion – Diffusion – Types of tool wear – flank wear – crater wear – Tool life – Tool life equations - factors affecting tool life – Illustrative problems- conventional and accelerated tool life tests-concept of machinability index-economics of machining.
- UNIT V WEAR MECHANISMS AND CHATTER IN MACHINING 9**  
 Processing and Machining – Measuring Techniques – Reasons for failure of cutting tools and forms of wear-mechanisms of wear-chatter in machining-factors affecting chatter in machining-types of chatter-mechanism of chatter.

**COURSE OUTCOMES:**

- At the end of this course the students are expected to impart the knowledge in the area of metal cutting theory and its importance.

**TOTAL: 45 PERIODS**

**REFERENCES**

1. Bhattacharya.A., Metal Cutting Theory and practice, Central Book Publishers, India,2012..
2. Boothroid D.G. & Knight W.A., Fundamentals of machining and machine tools, Marcel Dekker, Newyork, 2005.
3. Shaw.M.C.Metal cutting principles, Oxford Clare don press, 2012.
4. B L Juneja and G S Sekhon., Fundamentals of Metal Cutting and Machine Tools, 2017.

**CM4151**

**COMPUTER AIDED MANUFACTURING**

**L T P C**

**3 0 0 3**

**COURSE OBJECTIVES:**

- To introduce the evolution of CAD, CAM, CIM, engineering product specification and interpreting geometric specifications.
- To train the candidates on the integration of Computer Aided Design and Computer Aided Manufacturing.
- To impart knowledge on manual part program and generation of CNC part program using Computer Aided Manufacturing packages.
- To introduce with the implementation of CAD and CAM in manufacturing process.
- To introduce the importance of Internet of Things in Computer Aided Manufacturing.

- UNIT I INTRODUCTION TO CAM 9**  
Introduction CAD, CAM, CAE, CIM, system configuration for CAM including hardware and software, evolution of product realization, historical development, engineering product specification. Geometric Tolerancing - ASME standard, interpreting geometric specifications, multiple part features and datum.
- UNIT II CAD AND CAM INTEGRATION 9**  
Introduction - Networking - Techniques, components, interface cards, network standards, Graphics standards - Graphical kernel system, Data exchange format - IGES and STEP.  
Process planning, Computer Aided Process Planning (CAPP), Product life cycle management (PLM), Enterprise resource planning (ERP).
- UNIT III PROGRAMMING OF CNC MACHINES 9**  
Structure of CNC program, Coordinate system, G & M codes, cutter radius compensation, tool nose radius compensation, tool wear compensation, canned cycles, mirroring features, Manual part programming for CNC turning, machining center, wire electric discharge machining, abrasive water jet cutting machine, bulk and sheet metal forming, generation of CNC program using CAM softwares.
- UNIT IV CAD AND CAM FOR MANUFACTURING PROCESSES 9**  
Classification of Manufacturing process, construction and operations, Integration of CAD and CAM in CNC turning center, machining center, electric discharge machining, wire electric discharge machining, abrasive water jet cutting machine, bulk forming, sheet metal forming.
- UNIT V IOT IN CAM 9**  
Introduction, overview of IOT enabled manufacturing system, Real-time and multi-source manufacturing information sensing system, IOT enabled smart assembly station, cloud computing based manufacturing resources configuration method, Real-time key production performances analysis method, Real-time information driven production scheduling system.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**

At the end of this course, the students shall be able to:

- CO1: Recognize the importance of CAD, CAM, CIM, Engineering product specification and interpreting geometric specifications.
- CO2: Improve knowledge on the integration of CAD and CAM.
- CO3: Exhibit competency in manual part program and generation of CNC part program using CAM packages.
- CO4: Describe the implementation of CAD and CAM in manufacturing processes.
- CO5: Explain applications of IOT in computer aided manufacturing.

**REFERENCES:**

1. Chang T.C., Wysk, R.A. and Wang.H.P., "Computer Aided Manufacturing", Pearson Prentice Hall, India ,2009, ISBN: 978-0131429192.
2. HMT,"Mechatronics", Tata McGraw-Hill Publishing Company Limited, New Delhi, 2017.
3. Rao P.N., "CAD/CAM", 3rd Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, India, 2012, ISBN-13: 978-0070681934.
4. Radhakrishnan P., "Computer Numerical Control ", New Central Book Agency, India,2013.
5. Nee Y.C., Soh K. Ong, Yun G. Wang., "Computer Applications in Near Net-Shape Operations", Springer, United Kingdom, 2012.
6. Yingfeng Zhang and Fei Tao, "Optimization of Manufacturing Systems Using the Internet of

RM4151

**RESEARCH METHODOLOGY AND IPR**

**L T P C**  
**2 0 0 2**

**UNIT I RESEARCH DESIGN**

**6**

Overview of research process and design, Use of Secondary and exploratory data to answer the research question, Qualitative research, Observation studies, Experiments and Surveys.

**UNIT II DATA COLLECTION AND SOURCES**

**6**

Measurements, Measurement Scales, Questionnaires and Instruments, Sampling and methods. Data - Preparing, Exploring, examining and displaying.

**UNIT III DATA ANALYSIS AND REPORTING**

**6**

Overview of Multivariate analysis, Hypotheses testing and Measures of Association-Presenting Insights and findings using written reports and oral presentation.

**UNIT IV INTELLECTUAL PROPERTY RIGHTS**

**6**

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.

**UNIT V PATENTS**

**6**

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 Assignments, Licences, Licensing of related patents, patent agents, Registration of patent agents.

**TOTAL :30 PERIODS**

**REFERENCES**

1. Cooper Donald R, Schindler Pamela S and Sharma JK, "Business Research Methods", Tata McGraw Hill Education, 11e (2012).
2. Catherine J. Holland, "Intellectual property: Patents, Trademarks, Copyrights, Trade Secrets", Entrepreneur Press, 2007.
3. David Hunt, Long Nguyen, Matthew Rodgers, "Patent searching: tools & techniques", Wiley, 2007.
4. The Institute of Company Secretaries of India, Statutory body under an Act of parliament, "Professional Programme Intellectual Property Rights, Law and practice", September 2013.

MF4111

**CAD / CAM LABORATORY**

**L T P C**  
**0 0 4 2**

**COURSE OBJECTIVES:**

- To introduce components and assemblies used in machines and use of 3D parametric CAD, CAM software for mechanical design.
- To provide an experiential learning environment using projects done by student groups, while applying CAD, CAE software tools to design mechanisms and structures for mechanical design evaluation, optimization of mass properties, static-stresses, deformations, etc. with experimental validation of simulation models.
- To do some exercises in tool pre-setting and work piece referencing on CNC machine tools, manual part programming for CNC turning and milling centres, Use of software for simulation of turned and milled parts and simple surfaces, Automatic Cutter location data generation from CAD Models in APT format and post-processing for machining on CNC machines using standard CAD/CAM software

## **CAM LABORATORY**

1. Exercise on CNC Lathe: Plain Turning, Step turning, Taper turning, Threading, Grooving canned cycle
2. Exercise on CNC Milling Machine: Profile Milling, Mirroring, Scaling & canned cycle. Study of Sensors, Transducers & PLC: Hall-effect sensor, Pressure sensors, Strain gauge, PLC, LVDT, Load cell, Angular potentiometer, Torque, Temperature & Optical Transducers.
3. Standards, types, applications and working of following components and assemblies, Machine Components: Screw fasteners, Riveted joints, Keys, Cotters and joints, Shaft couplings, Pipe joints and fittings. Assemblies: Bearings, Hangers and brackets, Steam and IC engine parts, Valves, Some important machine assemblies.
4. Mechanical Drawing: Machining and surface finish symbols and tolerances in dimensioning.
5. CAD: Introduction to CAD, CAM, software in product life cycle.
6. Geometric Modelling: Parametric sketching and modelling, constrained model dimensioning, Relating dimensions and parameters. Feature and sequence of feature editing. Material addition and removal for extrude, revolve, blend, helical sweep, swept blend, variable section sweep. References and construction features of points, axis, curves, planes, surfaces. Cosmetic features, representation of welded joints, Draft and ribs features, chamfers, rounds, standard holes. Assembly modelling. Automatic production drawing creation and detailing for dimensions, BOM, Ballooning, sectioned views etc.
7. Productivity Enhancement Tools in CAD Software: Feature patterns, duplication, grouping, suppression. Top-down vs. bottom-up design

## **CAD LABORATORY**

2D modelling and 3D modelling of components such as

1. Bearing
2. Couplings
3. Gears
4. Sheet metal components
5. Jigs, Fixtures and Die assemblies.

**TOTAL: 60 PERIODS**

## **COURSE OUTCOMES:**

At the end of this course the students are expected to;

1. Interpret mechanical drawings for components, assemblies and use parametric 3D CAD software tools in the correct manner for creating their geometric part models, assemblies and automated drawings.
2. Apply the concepts of machining for the purpose of selection of appropriate machining centres, machining parameters, select appropriate cutting tools for CNC milling and turning equipment, set-up, program, and operate CNC milling and turning equipment.
3. Create and validate NC part program data using manual data input (MDI) and automatically using standard commercial CAM package for manufacturing of required component using CNC milling or turning applications.
4. Produce an industrial component by interpreting 3D part model/ part drawings using Computer Aided Manufacturing technology through programming, setup, and ensuring safe operation of Computer Numerical Control (CNC) machine tools.
5. Create and demonstrate the technical documentation for design/ selection of suitable drive technologies, precision components and an overall CNC machine tool system for automation of machining operations using appropriate multi-axis CNC technology.

**OBJECTIVE:**

- To enrich the communication skills of the student through presentation of topics in recent advances in engineering/technology

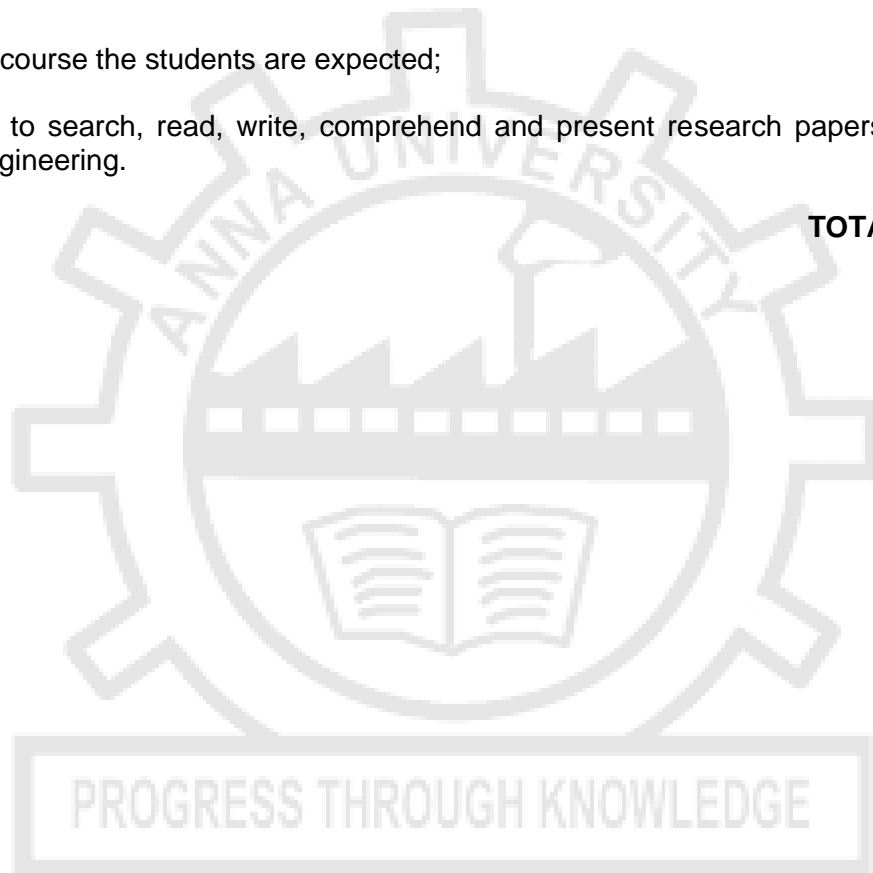
A group of 2 students have to choose a problem and carry out scientific systematic investigation experimentally/ theoretically in suggesting a viable solution. At the end of the semester, each group of students have to submit a report for evaluation.

Depth of understanding, coverage, quality of presentation material (PPT/OHP) and communication skill of the student will be taken as measures for evaluation.

**OUTCOME:**

At the end of this course the students are expected;

To develop skills to search, read, write, comprehend and present research papers in the areas of manufacturing engineering.

**TOTAL: 30 PERIODS**

## AUDIT COURSES

<b>AX4091</b>	<b>ENGLISH FOR RESEARCH PAPER WRITING</b>	<b>L T P C</b>
		<b>2 0 0 0</b>

### **COURSE OBJECTIVES**

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

### **UNIT I INTRODUCTION TO RESEARCH PAPER WRITING 6**

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

### **UNIT II PRESENTATION SKILLS 6**

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

### **UNIT III TITLE WRITING SKILLS 6**

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

### **UNIT IV RESULT WRITING SKILLS 6**

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

### **UNIT V VERIFICATION SKILLS 6**

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

**TOTAL: 30 PERIODS**

### **COURSE OUTCOMES**

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

### **REFERENCES**

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

**COURSE OBJECTIVES**

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

**UNIT I INTRODUCTION****6**

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

**UNIT II REPERCUSSIONS OF DISASTERS AND HAZARDS****6**

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

**UNIT III DISASTER PRONE AREAS IN INDIA****6**

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

**UNIT IV DISASTER PREPAREDNESS AND MANAGEMENT****6**

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

**UNIT V RISK ASSESSMENT****6**

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

**TOTAL : 30 PERIODS****COURSE OUTCOMES**

CO1: Ability to summarize basics of disaster

CO2: Ability to explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.

CO3: Ability to illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.

CO4: Ability to describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.

CO5: Ability to develop the strengths and weaknesses of disaster management approaches



## REFERENCES

1. Goel S. L., Disaster Administration And Management Text And Case Studies”, Deep & Deep Publication Pvt. Ltd., New Delhi, 2009.
2. Nishitha Rai, Singh AK, “Disaster Management in India: Perspectives, issues and strategies “New Royal book Company, 2007.
3. Sahni, Pardeep Et. Al. ,” Disaster Mitigation Experiences And Reflections”, Prentice Hall Of India, New Delhi, 2001.

**AX4093**

**CONSTITUTION OF INDIA**

**L T P C**  
**2 0 0 0**

## OBJECTIVES

Students will be able to:

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- 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.
- 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.

## **UNIT I HISTORY OF MAKING OF THE INDIAN CONSTITUTION**

History, Drafting Committee, (Composition & Working)

## **UNIT II PHILOSOPHY OF THE INDIAN CONSTITUTION**

Preamble, Salient Features

## **UNIT III CONTOURS OF CONSTITUTIONAL RIGHTS AND DUTIES**

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.

## **UNIT IV ORGANS OF GOVERNANCE**

Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.

## **UNIT V LOCAL ADMINISTRATION**

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.

## **UNIT VI ELECTION COMMISSION**

Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners - Institute and Bodies for the welfare of SC/ST/OBC and women.

**TOTAL: 30 PERIODS**

## OUTCOMES

Students will be able to:

- Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
- Discuss the intellectual origins of the framework of argument that informed the conceptualization
- of social reforms leading to revolution in India.
- 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.
- Discuss the passage of the Hindu Code Bill of 1956.

## SUGGESTED READING

- The Constitution of India, 1950(Bare Act), Government Publication.
- Dr.S.N.Busi, Dr.B. R.Ambedkar framing of Indian Constitution, 1st Edition, 2015.
- M.P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
- D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

AX4094

**நற்றமிழ் இலக்கியம்**

L T P C  
2 0 0 0

UNIT I

**சங்க இலக்கியம்**

6

1. தமிழின் துவக்க நூல் தொல்காப்பியம்  
– எழுத்து, சொல், பொருள்
2. அகநானூறு (82)  
- இயற்கை இன்னிசை அரங்கம்
3. குறிஞ்சிப் பாட்டின் மலர்க்காட்சி
4. புறநானூறு (95,195)  
- போரை நிறுத்திய ஔவையார்

UNIT II

**அறநெறித் தமிழ்**

6

1. அறநெறி வகுத்த திருவள்ளுவர்  
- அறம் வலியுறுத்தல், அன்புடைமை, ஒப்புறவு அறிதல்,  
ஈகை, புகழ்
2. பிற அறநூல்கள் - இலக்கிய மருந்து  
– ஏலாதி, சிறுபஞ்சமூலம், திரிகடுகம், ஆசாரக்கோவை  
(தூய்மையை வலியுறுத்தும் நூல் )

UNIT III

**இரட்டைக் காப்பியங்கள்**

6

1. கண்ணகியின் புரட்சி  
- சிலப்பதிகார வழக்குரை காதை
2. சமூகசேவை இலக்கியம் மணிமேகலை  
- சிறைக்கோட்டம் அறக்கோட்டமாகிய காதை

**UNIT IV****அருள்நெறித் தமிழ்**

6

1. சிறுபாணாற்றுப்படை
  - பாரி முல்லைக்குத் தேர் கொடுத்தது, பேகன் மயிலுக்குப் போர்வை கொடுத்தது, அதியமான் ஓளவைக்கு நெல்லிக்கனி கொடுத்தது, அரசர் பண்புகள்
2. நற்றிணை
  - அன்னைக்குரிய புன்னை சிறப்பு
3. திருமந்திரம் (617, 618)
  - இயமம் நியமம் விதிகள்
4. தர்மச்சாலையை நிறுவிய வள்ளலார்
5. புறநானூறு
  - சிறுவனே வள்ளலானான்
6. அகநானூறு (4) - வண்டு  
நற்றிணை (11) - நண்டு  
கலித்தொகை (11) - யானை, புறா  
ஐந்திணை 50 (27) - மான்  
ஆகியவை பற்றிய செய்திகள்

**UNIT V****நவீன தமிழ் இலக்கியம்**

6

1. உரைநடைத் தமிழ்,
  - தமிழின் முதல் புதினம்,
  - தமிழின் முதல் சிறுகதை,
  - கட்டுரை இலக்கியம்,
  - பயண இலக்கியம்,
  - நாடகம்,
2. நாட்டு விடுதலை போராட்டமும் தமிழ் இலக்கியமும்,
3. சமுதாய விடுதலையும் தமிழ் இலக்கியமும்,
4. பெண் விடுதலையும் விளிம்பு நிலையினரின் மேம்பாட்டில் தமிழ் இலக்கியமும்,
5. அறிவியல் தமிழ்,
6. இணையத்தில் தமிழ்,
7. சுற்றுச்சூழல் மேம்பாட்டில் தமிழ் இலக்கியம்.

**TOTAL: 30 PERIODS****தமிழ் இலக்கிய வெளியீடுகள் / புத்தகங்கள்**

1. தமிழ் இணைய கல்விக்கழகம் (Tamil Virtual University)  
- [www.tamilvu.org](http://www.tamilvu.org)
2. தமிழ் விக்கிப்பீடியா (Tamil Wikipedia)  
- <https://ta.wikipedia.org>

3. தர்மபுர ஆதின வெளியீடு
4. வாழ்வியல் களஞ்சியம்
  - தமிழ்ப் பல்கலைக்கழகம், தஞ்சாவூர்
5. தமிழ்கலைக் களஞ்சியம்
  - தமிழ் வளர்ச்சித் துறை (thamilvalarchithurai.com)
6. அறிவியல் களஞ்சியம்
  - தமிழ்ப் பல்கலைக்கழகம், தஞ்சாவூர்

