ANNAMALAI UNIVERSITY

Annamalainagar

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MANUFACTURING ENGINEERING

M.E. Manufacturing Engineering

Choice Based Credit System

(Full – Time & Part - Time)

2019

DEPARTMENT OF MANUFACTURING ENGINEERING

VISION

To prepare students to be life-long learners and global citizens with successful careers in design, research, development, and management of systems in manufacturing and service organizations

MISSION

A curriculum and educational experience designed and continuously improved through involvement and contribution of students, faculty, administrators, staff, and industry

A well-focused research program funded at the local, regional, and national level

A demonstrated competence and expertise in addressing the needs of industry and community at large

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

1. The graduates acquire ability to create model, design, synthesize and analyze essential production operational skills, mechanism and automation system.

2. The graduates use their talent, self-confidence, knowledge and engineering practice which facilitate them to presume position of scientific and/or managerial leadership in their career paths.

3. The graduates will adopt ethical attitude and exhibit effective skills in communication management team work and leader qualities.

4. The graduates apply their consciousness of moral, professional responsibilities and motivation to practice life-long learning in a team work environment.

M.E. MANUFACTURING ENGINEERING

PROGRAM OUTCOMES (PO)

Upon Completion of the two years of the Master of Manufacturing Engineering Degree,

PO1: INTEGRATION OF KNOWLEDGE

Demonstrate strong basics in mathematics, science, engineering and technology which serve as the foundation for the Programme.

PO2: PROBLEM ANALYSIS

Demonstrate the ability to design and conduct experiments, as well as to analyze and interpret data in the spheres of fundamental engineering.

PO3: DESIGN AND DEVELOPMENT OF SOLUTIONS

Demonstrate the ability to design a system, component or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability.

PO4: USE OF MODERN TOOLS AND TECHNIQUES

Become familiar with modern engineering tools and analyse the problems within the domains of Manufacturing Technology as the members of multidisciplinary teams

PO5: COLLABORATIVE AND MULTIDISCIPLINARY APPROACH

Acquire the capability to identify, formulate and solve engineering problems related to manufacturing engineering in interdisciplinary and multidisciplinary sciences

PO6: ETHICAL PRACTICES AND SOCIAL RESPONSIBILITIES

Demonstrate an understanding of professional and ethical responsibility with reference to their career in the field of manufacturing engineering.

PO7: COMMUNICATION SKILLS

Interact with engineering community and with society at large, regarding intricate engineering activities on technical perspectives and emerge as an efficient motivator. He will be able to communicate effectively both in verbal and non verbal forms.

PO8: PROJECT MANAGEMENT

Design and develop innovative / manufacturable / marketable/ environmental friendly products useful to the society and nation at large. Graduate will be able to manage any organization well and will be able to emerge as a successful entrepreneur

PO9: LIFE LONG LEARNING

Understand the value for life long-long learning, in the context of technological challenges.

PO10: ENVIRONMENT AND SUSTAINABLITY

Acquire ample knowledge essential for sustainable development in consideration of environmental impacts and contemporary issues.

PO11: SOCIAL RESPONSIBILITY

Understand the nature of profession and be vigilant in order to maximize the chances of a positive contribution to society.

PO12: INVESTIGATION OF COMPLEX PROBLEM

Perform investigations, design and conduct experiments, analyze and interpret the results to provide valid conclusion.

PROGRAM SPECIFIC OUTCOMES (PSO)

PSO 1: Inculcate research attitude and develop innovative methodologies independently to solve Manufacturing Engineering problems

PSO 2: Inscribe and be exposed with significant technical reports / documents in the domain of Manufacturing Engineering

PSO 3: Demonstrate an acceptable degree of mastery with an exposure to the state-of-the-art practices for employability / higher education.

Mapping PEOs with POs												
POs/ PEOs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
PEO1	1	2	1	1	2		2		1	1	1	1
PEO2			1	1	1	2	1	2	2	1	2	1
PEO3						2	1					1
PEO4			1	1		1		1		1		

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MANUFACTURING ENGINEERING

Program: M.E **Specialization: Manufacturing Engineering**

Courses of Study and Scheme of Examination (REGULATION-2019)

SEMESTER I									
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**
MFMEPC11	**PC-I**	Applied Probability & Statistical Inferences	3	-	-	25	75	100	3
MFMEPC12	**PC-II**	Mechanical Behaviour of Materials	3	-	-	25	75	100	3
MFMEPE13	**PE-I**	Program Elective-I	3	-	-	25	75	100	3
MFMEPE14	**PE-II**	Program Elective-II	3	-	-	25	75	100	3
MFMEMC15	**MC**	Research Methodology and IPR	2	-	-	25	75	100	2
MFMECP16	**CP-I**	Production Engineering Laboratory	-	-	3	40	60	100	2
MFMECP17	**CP-II**	Computer Aided Engineering Laboratory	-	-	3	40	60	100	2
MFMEAC18	**AC-I**	Audit Course-I	2	-	-	-	-	-	0
			Total			205	495	700	**18**

SEMESTER II									
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**
MFMEPC21	**PC-III**	Metal Forming Technology	3	-	-	25	75	100	3
MFMEPC22	**PC-IV**	Metal Joining Technology	3	-	-	25	75	100	3
MFMEPE23	**PE-III**	Program Elective-III	3	-	-	25	75	100	3
MFMEPE24	**PE-IV**	Program Elective-IV	3	-	-	25	75	100	3
MFMECP25	**OE-I**	Open Elective I (Inter Faculty)	3	-	-	25	75	100	3
MFMEOE26	**CP-III**	Computing and Simulation Laboratory	-	-	3	40	60	100	2
MFMETS27	**TS**	Industrial Training and Seminar / Mini project		Tr 2	S 2	40	60	100	2
MFMEAC28	**AC-II**	Audit Course-II	2	-	-	-	-	-	0
			Total			205	495	700	**19**

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MANUFACTURING ENGINEERING

Program: M.E **Specialization: Manufacturing Engineering**

Courses of Study and Scheme of Examination (REGULATION-2019)

SEMESTER III									
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**
MFMEPE31	**PE-V**	Program Elective-V	3	-	-	25	75	100	3
MFMEOE32	**OE-II**	Open Elective II (Inter faculty)	3	-	-	25	75	100	3
MFMEPV33	**TH-I**	Thesis Phase- I & Viva-voce	-	Pr 16	S 4	40	60	100	10
			Total			90	210	300	**16**

SEMESTER IV									
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**
MFMEPV41	**TH-II**	Thesis Phase- II & Viva-voce	-	Pr 24	S 6	40	60	100	15
			Total			40	60	100	**15**

PC	Program Core	**CP**	Core Practical	**AC**	Audit Course
PE	Program Elective	**TS**	Industrial Training and Seminar	**PV**	Project work & Viva-voce
OE	Open Elective	**MC**	Mandatory Learning Course	**XX**	Branch code
				yy	M.E Specialization Code

DEPARTMENT OF MANUFACTURING ENGINEERING

M.E. (MANUFACTURING ENGINEERING) PART TIME - DEGREE PROGRAMME

Choice Based Credit System (CBCS)

Courses of Study and Scheme of Examination (REGULATION-2019)

S E M E S T E R – I

Course Code	Category	Course	L	T	P	CA	FE	Total	Credits	Equivalent Course Code in M.E. Full Time
PMFMEPC11	**PC-I**	Applied Probability & Statistical Inferences	3	-	-	25	75	100	3	MFMEPC11
PMFMEPC12	**PC-II**	Mechanical Behaviour of Materials	3	-	-	25	75	100	3	MFMEPC12
PMFMEMC13	**MC**	Research Methodology and IPR	2	-	-	25	75	100	2	MFMEMC15
PMFMECP14	**CP-I**	Production Engineering Laboratory	-	-	3	40	60	100	2	MFMECP16
Total						115	285	400	**10**	

S E M E S T E R – II

Course Code	Category	Course	L	T	P	CA	FE	Total	Credits	Equivalent Course Code in M.E. Full Time
PMFMEPC21	**PC-III**	Metal Forming Technology	3	-	-	25	75	100	3	MFMEPC21
PMFMEPC22	**PC-IV**	Metal Joining Technology	3	-	-	25	75	100	3	MFMEPC22
PMFMEOE23	**OE-I**	Open Elective - I (Parent dept.)	3	-	-	25	75	100	3	MFMEPE24
PMFMECP24	**CP-III**	Computing and Simulation Laboratory	-	-	3	40	60	100	2	MFMECP25
Total						115	285	400	**11**	

S E M E S T E R – III

Course Code	Category	Course	L	T	P	CA	FE	Total	Credits	Equivalent Course Code in M.E. Full Time
PMFMEPE31	**PE-I**	Program Elective-I	3	-	-	25	75	100	3	MFMEPE13
PMFMEPE32	**PE-II**	Program Elective-II	3	-	-	25	75	100	3	MFMEPE14
PMFMECP33	**CP-II**	Computer Aided Engineering Laboratory	-	-	3	40	60	100	2	MFMECP17
Total						90	210	300	**8**	

DEPARTMENT OF MANUFACTURING ENGINEERING

M.E. (MANUFACTURING ENGINEERING) PART TIME - DEGREE PROGRAMME

Choice Based Credit System (CBCS)

Courses of Study and Scheme of Examination (REGULATION-2019)

S E M E S T E R – IV										
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**	**Equivalent Course Code in M.E. Full Time**
PMFMEPE41	**PE-III**	Program Elective-III	3	-	-	25	75	100	3	MFMEPE23
PMFMEPE42	**PE-IV**	Program Elective-IV	3	-	-	25	75	100	3	MFMEPE24
PMFTS43	**TS**	Industrial Training and Seminar / Mini project		Tr	S	40	60	100	2	MFMETS27
				2	2					
Total						90	210	300	**8**	

S E M E S T E R – V										
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**	**Equivalent Course Code in M.E. Full Time**
PMFMEPE51	**PE-V**	Program Elective-V	3	-	-	25	75	100	3	MFMEPE31
PMFMEOE52	**OE-II**	Open Elective - II (Parent department.)	3	-	-	25	75	100	3	MFMEOE32
PMFMEPV53	**TH-I**	Thesis work & Viva-voce (Phase-I)		Pr	S	40	60	100	10	MFMEPV41
				16	4					
Total						90	210	300	**16**	

S E M E S T E R – VI										
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**	**Equivalent Course Code in M.E. Full Time**
PMFMEPV61	**TH-II**	Thesis work & Viva-voce (Phase-II)		Pr	S	40	60	100	15	MFMEPV33
				24	6					
Total						40	60	100	**15**	

P - Part-Time
XX – Department Branch Code
YY - PG Specialization
L: Lecture ,**P:** Practical, **T**: Thesis, **CA:** Continuous Assessment; **FE:** Final Examination

LIST OF PROFESSIONAL ELECTIVES

1. MFMEPEXX Mechanics of Metal Machining
2. MFMEPEXX Manufacturing Management
3. MFMEPEXX Metal Casting Technology
4. MFMEPEXX Machine Tool Drives and Controls
5. MFMEPEXX Maintenance Management
6. MFMEPEXX Computer Integrated Manufacturing Systems
7. MFMEPEXX Plant Layout and Material Handling
8. MFMEPEXX Composite Materials
9. MFMEPEXX Tool Engineering
10. MFMEPEXX Automats and Transfer Machines
11. MFMEPEXX Design for Manufacturing and Assembly
12. MFMEPEXX Impact Engineering
13. MFMEPEXX Precision Engineering and Nano-Technology
14. MFMEPEXX Nano Materials Technology

LIST OF OPEN ELECTIVES

1. MFMEOEXX Engineering Economics
2. MFMEOEXX Total Quality Management
3. MFMEOEXX Supply Chain Management

LIST OF AUDIT COURSES

1. MFMEACXX English for Research Paper Writing
2. MFMEACXX Disaster Management
3. MFMEACXX Sanskrit for Technical Knowledge
4. MFMEACXX Value Education
5. MFMEACXX Constitution of India
6. MFMEACXX Pedagogy Studies
7. MFMEACXX Stress Management by Yoga
8. MFMEACXX Personality Development through Life Enlightenment Skills

FIRST SEMESTER

MFMEPC11	APPLIED PROBABILITY & STATISTICAL INFERENCES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To understand the statistical concepts and to motivate in students an intrinsic interest in statistical thinking.
- To introduce probability theory and statistics from a computational perspective
- Instill the belief that Statistics is important for scientific research, to be able to effectively conduct research.
- Provide a foundation and motivation for exposure to statistical ideas subsequent to the course.

No derivation, only application in problem solving

Introduction to Probability Theory: Classical, empirical and subjective probabilities. Introduction to Statistics and Data – Types of Data - Quantitative Data, Qualitative Data, Logical Data, Multivariate Data etc. - nominal, ordinal, interval and ratio data. Features of Data distributions - Center, Spread, Shape, Symmetry, Skewness and Kurtosis (Definitions only), Frequency Distributions and Histogram, Stem and Leaf Diagrams, Measures of Center - Mean, Median, Mode, Measures of Spread - Range, Variance, Standard Deviation, Measures of Relative Position: Quartiles, Percentiles, Inter quartile range.

Distribution and functions: Random Variables, Discrete Random Variables, Probability Distributions and Probability Mass Functions, Mean and Variance of a Discrete Random Variable, Discrete Uniform Distribution - Mean and Variance, Binomial Distribution - Mean and Variance, Poisson Distribution - Mean and Variance.
Continuous Random Variables, Probability Distributions and Probability Density Functions, Mean and Variance of a Continuous Random Variable, Continuous Uniform Distribution, Mean and Variance, Normal Distribution, Mean and Variance (Proof not required).

Inference: Statistical Inference, Types of sampling and sampling error, Random Sample & Statistic, Sampling Distribution, Central Limit Theorem (Statement Only), Distribution of sample mean and sample variance, t, chi-square and F distributions (derivation not required), Confidence Interval on the Mean, Confidence Interval on the Variance, Confidence Interval for a Population Proportion, Confidence Interval on the Difference in Means, Confidence Interval on the Ratio of two Variances.

Testing of Hypothesis & Non Parametric Test: Introduces hypothesis testing methodology, one and two sample z and t tests, Type I and Type II errors - testing of mean, difference in mean and proportions – Tests for Independence of attributes , Goodness of fit and simple linear regression and correlation. Non parametric test: run test, sign test, U test & H test.

Design of Experiment: Experimental design – Analysis of variance – Methods for one, two factor models, completely randomized blocks - concepts of factorial design, fractional factorial design, response surface methods and central composite design.

REFERENCES

1. Jay L. Devore, "Probability and Statistics For Engineering and the Sciences", Thomson and Duxbury, 2002.
2. Mario F. Triola. Elementary Statistics, Ninth Edition. Boston: Pearson Education, Inc., 2004. Johanna
3. Richard Levin. I., "Statistics for Management", PHI, 1988.
4. Douglas C. Montgomery and George C. Runger, "Applied Statistics and Probability for Engineers", Wiley India, 5th Edition, 2012.
5. David S. Moore and George P. McCabe, "Introduction to practice of statistics", W.H. Freeman & Company, 5th Edition, 2005.
6. Richard A .Johnson, Miller and Freunds, "Probability and Statistics for Engineers", Prentice Hall of India, 8th Edition, 2015.
7. Gupta S.C and Kapoor V .K, "Fundamentals of Mathematical Statistics", Sultan Chand and Sons, 2014.
8. Mendenhall, Beaver, Beaver, Introduction to Probability & Statistics, Cengage Learning, 14th Edition, 2014.

COURSE OUTCOMES

Upon completing this course, students should be able to:

1. Acquire the basic knowledge of probability and statistics
2. Distinguish between discrete and continuous random variables and construct the probability distribution of some of the discrete and continuous random variables.
3. Describe general properties of the sampling distribution of mean, proportion and variance and construct and interpret their confidence interval.
4. Formulate the hypothesis and carry out testing.
5. Develop experimental design and analyze to improve product design and improve process performance.

	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**	**PSO-3**
CO1		2			2									2	3
CO2		3			3									3	
CO3		3			3									3	
CO4	3	2			2									2	3
CO5	3	3			3									3	

1: High; 2: Medium; 3: Low

MFMEPC12	MECHANICAL BEHAVIOUR OF MATERIALS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To impart a sound understanding of the tensile, hardness and toughness behaviour of materials.
- To understand the factors affecting the fatigue and fracture behaviour of materials.
- To study the time dependant mechanical behaviour of materials.

Tensile behaviour: Engineering stress-strain curve: Derivation of tensile strength, yield strength, ductility, modulus of elasticity, resilience and toughness from stress strain curves, comparison of stress-strain curves for different materials - True Stress - Strain Curve: true stress at maximum load, true fracture strain, true uniform strain, Necking strain - necking Criteria - Effect of strain rate, temperature and testing machine on flow properties - Notch tensile test - Tensile properties of steel - strengthening mechanisms - Strain hardening - Strain aging - Yield point phenomena - Solid solution strengthening - Martensite Strengthening - Grain refinement, Hall-Petch relation**.**

Hardness & Toughness behaviour: Hardness Measurements: Brinnell hardness, Meyer's hardness, Vickers hardness, Rockwell hardness and Microhardness - Relationship between hardness and the flow curve - Hardness at elevated temperatures - Toughness measurements: Charpy, Izod and Instrumented Charpy - Transition Temprature Curves: significance, various criteria, metallurgical factors affecting the curves, Drop weight test, explosion crack starter test, Dynamic tear test and Robertson crack arrest test - Fracture Analysis Diagram.

Fatigue behaviour: Introduction: Stress cycles, S-N curves Goodman diagram, Soderberg diagram, Gerbar diagram - Cyclics stress strain curve - Low cyle fatigue - Strain life Equation - Fatigue mechanisms - High cycle fatigue - Effect of following paramenters on Fatigue: mean stress, stress concentration, specimen size, surface roughness, residual stress, microstructure and temperature. Fatigue crack propagation - Fatigue under combined stresses - Cumulative fatigue damage - Design for fatigue.

Fracture behaviour: Types of fracture in metals: ductile and brittle fracture - Theoretical cohesive strength of metals - Griffith theory - Metallographic aspects of fracture - Fractography - Notch effect - Concept of fracture curve - Fracture under Combined Stresses - Environment sensitive fracture: hydrogen embrittlement, stress corrosion cracking - Fracture mechanics: strain energy release rate, stress intensity factor, crack deformation modes, fracture toughness testing, plastic zone size correction, crack opening displacement, J-integral and R-curve.

Time dependant mechanical behaviour: Creep curve - Stress rupture Test - Structural changes during creep - Mechanisms of creep deformation - Deformation mechanisms maps - Activation energy for steady state creep - Fracture at elevated temperature - Introduction to high temperature alloys - Predication of long time properties - Creep under combined stresses - Creep- Fatigue Interaction.

REFERENCES

1. George E.Dieter, Mechanical Metallurgy, Tata McGraw – Hill Education Pvt.Ltd, 3rd Edition. New Delhi, 2014.
2. Hertzberg R.W., Richard W. Hertzberg , Richard P. Vinci , Jason L. Hertzberg, Deformation and Fracture Mechanics of Engineering Materials, John Wiley & Sons, Inc., 5th Revised Edition, New York, 2012.
3. Thomas Courtney. H, Mechanical Behavoiur of Materials, McGraw Hill 2nd Edition, 2005.
4. M.A.Meyers and K K.Chawla, Mechanical Behavior of Materials, Cambridge University Press, 2009
5. H. Kuhn and D. Medlin , Metals Handbook, Mechanical Testing, Vol.8, American Society for Metals, Metals Park, Ohio, 2000.
6. Broek.D, Elementary Engineering Fracture Mechanics, 4th Edition., Martinus Nijhoff Publishing, The Hague, 2008.

COURSE OUTCOMES

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

1. Evaluate the tensile behavior of the metals and to study the various strengthening mechanisms
2. Evaluate the hardness and impact behavior of the metals
3. Illustrate the fatigue properties of Metals
4. Illustrate the fracture and fracture mechanics of metals.
5. Describe the time dependent behavior and the various creep mechanisms

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	1	1	3									2			
CO-2	1	1	3	3								2		2	
CO-3	1	1	3	3								2	3	2	
CO-4	1	1	3	3								2		2	
CO-5	1	1										2		2	

MFMEMC15	RESEARCH METHODOLOGY AND IPR	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES

- To formulate research problems
- To understand the importance of research ethics
- To educate the effects of Computer and Information Technology
- To impart an understanding of growth of individuals & nation

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research

problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

Effective literature studies approaches, analysis Plagiarism, Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

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

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

REFERENCES

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction" Ranjit Kumar, 2 nd Edition, "Research Methodology: A Step by Step Guide for beginners"
3. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd, 2007.
4. Mayall, "Industrial Design", McGraw Hill, 1992.
5. Niebel, "Product Design", McGraw Hill, 1974.
6. Asimov, "Introduction to Design", Prentice Hall, 1962.
1. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.
2. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

COURSE OUTCOMES

At the end of the course, the student will be able to:

1. Identify a good research problem
2. Develop a research problem
3. Compile and report research findings
4. Facilitate the process for protecting intellectual property
5. Administer and employ a patent system

	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**	**PSO-3**
CO1	3	3	3	3	3	-	-	2	-	-	-	-	-	2	-
CO2	3	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO3	3	3	3	3	1	-	-	2	-	3	-	-	-	1	-
CO4	1	1	3	-	3	-	-	1	-	2	-	-	-	-	2
CO5	2	1	1	-	3	-	-	-	-	2	-	-	-	-	1

MFMECP107	PRODUCTION ENGINEERING LABORATORY	L	T	P	C
		0	0	3	2

COURSE OBJECTIVES

- To provide hands on experience on different materials processing techniques
- To study the effect of process parameters on difference characteristics in material processing

LIST OF EXPERIMENTS:

1. Formability of sheet metals by water hammer technique
2. Rolling of metal strips
3. Temperature measurement in arc welding process
4. Influence of multi-pass welding on microstructure and hardness
5. Estimation of cutting forces by Merchant's theory
6. Power measurement in a lathe
7. Electric Discharge Machining
8. Abrasive Jet Machining
9. Estimation of flow stress by disc compression test
10. Phase diagram of a two-component system
11. Characteristic of moulding sand
12. Process capability

COURSE OUTCOMES

Upon completing this course, students should be able to correlate the theoretical knowledge with the practical knowledge in the following areas

1. Forming processes and its metallurgy
2. Welding processes and its metallurgy
3. Forces involved and power consumption during metal machining
4. Non-traditional machining processes
5. Casting processes and its metallurgy and Quality control

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	1		2											2	
CO-2	1	2											2		
CO-3		1		2										2	
CO-4	2			1											2
CO-5		2			1								1		

MFMECP17	COMPUTER AIDED ENGINEERING LABORATORY	L	T	P	C
		0	0	3	2

COURSE OBJECTIVES

- To impart hands on experience to students in Geometric Modeling, Assembly and Engineering Drafting.
- To introduce the concepts of CNC programming and simulation on CNC turning, CNC Milling trainer machines
- To train the students to make use of software for finite element analysis for various applications in the field of manufacturing engineering.

CAD

1. SKETCHER- Introduction- Basic sketch, Constraints – Geometry & Dimensional.
2. SOLID MODELING - Extrude, Revolve, Sweep, Loft, Datum plane creation etc
3. SURFACE MODELING - Extrude & Revolve surfacing, Advance surfacing technique – Ruled & Loft surfacing, Mesh of curves, Free form surfaces, Surface operations – trim, merge, intersect, etc.
4. FEATURE MANIPULATION - Copy, Edit, Pattern, Suppress, History operations etc
5. ASSEMBLY - Constraints, Patterns, Exploded views, Interference check, creating components from assembly, mass property calculations, and assembly cut sections.
6. DRAFTING - Standard view, Sectional views and Detailing.

CAM

1. Study of different control systems and CNC codes
2. Programming and simulation for turning, taper turning, circular interpolation, thread, Cutting and facing operation,
3. Programming and simulation using Do-Loop and Sub-routine for CNC turning centre, machining of internal surfaces in CNC turning centre,
4. Programming and simulation of profile milling operation, circular interpolation, circular and rectangular pocket milling, Programming using canned cycles.
5. CNC code generation using CAM software packages – Turning, Milling

FEA

1. Study on Basics of FEA, Nodes, Elements, Boundary Conditions
2. One Dimensional FEA Problem - Truss structure analysis, Cantilever analysis.
3. Two Dimensional FEA Problems - Plane stress analysis, Temperature distribution analysis, Axisymmetric analysis, Contact element analysis.
4. Nonlinear FEA Problem - Nonlinear Beam analysis, Geometrical nonlinear analysis, Material nonlinear analysis.
5. Three Dimensional FEA Problems - 3D Shell Analysis, 3D Analysis.
6. FEA Application in metal forming, metal cutting, fluid flow process etc.

COURSE OUTCOMES

Upon successful completion of the course, the students are able to:

1. Gain practical experience in handling 2D drafting and 3D modeling using modeling software systems.
2. Acquire hands on experience on the finite element modeling
3. Understand the effective input parameters of FEA
4. Understand and apply the concepts G and M codes and manual part programming of turning and milling processes

5. Perform finite element modeling analysis of solid mechanics, heat transfer problems, shell and contact problems in 2D and 3D.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1							2	1		
CO2	1	1	1	2											
CO3	1	1	1	1											
CO4	1	1	1								1				
CO5	1	1	1	1	1						1	2	1	1	1

SECOND SEMESTER

MFMEPC21	METAL FORMING TECHNOLOGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To familiarize response of materials under plastic deformation
- To predict the stress for various metal working processes
- To determine the working load for various forming process
- To familiarize the slip line field theory and upper bound analysis
- To introduce Recent developments in high speed forming

Description of stress at a point-state of stress in two dimensions and three dimensions-stress tensor –Mohr's circles- two dimensions and three dimensions state of stress. Hydrostatic and stress deviator. Fundamentals of plasticity-flow curve-true stress and true strain-yielding criteria for ductile loads combined stress test-octahedral shear stress and shear strain-invariants of stress and strain-plastic stress and strain relations-Levy-mises equation-Prandtl-Resus equations.

Determination of workload-work formula for homogenous deformation-rolling, rod drawing and extrusion processes. Determination of load by stress evaluation method: Determination of drawing load-strip drawing with wedge shaped dies , cylindrical rod drawing with a conical die, tube drawing and tube sinking. Determinations of roll loads and roll force.

Determination of load by stress evaluation method: Determination of forging load-plane strain forging of a thin strip and a flat circular disc. Determination of extrusion load for round bar and flat strip. Slip line field theory - Plane strain indentation of punch and Plane strain extrusion process. Upper bound analysis – Plane strain indentation with frictionless interface and Plain strain frictionless extrusion

Effect of high speed on stress strain relationships - effect of friction, temperature and stress waves-comparison and requirements of HVF equipments. Description of high speed forming machine-hot forging, pneumatic - mechanical, high velocity forging - Fuel combustion process. Electro-magnetic forming: principle-essential of process-process variables-applications.

Explosive forming-Explosives-characteristics-stand off and contact operations, stress waves and their effects-requirements for standoff operations-process variables-properties of formed components-applications. Electro hydraulic forming-principles, requirements and characteristics - process variables, Water hammer forming - principle and parameters governing the process.

REFERENCES:

1. An Introduction to the Principles of Metal Working, Rowe G.W, Edward Arnold Publication.
2. Mechanical Metallurgy, George. E Dieter McGraw-Hill International edition, Newyork,1988
3. Developments in High Speed Metal Forming, Davies. R and Austin. E.R., The Machinery Publishing Co. Ltd. London. 1970.
4. Fundamentals of Metal Forming, Robert H. Wagoner and Jean Loup Chenot., John Wiley & Sons Inc., New York, 1992.
5. Plasticity for Engineers, Calladine C. R., John Wiley & Sons, 1991.
6. Metals Handbook, Material Information Society, ASM, V4, Metals hand book,1979.

COURSE OUTCOMES:

Upon completing this course, students should be able to:

1. Describe the fundamentals of theory of plasticity.
2. Appraise the rod, wire and strip drawing processes and evaluate the force requirements.
3. Appraise the forging and extrusion processes and evaluate the force requirements.
4. Enumerate the different high speed energy forming machines and its features
5. Discuss the characteristics and application of various high speed forming processes.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3											1	3		
CO2		3	2	1										3	
CO3		3	2	1										3	
CO4	3		2												2
CO5	3		1												2

MFMEPC22	METAL JOINING TECHNOLOGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To provide the fundamental knowledge on basic physical metallurgy and welding metallurgy.
- To study about the weldability aspects of ferrous metals and non-ferrous metals.
- To know the details of various welding defects.
- To study about the weldability tests, Service tests and Corrosion test

Basic characteristics of fusion welds: Brief introduction to fusion welding process - Heat flow in welding: temperature distribution in welding, heat flow equations, simple problems, metallurgical effects of heat flow in welding, TTT diagrams, CCT diagrams - Metallurgy of fusion Weld: different zones of steel weldments and their properties, microstructure products in weldments.

Weldability of ferrous metals: Weldability of Carbon Steels, HSLA steels, Q&T steels, Cr-Mo steels, Significance of carbon equivalent, important problems encountered in welding of above steels and remedial steps - Weldability of Stainless Steels: stainless steel classification, Schaffler diagram, Delong diagram, WRC diagram problems associated with welding of austenitic stainless steel, ferritic stainless steel, martensitic stainless steel and duplex stainless steels.

Weldability of non-ferrous metals: Weldability of Aluminum alloys: Classification of aluminum alloys, various processes used for aluminum welding, problems involved in aluminum welding, precaution and welding procedure requirements, Weldability of Titanium alloys: classifications of titanium alloys, various welding processes and procedures involved in titanium welding problems involved and remedial steps - welding of nickel base alloys and magnesium alloys.

Welding defects: Cracks: hot cracks, cold cracks, nomenclature, location and orientation of weld cracks, chevron cracks, lamellar cracks, reheat cracks, stress corrosion cracks - Residual Stresses: mechanism involved, types of residual stresses, measuring residual stress by hole drilling method, x-ray diffraction method, method of stress relieving, vibratory stress relief - Distortion: longitudinal, traverse, angular distortion, simple problems, bowing, rational distortion, buckling and twisting, controlling of distortions in weldments.

Weldability testing: Hot crack Tests: Murex test, Houldcroft test, Varestraint test, ring weldability test, hot ductility test - Cold Crack Tests: controlled thermal severity test, tekken test, lehigh test, longitudinal bead weld test, implant test - Service Weldability Tests: tensile test, nick break test, bend test, impact test, hardness test, fracture toughness test, fatigue test, creep test and corrosion test.

REFERENCES

1. Welding Engineering and Technology, Parmar R.S, Khanna Publishers, New Delhi. 1998
2. Welding Metallurgy, Linnert G.E, Vol. I & II, 4th edition, American Welding Society, 1994
3. Introduction of Physical Metallurgy of Welding, Kenneth Easterling, 2nd Edition, Butterworth - Heinman, 1992
4. The Metallurgy of Welding, Saferian. D, Pergamon Press, 1985
5. Welding Metallurgy, Kuo S, Kohn Wiley, 1987
6. Welding Hand Book, Welding Process Vol. II 8th Edition, American Welding Society, 1991
7. Welding Hand book, Material and Application Vol.III, 8th Edition, American -Welding Society, 1991
8. Modern Arc Welding Technology, Nadkarni S.V, Oxford & IBH Publishing Co. Ltd., New Delhi

COURSE OUTCOMES

Upon completing this course, students should be able to:

1. Understand the basics of Physical Metallurgy SUCH AS Welding Metallurgy and heat flow equations and different zones of Steel weldment in Fusion welding
2. Differentiate the Weldability of ferrous metals like Carbon Steels and High Strength Low Alloy Steels(HSLA)
3. Select the appropriate technique for welding of Non- ferrous metals like aluminium, nickel and titanium
4. Classify the various types of welding defects such as Cracks, Residual stress and Distortion.
5. Evaluate the Weldability testing, Service Weldability tests and Corrosion tests.

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	**3**	**1**	**1**	**1**								**1**	**2**	**2**	
CO-2	**2**	**1**	**1**		**1**								**2**	**1**	
CO-3	**2**	**1**		**1**	**1**								**2**	**1**	
CO-4	**1**	**2**		**2**	**2**								**2**	**1**	**1**
CO-5	**2**	**2**		**2**									**2**	**2**	

MFMECP25	COMPUTING AND SIMULATION LABORATORY	L	T	P	C
		0	0	3	2

COURSE OBJECTIVES

- To provide hands on experience in some mathematical and simple statistical analysis using mathematical software.

TOPICS

Simulation: dealing with matrices, Graphing- Functions of one variable and two variables, Response of under damped single degree of freedom systems to initial excitations, Response of single degree freedom to harmonic and pulse excitations, Random number generation.

2D, 3D plots, Control Charts, Frequency response plots, Solving of Linear Algebraic Equations, Quadratic Function, Discrete Function.

Manufacturing Design Calculations and Process simulation.

DOE - Response Surface Methodology, T-test, ANOVA, Correlation and Regression Analysis, Cluster Analysis, Factor Analysis.

COURSE OUTCOMES

Upon the completion of the course, the students will be able to:

1. Accomplish mathematical calculation such a matrix, graphing and random generations using computer software
2. Draw various types of 2D and 3D plots used for engineering applications.
3. Acquire knowledge on ANOVA, Regression and correlation analysis
4. Carryout process simulations and production design calculations.
5. Understand the basic concepts of Response surface methodology and its importance in experimental works

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	3	3	3	2							2	3	3	
CO-2	3	3	3	3	2							2	3	3	
CO-3	3	3	3	3	3							1	2	2	
CO-4	2	3	3	3	3							1	2	2	
CO-5	2	3	3	3	3							1	2	2	

MFMETS27	**INDUSTRIAL TRAINING AND SEMINAR / MINI PROJECT**	**L**	**T**	**P**	**C**
		0	**2**	**2**	**2**

COURSE OBJECTIVES

- To train the students in the field work related the Manufacturing Engineering and to have a practical knowledge in carrying out Structural field related works.
- To train and develop skills in solving problems during execution of certain works related to Manufacturing Engineering.

The students individually undergo a training program in reputed concerns in the field of Manufacturing Engineering during the summer vacation (at the end of second semester for full – time / fourth semester for part – time) for a minimum stipulated period of four weeks. At the end of the training, the student has to submit a detailed report on the training he had, within ten days from the commencement of the third semester for Full-time / fifth semester for part-time. The students will be evaluated by a team of staff members nominated by head of the department through a viva-voce examination.

** - Four weeks during the summer vacation at the end of II Semester.*

COURSE OUTCOMES

1. Face the challenges in the field with confidence.
2. Benefit by the training with managing the situation that arises during the execution of works related to Manufacturing Environments.
3. Get the training to face the audience and to interact with the audience with confidence.
4. Tackle any problem during group discussion in the corporate interviews.
5. Gain practical knowledge in carrying out manufacturing related works.

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	2		2		2	2		1		1		2	2	2
CO-2	2			2		2			1				2		2
CO-3				2		2			1	2	1		2	1	1
CO-4						1			2	2	1			1	1
CO-5	2	2	2			1	1						1		1

THIRD SEMESTER

MFMETH33	THESIS PHASE-I & VIVA-VOCE	L	T	P	C
		0	16	4	10

COURSE OBJECTIVES

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
- To train the students in preparing project reports and to face reviews and viva voce examination.

METHOD OF EVALUATION:

- The student undergoes literature survey and identifies the topic of thesis and finalizes in consultation with Guide/Supervisor and prepares a comprehensive thesis report after completing the work to the satisfaction of the supervisor.
- The progress of the thesis is evaluated based on a minimum of three reviews.
- The review committee will be constituted by the Head of the Department.
- A thesis report is required at the end of the semester.
- The thesis work is evaluated based on oral presentation and the thesis report jointly by external and internal examiners constituted by the Head of the Department.

COURSE OUTCOMES

Upon completing this course, students should be able to:

1. Take up any challenging practical problems and find solution by formulating proper methodology.
2. Students will acquire the ability to make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task.
3. Students will acquire collaborative skills through working in a team to achieve common goals.
4. Students will be able to learn on their own, reflect on their learning and take appropriate actions to improve it.
5. Students will acquire the skills to communicate effectively and to present ideas clearly and coherently to specific audience in both the written and oral forms.

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO -1	PSO -2	PSO -3
CO-1		1	1	1			2		2			1	1	2	2
CO-2	2		2			1		1		2		2	2		
CO-3			2						2	2		2	2	1	
CO-4				2	2		2	2			2		2		2
CO-5	2	2	2	2		1	1		1			2		2	2

FOUURTH SEMESTER

MFMETH41	THESIS PHASE-II & VIVA-VOCE	L	T	P	C
		0	26	6	15

COURSE OBJECTIVES

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
- To train the students in preparing project reports and to face reviews and viva voce examination.

METHOD OF EVALUATION:

- The progress of the thesis is evaluated based on a minimum of three reviews.
- The review committee will be constituted by the Head of the Department.
- A thesis report is required at the end of the semester.
- The thesis work is evaluated based on oral presentation and the thesis report jointly by external and internal examiners constituted by the Head of the Department.

COURSE OUTCOMES

Upon completing this course, students should be able to:

1. Take up any challenging practical problems and find solution by formulating proper methodology.
2. Students will acquire the ability to make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task.
3. Students will acquire collaborative skills through working in a team to achieve common goals.
4. Students will be able to learn on their own, reflect on their learning and take appropriate actions to improve it.
5. Students will acquire the skills to communicate effectively and to present ideas clearly and coherently to specific audience in both the written and oral forms.

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO -1	PSO -2	PSO -3
CO-1		1	1	2			2		2			2	1	2	2
CO-2						2		2							
CO-3			1						1			1		1	
CO-4				2	2		2	1			2		2		2
CO-5	2	2	2	2		1	1		1			2		2	2

PROFESSIONAL ELECTIVE COURSES

MFMEPEXX	MECHANICS OF METAL MACHINING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To impart fundamental knowledge on mechanics of chip formation
- To impart knowledge about tool failure analysis, and thermodynamics involved in metal cutting.
- To impart knowledge about wear-mechanisms of cutting tools and wear-chatter in machining.
- To provide an understanding of the mechanics of chip formation, tool failure analysis, and thermodynamics involved in metal cutting and the evolution of tool materials.

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.

Nomenclature of single point cutting tool-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

Heat distribution in machining - effects of various parameters on temperature - methods of temperature measurement in machining - hot machining - cutting fluids.

Tool failure: Mechanism of plastic failure – form stability, measurement of tool wear – tool life tests – tool life equation for variable theories – variables affecting tool life – economics of machining – machinability – machinability index – problems

Processing and Machining – Measuring Techniques – Reasons for failure of cutting tools and forms of wear-mechanisms of wear-chatter in machining-factors effecting chatter in machining-types of chatter-mechanism of chatter

REFERENCES

1. Boothroid, D.G. & Knight W.A., Fundamentals of machining and machine tools, Marcel Dekker, New York, 1989.
2. Shaw. M.C., Metal cutting principles, Oxford Clare don press, 1984.
3. Bhattacharya. A., Metal Cutting Theory and practice, Central Book Publishers, India, 1984.
4. Principles of metal cutting, Kuppusamy G., University Press, 1996.
5. The machining of metals, Armargeo, E.J.A. and Brown R.H. prentice Hall, 1969
6. Fundamentals of metal machining, Boothrough G., McGraw Hill, 1982.
7. Fundamentals of metal cutting and machine tools, Juneja B.L and Sekhar G.S, New age international, 1995.

COURSE OUTCOMES

Upon successful completion of the course, the students are able to:

1. To understand fundamental knowledge on mechanics of chip formation and to distinguish between orthogonal and oblique cutting
2. To acquire fundamental knowledge about the basic structures of concept of tools and tool materials
3. To understand the heat distribution during machining
4. To impart knowledge about tool failure analysis and thermodynamics involved in metal cutting
5. To differentiate various types of wear

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO -1	PSO -2	PSO -3
CO-1	1												1		
CO-2	1	2	3										1		
CO-3			2			1							2	1	3
CO-4	1		2	3									3	1	2
CO-5	1		3	2									1		

MFMEPEXX	MANUFACTURING MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To introduce the operations management principles, and the related quantitative approaches, that helps in achieving the organizational goals.

Manufacturing management – Evolution and objectives - Concept of Production system - Types of Production systems – Continuous, Intermittent - Production versus Services
Forecasting - components of demand - Quantitative methods - Single moving average method - Single exponential smoothing method - Simple linear regression models – Seasonal model – Measures of accuracy - Simple problems - Qualitative Methods

Capacity planning: Defining and measuring capacity – determinants of effective capacity – Developing capacity alternatives. Aggregate planning: Costs, Strategies – Application of chase and level strategies - Transportation model - Simple problems.

Inventory planning and control: Need, inventory costs, Determination of EOQ, EPQ/ELS (without shortages) - Effect of quantity discounts. Determination of ROL, Safety Stocks – Service level - Methods of calculating safety stock using Normal distribution – unit service level - single period inventory model- Inventory control systems - P, Q, and S-s System – Selective inventory control techniques - Simple problems

Materials Requirements Planning (MRP) – Master production schedule, Bill of materials, MRP concepts, Lot sizing: Lot-for-lot technique, EOQ approach, Periodic order quantity approach – Simple problems. Concepts of manufacturing : Enterprise Resource planning (ERP) - TPM – pillars of TPM – six big losses – TPM implementation – Overall equipment effectiveness - Principles of JIT production – value added focus – sources of waste – Toyoto's seven waste – waste reduction – push pull system – Kanban theory – JIT implementation - JIT purchasing - Supply chain management

Scheduling and assignment problems - Notations and definitions – criteria, objective functions of scheduling – Job shop scheduling: Sequencing of n jobs through 1 machine – priority rules - Measures of Performance - n jobs through 2 machines – Jackson's rule - Simple problems. Flow shop scheduling – n jobs through 2, 3 machines – Johnsons rule, CDS algorithm, Palmer algorithm, Dannenbring algorithm, 2 jobs on m machines – graphical method – Multiproduct assignment problem - Index method - Simple problems

REFERENCES

1. Production and Operations Management: Theory and Problems, Chary; S.N., TMH, New Delhi, 1990
2. Production and Operation Management, Paneerselvam R. PHI, 1999
3. Operation Management : Theory & Problems, Monks J. G., McGraw Hill, 1987
4. Production and Operations Management, Chase R.B., Aquilano N.J and Jacobs R.R., 8th e edition, TMH, 1998
5. Production Planning and Inventory Control, Narasimhan S.L., Mc Leavey D.W., and Billington P.J., 2nd Edition, PHI, 1997
6. Production and Operations Management, Jay Heizer and Barry Render, Prentice Hall Inc. fourth edition, 1996

COURSE OUTCOMES

Upon completing this course, students should be able to:

1. Develop an understanding of various types of production systems
2. Differentiate Production and services
3. Gain an understanding and appreciation of the principles and applications relevant to the planning, design, and operations of manufacturing/service firms
4. Develop the ability to identify operational methodologies to assess and improve an organizations performance
5. Gain ability to recognize situations in a production system environment that suggests the use of certain quantitative methods to assist in decision making in the areas such as Aggregate planning, Inventory control, forecasting MRP and scheduling

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3		2	2				2	3	3		2	2	3
CO2	2	2		3	2				2		2		2	2	3
CO3	1	2		2	2				1		2		1	2	2
CO4	1	2		2	3				2		3		1	2	3
CO5	2	3		2	3				2		3		2	3	3

MFMEPEXX	METAL CASTING TECHNOLOGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To provide the knowledge on modern casting techniques,
- To impart an understanding of the design of runners, risers, gating and casting defects, design considerations and modernization of foundries.

Modern casting techniques: Shaw process, slush casting, continuous casting, squeeze casting, Rheo casting, Thixo casting, Electro slag casting, Full mould process, Low pressure die casting, High pressure die casting.

Pouring: Gating design - Illustrative Problems in determination of filling time and discharge rate - Aspiration effect - Effects of friction and velocity distribution. Riser design and placement - determination of dimensions of riser - residual stress.

Solidification: Solidification shrinkages of pure metals and alloys - Effect of mould materials and alloy Composition on casting - Metal fluidity measurement and application of fluidity - gases in metals - degassing - grain refinement, Heat treatment of castings. Illustrative Problems related to determination of solidification time.

Casting defects and testing: Specification of castings - Inspection of castings - Analysis of casting defects - Quality control and quality assurance. Foundry mechanization: Principles and practice. Modernization of foundries: Pollution control-Energy saving- Layout for foundry. Material handling equipments: Sand handling, Mould handling, Core handling, Charge handling, Hot metal handling, handling of castings.

Casting design consideration: Design problems involving thin sections: Alloy selection, feeding through thin sections, non-uniform wall thickness, chilling effect of the mould. Design problems involving junctions - Design problems involving unequal sections: Padding, feed paths in permanent and investment castings.

REFERENCES

1. Foundry Engineering, Howard F. Taylor, Merton C. Flemings, John Wulff, Wiley Eastern Limited, 1993
2. Fundamentals of Metal Casting Technology, Mukerjee. P.C, Oxford & IBH. Co., 1979

3. Principles of Foundry Technology, Jain. P.L, Tata McGraw-Hill Pub. Ltd., New Delhi,1997
4. Metal Casting - Principles and Practice, Ramana rao .T.V, New Age international, 1996
5. Manufacturing Science, Amitabha Gosh, Affiliated East-West Press,1985

COURSE OUT COMES

Upon completing this course, students should be able to:

1. To teach the uncoventional/modern casting techniques along with their merits and demerits
2. To teach the design philosophies, that, help in good riser & gating design leading to economising the mold material requirement and at the same to reduce cost & defects of the casting made
3. To teach the thermal expansion and frictional effects occurring, after the metal is poured in to the mould and to teach the relevant design philosophies
4. To impress upon the possible casting defects and the ways of minimising them and on the economics of foundry mechanisation and energy utilized
5. To teach the design philosophies, that help in, thin section casting with minimum defects at junctions

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	1	1	1	1						2	1	1		1	1
CO-2	1	1	1	1						2	1	1		1	1
CO-3	1	1	1	1						2	1	1		1	1
CO-4	1	1	1	1						2	1	1		1	1
CO-5	1	1	1	1						2	1	1		1	1

MFMEPEXX	**MACHINE TOOL DRIVES AND CONTROLS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES

- Remember different type of drives mechanism, selection of speeds and feeds and designs the machine tool gear box.
- Understand the working principle of hydraulic circuit components like control valves, controllers, actuators, sensors and its selection.
- Develop different logic circuits using logic elements to control machine tools.
- Acquire knowledge of trouble shooting and design of hydraulic circuits for different applications.
- Apply APT program to design different hydraulic control circuits.

Machine Tool Drives: Selection of range of speeds and feeds – advantages of G.P series - Design of machine tool gear boxes. Types of drives: sliding clustered drives, Ruppert drives, Meander drives, Mechanical stepless drives.

Oil Hydraulics: Basics of Hydraulics drives : Application - Advantages of hydraulic control drives. Pump Classification: gear, vane, piston, Linear, Rotary- Fixed and Variable displacement pumps hydraulic pumps. Types of valves: Direction control, Flow control and Pressure control valves- Types, unloading - sequence valves, counter balance valves - Construction and Operation. Simple hydraulic circuits: Meter in, Meter out, Bleed off circuits, Regenerative circuits.

Fluidic control: Wall attachment principle – Types of amplifiers – Types of Logic elements – Types of Sensors – Simple logic circuits.

Numerical control: Introduction to numerical control – Application of NC machines – Economics of NC machines – Open loop – closed loop system – Interpolator – transducers – Comparators

Manual and Computer Aided Programming Languages: APT programming – Exercises in programming

REFERENCES

1. Machine Tool Design and Numerical Control, Metha, N.K., Tata McGraw – Hill Publication
2. Industrial Hydraulics, John Pippenger and Tyler Hicks, McGraw Hill Co.
3. Machine Tool Design, Vol III and IV, Acherkan, N.S. MIR Publishers, Moscow
4. Programming for NC Machines, Roberts & Prentice, McGraw Hill
5. Computer Numerical Control of Machine Tools, Radhakrishnan., P, New Central Book Agency, Calcutta
6. Hydraulic Hand book, Warring R.H, Gulf Publishing Company
7. Principles of Machine Tools, Sen G.S, & Bhattacharya, New Central Book Agency, Calcutta

COURSE OUTCOMES

Upon successful completion of the course, the students are able to:

1. Understand machine tool drives and their types
2. Identify hydraulic components and circuits
3. Ability to design simple logic circuits
4. Understand the benefits and applications of Numerical control machines.
5. Get the knowledge on the design aspects of circuits for Machine Tool Control, the drive systems used for Machine Tools and N.C. systems
6. Ability to develop N.C machines programming

	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**	**PSO-3**
CO-1	1	2			3								2		
CO-2	2	1	3							3				1	
CO-3		3	1	2									1		
CO-4			2		1				3			3			2
CO-5	2	1		3						2			3		

MFMEPEXX	MAINTENANCE MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To impart a better understanding of the fundamental philosophies of Maintenance Management, and the different techniques that enable the selection of the optimum maintenance strategy. It also discuss the concepts of reliability engineering and spare parts management

Maintenance system: Types of Maintenance - Maintenance strategies and planning – quantitative analysis – Breakdown – time frequency distributions – Breakdown maintenance policy, preventive maintenance policy- Selection of repair Vs preventive maintenance policy – simple problems. Introduction to TPM – six big losses – pillars of TPM – 5s – Overall Equipment Effectiveness (OEE)

Maintenance facilities planning: Planning of Maintenance Function – Long range planning – Short range planning – Man power allocation - Planning techniques – Planning steps - Optimal number of machines / crew size - Use of waiting line and Simulation model.

Replacement strategies and Policies: Basic concepts of replacement analysis, economic service life, opportunity costs - cash flow approaches to replacement analysis - Replacement analysis using specified time period - probabilistic replacement models – simple problems

Reliability Engineering: Bath tub curve - Failure data analysis and life testing – Reliability parameters – Reliability models – Reliability evaluation methods – Weibull analysis – System reliability with components in series, parallel and mixed configuration – Active, partial and standby redundancy – Availability and Maintainability concepts - Reliability centered maintenance – FTA, FMECA.

Spares management: Spare parts management - Characteristics of spare parts inventory – Approaches for selective inventory control – VED/ABC analysis – Models for breakdown spares, capital spares, insurance spares and rotable spares – simple problems. Introduction to Maintenance Resource Planning (MRP) – maintenance Manpower Resources and Spares Requirement Planning (MRSRP).

REFERENCES

1. Production and Operations Management: Theory and Problems, Chary S.N., TMH, New Delhi, 1990
2. Operation Management: Theory & Problems Monks J.G., McGraw Hill, 1987
3. Concepts in Reliability Engineering, Srinath L.S., East west press Ltd. 1991
4. Terrotechnology: Reliability Engineering and Maintenance Management, Bikas Bhadury and S.K. Basu, Asian Books Pvt., Ltd., New Delhi, 2003
5. Introduction to Total Productive Maintenance, Seiichi Nakeiima, Productivity Press (India) Pvt Ltd., Madras, 1988
6. Maintenance and Engineering Management, Mishra R.C., Pathak K., Prentice hall India Private Limited, New Delhi, 2002

COURSE OUTCOMES

Upon completing this course, students should be able to:

1. Develop a maintenance plan for a technical system
2. Have a working knowledge of the techniques of reliability engineering
3. Apply learned concepts to improve the maintenance, the maintainability, hazard risk and the safety of the plant
4. Apply problem solving models to maintenance
5. Analyze different failure of a component/equipment

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO1	2	2	3	3	3		3		2	2	2		3	2	2
CO2	3	3			3		3			3	3		3	2	
CO3	3	3								3	3		2		
CO4	2	2			3				3	3	2		1	2	2
CO5	1	2			2		2		3	2	3		2	2	3

MFMEPEXX	COMPUTER INTEGRATED MANUFACTURING SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To familiarize the basic concepts of CIM
- To introduce the fundamentals of robotics and its applications in manufacturing industries
- To introduce the concept of FMS and the materials handling and storage system used
- To familiarize the group technology concept and the clustering algorithms associated with it.
- To introduce the concepts of CAPP and CAQC

Introduction to CIM: An overview of CIM – Significance – Product development through CIM – Design and Implementation – CIM models – Present status.

Industrial Robotics: Automation and Robotics – Robot Anatomy, Joint motions – End effectors: Grippers and Tools – Robotic sensors – Robot vision system – Robot programming – Robot cell: Types – Design and control. Applications of Industrial Robots in Material transfer, Machine loading/unloading, Welding, Spray coating, Processing operations, Assembly and Inspection, Advanced Applications.

Flexible Manufacturing System (FMS): Definition – Components – Types – Flexibilities – Materials Handling and storage system: Conveyors: Types – Automated Guided Vehicle (AGV): Types, Guidance and Routing – Automated Material Handling and Storage system (AS/RS): Types, Components and Special features – Carousel system – WIP storage – Role of computers in FMS – FMS Layouts – Benefits of FMS.

Group Technology (GT): Part family – Parts classification and coding – Cellular Manufacturing – Benefits of GT. Algorithms for Machine cell formation: Algorithms based on

similarity coefficients: Single Linkage Clustering Analysis (SLCA), Algorithms based on sorting of Part-Machine Incidence Matrix: Production Flow Analysis (PFA) – Rank Order Clustering (ROC), Cluster Identification Algorithm (CIA) – Cellular Layouts.

Automated Process Planning: Generative and Variant types of process planning – AI in process planning – Software. Computer- Aided Quality Control (CAQC): Overview – Inspection Technology: Types of Coordinate Measuring Machines (CMM) – Non-contact inspection methods – Machine vision system.

REFERENCES

1. Mikell P. Groover, Automation, Production Systems and Computer Integrated Manufacturing, Prentice-Hall of India Pvt. Ltd., New Delhi, 2002
2. Mikell P. Groover, Mitchell Weiss, Roger N. Nagel and Nicolas G. Odery, Industrial Robotics: Technology, Programming and Applications, McGraw-Hill Book Co., 1986
3. Radhakrishnan, P., Subramanyam, S, and Raju, V., CAD/CAM/CIM, Second Edition, New Age International Pvt., Ltd., 2002
4. Deb, S.R., Robotics Technology and Flexible Automation, Tata McGraw-Hill Publishing Co. Ltd., 1996

COURSE OUTCOMES

Upon completing this course, students will able to:

1. Outline the basic concepts of CIM and its importance in the global competitive market
2. Understand the anatomy of industrial robots and their application in various areas of manufacturing
3. Apply the concepts of FMS and automated materials handling and storage systems
4. Adapt the group technology concept and clustering algorithms in modern manufacturing systems
5. Get familiarize with the concepts of CAPP, CAQC and the usage of CMM.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	1		3		2								1		3
CO2	1		2		2								1	3	
CO3	1		3		1		2			3		1		2	2
CO4	1	2	2	3	1							1	2	2	
CO5	1		2		2							1			2

MFMEPEXX	**PLANT LAYOUT AND MATERIAL HANDLING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES

- To introduce the concepts of layout planning and the various algorithms used in and also to introduce the design of material handling systems, mechanized assembly, hoppers and feeders and transfer systems.

Plant Layout: Need for Layout Planning – Layout Objectives and Determinants. Process Layout: Operation Sequence Analysis – Load-Distance Analysis – Travel Chart – Muthur's systematic layout planning – Pair-wise Exchange Method–Simple Problems. Product Layout: Line Balancing– Largest Candidate Rule – Kilbridge & Wester's Method – Ranked Positional Weight Method – COMSOAL.

Apples plant layout procedure – Reed's plant layout procedure - Computer Aided Plant Layout Planning: CORELAP, PLANET, MAT, ALDAP, CRAFT - Plant Layout Algorithms: Modified spanning tree algorithm – Graph based method – BLOCPLAN Algorithm

Facilities planning - Introduction to models for single row machine layout problem - multi-row layout problem and quadratic assignment model - introduction to algorithms for the multi-row layout problems.

Material Handling Functions - Principles - Types of Material Handling Systems. Analysis of Material Handling Equipment. Economic Analysis of Material Handling Equipments: Breakeven Analysis – Equipment Operating Cost Per Unit Distance – Work Volume Analysis – Illustrative Problems. Productivity / Indicator Ratios. Packaging: Functions – Materials – Palletizing – Packaging Equipments.

Mechanized Assembly: Principles and Operating characteristics of Part Feeders such as Vibratory Bowl Feeder, Reciprocating Tube Hopper, Centrifugal Hopper Feeder and Center Board hopper feeder – Orientation of Parts – In-bowl and Out-of-bowl tooling – Different Types of Escapements Transfer Systems and Indexing Mechanisms.

REFERENCES

1. Material Handling, John R. Immer, McGraw Hill Book Coy, 1953
2. Facility Layout and Location: An Analytical Approach, Francis R. L., McGinnis L. F., & White J. A., PHI, 1999
3. Manufacturing Facilities: Location, Planning & Design. Sule D. R., PWS Publishing Co., Boston, 2nd Edition, 1994
4. Facilities Design, Sunderesh Heragu, PWS Publishing Co., Boston, 1997
5. Materials Management & Materials Handling, Sharma S. C., Khanna Publishers, New Delhi
6. Production and Operations Management – Principles and Techniques, Ray Wild, ELBS
7. Analysis and control of production systems, 2nd edition, Elsayed A., and Thomas O. Bouchar Prentice Hall, NJ, 1994
8. Theory and Problems in Operation and Production Management, Chary S. N., Tata-McGraw Hill, 1994
9. Mechanised Assembly, Boothroyd & Redford
10. Automation, Production Systems and Computer-Integrated Manufacturing, Groover M.P., PHI, New Delhi, 2002
11. Facilities Planning, III Edition, Tompkins, White, Bozer, Tanchoco, John Wilery & Sons Pvt.Ltd, Singalore, 2003

COURSE OUTCOMES

Upon completing this course, students should be able to:

1. Understand the different layout planning and its techniques such as process layout and product layout

2. Differentiate various types of layout procedure, computer aided plant layout planning and plant layout Algorithm
3. Select appropriate facilitate planning for different layout problems
4. Classify various types of material handling functions of material handling system, and analysis of material handling system
5. Evaluate the Mechanized assembly on part feeders and Transfer system

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	2	2	1										1	2	
CO-2	3	1	2	1	1								2	2	
CO-3	2	3	1		2								1	2	
CO-4	2	3		1	2	1							1	1	
CO-5	2		1		1								1	1	

MFMEPEXX	COMPOSITE MATERIALS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To impart an in-depth knowledge on composite materials, types, production processing and the structural development in composite materials.

Introduction: Fundamentals of composites – need for composites – Enhancement of properties – classification of composites - Matrix-Polymer matrix composites (PMC), Metal matrix composites (MMC), Ceramic matrix composites (CMC) Reinforcement - Particle reinforced composites, Fibre reinforced composites, Applications of various types of composites.

Classification .of Polymers - properties and applications of selective engineering polymers - Polymer Matrix Composites: Polymer matrix resins - Thermosetting resins, thermoplastic resins - Reinforcement fibres - Rovings - Woven fabrics - Non Woven random mats - various types of fibres. PMC processes - Hand layup processes - Spray layup processes - Compression moulding - Reinforced reaction injection moulding - Resin transfer moulding Pultrusion - Filament winding - Injection moulding. Fibre reinforced plastics (FRP), (Glass fibre reinforced plastics (GRP)).

Metal Matrix Composites: Characteristics of MMC, Various types of Metal matrix composites Alloy vs. MMC, Advantages of MMC. Limitations of MMC, Metal Matrix, Reinforcements - particles - fibres. Effect of reinforcement - Volume fraction - Rule of mixtures, Processing of MMC - Powder metallurgy process - diffusion bonding - stir casting, squeeze casting.

Ceramics Matrix Composites: Engineering ceramic materials - properties - advantages - limitations - Monolithic ceramics - Need for CMC Ceramic matrix - Various types of Ceramic Matrix composites - oxide ceramics - non oxide ceramics aluminium oxide - silicon nitride - reinforcements particles - fibres - whiskers. Sintering - Hot pressing Cold isostatic pressing (piping) - Hot isostatic pressing. (HIPing)

Advances in Composites: Carbon/carbon composites - Advantages of carbon matrix - limitations of carbon matrix Carbon fibre - chemical vapour deposition of carbon on carbon fibre perform. Sol gel technique. Composites for aerospace industrial applications.

REFERENCES

1. Composite materials, Engineering and Science, Mathews .F.L. and Rawings .R.D., Chapman
2. Composite materials, Chawla K.K., SpringerVerlag, 1987
3. Engineering Materials, Kenneth G.Budinski, Prentice Pvt. Ltd., 41th Indian Reprint, 2002
4. Introduction to Metal Matrix Composites, T.W.Clyne and P.J. Withers, Cambridge University Press, 1993
5. Fundamentals of Composite Manufacturing, B. Strong, SME, 1989
6. Composite materials, S.C. Sharma, Narosa Publications, 2000
7. "Short Term Course on Advances in Composite Materials", Composite Technology Centre, Department of Metallurgy, lIT - Madras, December 2001
8. Hand Book of Plastic processing, Brydson,
9. FRP Technology (Fibre Reinforced Resin System), Weatherhead, R.G Applied Science Publishers Limited, London, 1990

COURSE OUTCOMES

Upon completing this course, students should be able to:

1. To teach the need for various types composite materials and to list the performance requirements of good matrices and reinforcements, with which, the composite material is fabricated
2. To explain the purpose of Polymer matrix composites and to teach the different techniques of manufacturing the same, along with, their comparative advantages
3. To teach the purpose of different types of metal matrix composites and to tailor make them to suit to the design needs
4. To teach the purpose of ceramic matrix composites and the underlying philosophies of imparting toughness, and also to teach the manufacturing techniques
5. To teach the purpose of carbon-carbon composites and manufacturing techniques along with comparative advantages and limitations

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	1	1	1	1						2	1	1		1	1
CO-2	1	1	1	1						2	1	1		1	1
CO-3	1	1	1	1						2	1	1		1	1
CO-4	1	1	1	1						2	1	1		1	1
CO-5	1	1	1	1						2	1	1		1	1

MFMEPEXX	TOOL ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To introduce different production tools, including press tools, their design,
- To provide an understanding of design and use of jigs and fixtures.
- To introduce the students, the modern concepts of tool engineering

Design principles of cutting tools – problems in cutting tool design – factors in tool design – Single point cutting tool – chip breakers – determination of tool shank dimensions. Milling cutters – determination of number of teeth, teeth size and other features. Design features – drills – reamers - broaching tools.

Press tool design: Press classification – selection and features of press. Dies – types – clearances. Progressive die design for typical components for blanking and piercing – compound die –combination die – Illustrative examples. Strip layout design – influencing factors

Bending: Types of bending – determination of bending force – bend allowance – Springback. Drawing dies: Design of dies – blank development – Cup drawing - illustrative examples. Ironing – calculation of number of draws. Design of forging dies – blank size, materials for die block.

Elements of Jigs and Fixure – Locating and clamping principles. Locating method and devices – Clamping devices. Types of Jigs: Plate, Template, Latch, Channel Leaf, Box and Indexing.

Modular work holding systems – quick change toolings - single minute exchange of dies – Computer aided fixture design – phases. Plastic tooling – Plastic tool materials – construction methods – applications. Safety aspects of tool design – criteria for selection of tool material

REFERENCES

1. A Text Book of Production Engineering, P.C. Sharma, S.Chand, 2001
2. Tool Design, Donaldson G.H, Lecain, Goold V.V, TMH, 2000
3. Cutting Tool Design, Rodin P., MIR Publisher, Moscow, 1968
4. Die design Hand book, Wilson F.W., McGraw Hill
5. Fundamentals of Tool Design, ASTME, Prentice Hall, 1974

COURSE OUTCOMES

Upon completing this course, students should be able to

1. Gain knowledge in nomenclature of cutting tools and design of multi point cutting tools.
2. Classify types of presses, press tools and design of dies.
3. Design bending, drawing and forging dies for different components.
4. Classify jigs and fixtures for different components.
5. Gain knowledge on lean manufacturing tools and plastic toolings.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2							2		3		3
CO2	3	3	3	2									3		3
CO3	3	3	3	2									3		2
CO4	2		2											1	2
CO5	2	2									2		1	2	3

MFMEPEXX	AUTOMOTS AND TRANSFER MACHINES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- The aim of present course is to introduce the students about the basic automation theory and understanding of its devices. Students can think and get innovative idea in the area of shop floor automation.

Automation introduction: Automated Manufacturing System, Reasons for Automating, strategies for automation and process improvement, automation migration strategies, levels of automations, Types of Automations. Classification of Automatic Machines

Pneumatic System Design: Introduction, pneumatics system components, pneumatics actuators, application of pneumatics system in automation, pneumatics circuit design for automation, limitations of pneumatic system.

Hydraulics System Design: Introduction, Hydraulic system components, hydraulic actuators, application of hydraulic system in automation, hydraulic circuit design for automation, limitations of hydraulic system.

Automated Machinery: Introductions, Automated transfer machine, automated transfer line, Continuous and rotary transfer line, auto-storage and retrieval system, automated guided vehicles, automated material handling system, automated inspection system and CMM.

Industrial Robotics and Mechatronics System: Introduction, Robot Anatomy and Related Attributes, Robot Control Systems, End Effectors, Sensors in Robotics, Industrial Robot Applications, Robot Programming overview. Transducers, Sensors and Actuators: Classification, Principle of Operation, Selection Criteria, Signal Conditioning, Calibration.

REFERENCES

1. Automation, Production Systems and Computer Integrated Manufacturing Mikell P. Groover, P.H.I. Learning Private Limited
2. Hydraulics and Pneumatics Andrew Parr, JAICO Publishing Home, Ahmedabad
3. Industrial Automation and Robotics A. K. Gupta and S. K. Arora, University Science Press, Laxmi Publishing Pvt. Ltd.
4. Programmable Logic Controller Vijay R. Jadhav, Khanna Publishers, New Delhi

5. Robotics and Control R. K. Mittal and I. J. Nagrath, McGraw Hill Education (India) Private Limited
6. Automatic Machine Tools –Town H.C
7. Assembly automation and product design, Boothroyd. G

COURSE OUTCOMES

Upon completing this course, students should be able to

1. Understand the basic knowledge on automated manufacturing system, strategies and types of automation and classification of automatic machines.
2. Develop knowledge and skill to design of hydraulic, pneumatic and electro-pneumatic logic circuits using different sensors, control valves, controllers and actuators for automating processes in manufacturing.
3. Demonstrate problem-solving skills in automation and safely use the machines in the industries.
4. Acquire knowledge about the various Automated Machineries.
5. Gain an insight into the Industrial Robotics and Mechatronics System.

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	1	3			2									3	
CO-2		3	1	2							2		1		
CO-3	2		1		3									2	
CO-4	1			3	2					3		1			1
CO-5		3	2	1								1	2		

MFMEPEXX	DESIGN FOR MANUFACTURING AND ASSEMBLY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Understand the relationship between customer desires, functional requirements, and product design.
- The aim is to make the student aware of fits and tolerance that are used in the industry.
- To make students aware of the necessity to produce best design processes and systems for the best use of material.
- To acquaint the students with recent developments in reverse engineering and rapid prototyping.
- To aid in efficient in design to minimize material usage on an application perspective

Fits and tolerance -Terminology for limits and fits, general limits of tolerance, limit system, selective assembly- problem. Gauges and gauge design-Plain gauge, design of limit gauges, manufacturing of limit gauges, choice of limit gauges-problem.

Jigs and fixtures -Design principles common to jigs and fixtures, fundamentals of jigs and fixtures design, materials for jigs and fixtures, construction-problem.

Forging -Die design for machine forging, determination of stock design, selection of forging equipment, size of die blocks-problem. Extrusion -Design of parts of extrusion block, analysis of extrusion process, variation of extrusion pressure-problem. Sheet metal drawing -Press selection, cutting forces, methods of reducing cutting forces, blanking die design, piercing die design, pilots, drawing die, bending dies, design procedure for progressive dies.

Welding-Basic consideration, introduction, critical dimensions of weld connections, stress analysis in static loading, tensile load in butt welds, bending load in butt welded joints, fillet welds, concentric and eccentric loading of fillet welds, some typical structural parts, design of spot welds and plug welds-problem.

CMM, reverse engineering, rapid prototyping, 3D printer, design to minimize material usage, design for assembly, design for recyclability.

REFERENCES

1. P.C, Sharma, "Production engineering", S. Chand and Co. Pvt. LTD. New Delhi.
2. V.M. Radhakrishnan, "Welding technology and design", New age international publishers.
3. Chua C.K, Leong K.F and Lim C.S, "Rapid prototyping: Principles and applications", Third Edition, World Scientific Publishers, 2010.
4. Liou L.W and Liou F.W, "Rapid prototyping and Engineering applications: A tool box for prototype development", CRC Press, 2007.

COURSE OUTCOMES

Upon successful completion of the course, the students are able to:

1. To make the student aware of fits and tolerance those are used in the industry.
2. To study the fundamentals and design principles of Jigs and fixtures and their construction-problem
3. To make students aware of the different manufacturing process such as Forging, Extrusion and Sheet metal drawing and to study the equipment design procedures
4. To aware the welding activity in fabrication and to study the design of welded joints
5. To acquaint the knowledge in the advanced manufacturing techniques such as in reverse engineering, rapid prototyping and 3D printing and to aid in efficient in design to minimize material usage on an application perspective

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	1	1	1		2							2	2	1	2
CO-2	1	1	1		2							2	2	1	2
CO-3	1	1	1	2	2							2	2	1	1
CO-4	1	1	1	1	2							2	2	1	1
CO-5	1	1	1	1	1	1	1	2			2	2	1	1	1

MFMEPEXX	IMPACT ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To impart an in-depth study of impact engineering with a focus on the current status of materials processing using explosives.
- To familiarize the basic concepts of explosive forming process
- To introduce the fundamentals of explosive welding and cladding of metals
- To introduce the effect of explosive forming processes
- To introduce the concepts of explosive compaction techniques of powders and composites using explosives

Explosives - Types - Propagation of ideal detonation - reaction zone. Shock waves - general considerations - Pressure, Impulses and energies of shocks generated by explosions in air and water Mechanics of energy transfer - ecometrical method - bubble phenomenon.

Stand-off and contact operations - parameters and applications. Interaction between explosion and work Piece in contact operation - Pressure time relation in metal- explosive system. Stress waves in solids - Microstructural changes - Hugoniot curves for iron and brass - changes in physical properties - fracturing under impulsive loads

Explosive welding of metals - Mechanism- Jetting collision Karman Vortex - Welding of semi cylindrical parallel plates - parameters welding window of dynamic angle of obliguity and velocity of welding - Transition from smooty to wavy flow - Loyer's welding window different types of explosive cladding setup - multilayered welding Applications - Metallurgy of explosive welding.

Explosive forming - strain energy of deformation - effect of explosive stand off and strain distribution in the explosive forming of flat circular blanks - Simple problems - Multiple shot explosive forming - Use of scale models in explosive Conning -explosive Conning dies- Effect of explosive forming on materials properties

Shock consolidation ceramics and composites - shock waves. The jump-relations- Equation (Hugoniot) – Compaction mechanism static versus shock compaction - different shock compaction techniques - (Cylinrical, Converged, Underwater and high temperature) - Temperature measurements - shock consolidation of bio-compatibles - ceramics - melt - infiltration of shock compacted ceramics - Metallurgy of shock consolidation

REFERENCES

1. Explosive working of metals and its applications, Bernard Crossland, Oxford University Press, 1983
2. Explosive working of metals, Jolm Rineheart and John Pearson, Pergamon, London, 1985
3. Development of High Speed Forming, Davies and Austin, ASTME, 1976
4. High velocity forming of metals, Wilson, Prentice Hall of India Private Ltd., 1976

COURSE OUTCOMES

Upon successful completion of the course, the students are able to:

1. Understand the processes variables generated by explosions
2. Protect the metals from surface damages.

3. Understand the environmental factors affecting the atmospheric contaminations
4. Evaluate the high temperature explosive properties of metals.
5. Studying the metallurgical properties of explosive cladded process

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PSO1	PS02	PSO3
CO 1	1		1	2							2		2	2	
CO 2	1	2	1	2								3	2	1	
CO 3	1	2	1	1	1						1		1	2	1
CO 4	1	2	1	1	1						1		1	1	
CO 5	1	2	1	1	1						1		1	1	

MFMEPEXX	PRECISION ENGINEERING AND NANO-TECHNOLOGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To impart fundamental knowledge on Precision Engineering
- To impart knowledge about Nano Technology

Introduction: Definition - Introduction to Precision Engineering and Manufacturing- Accuracy, Repeatability - Principles of Measurement - Precision Flexure Design. Precision Optical Manufacturing - Micro - Optics - Precision Machine Design - Micro - Sensors: Design - fabrication - Testing and packaging.

Principles: Principles and Application of precision Engineering to the design of Instruments and Manufacturing Equipment. Principles of Metrology – Accuracy and Resolution - Sensors, Actuators. Bearings flexures for Precision Motion Generation.

Precision Manufacturing: Manufacturing Methods in Precision Engineering - Joining Technologies - Finishing processes - Special Casting techniques - Etching techniques - Coatings with metals & Inorganic Materials - Optical Production Methods - Vacuum Deposition MEMS & Micro Machining.

Nano Technology & Instrumentation: Nano Technology - Introduction to Scanning Probe Microscopy (SPM) - contact mode, Tapping Mode, Scanning Tunneling Mode (STM), Atomic Force Microscope (AFM), Advanced SPM - Electrostatic Force Mode (EFM)- Magnetic Force Mode(MFM)- Scanning Capacitance Mode (SCM), Nano-indentation - High Resolution, Drexlerian Nano Technology. Introduction to biological Applications, Quantum Effects & Futures, Quantum Dots, Quantum Computing

Smart structures, Materials and Micro Actuators: Smart structures – smart sensors – micro valves – MEMS - micro motors - micro pumps - micro dynamometer - micro machines - structures assembly - cooling channels - micro optics - micro nozzIes.

REFERENCES

1. Principles of Precision Engineering, NakazawaH. Oxford University press, 1994.
2. Nano Technology, Mark Ratner and Daniel Ratner, Pearson Education, Delhi 2003.
3. Precision engineering in Manufacturing, Murthy.R.L. New Age international Pvt.

Limited.
4. Hand book of Surface and Nano Technology, D.J. White House.
5. Institute of Physics Publishing, Bristol and Philadelphia, Bristol. BSI 6BE U.K.
6. The Science and Engineering of Micro-electronic Fabrication, Stephen A. Campbell, Oxford University Press, 1996.
7. Understanding Smart Sensors, Randy Frank, Artech. House, Boston, 1996.

COURSE OUTCOMES

Upon successful completion of the course, the students are able to:

1. Understand the basic concepts of Precision Engineering.
2. Impart fundamental knowledge about MEMS.
3. Evaluate the Quantum Effect Futures
4. Design the smart materials for specific applications.
5. Acquire knowledge about the nano instrumentation

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PSO1	PS02	PSO3
CO 1		1	2		2							2	1		
CO 2	1				2			2						1	
CO 3			2	1	2					2			2		
CO 4	2			1			2							1	
CO 5		2			1			2						2	3

MFMEPEXX	NANO MATERIALS TECHNOLOGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- This course has been designed to provide in depth knowledge on nano materials fabrication methods, characterization techniques and application of nano materials

Introduction to nano technology : Scientific revolutions - Types of nanotechnology and nanomachines - The periodic table - Atomic structure - Molecules and phases - Energy - Molecular and Atomic Size, Surfaces and Dimensional space - Atoms by inference - Scanning probe microscopy: atomic force microscope - Scanning tunneling microscope – Nanomanipulator, Nanotweezers - Atom Manipulation - Nanodots - Self assembly - Dip pen nanolithography.

Nanopowders and Nanomaterials: Classification of nano materials - Properties of nano materials - characteristics of nano particulate materials; Production Methods: Top down approach - mechanical milling, Chemical Etching, Electro explosion, Sputtering, Laser ablation; Bottom up approach Plasma spraying, Chemical vapour deposition, Sol Gels, Laser pyrolosis, Atomic or molecular condensation.

Characterisation and Detection Techniques: Atomic structure and chemical composition: spectroscopic methods, vibrational spectroscopies, Nuclear magnetic resonance, X-ray and UV

spectroscopies, X-ray and neutron diffraction. Determination of size, shape and surface area: Electron microscopes, BET and pycnometry, Ephiphaniometer, Laser granulometries and Zeta potential, Elliptically polarised light scattering; Determination of nanoparticles in aerosols and in biological tissues

Applications of Nanomaterials: New forms of carbon - Types of Nanotubes - Formation of Nanotubes - Assemblies Purification of carbon nanotubes - Properties of Nanotubes - Uses of Nanotubes: electronics, hydrogen storage, materials, mechanical machines - Space elevators. Application of Nanomaterials : insulation materials, machine tools, batteries, high power magnets, motor vehicles and aircraft, medical implants and other medical uses,- Nanocomposites and Nanowires.

Applications of Nanotechnology: Nanotechnology in industries - Nanotechnology in computing: quantum computing and molecular computation - Nanotechnology in electronics: computational nanotechnology and optoelectronics, mechanical nanocomputers, super computing systems Nanotechnology in health and life sciences: drug delivery, drug encapsulation, tissue repair and implantation, biorestorable materials - Nanotechnology in smart materials: sensors and smart instruments, ageless materials, nanoparticle coatings.

REFERENCES

1. Nanotechnology: Basic Science and Emerging Technologies, Michael Wilson and Geoff Smith, Chapman and Hall, London, 2002
2. Industrial application of nanomaterials - chances and risks, Wulfgang Luther, Future Technologies Division, Germany, 2004
3. Nanotechnology: Applications and Trends,J.Schulte, John Wiley and Sons, 2005
4. Nanotechnology, G.L.Timp, Springer-Verlog, New York, 1999
5. Handbook of Nanotechnology, Editor: B.Bhushan,SpringerVerlog, New York, 2004

COURSE OUTCOMES

Upon the completion of the course, the students will be able to:

1. Classify the types of Nano technology and nano Machines for the analysis of Molecules and Phases.
2. Gain Knowledge on various types of nano materials and powders and their production techniques.
3. Determine the size, shape and surface area of nano materials suing advanced spectroscopic techniques.
4. Learn the formation of carbon nano tubes and its significance in the development of nano composites.
5. Realise the application of nano technology in the field of computing and drug delivery systems.

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3		3		1		2					2	3		
CO-2	3		3		1		3					3	2		
CO-3	3		3		1		3					2	2		
CO-4	3		3		1		3					1	2		
CO-5	3		3		1		2					1	2		

OPEN ELECTIVE COURSES

MFMEOEXX	ENGINEERING ECONOMICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To enable students to understand the fundamental economic concepts applicable to engineering and to learn the techniques of incorporating inflation factor in economic decision making towards the design and manufacturing problems.

Introduction to Economics: Introduction to Economics- Flow in an economy, Law of supply and demand, Concept of Engineering Economics – Engineering efficiency, Economic efficiency, Scope of engineering economics – Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis – V ratio, Elementary economic Analysis – Material selection for product Design selection for a product, Process planning.

Value Engineering: Make or buy decision, Value engineering – Function, aims, Value engineering procedure. Interest formulae and their applications –Time value of money, Single payment compound amount factor, Single payment present worth factor, Equal payment series sinking fund factor, Equal payment series payment Present worth factor- equal payment series capital recovery factor – Uniform gradient series annual equivalent factor, Effective interest rate, Examples in all the methods.

Cash Flow: Methods of comparison of alternatives – present worth method (Revenue dominated cash flow diagram), Future worth method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), rate of return method - Examples in all the methods.

Replacement and Maintenance Analysis: Replacement and Maintenance analysis – Types of maintenance, types of replacement problem, determination of economic life of an asset, Replacement of an asset with a new asset – capital recovery with return.

Depreciation: Depreciation- Introduction, Straight line method of depreciation, declining balance method of depreciation-Sum of the years digits method of depreciation, sinking fund method of depreciation/ Annuity method of depreciation, service output method of depreciation-Examples on comparison of alternatives and determination of economic life of asset.

REFERENCES

1. Panneer Selvam, R, “Engineering Economics”, Prentice Hall of India Ltd, New Delhi, 2001.
2. Chan S.Park, “Contemporary Engineering Economics”, Prentice Hall of India, 2011.
3. Donald.G. Newman, Jerome.P.Lavelle, “Engineering Economics and analysis” Engg. Press, Texas, 2010.
4. Degarmo, E.P., Sullivan, W.G and Canada, J.R, “Engineering Economy”, Macmillan, New York, 2011.
5. Zahid A khan: Engineering Economy, “Engineering Economy”, Dorling Kindersley, 2012

COURSE OUTCOMES

At the end of the course, the student will be able to:

1. Formulate economic decisions based on Supply, Demand, Break-even analysis and Costing.
2. Recommend make or buy decisions for products.
3. Evaluate business options based on cash flow analysis.
4. Analyze economic factors to decide on maintenance or replacement of machines.
5. Calculate depreciation of an asset using different methods.

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO1	2	2	1	1	1	-	-	-	-	-	3	-	-	-	3
CO2	2	3	1	1	1	-	-	-	-	-	3	-	1	-	3
CO3	2	2	2	2	1	-	-	-	-	-	3	-	-	-	3
CO4	2	3	2	1	1	-	-	-	-	-	3	-	1	1	3
CO5	2	2	2	1	1	-	-	-	-	-	3	-	-	-	3

MFMEOEXX	TOTAL QUALITY MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To provide an understanding of philosophiesand tools of quality management.
- To impart the knowledge and on the application of the statistical quality control techniques which are used in manufacturing and service industries.
- To provide knowledge and understanding of acceptance sampling and reliability in modern manufacturing.

Concepts of TQM – Dimensions of Quality - Deming, Crosby and Juran's Philosophies – Barriers to TQM - Quality system – ISO 9000:2000, ISO 14000 Quality system standards - Quality costs, Seven tools for Quality Control, Seven tools for Quality management, Quality Function Deployment (QFD) – Taguchi loss function

Statistical Process Control: Control charts for attributes and count of defects – p chart, np chart, c chart, u chart.

Control charts for variables – $\bar{X}$ chart, R chart, σ chart – process capabilities studies (C_p and C_{pk}) – Concept of Six sigma. Special control charts – Group control chart, sloping control chart, moving averages and moving ranges control charts, coefficient of variation control chart.

Acceptance sampling plans for attributes: Concepts – Difference between inspection and quality control - single sampling plan - OC curve. Reliability Engineering: Definition – Bath tub curve - MTBF – MTTF - System reliability with components in series, parallel– FTA, FMECA.

REFERENCES

1. Introduction to Statistical Quality Control, Montgomery D.C., John Wiley, 1994

2. Statistical Quality Control, Gupta R.C., Khanna Pub., 1998
3. Amitava Mitra, "Fundamentals of quality control and improvement", prentice hall, 2nd edition, 1998
4. Besterfield, "Total Quality Management", Pearson Education, 2nd Edition, 2003
5. Mahajan,M., " Statistical Quality Control", dhanpat rai & co., pvt ltd, 2010
6. The Assurance Sciences, Halpern Siegmund, PHI, 1978
7. Concepts in Reliability Engineering, Srinath L.S., Eastwest Press Ltd., 1991. IS 397 Part I, II and III, IS 2500

COURSE OUTCOMES

Upon completing this course, students should be able to:

1. Describe quality management philosophies and able to apply the tools of quality for improvement.
2. Understand the statistical basis of attributes control charts and know how to set up and use the *p* chart, np chart, c chart and u chart.
3. Understand the statistical basis of charts for variables and know how to set up and use x bar, s and *R* control charts and special control charts and to estimate process capability from the control chart information.
4. Understand the role of acceptance sampling in modern quality control systems.
5. Understand the concept of reliability, and the various techniques to obtain reliability.

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO1		2		2										3	
CO2		2		2	3									2	
CO3		2		2	3									2	
CO4				3											
CO5				3											

MFMEOEXX	SUPPLY CHAIN MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- Discuss the fundamental concepts of supply chain management; impart the knowledge on how to align the management of a supply chain with corporate goals and strategies.

Introduction to Supply Chain Management- Definition- Decision phases in supply chain, Process Vs Push pull view of supply chain-The development chain - Design the right sc-functional Vs innovative products- product life cycle and SC design – clock speed.

Supply chain (SC) performance and evaluation: Order Winning to Order fulfillment- SCOR Model – Balance Score card model. SC Strategies: Efficient Vs Responsive strategy- Agile Vs Lean supply chain, postponement strategy- push pull strategy.

Value of Information- Bullwhip effect- information and supply chain technology- Supply chain integration- Concepts of MTO, MTS, ETO and ATO -demand driven strategies- impact of internet on SCM-

Supply network – factors influencing supply chain network design - distribution strategies VAT material flow analysis. Strategic alliances – Make or buy decision – Framework for strategic alliance – outsourcing - Krajalic matrix - core competency – 3PL- 4PL – Effect of Demand and supply uncertainty- cross docking- - risk pooling- Square root law -centralized vs decentralized system

Global SC - International Issues in SCM- Introduction- risks and advantages- design for logistics- supplies integration into to new product-development- mass customization- Issues in customer value – Information technology for SCM- Goals - standardization- infrastructure- DSS for supply chain management.

REFERENCES

1. Designing and managing the Supply Chain, Simchi - Levi Davi, Kaminsky Philip and Simchi-Levi Edith, Tata McGraw Hill Publishing Company Ltd, New Delhi, 2003
2. Supply chain management, 2nd edition, Sunil Chopra and Peter Meindl, Pearson Education, New Delhi, 2003.
3. Supply Chain Management: Text and Cases, Janat Shah, Pearson Education India, 2009.
4. Supply Chain Management, Robert B Hand Field and Ernest Nichols, Prentice Hall, New Jersey, 1999.
5. Supply chain management: concepts, techniques and practices, Ling Li, world scientific press, 2011
6. Supply chain management (Theories & practices), R Mohanty andS G Deshmukh, Ist edition, Biztantra innovation in management, 2005

COURSE OUTCOMES

Upon completing this course, students will be able to:

1. Understand the roles of supply chain among various business functions and their roles in the organizations strategic planning and gaining competitive advantage.
2. Identify and make use of supply chain management methodologies
3. Apply supply chain concepts in both manufacturing and service industry
4. Analyze the principles, concepts and challenges for developing sourcing, manufacturing and distribution strategies in a global market.
5. Describe the role of information technology to improve the performance of the supply chain

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1		1		2								1		
CO2		2		3	2									2	
CO3	1		2	3								1	2		
CO4	1	2	2		1							2		2	
CO5	2				2							2	3		

AUDIT COURSES

MFMEACXX	ENGLISH FOR RESEARCH PAPER WRITING	L	T	P
		2	0	0

COURSE OBJECTIVES

Students will be able to:

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

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

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

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

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,

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

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

REFERENCES

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

MFMEACXX	DISASTER MANAGEMENT	L	T	P
		2	0	0

COURSE OBJECTIVES

Students will be able to:

- Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- Critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in

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

Repercussions of Disasters And Hazards: 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.

Disaster Prone Areas In India: 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

Disaster Preparedness and Management: 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.

Risk Assessment: 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.

Disaster Mitigation: Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation in India.

REFERENCES

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

MFMEACXX	SANSKRIT FOR TECHNICAL KNOWLEDGE	L	T	P
		2	0	0

COURSE OBJECTIVES

- To get a working knowledge in illustrious Sanskrit, the scientific language in the world
- Learning of Sanskrit to improve brain functioning
- Learning of Sanskrit to develop the logic in mathematics, science & other subjects Enhancing the memory power
- The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature

Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences, Order, Introduction of roots, Technical information about Sanskrit Literature, Technical concepts of Engineering - Electrical, Mechanical, Architecture, Mathematics

REFERENCES

1. "Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi
2. "Teach Yourself Sanskrit" Prathama Deeksha-Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.

COURSE OUTCOMES

Upon successful completion of the course, the students are able to:

1. Understanding basic Sanskrit language
2. Ancient Sanskrit literature about science & technology can be understood
3. Being a logical language will help to develop logic in students

MFMEACXX	VALUE EDUCATION	L	T	P
		2	0	0

COURSE OBJECTIVES

Students will be able to

- Understand value of education and self- development
- Imbibe good values in students
- Let the should know about the importance of character

Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgements

Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism.Love for nature ,Discipline

Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from

anger, Dignity of labour. Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature

Character and Competence –Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence ,Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively.

REFERENCES

1. Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi

COURSE OUTCOMES

Upon successful completion of the course, the students are able to:

1. Knowledge of self-development
2. Learn the importance of Human values
3. Developing the overall personality

MFMEACXX	CONSTITUTION OF INDIA	L	T	P
		2	0	0

COURSE 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 of nationhood 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.

History of Making of the Indian Constitution: History Drafting Committee, (Composition & Working)

Philosophy of the Indian Constitution: Preamble Salient Features

Contours of Constitutional Rights & 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.

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

Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of 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

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

REFERENCES

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

COURSE OUTCOMES

Upon successful completion of the course, the students are able to:

1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.

3. 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.
4. Discuss the passage of the Hindu Code Bill of 1956.

MFMEACXX	PEDAGOGY STUDIES	L	T	P
		2	0	0

COURSE OBJECTIVES

Students will be able to:

- Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.
- Identify critical evidence gaps to guide the development.

Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology, Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions**.** Overview of methodology and Searching.

Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.

Evidence on the effectiveness of pedagogical practices Methodology for the in depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.

Professional development: alignment with classroom practices and follow- up support Peer support Support from the head teacher and the community. Curriculum and assessment Barriers to learning: limited resources and large class sizes

Research gaps and future directions: Research design, Contexts, Pedagogy, Teacher education, Curriculum and assessment, Dissemination and research impact.

REFERENCES

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
6. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.

7. www.pratham.org/images/resource%20working%20paper%202.pdf.

COURSE OUTCOMES

Upon successful completion of the course, the students are able to:

1. What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?
2. What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
3. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

MFMEACXX	STRESS MANAGEMENT BY YOGA	L	T	P
		2	0	0

COURSE OBJECTIVES

- To achieve overall health of body and mind
- To overcome stress

Definitions of Eight parts of yog. (Ashtanga) Yam and Niyam.

Do`s and Don't's in life.

(i) Ahinsa, satya, astheya, bramhacharya and aparigraha

(ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

Asan and Pranayam

(i) Various yog poses and their benefits for mind & body

(ii) Regularization of breathing techniques and its effects-Types of pranayama

REFERENCES

1. 'Yogic Asanas for Group Tarining-Part-I" : Janardan Swami Yogabhyasi Mandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata

COURSE OUTCOMES

Upon successful completion of the course, the students are able to:

1. Develop healthy mind in a healthy body thus improving social health also
2. Improve efficiency

MFMEACXX	PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS	L	T	P
		2	0	0

COURSE OBJECTIVES

- To learn to achieve the highest goal happily
- To become a person with stable mind, pleasing personality and determination
- To awaken wisdom in students

Neetisatakam-Holistic development of personality

- Verses- 19,20,21,22 (wisdom)
- Verses- 29,31,32 (pride & heroism)
- Verses- 26,28,63,65 (virtue)
- Verses- 52,53,59 (dont's)
- Verses- 71,73,75,78 (do's)

Approach to day to day work and duties.
Shrimad Bhagwad Geeta :

- Chapter 2-Verses 41, 47,48,
- Chapter 3-Verses 13, 21, 27, 35,
- Chapter 6-Verses 5,13,17,23, 35,
- Chapter 18-Verses 45, 46, 48.

Statements of basic knowledge.
Shrimad Bhagwad Geeta:

- Chapter2-Verses 56, 62, 68
- Chapter 12 -Verses 13, 14, 15, 16,17, 18

Personality of Role model.
Shrimad Bhagwad Geeta:

- Chapter2-Verses 17,
- Chapter 3-Verses 36,37,42,
- Chapter 4-Verses 18, 38,39
- Chapter18 – Verses 37,38,63

REFERENCES

1. "Srimad Bhagavad Gita" by Swami Swarupananda Advaita Ashram (Publication Department), Kolkata
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.

COURSE OUTCOMES

Upon successful completion of the course, the students are able to:

1. Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
2. The person who has studied Geeta will lead the nation and mankind to peace and prosperity
3. Study of Neetishatakam will help in developing versatile personality of students.