VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI.

Scheme of Teaching and Examinations and Syllabus

M.Tech**Product Design and Manufacturing (MPD)**

(Effective from Academic year 2020 - 21)

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examinations – 2020 - 21
M.Tech Product Design and Manufacturing (MPD)
Choice Based Credit System (CBCS) and Outcome Based Education(OBE)

I SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Hours per Week			Examination				Credits
				Theory	Practical	Skill Development Activities	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	P	SDA					
1	PCC	20MPD11	Mathematical Methods in Engg.	03	--	02	03	40	60	100	4
2	PCC	20MPD12	Product Design and Development	03	--	02	03	40	60	100	4
3	PCC	20MPD13	Finite Element Analysis	03	--	02	03	40	60	100	4
4	PCC	20MPD14	Product life cycle Management	03	--	02	03	40	60	100	4
5	PCC	20MPD15	Advanced Materials & Processing	03	--	02	03	40	60	100	4
6	PCC	20MPDL16	Basic Product DesignLaboratory-I	--	04	--	03	40	60	100	2
7	PCC	20RMI17	Research Methodology and IPR	01	--	02	03	40	60	100	2
			TOTAL	**17**	**04**	**12**	**21**	**280**	**420**	**700**	**24**

Note: PCC: Professional core.

Skill development activities:
Students and course instructor/s to involve either individually or in groups to interact together to enhance the learning and applicationskills.
The students should interact with industry (small, medium and large), understand their problems or foresee what can be undertaken for study in the form of research/ testing / projects, and for creative and innovative methods to solve the identified problem.
The students shall
(1) Gain confidence in modelling of systems andalgorithms.
(2) Work on different software/s (tools) to Simulate, analyse and authenticate the output to interpret and conclude. Operate the simulated system under changed parameter conditions to study the system with respect to thermal study, transient and steady state operations,etc.
(3) Handle advanced instruments to enhance technicaltalent.
(4) Involve in case studies and field visits/ fieldwork.
(5) Accustom with the use of standards/codes etc., to narrow the gap between academia andindustry.
All activities should enhance student's abilities to employment and/or self-employment opportunities, management skills, Statistical analysis, fiscal expertise,etc.

Internship: All the students have to undergo mandatory internship of 6 weeks during the vacation of I and II semesters and /or II and III semesters. A University examination shall be conducted during III semester and the prescribed internship credit shall be counted for the same semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared as fail in internship course and have to complete the same during the subsequent University examination after satisfying the internship requirements.

Note: (i) Four credit courses are designed for 50 hours Teaching – Learning process.
(ii) Three credit courses are designed for 40 hours Teaching – Learningprocess.
(iii) Two credit courses are designed for 25 hours Teaching – Learningprocess.

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II SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Hours /Week			Examination				Credits
				Theory	Practical/ Seminar	Skill Development Activities	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	P	SDA					
1	PCC	20MPD21	Industrial Design & Ergonomics	03	--	02	03	40	60	100	4
2	PCC	20MPD22	Design for Manufacturing	03	--	02	03	40	60	100	4
3	PCC	20MPD23	Product Planning & Marketing	03	--	02	03	40	60	100	4
4	PEC	20MPD24X	Professional elective 1	04	--	--	03	40	60	100	4
5	PEC	20MPD25X	Professional elective 2	04	--	--	03	40	60	100	4
6	PCC	20MPDL26	Product DesignLaboratory - II	--	04	--	03	40	60	100	2
7	PCC	20MPD27	Technical Seminar	--	02	--	--	100	--	100	2
TOTAL				**17**	**06**	**06**	**18**	**340**	**360**	**700**	**24**

Note: PCC: Professional core, PEC: Professional Elective.

Professional Elective 1		**Professional Elective 2**	
Course Code under 20MPD24X	**Course title**	**Course Code under 20MPD25X**	**Course title**
20MPD241	Product Data Management	20MPD251	Quality & Reliability Engineering
20MPD242	Advanced Manufacturing Practices	20MPD252	Virtual Design and Manufacturing
20MPD243	Non Traditional Machining Process	20MPD253	Lean Manufacturing System
20MPD244	Non Destructive Testing	20MPD254	Design of Experiments

Note:

1. Technical Seminar: CIE marks shall be awarded by a committee comprising of HoDas Chairman, Guide/co-guide, if any, and a senior faculty of the department. Participation in the seminar by all postgraduate students of the programme shall be mandatory.

The CIE marks awarded for Technical Seminar, shall be based on the evaluation of Seminar Report, Presentation skill and performance in Question and Answer session in the ratio50:25:25.

2. Internship: All the students shall have to undergo mandatory internship of 6 weeks during the vacation of I and II semesters and /or II and III semesters. A University examination shall be conducted during III semester and the prescribed internship credit shall be counted in the same semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared as fail in internship course and have to complete the same during the subsequent University examination after satisfyingthe internship requirements.

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III SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Hours /Week			Examination				Credits
				Theory	Practical/ Mini–Project/ Internship	Skill Development activities	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	P	SDA					
1	PCC	20MPD31	Product Analysis and cost optimization	03	--	02	03	40	60	100	4
2	PEC	20MPD32X	Professional elective 3	03	--	--	03	40	60	100	3
3	PEC	20MPD33X	Professional elective 4	03	--	--	03	40	60	100	3
4	Project	20MPD34	Project Work phase -1	--	02	--	--	100	--	100	2
5	PCC	20MPD35	Mini-Project	--	02	--	--	100	--	100	2
6	Internship	20MPDI36	Internship	(Completed during the intervening vacation of I and II semesters and /or II and III semesters.)			03	40	60	100	6
TOTAL				**09**	**04**	**02**	**12**	**360**	**240**	**600**	**20**

Note: PCC: Professional core, PEC: Professional Elective.

Professional elective 3		**Professional elective 4**	
Course Code under	**Course title**	**Course Code under**	**Course title**
20MPD321	Optimization Techniques for Decision Making	20MPD331	Robust Design
20MPD322	Rapid Prototyping	20MPD332	Simulation and Modelling
20MPD323	Value Engineering	20MPD333	Computer Application in Design
20MPD324	Advanced Fluid Power Systems	20MPD334	Human Resources Management

Note:

1. Project Work Phase-1: Students in consultation with the guide/co-guide if any, shall pursue literature survey and complete the preliminary requirements of selected Project work. Each student shall prepare relevant introductory project document, and present aseminar.

CIE marks shall be awarded by a committee comprising of HoDas Chairman, Guide/co-guide if any, and a senior faculty of the department. The CIE marks awarded for project work phase -1, shall be based on the evaluation of Project Report, Project Presentation skill and performance in Question and Answer session in the ratio50:25:25.

SEE (University examination) shall be as per the University norms.

2. Internship: Those,whohavenotpursued/completedtheinternshipshallbedeclaredasfailininternshipcourseand have to complete the same during subsequent University examinations after satisfying the internship requirements. Internship SEE (University examination) shall be as per the University norms.

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IV SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Field work	Duration in hours	CIE Marks	SEE Marks Viva voce	Total Marks	
				L	P					
1	Project	20MPD41	Project work phase -2	--	04	03	40	60	100	20
			TOTAL	--	**04**	**03**	**40**	**60**	**100**	**20**

Note:

1. Project Work Phase-2:

CIE marks shall be awarded by a committee comprising of HoDas Chairman, Guide/co-guide, if any, and a Senior faculty of the department. The CIE marks awarded for project work phase -2, shall be based on the evaluation of Project Report subjected to plagiarism check, Project Presentation skill and performance in Question and Answer session in the ratio50:25:25.

SEE shall be at the end of IV semester. Project work evaluation and Viva-Voce examination (SEE), after satisfying the plagiarism check, shall be as per the University norms.

MATHEMATICAL METHODS IN ENGG. (common to MPT, MPE, MPD, MEM, MPM, MPY, & MSE)			
Course Code	**20MPD11**	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Errors and Simple Mathematical modeling: Error definition, roundoff errors and truncation errors.Mathematical modeling and Engineering problem solving: Simple mathematical model, Conservation Laws of Engineering.

Engineering Applications on :

i) Deflection of Beams
ii) Whirling of shafts
iii) Terminal velocity of a freely falling body

(RBT Levels: L1 & L2) (Text Book:1)**10Hrs**

Module-2

System of Linear Algebraic Equations And Eigen Value Problems: Gauss-Jordan Method, Cholesky Method, Partition method, Givens method for symmetric matrices, (RBT Levels: L1 & L2) (Text Book:3) **10Hrs**

Module-3

Roots of Equations: Muller's method ,Graeffe's roots squaring method.

Numerical solutions of ordinary differential equations: Introduction, Picard`s method of successive approximation, first order simultaneous equations by Picard`s & Runge Kutta methods. & second order equations by Picard`s & Runge Kutta methods. (RBT Levels: L2 & L3) (Text Book:3)**10Hrs**

Module-4

Partial Differential Equations: Numerical solution of one dimensional wave equation, Heat equation,(Schmidt`s explicit formula)& Laplace equation(Gauss-Seidel process) by finite difference schemes. Illustrative examples on each method, (RBT Levels: L2 & L3) (Text Book:2). **10Hrs**

Module-5

Sampling theory: Testing of hypothesis: Chi square test and F-test. Analysis of Variance (ANOVA): one way classification, Design of experiments, RBD.

(RBT Levels: L2 & L3) (Ref. Book:1). **10Hrs**

Course Outcomes:

On completion of this course, students are able to:

1. Acquire the idea of significant figures, types of errors during numerical computation.
2. Understand statistical and probabilistic concepts required to test the hypothesis and designing the experiments using RBD.
3. Learn various numerical methods to solve system of linear equations.
4. Understand the roots of algebraic/transcendental equations and solve PDE's numerically.
5. Analyze and solve PDE's related to wave equation arising in vibration analysis.

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20marks.
- There will be two full questions (with a maximum of four sub questions) from eachmodule.
- Each full question will have sub question covering all the topics under amodule.
- The students will have to answer five full questions, selecting one full question from eachmodule.

Textbooks

1. Steven C Chapra and Raymond P Canale, "Numerical Methods for Engineers," 7th Ed., cGraw-Hill Edition, 2015

2. Theory of ordinary differential equations, Coddington E., Levinson N., McGraw-Hill publishing Company, TMH Edition, 9th Reprint, 1987..

3. M K Jain, S.R.K Iyengar, R K. Jain, Numerical methods for Scientific and engg computation, New Age International, 2003.

Reference books:

1.R.E, Walpole, R.H.Myres, S.L.Myres and Keying Ye, "Probability and Statistics for Engineers and Scientists", 9th Edition, Pearson, 2012

2.Dr. B.S. Grewal, "Numerical Methods in Engineering and Science", Khanna Publishers, 1999.

3.K Shankar Rao, "Introduction to Partial Differential Equations" Prentice - Hall of India Pvt. Lt. , 1995 Edition

4. C. Ray Wylie and Louis C Barrett, "Advanced Engineering Mathematics". 6th edition, McGraw-Hill, 1995.

PRODUCT DESIGN AND DEVELOPMENT			
Course Code	**20MPD12**	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Introduction: Characteristics of successful product development, Design and development of products, duration and cost of product development, the challenges of product development.

Development Processes and Organizations: A generic development process, concept development: the front-end process, adopting the generic product development process, the AMF development process, product development organizations, the AMF organization.

Product Planning: The product planning process, identify opportunities. Evaluate and prioritize projects, allocate resources and plan timing, complete pre project planning, reflect all the results and the process. **10Hrs**

Module-2

Identifying Customer Needs: Gather raw data from customers, interpret raw data in terms of customer needs, organize the needs into a hierarchy, establish the relative importance of the needs and reflect on the results and the process.
Product Specifications: What are specifications, when are specifications established, establishing target specifications, setting the final specifications.

Concept Generation: The activity of concept generation, clarifies the problem, search externally, search internally, explore systematically, reflect on the results andtheprocess. **10Hrs**

Module-3

Concept Selection: Overview of methodology, concept screening, and concept scoring,

Concept Testing: Define the purpose of concept test, choose a survey population, choose a survey format, communicate the concept, measure customer response, interpret the result, reflect on the results and the process.

Product Architecture: What is product architecture, implications of the architecture, establishing the architecture, variety and supply chain considerations, platform planning, related system level design issues.
. **10Hrs**

Module-4

Industrial design: Assessing the need for industrial design, the impact of industrial design, industrial design process, managing the industrial design process, assessing the quality of industrial design.

Design for Manufacturing: Definition, estimation of manufacturing cost, reducing the cost of components, assembly, supporting production, impact of DFM on otherfactors.

Prototyping: Prototyping basics, principles of prototyping, technologies, planning for prototypes.**10Hrs**

Module-5

Product Development Economics: Elements of economic analysis, base case financial mode,. Sensitive analysis, project trade-offs, influence of qualitative factors on project success, qualitative analysis.

Managing Projects: Understanding and representing task, baseline project planning, accelerating projects, project execution, postmortem projectevaluation. **10Hrs**

Course outcomes:
At the end of the course the student will be able to:

1. Identify and analyse the product design and development processes in manufacturingindustry.
2. Define the components and their functions of product design and development processes and their relationships from concept to customer over whole productlifecycle.
3. Analyse, evaluate and apply the methodologies for product design, development andmanagement.
4. Undertake a methodical approach to the management of product development to satisfy customerneeds.
5. Carry out cost and benefit analysis through various costmodels

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20marks.
- There will be two full questions (with a maximum of four sub questions) from eachmodule.
- Each full question will have sub question covering all the topics under amodule.
- The students will have to answer five full questions, selecting one full question from each module.■

Textbooks

(1)Product Design and Development - Karl.T.Ulrich, Steven D Eppinger - Irwin McGrawHill - 2000.

Reference Books

(1) Product Design and Manufacturing - A C Chitale and R C Gupta, PH1, - 3rd Edition, 2003

(2) New Product Development - Timjones. Butterworth Heinmann - Oxford. UCI -1997

(3)Product Design for Manufacture and Assembly - GeofferyBoothroyd, Peter Dewhurst and Winston Knight -2002

FINITE ELEMENT ANALYSIS			
Course Code	**20MPD13**	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Introduction: Equations of equilibrium, stress-strain relations for 2-D and 3-D, Potential energy and equilibrium, Boundary conditions, Von Misses Stresses.

FEM for 1-D Problems: General procedure for FEA, Raleigh Ritz method, Galerkin Approach, shape functions, stiffness matrix, load vectors, temperature effects, Applications of boundary conditions using elimination and penalty approaches. . **10Hrs**

Module-2

FEM for 1 D and 2-D Problems: Application problems – 1-D bar element. Trusses and beams, Shape functions (2D element), stiffness matrix, strain matrix, load vectors for CST Elements and application problems. **10 Hrs**

Module-3

FEM for Axisymmetric Problems: Axisymmetric formulation, triangular elements, PE approach, Body force term, application problems. **10 Hrs**

Module-4

FEM for Scalar Field Problems: 1-D Steady state heat transfer, torsion, potential flow and fluid flow in ducts and application Problems. **10Hrs**

Module-5

Dynamic Analysis: Equations of motion for dynamic problems consistent and lumped mass matrices formulation of element mass matrices free vibration and forced vibration problems formulation. **. 10Hrs**

Course outcomes:

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

1. Solve differential equations using weighted residualmethods
2. Develop the finite element equations to model engineering problems governed by second order differential equations
3. Apply the basic finite element formulation techniques to solve engineering problems by using one dimensionalelements
4. Apply the basic finite element formulation techniques to solve engineering problems by using two dimensionalelements
5. Apply the basic finite element formulation techniques to find natural frequency of single degree of vibrationsystem

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20marks.
- There will be two full questions (with a maximum of four sub questions) from eachmodule.
- Each full question will have sub question covering all the topics under amodule.
- The students will have to answer five full questions, selecting one full question from each module.■

Reference Books

(1)Introduction to Finite Elements in Engineering – Tirupathi R.-Chandrupatla Ashok DBelegundu -Prentice Hall India Pvt. Ltd., New Delhi – 3rd Edition, 2003

(2) Concepts and Applications of finite Element Analysis - Cook R.D - Malkus D.S &PleshaM.E – JohnWiley& Sons - 1989.

(3)Applied Finite Element Analysis -Segerlind L.J - John Wiley & Sons Edition-1984

(4) The Finite Element Method in Engineering, - Rao SS Pergomon Press – Oxford -

(5) Finite Element Procedures in Engineering Analysis - Bathe K .J - Prentice Hall NewJersey- 1982.

(6) Energy and Finite Element Methods in Structural mechanics - Shames III &DymC L -Wiley eastern ltd– 1995.

PRODUCT LIFE CYCLE MANAGEMENT			
Course Code	**20MPD14**	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Product life cycle management: Need for PLM, Components of PLM, Product Data and Product workflow, Drivers forChange. . **10Hrs**

Module-2

The PLM Strategy, Developing a PLM Strategy, A Five-step Process, Strategy Identification and Selection, Strategy Elements, Implications of Strategy Elements, Policies, Strategy Analysis, Communicating the Strategy. **10 Hrs**

Module-3

Change Management for PLM, Configuration management, Cost of design changes, schemes for concurrent engineering, Design for manufacturing and assembly, robust design, failure mode and effect-analysis. **10 Hrs**

Module-4

Modeling, Current concepts, part design, sketching, use of datum's construction features, free ovulation, pattering, copying, and modifying features, reference standards for datum specification, Standards for Engineering data exchange. **10 Hrs**

Module-5

Tolerance mass property calculations, rapid prototyping and tooling, finite modeling and analysis, general procedure, analysis techniques, Finite element modeling. Applicability of FEM, Static analysis, thermal analysis,dynamicanalysis. **10Hrs**

Course outcomes:

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

1. Gain knowledge about phases of PLM, PLM strategies and methodology for PLM feasibility study and PDMimplementation.
2. Illustrate various approaches and techniques for designing and developingproducts.
3. Apply product engineering guidelines / thumb rules in designing products for molding, machining, sheet metal workingetc.
4. Acquire knowledge in applying virtual product development tools for components, machining and manufacturingplan
5. Understand the Tolerance mass propertycalculations.

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20marks.
- There will be two full questions (with a maximum of four sub questions) from eachmodule.
- Each full question will have sub question covering all the topics under amodule.
- The students will have to answer five full questions, selecting one full question from eachmodule.

Reference Books

(1)Product Lifecycle Management Paradigm for century Product Realization - John Stark, Springer-Verlag, 21st, London, 3rd printing - 2006. 441 pp., ISBN: 1-85233-810-5.

(2) CAD/CAM Theory and Practice - Zeid, McGraw Hill.- 1991.

(3)Computer Integrated Design and Manufacturing, - Mark Henderson & Philip Wolfe, BedworthMcGraw hill inc.- 1991.

(4)Part modeling Users Guide, Engineer - I998.

ADVANCED MATERIALS & PROCESSING			
Course Code	**20MPD15**	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Classification and characteristics: Metals, Ceramics, Polymers and composites.

General properties and structure: Atoms, molecules bonds in solids, Crystalline - Defects in Metallic structure, Dislocations and plastic deformation - Strengthening mechanism - grain size, dislocation - Cold work, precipitation hardening, dispersion hardening - phase reactions, fatigue and Creep behaviour.**10 Hrs**

Module-2

Ferrous Alloys: iron carbon equilibrium diagrams - Steels and cast irons - properties, structure, composition and applications transformation hardening in steels - TIT diagrams - Heat treatment processes - Effect of alloying elements - High alloy steels, Stainless steel types, tool Steels, Manganese steels, heat resistant steels, HSLA, Maragingsteels. **10Hrs**

Module-3

Non Ferrous alloys: AlIoysof copper, Aluminum, nickel, magnesium, titanium, lead, tin, Zinc - composition, heat treatment, structure, propertiesandapplication. **10Hrs**

Module-4

Polymers and polymerizations: Structure and properties of thermoplastics and thermo sets Engineering Applications - property modifications - Mechanical and thermal behavior – processing methods.
Ceramics : Nature and structure of Ceramics - Refractory Abrasives glasses - glass ceramics - Advanced ceramics processing methods. **. 10Hrs**

Module-5

Composites : Definition - classification and characteristics of composite materials - Volume fraction - laminated composites particulate composites, fibrous composites - Types of reinforcements, their shape and size - production and properties of fiber reinforced plastics, Metal Matrix composites and ceramic matrix composites - Applications.

Processing of Polymers: composites, ceramics - thermal spraying - Ion beam machining diamond coating techniques-tribological Applications. **10Hrs**

Course outcomes:

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

1. an understanding of the principles, capabilities, limitations and applications of commonly used advanced materials processing technologies
2. an in-depth knowledge of precision materials removal and laser processingtechnologies.
3. Understand the non ferrous alloys and itsapplications.
4. Understand the properties of Polymers andCeramics.
5. Understand the processing of composites andpolymers.

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20marks.
- There will be two full questions (with a maximum of four sub questions) from eachmodule.
- Each full question will have sub question covering all the topics under amodule.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks

(1)Engineering Metallurgy - Raymond and Higgens - ELBS/EA

(2)Introduction to Material Science and Engineering James.F.Shackleford - McMillan, NY - 7th edition

Reference Books

(1)Powder Metallurgy-Metals Hand Book -ASM, USA - Vol.7, 1974

(2)Composite Materials - Science and Engineering - Chawla K.K. ,Springer - Verlag, Newyork - 2nd edition, 1998.

(3)Cast Metal Matrix Composites ASM Metals Hand Book - P.K. Rohagti - VI5.

(4)Elements of Material science and Engineering - Van Vlack L.H. - Addison Wesley, NY - 1989

BASIC PRODUCT DESIGN LABORATORY -I			
Course Code	**20MPDL16**	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	0:4:0	SEE Marks	60
Credits	02	Exam Hours	03

Sl. NO	**Experiments**
1	Static (Structural) Analysis of 1-D problems
2	Static (Structural) Analysis of plane stress and Plane Strain Problems
3	Structural Analysis of Trusses
4	Static Analysis of Axis Symmetric problems
5	Transient Heat Transfer Analysis of 1D problems
6	Transient Heat Transfer Analysis of 2D problems
7	Heat Transfer Analysis of Axis Symmetric Problems
8	Dynamic Analysis of 1D problems – Free vibration Analysis
9	Non-linear Static Analysis – Typical problems in geometric and material non-linear Analysis
10	Buckling Analysis of Shell Structures

Question paper pattern:

The SEE questions will be set for **100** marks:

1. Two experiments for **80**marks.
2. Viva voce for **20**marks.

RESEARCH METHODOLOGY AND IPR			
Course Code	20RMI17	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	1:0:2	SEE Marks	60
Credits	02	Exam Hours	03

Module-1

Research Methodology: Introduction, Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Research Process, Criteria of Good Research, and Problems Encountered by Researchers in India.

Defining the Research Problem: Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem,AnIllustration. **05Hrs**

Module-2

Reviewing the literature: Place of the literature review in research, Bringing clarity and focus to your research problem, Improving research methodology, Broadening knowledge base in research area, Enabling contextual findings, How to review the literature, searching the existing literature, reviewing the selected literature, Developing a theoretical framework, Developing a conceptual framework, Writing about the literature reviewed.

Research Design: Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs. **05Hrs**

Module-3

Design of Sampling: Introduction, Sample Design, Sampling and Non-sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs.

Measurement and Scaling: Qualitative and Quantitative Data, Classifications of Measurement Scales, Goodness of Measurement Scales, Sources of Error in Measurement Tools, Scaling, Scale Classification Bases, Scaling Technics, Multidimensional Scaling, Deciding the Scale.

Data Collection: Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, CaseStudyMethod. **05Hrs**

Module-4
Testing of Hypotheses: Hypothesis, Basic Concepts Concerning Testing of Hypotheses, Testing of Hypothesis, Test Statistics and Critical Region, Critical Value and Decision Rule, Procedure for Hypothesis Testing, Hypothesis Testing for Mean, Proportion, Variance, for Difference of Two Mean, for Difference of Two Proportions, for Difference of Two Variances, P-Value approach, Power of Test, Limitations of the Tests ofHypothesis. **Chi-square Test:** Test of Difference of more than Two Proportions, Test of Independence of Attributes, Test of Goodness of Fit, Cautions in Using ChiSquareTests. **05Hrs**
Module-5
Interpretation and Report Writing: Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports. **Intellectual Property:** The Concept, Intellectual Property System in India, Development of TRIPS Complied Regime in India, Patents Act, 1970, Trade Mark Act, 1999,The Designs Act, 2000, The Geographical Indications of Goods (Registration and Protection) Act1999, Copyright Act,1957,The Protection of Plant Varieties and Farmers' Rights Act, 2001,The Semi-Conductor Integrated Circuits Layout Design Act, 2000, Trade Secrets, Utility Models, IPR and Biodiversity, The Convention on Biological Diversity (CBD) 1992, Competing Rationales for Protection of IPRs, Leading International Instruments Concerning IPR, World Intellectual Property Organisation(WIPO),WIPO and WTO, Paris Convention for the Protection of Industrial Property, National Treatment, Right of Priority, Common Rules,Patents,Marks, Industrial Designs, Trade Names, Indications of Source, Unfair Competition, Patent Cooperation Treaty (PCT), Advantages of PCT Filing, Berne Convention for the Protection of Literary and Artistic Works, Basic Principles, Duration of Protection, Trade Related Aspects of Intellectual Property Rights(TRIPS) Agreement, Covered under TRIPS Agreement, Features of the Agreement, Protection of Intellectual Property under TRIPS, Copyright and Related Rights, Trademarks, Geographical indications, Industrial Designs, Patents, Patentable Subject Matter, Rights Conferred, Exceptions, Term of protection, Conditions on Patent Applicants, Process Patents, Other Use without Authorization of the RightHolder, Layout-Designs of Integrated Circuits, Protection of Undisclosed Information, Enforcement of Intellectual Property Rights, UNSECO. **05Hrs**

Course outcomes:

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

- Discuss research methodology and the technique of defining a researchproblem
- Explain the functions of the literature review in research, carrying out a literature search, developing theoretical and conceptual frameworks and writing areview.
- Explain various research designs, sampling designs, measurement and scaling techniques and also different methods of datacollections.
- Explain several parametric tests of hypotheses, Chi-square test, art of interpretation and writing researchreports
- Discuss various forms of the intellectual property, its relevance and business impact in the changing global business environment and leading International Instrumentsconcerning IPR.■

Question paper pattern:

- The question paper will have tenquestions.
- Each full question is for 20marks.
- There will be 2full questions (with a maximum of four sub questions in one full question) from eachmodule.
- Each full question with sub questions will cover the contents under a module.
- Students will have to answer 5 full questions, selecting onefull question from each module.■

Textbooks

(1) Research Methodology: Methods and Techniques, C.R. Kothari, Gaurav Garg,New Age International,4th Edition, 2018.

(2) Research Methodology a step-by-step guide for beginners. (For the topic Reviewing the literature under module 2), RanjitKumar,SAGE Publications,3rd Edition, 2011.

(3) Study Material (For the topic Intellectual Property under module 5), Professional Programme Intellectual Property Rights, Law and Practice, The Institute of Company Secretaries of India, Statutory Body Under an Act of Parliament, September2013.

Reference Books

(1) Research Methods: the concise knowledge base, Trochim, Atomic Dog Publishing, 2005.

(2) Conducting Research Literature Reviews: From the Internet to Paper, Fink A, Sage Publications, 2009.

∗∗∗ END OF I SEMESTER ∗∗∗

INDUSTRIAL DESIGN & ERGONOMICS			
Course Code	**20MPD21**	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Introduction: An approach to industrial design -elements of design structure for industrial design in engineering application in modern manufacturing systems.
Ergonomics and Industrial Design: Introduction -general approach to the man- machine relationship- workstation design-working position.. **10 Hrs**

Module-2

Control and Displays: Shapes and sizes of various controls and displays-multiple, displays and control situations - design of major controls in automobiles, machine tools etc.

Ergonomics and Production: ergonomics and product design - ergonomics in automated systems- expert systems for ergonomic design. Anthropometric data and its applications in ergonomic, design-limitations of anthropometric data- use of computerizeddatabase. . **10Hrs**

Module-3

Visual Effects of Line and Form: The mechanics of seeing-psychology of seeing general influences of line and form.

Colour: Colour and light -colour and objects- colour and the eye - colour consistency- colour terms- reactions to colourand colourcontinuation -colouronengineeringequipments. **10Hrs**

Module-4

Aesthetic Concepts: Concept of unity- concept of order with variety - concept of purpose style and environment- Aesthetic expressions. Style-components of style- house style, observation style in capital goods, casestudy**. 10 Hrs**

Module-5

Industrial Design in Practice: General design -specifying design equipments- rating the importance of industrial design -industrial design in thedesignprocess. **10Hrs**

Course outcomes:
At the end of the course the student will be able to:
1. Understanding the concepts of Industrial design and man-machine relationship.
2. Design of optimistic display and control devices for various applications.
3. Applying the anthropomorphic data in ergonomicdesign.
4. Understanding the visual effects of lines, form and color on engineeringequipments.
5. Choosing appropriate aesthetic aspects for design of industrial machinery anddevices.

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20marks.
- There will be two full questions (with a maximum of four sub questions) from eachmodule.
- Each full question will have sub question covering all the topics under amodule.
- The students will have to answer five full questions, selecting one full question from eachmodule.■

Textbooks

(1)Industrial Design for Engineers - Mayall W.H. - London Hiffee books Ltd.-1988.

Reference Books

(1)Applied Ergonomics Hand Book - Brain Shakel (Edited) - Butterworth scientific. London

(2)Introduction to Ergonomics - R. C. Bridger - McGraw Hill Publications -1995.

(3)Human Factor Engineering - Sanders & McCormick - McGraw Hill Publications – 6thedition,2002.

DESIGN FOR MANUFACTURING			
Course Code	**20MPD22**	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Material and process selection – Introduction, Advantages of applying DFMA, General requirements of early materials and process selection, Selection of Manufacturing processes, Selection ofmaterials.

Engineering Design features. – Dimensioning, Tolerances, General Tolerance, Geometric Tolerances, Assembly limits, achieving larger machining tolerances,Datum features. **10Hrs**

Module-2

Component design – Machining Considerations – Drills, Milling cutters, Drilling, Keyways, Dowels, Screws, Reduction in marhining areas, Simplification by separation and amalgamation, work piece holding, surface grinding, Examples. **.** **10Hrs**

Module-3

Component design – Casting Considerations – Pattern, Mould, parting line, cast holes, machined holes, identifying parting line, special sand cores, designing to obviate sand cores. Examples. **10 Hrs**

Module-4

Design for Injection molding and Sheet metal working – Injection molding materials, Molding cycle, Systems, molds, machine size, cycle time, Cost estimation, Insert molding, Design guidelines, Introduction to sheet metalworking, Dedicated Dies and Press working, Press selections, Design Rules.**10 Hrs**

Module-5

Design for Die casting and Powder metal processing – Die casting alloys, cycle, machines, dies, finishing, Assembly techniques, Design principles, Powder metallurgy processing, stages, compaction characteristics, Tooling, Sintering, Design guidelines.**10 Hrs**

Course outcomes:

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

1. Understand the principles of manufacturability and design for manufacture.
2. Design casting and weldment for economic production quantity.
3. Understand the concept of assembly, its design and true position of datumsystem.
4. Design parts cut to length and screw machine parts of various processes, open and closed dieforging.
5. Design guidelines and background for powder metallurgy parts and reviewing of formedparts.

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20marks.
- There will be two full questions (with a maximum of four sub questions) from eachmodule.
- Each full question will have sub question covering all the topics under amodule.
- The students will have to answer five full questions, selecting one full question from eachmodule.■

Textbooks

(1)Product Design for Manufacture and Assembly – Geoffrey Boothroyd - Peter Dewhurst - Winston Knight

(2)Designing for Manufacturing – Harry Peck - Pitman Publications – 1983.

Reference Books

(1)Dimensioning and Tolerancing for Quantity Production – Merhyle F Spotts –Inc. Englewood Cliffs - New Jersey - Prentice Hall, 5thedition.

PRODUCT PLANNING AND MARKETING			
Course Code	**20MPD23**	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Product strategy and planning product - market evolution, successful product development process, characteristics of successful productdevelopment.

New Product Strategy: Strategic response, reactive verses proactive strategies, marketing verses Research and Development, Comprehensive strategy. **10 Hrs**

Module-2

Proactive new product development process - Sequential decision process, reasons for product failure and strategies to avoid failures, cost, time, risk and expected benefit in new product development. . **10Hrs**

Module-3

Opportunity Identification - Market definition and entry strategy, desirable characteristics of markets, market profile analysis, methods for market definition, target group selection through market segmentation, market selection, idea generation – idea sources, method of generating ideas, idea management. . **10Hrs**

Module-4

Consumer measurement and Perceptual mapping – Consumer measurement process, research methods, sampling, measuring instruments, attitude scaling, Consumers perceptions of new and existing products: Perceptual positioning, Perceptual maps, Analytic Methods used to produce Perceptual maps, Managerial review ofmaps.

Product positioning – Preference analysis and benefits, segmentation-Role of preference in product positioning, proactive product positioning, Analytic preference models and estimation methods, Benefit segmentation, managerial use of preference models. . **10Hrs**

Module-5

Forecasting sales potential – Roleof purchase potential in design process, models of purchase potential, models of sales formation, managerial use of purchase models.

Launching the products and Strategy for Testing new products – Planning and tracking launch of durable and industrial products, advertising testing and productqualitytesting. **10Hrs**
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Course outcomes:

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

1. Understand the Product strategy and planning product and new productstrategy.
2. Analysethe concept of Proactive new product developmentprocess.
3. Understand the concept of Market definition and entry strategy, desirable characteristics of markets, market profileanalysis.
4. Understand the concept of Productpositioning.
5. Analyse the concept of Launching the products and Strategy for Testing new products – Planning and tracking launch of durable and industrialproducts.

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20marks.
- There will be two full questions (with a maximum of four sub questions) from eachmodule.
- Each full question will have sub question covering all the topics under amodule.
- The students will have to answer five full questions, selecting one full question from each module.■

Textbook/ Textbooks

(1)Glen L. Urban. .John R. Hauser, "Design and Marketing of New products" A Prentice Hall, Englewood cliffs, New Jersey, 1993

(2)William L. Moore & Edgar, "Product Planning and Management",

Reference Books

PRODUCT DATA MANAGEMENT			
Course Code	**20MPD241**	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Product Data Management : Product life cycle, Complexity in Product Development, General Description of PDM Basic functionality of PDM: Information architecture, PDM System architecture, Applications used in PDM systems. Trends in PDM. . **10Hrs**

Module-2

Document Management Systems: Document management and PDM, Document life cycle, Content Management, Document management and related technologies, Document management resources on the Internet. **10Hrs**

Module-3

Workflow Management in PDM: Structure Management, Engineering Change Management, Release Management, Version Management, Configuration Management. **10 Hrs**

Module-4

Creating Product Structures: Part centric approach, CAD centric approach, Product Structure configuration, Managing Product Structures,PDM Tools: Matrix One, TeamCenter, Windchill. Enovia, PDM resources on the Internet. . **10Hrs**

Module-5

PDM Implementation Case Studies: Sun Microsystems, Inc., Mentor Graphics Corporation, Ericsson Radio Systems AB, Ericsson Mobile Communications AB, ABB Automation Technology Products, SaabTech Electronics AB.**10 Hrs**

Course outcomes:

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

1. Explain the concepts, tools and techniques for managing product data.
2. Analyze various processes in the product data management frameworks.
3. Evaluate risks in large and complex workflow management environments.
4. Develop product data management plans for various types of organizations.
5. Understand the PDM and ABBtechnologies.

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20marks.
- There will be two full questions (with a maximum of four sub questions) from eachmodule.
- Each full question will have sub question covering all the topics under amodule.
- The students will have to answer five full questions, selecting one full question from eachmodule.

Reference Books

(1)Implementing and Integrating Product Data Management and Software Configuration Management - 20 - IvicaCmkovic Ulf Asklund - AnnitaPerssonDahlqvist - ArchtechHousePublishers.

(2)Product Data Management - Rodger Burden - Publisher: Resource Publishing- ISBN-10: 0970035225, ISBN-13: 978-0970035226 –2003.

(3)The AutoCAD Database Book – Accessing and Managing CAD Drawing Information- Galgotia Publications - ThirdEdition.

ADVANCED MANUFACTURING PRACTICE			
Course Code	**20MPD242**	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Need of CPC for a company, what CPC can do, CPC-getting the right tool.

JIT – Introduction – The spread of JIT Movement, some definitions of JIT, core Japanese practices of JIT, Creating continuous Flow Manufacture, Enabling JIT to occur, Basic elements of JIT, Benefits of JIT.

Just in Time Production – Primary purpose, profit through cost reduction, Elimination of over production, Quality control, Quality Assurance, Respect for Humanity, Flexible work Force, JIT Production Adapting to changing production Quantities, process layout for shortened lead Times, Standardization of operation, Automation.

Sequence and Scheduling Used by Suppliers: Monthly and daily Information. Sequenced withdrawal system by sequenced schedule table, problems and counter measures in applying the Kanban system tosub contractors. **12Hrs**

Module-2

Toyota Production System-The philosophy of TPS, Basic Frame work of TPS, Kanbans. Determining the Number of Kanbans in Toyota ProductionSystem.
a) Kanban Number under Constant Quantity WithdrawalSystem.
b) Constant Cycle, Non-constant Quantity WithdrawalSystem.

Supplier Kanban and the Sequence Schedule for Use by Suppliers.
a) Later Replenishment System byKanban.
b) Sequenced WithdrawalSystem.
c) Circulation of the Supplier Kanban withinToyota.

Production Smoothing in TPS, Production Planning, Production Smoothing, Adaptability to Demand Fluctuations Sequencing Method for the Mixed Model Assembly Line to Realize Smoothed Production of Goal.**12Hrs**

Module-3

Just-in-Time Production with Total Quality Control just in time concept, cutting lot sizes, cutting set-up times, cutting purchase order costs, the JIT cause-Effect chain, Scrap/Quality Improvements, Motivational effects, Responsibility effects, small Group improvement Activities, withdrawal of Buffer Inventory, the total Quality Control Concept. **06Hrs**

Module-4

Total Quality Control- Introduction-Total Quality Control concepts, responsibility, learning from the west, TQC concepts categorized, Goals, Habit of improvement, perfection, Basics, process control, Easy to see Quality control as facilitator, small lot sizes, Housekeeping, Less than full capacity scheduling, Daily machine checking, Techniquesand Aids, Exposure of problems, Fool proof Devices, Tools ofAnalysis,

QC Circles, TQC in Japanese-owned US Electronics plant, TQC in Japanese-ownedAutomotiveplants. **10Hrs**

Module-5

Plant Configurations: Introduction-ultimate Plant configuration, job shop Fabrication, Frame Welding, Forming Frame parts from Tubing, Dedicated production lines, overlapped production, the daily schedule, Forward Linkage by means of Kanban, physical merger of processes, Adjacency, mixed Models, Automated production Lines, Pseudo Robots, Robots, CAD and Manufacturing, Conveyors and stacker Cranes, Automatic Quality Monitoring. **10 Hrs**

Course outcomes:

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

1. Explaining the details of types of advanced manufacturing and machining processes, theirϖ evolution andneed.
2. Identifying the correct advanced manufacturing processes by formulating and determiningϖ the correct AMPs for development of various complex shapedgeometries.
3. Hands on experiments on the Advanced Machines such as EDM, WEDM etc.
4. Design and development of experimental apparatus of any one advanced or derived andϖ hybridmanufacturing.
5. Understand the different Plantconfiguration.

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20marks.
- There will be two full questions (with a maximum of four sub questions) from eachmodule.
- Each full question will have sub question covering all the topics under amodule.
- The students will have to answer five full questions, selecting one full question from each module.■

Textbooks

(1)Japanese Manufacturing Techniques - Richard Schonberger - Pearson Higher Education - ISBN:00292910031982

(2)Just In Time Manufacturing – Kargoanker (manual).

(3)Wind-chill reference manual

Reference Books

(1)An Integrated Approach To Just In Time - Yasuhiro Monden - Toyota Production system.

(2)Lean Thinking - James Womack - Simon & Schuster Adult - ISBN: 0743249275, 2003

(3)The machine that changed the World - James P. Womack, Daniel T Jones, and Daniel Roos - The story of Lean production – by– Harper Perennial edition published -1991.

NON-TRADITIONAL MACHINING PROCESS			
Course Code	**20MPD243**	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Introduction: Need for non-traditional machining processes. Mechanical Process: Ultrasonic Machining-Definition-Mechanism of metal elements of the process- Tool feed mechanism. theories of mechanics of causing effect of parameter applications. . **10Hrs**

Module-2

Abrasive Jet Machining: Principles - parameters of the process applications-advantages and advantages.
Thermal Metal Removal Process: Electric discharge machining Principle of operation – mechanism of meta removal basic EDM circuitry-spark erosion get Analysis of relaxation type of circuit material removal rate in relaxation. . **10Hrs**

Module-3

Electro chemical and chemical processes: Electro chemical machining (ECM) Classification ECM process-principle of ECM Chemistry of the ECM parameters of the processes- determination of the metal removal rate - dynamics of ECM process-Hydrodynamics of ECM process-polarization-.Tool Design-advantages and disadvantages - applications. Electro Chemical Grinding-Electro Chemical holding Electrochemical deburring. **10 Hrs**

Module-4

Chemical Machining: Introduction-fundamental principle types of chemical machining Maskants- Etchenes- Advantages and disadvantages-applications.

Plasma arc Machining: Introduction-Plasma-Generation of Plasma and equipment Mechanism of metals removal, PAN parameters-process characteristics - type of torches applications.**10Hrs**

Module-5

Electron Beam Machining (EBM): Introduction-Equipment for production of Electron beam - Theory of electron beam machining Thermal & Non thermal types characteristics - applications.

Laser Beam Machining (LBM): Introduction-principle of generation of lasers Equipment and Machining procedure- Types of Lasers-Process characteristics-advantages and limitations- applications.
Ion Beam Machining: Introduction-Mechanism of metal removal and associated equipment- process characteristics applications.**10 Hrs**

Course outcomes:

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

1. Compare conventional and non-conventional manufacturing process and understand the mechanism of USM andAJM.
2. Understand EDM concept and operatingcharacteristic.
3. Distinguish ECM with other operations and various application and understand the usage of various chemical and maskants inCHM.
4. Understand the generation of plasma, electron beam, laser and their machiningcharacteristics.
5. Understand the formation of ion beam and this application and various high velocity formingprocess.

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20marks.
- There will be two full questions (with a maximum of four sub questions) from eachmodule.
- Each full question will have sub question covering all the topics under amodule.
- The students will have to answer five full questions, selecting one full question from each module.■

Reference Books

(1) New technology Institution of Engineers - Bhattacharya -India

(2) Production Technology - HMT - Tata McGraw Hill - ISBN-10;0070964432

(3) Modern Machining Process - P.C Pandy& H.S. Shan - Tata McGraw Hill - ISBN: 0070965536 - Publishing Date:Feb-80

(4) Metals Hand Book - ASM -Vol-3.

(5)Modern Manufacturing Method - Adithan- New Age International (p) Limited - ISBN: 8122408176,2007.

(6) Modern Machining Processes - P.K. Mishra - Narosa Publishing

NON DESTRUCTIVE TESTING			
Course Code	**20MPD244**	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Introduction: Definition, concept of NDT, comparison between destructive and non destructive testing, purposes of NDT, classification of NDT methods, advantages, disadvantages, application of NDT in industries, visual inspection, pressure and leak testing.
Liquid Penetrant Inspection: Basic processing steps of LPI, penetrant testing materials, penetrant dwell time, developers, material smear and its removal, advantages, disadvantages &applications.
. **10Hrs**

Module-2

Magnetic particle inspection: Basic principle of MPI, Processing steps of MPI, Methods of generating magnetic fields, types of magnetic particles and suspension liquids, advantages, disadvantages and applications.
Eddy current inspection: Basic principle of eddy current inspection, operating variables, procedure, inspection coils, and detectable discontinuities by the method of eddy current inspection, advantages, disadvantages and applications. **10 Hrs**

Module-3

Ultrasonic inspection: Principle of ultrasonic inspection, basic equipment, characteristics of ultrasonic waves, variables in inspection, inspection methods - scanning systems, pulse echo A-scan, B-scan, and C-scans, contact and immersion methods, transducer elements, couplants, search units, reference blocks, applications.**. 10Hrs**

Module-4

Microwave inspection: Principle of microwave inspection, basic equipment & inspection procedure, advantages, disadvantages and applications.
Radiography inspection: Principle of radiographic inspection, radiation sources, X-rays and Gamma-rays, X-ray tubes, Radiographic films, screens and filters, image intensifiers, penetrameters, image quality, radiographic sensitivity, neutron radiography, safety aspects related to testing, applications. **10 Hrs**

Module-5

Holographic Inspection: Basic principle of optical holography, The basic hologram, recording and reconstruction, interferrometric holography, methods of storing for interferrometric holography, basic principle of acoustic holography, systems and techniques, advantages, disadvantages, and applications of holography**..10Hrs**

Course outcomes:

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

1. Distinguish the destructive and non-destructive testing and find effectiveness.
2. Find the surface defect using liquid penetrant and magnetic particle test and eddy currenttest.
3. Learn the mechanism of flaw detection using ultrasonic wave system.
4. Understand the operations of microwave and radiography inspection system.
5. Understand the basics of holography and interferometry and its application in defectdetection.

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20marks.
- There will be two full questions (with a maximum of four sub questions) from eachmodule.
- Each full question will have sub question covering all the topics under amodule.
- The students will have to answer five full questions, selecting one full question from each module.

Textbooks

(1) Non DestructiveTestingMcGonnagle J J, Garden and Reach, New York

(2) Non Destructive Inspection and Quality Control- Metals Hand Book American Society of Metals

Reference Books

(1) The Testing and Inspection of Engineering materialsDavis H.E, Troxel G.E,Wiskovil C.T

(2) Non Destructive Evaluation and Quality Controlvolume 17 of metals hand book9 edition Asia internal1989.

(3) The Testing instruction of Engineering materialsDavis H.E Troxel G.EwiskovilC.TMcGraw Hill

QUALITY AND RELIABILITY ENGINEERING			
Course Code	**20MPD251**	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Basic Concepts: Definitions of quality and Reliability, Parameters and Characteristics, Quality control, statistical Quality Control, Reliability concepts.

Concepts in Probability and Statistics : Events, Sample Space, Probability rules, Conditional probability, Dependent and Independent Events, Application of Probability concepts in Quality Control, Problems.**10 Hrs**

Module-2

Introduction to Probability Distributions : Normal, Poisson and Binomial distribution. Control Charts : Variable Chart – X Bar chart, R-chart and Sigma chart. Attribute Chart : P – Chart, nP Chart, C-Chart and U – Chart. **10Hrs**

Module-3

Acceptance Sampling: Fundamentals of acceptance sampling, types of acceptance sampling, O.C Curve, AQL, LTPD,AOQL.

Failure Data Analysis : Introduction, Failure Data, Quantitative measures, MTTF, MTBF, Bathtub Curve, Mean Life, Life Testing, Problems, Introduction to Failure Mode and Effect Analysis.**10 Hrs**

Module-4

System Reliability: Series, parallel and mixed configuration, Block diagram concept, r- out- of-n structure solving problems using mathematical models.

Reliability Improvement and Allocation : Difficulty in achieving reliability, Methods for improving reliability during design, Different techniques available to improve reliability.**10 Hrs**

Module-5

Maintainability and Availability: Introduction, Formulas, Techniques available to improve maintainability and availability trade-off among reliability, maintainability and availability, Simple problems.**10Hrs**

Course outcomes:

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

1. Understand the quality and basic probabilityconcept.
2. Construct the control chart forvariables.
3. Construct the control chart for attributes and analyse failuredata.
4. Construct OC curve for determining the probability of lot acceptance.
5. Understand the basic concept of reliability and calculate maintainability and availability ofresources.

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20marks.
- There will be two full questions (with a maximum of four sub questions) from eachmodule.
- Each full question will have sub question covering all the topics under amodule.
- The students will have to answer five full questions, selecting one full question from each module.■

Reference Books

(1)Quality Planning and Analysis - Tata McGraw - Juran, J.M and Gryna, F.M. - Hill publishing Coimpany Ltd., New Delhi, India –1982.

(2)Maintainability and Reliability Handbook of Reliability Engineering and Management - Editors –Ireson. W.G. and Cooms- C.F. McGraw - Hill Book Company Inc. –1988.

(3)Concepts in Reliability Engineering- Srinath L S - Affiliated East-West Press Private Limited, New Delhi, India. –1985.

(4) An Introduction to Reliability and Maintainability Engineering - TMH Charles Ebeling - Tata Mcgraw Hill –2000.

(5) Reliability Engineering - A K Govil - Prentice Hall –1981

VIRTUAL DESIGN AND MANUFACTURING			
Course Code	**20MPD252**	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Review of Computer Graphics: Review of computer graphics, 2D graphics.2D primitives and transformations. Algorithm to digitize the graphic entities, rasterization, 3D graphics.3D primitives and transformations, projections and viewing, algorithms for hidden line removals, lighting.Shading and raytracing.

10 Hrs

Module-2

VR Devices: Input devices-track balls, 3D Mouse, data gloves, Virtual hand and trackers, output devices graph terminal, stereo glasses, head mounting devices, vision dome, caves.

10 Hrs

Module-3

Applications: Virtual prototyping, behavior simulation, digital mockup, walk through/flythrough. Virtual training/simulation, micro electro mechanical systems and nanotechnology.

10 Hrs

Module-4

Virtual Modeling language: History, Concepts, syntax, basic nodes-group, transform switch, LOD etc, geometry nodes-indexed face set, indexed line set, coordinate, coordindwx, textures etc. sensor nodes-time sensor touch sensor, sphere sensor, cylinder sensor and proximity sensor, scriping- VRML Script and JAVA Script.

10 Hrs

Module-5

Tutorials and samples: VRML authoring tools-3D studio MAX, cosmo World, VRML Pad (editor) VRML Viewing tools-cosmo player, auto Vue, SGI's open inventor, virtual collaborativetools.

10 Hrs

Course outcomes:

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

1. Use a robot simulation system as an aid during development of industrial robot work-cells and production systems containing products, processes andresources.
2. Make analysis of robot reach, pose and collision with the aid of a simulation system during production planningwork.
3. Create mechanisms in the simulation system for use in the planning work, for example robot grippers and machinemovements.
4. Create simulation sequences for the simulation of a planned productionsystem.
5. Create an assembly simulation for a specificproduct.

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20marks.
- There will be two full questions (with a maximum of four sub questions) from eachmodule.
- Each full question will have sub question covering all the topics under amodule.
- The students will have to answer five full questions, selecting one full question from each module.■

Reference Books

(1)Computer Graphics-Principles and practice - JanesD,Foley et al., - Second edition. inC,Addision -Wesley 1997.

(2)The VRML- 2.0 Hand book - Jed Hartman and Josie wernecke - Addision-Wesley-1997.

(3)TheAnnocated VRML 2.0 hand book Addision - R Carey and G Bell -Wesley1997.

LEAN MANUFACTURING SYSTEMS			
Course Code	**20MPD253**	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Just in time production system. JIT Logic -Pull system Japanese approach to production elimination of waste - JIT implementation requirements JIT application for job shops, Case studies.

10 Hrs

Module-2

Kanban system:-Kanban rules supplier Kanban and sequence schedule used by supplier. Monthly information & daily information. Later replenish system by Kanban sequenced withdrawal P system by sequence schedule table - problems & counter measures in applying Kanban system to subcontractors -Supplier Kanban circulation in the paternal manufacturer - structure of supplier Kanban sortingoffice.

10 Hrs

Module-3

The rise of lean production: - Birth place, concrete example, company as community, Final assembly plant, product development and engineering. Changing customer demand, dealing with the customer, future of leanproduction.

Shortening of production lead times: reduction of setup times, practical procedures for reducing setup time.

10 Hrs

Module-4

Standardization of operations: Machine layout, multi function workers and job rotation. Improvement activities to reduce work force and increase worker morale -foundation for improvements.
Elements of lean production viz G M Framingharn: Toyota Takaoka Mass Production V /s lean production, diffusing lean production.

10 Hrs

Module-5

Managing lean enterprise:-Finance, Career ladders, geographic spread and advantages of global enterprise.
Prospects for catching up. Simplicity in the natural state: institutional factors -life time employment -educational commodities - quality & productivity in full circle.

10 Hrs

Course outcomes:

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

1. To understand issues & challenges in implementing & developing lean manufacturing techniques from TPS & its contribution for improving organizational performance.
2. Apply lean techniques to bring competitive business culture for improving organization performance.
3. Analyze how lean techniques can be applied to manufacturing & serviceindustry
4. Developing lean management strategy for Supply chain management.
5. Analyzing how lean technique can create value generation for organization

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20marks.
- There will be two full questions (with a maximum of four sub questions) from eachmodule.
- Each full question will have sub question covering all the topics under amodule.
- The students will have to answer five full questions, selecting one full question from each module.■

Reference Books

(1) Productions and Operations Management - ChaselAquilino - Dreamtechlatestedition.

(2)Toyoto Production System -An integrated approach to Just in Time - Yasuhiro Monden -
Engineering aild Management Press -Institute of Industrial Engineers Norcross Georgia -1983.

(3)The Machine that changed the World. The Story of Lean Production - James P Womack -
Daniel TJones and Daniel Roos -Harper Perennial - edition published 1991.

(4)Lean Thinking - James Womack – ISBN 0743249275 –2003.

(5)Japanese Manufacturing Techniques. The Nine Hidden Lessons by simplicity - Richard Schourberger - ASQC Press1991.

(6)Quality Function Development - James Bossert - ASQC Press1991

DESIGN OF EXPERIMENTS			
Course Code	**20MPD254**	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Strategy of Experimentation, Typical applications of Experimental design, Basic Principles, Guidelines for Designing Experiments.

Concepts of random variable, probability, density function cumulative distribution function. Sample and population, Measure of Central tendency; Mean median and mode, Measures of Variability, Concept of confidence level. Statistical Distributions: Normal, Log Normal &Weibull distributions. Hypothesis testing, Probability plots, choice ofsample size. Illustration through Numerical examples. .
. **12Hrs**

Module-2

Classical Experiments: Factorial Experiments: Terminology: factors, levels, interactions, treatment combination, randomization, Two-level experimental designs for two factors and three factors. Three-level experimental designs for two factors and three factors, Factor effects, Factor interactions, Fractional factorial design, Saturated Designs, Central composite designs. Illustration through Numerical examples.
. **08Hrs**

Module-3

Measures of variability, Ranking method, Column effect method & Plotting method, Analysis of variance (ANOVA) in Factorial Experiments: YATE's algorithm for ANOVA, Regression analysis, Mathematical models from experimental data. Illustration through Numerical examples.

Quality, Western and Taguchi's quality philosophy, elements of cost, Noise factors causes of variation. Quadratic loss function & variations of quadratic loss function. Robust Design: Steps in Robust Design: Parameter design and Tolerance Design. Reliability Improvement through experiments, Illustration through Numerical examples**. 12Hrs**

Module-4

Types of Orthogonal Arrays, selection of standard orthogonal arrays, Linear graphs and Interaction assignment, Dummy level Technique, Compound factor method, Modification of linear graphs. Illustration through Numerical examples. **08Hrs**

Module-5

Evaluation of sensitivity to noise. Signal to Noise ratios for static problems: Smaller-the-better type, Nominal-the –better-type, Larger-the-better type. Signal to Noise ratios for Dynamic problems. Illustration through Numerical examples.

Parameter and tolerance design concepts, Taguchi's inner and outer arrays, parameter design strategy, tolerance design strategy. Illustration through Numericalexamples. **10Hrs**

Course outcomes:
At the end of the course the student will be able to:

1. Critically review basic concepts and models of experimental design.
2. Analyse the results of a designed experiment in order to conduct the appropriate statistical analysis of thedata.
3. Interpret statistical results from an experiment and report them in non-technicallanguage
4. Understand the different types of orthogonalarrays.
5. Analyse the Taguchi's inner and outer arrays, parameter design strategy.

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20marks.
- There will be two full questions (with a maximum of four sub questions) from eachmodule.
- Each full question will have sub question covering all the topics under amodule.
- The students will have to answer five full questions, selecting one full question from each module.

Textbook/ Textbooks

(1) Design and Analysis of Experiments, Douglas C Montgomerry, Wiley, 8th Edition

(2) Design and Analysis of Experiments, R. Panneerselvam, PHI

Reference Books

(1) Design of Experiments with Minitab, Paul Mathews, New Age International.

(2) Design of Experiments with Minitab, Virgil L Anderson and Robert A Mclean, Taylor and Francis

PRODUCT DESIGN LABORATORY – II			
Course Code	20MPDL26	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	0:4:0	SEE Marks	60
Credits	02	Exam Hours	03

General Guidelines:

Students need to generate the Solid Model and Draft the required views.

1. The orthographic views and solution shall be drawn.
2. If required, various manufacturing sequences shall be shown in the model and drawing.
3. Any 3D Modeling and Drafting CAD tools are permitted.
4. Dimensions that are not defined may be assumed.
5. Results including the calculations shall be shown along with the drawing.

Sl. NO	Description	Suggested Books and references
1	The shaft assembly of the intermediate transmission unit shown in Fig.1.42 is required to have an axial freedom of maximum 0.18 mm and minimum 0.06 mm when assembled in working condition. Using the nominal sizes specified for the miter bevel gear, shaft, housing, bearing bushes and spur gear, shown in Fig. 1.43, draw only the relevant components and state only the appropriate limits to achieve the required axial freedom.	Fig.1.42 and Fig.1.43 from the book "DESIGN FOR MANUFACTUR E" by Harry Peck.
2	The partial assembly of an oil pump is shown in Fig.1.45. A four lobe inner rotor is mounted off-set to the body bore in which a five lobe outer rotor rotates, driven by the inner rotor. Both the specified clearances are to be measured by a feeler gauge when the parts are assembled. Taking this	Fig.1.45 and Fig.1.46 from the book "DESIGN FOR MANUFACTUR E" by Harry Peck.

	procedure into account, and also the fact that the outer rotor can "float" radially, state the appropriate limits for the relevant dimensions which will ensure that the specified clearance limits are not exceeded. Assume zero clearance between inner rotor stem and body bore (20 mm diameter). Nominal sizes are shown inFig.1.46.	
3	The shaft is to be manufactured from 0.4 % carbon steel to the sizes shown in Fig. 2.31. The 30 mm and the 25 mm diameter are to be ground. Prepare a production detail drawing for the shaft.	Fig.2.31 from the book "DESIGN FOR MANUFACTUR E" by Harry Peck.
4	The slide block shown in Fig.3.42 is to be manufactured in batches of 100. Describe a method of manufacture intended to reduce machining time to aminimum. Redraw the block showing the appropriate manufacturingdimensions.	Fig.3.42 from the book "DESIGN FOR MANUFACTUR E" by Harry Peck.
5	In the fulcrum block shown in Fig.4.39, a lever, mounted on a hinge pin, oscillates 30° each side of the vertical centreline; this lever is shown, chain dotted, in the two extremes of the position. Comment on the machining involved and show design modifications to facilitate themachining.	Fig.4.39 from the book "DESIGN FOR MANUFACTUR E" by Harry Peck.
6	A suitable operation sequence for the stub	Fig.4.40 from the book "DESIGN FOR MANUFACTUR E" by

	carrier shown in Fig.4.40 and redraw the component incorporating features to facilitate manufacture. The carrier is to be produced from a steel casting and the symbol 'G' indicates a ground surface for the 30 mm diameter f8limits.	Harry Peck.
7	Indicate the parting line for the steel forked lever casting seen inFig.5.27, and also the necessary sand cores. Maintaining as nearly as possible, the existing weight of the casting, offer adesign modification that will alleviate the sand core requirements.	Fig.5.27 from the book "DESIGN FOR MANUFACTUR E" by Harry Peck.
8	For the pedestal shown inFig.5.28 indicate the probable parting line and any unnecessary sand cores, accepting that the probable parting line is the one involving the minimum sand cores. Show a design modification to reduce or eliminate the need for sand cores; maintain approximately same weight of casting in the modified design.	Fig.5.28 from the book "DESIGN FOR MANUFACTUR E" by Harry Peck
Question paper pattern: The SEE questions will be set for **100** marks: 1. Two experiments for **80**marks. 2. Viva voce for **20**marks.		

TECHNICAL SEMINAR			
Course Code	20MPD27	CIE Marks	100
Number of contact Hours/week	0:0:2	SEE Marks	--
Credits	02	Exam Hours	--

Course objectives:

The objective of the seminar is to inculcate self-learning, face audience confidently, enhance communication skill, involve in group discussion and present and exchange ideas.

Each student, under the guidance of a Faculty, is required to

- Choose, preferably through peer reviewed journals, a recent topic of his/her interest relevant to the Course ofSpecialization.
- Carryout literature survey, organize the Course topics in a systematicorder.
- Prepare the report with ownsentences.
- Type the matter to acquaint with the use of Micro-soft equation and drawing tools or any suchfacilities.
- Present the seminar topic orally and/or through power point slides.
- Answer the queries and involve indebate/discussion.
- Submit two copies of the typed report with a list of references.

The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and becomeself-confident.

The CIE marks for the seminar shall be awarded (based on the relevance of the topic, presentation skill, participation in the question and answer session and quality of report) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculties from the department with the senior most acting as theChairperson.

Marks distribution for CIE of the course 20MPD27 seminar:

Seminar Report: 30 marks

Presentation skill:50 marks

Question and Answer:20 marks

*** END OF II SEMESTER***

PRODUCT ANALYSIS AND COST OPTIMIZATION			
Course Code	**20MPD31**	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Introduction: New products, new product strategy -market definition Idea generation introduction to the design process -forecasting sales potential -product engineering and markets- monopoly competitive.
Manufacturing Planning: Selection of optimum process, standardization. Break even analysis- application and area of use -problems -multi - product analysis.

10Hrs

Module-2

Value Analysis: Steps in selection, analysis and implementation, Selection of cutting speed for optimum cost -problems.
Cost Accounting: Cost estimation -difference -types -steps involved in cost estimation.

10Hrs

Module-3

Types of Cost: Cost Centres, Direct –indirect, material cost -direct indirect material cost Overhead cost, Elements in overheads: Preparation of cost sheet, machine hour rate, apportioning methods.

10Hrs

Module-4

Variance Analysis – Labourvariance, Material variance and Overhead variance, Activity based costing - Introduction to target costing.

10Hrs

Module-5

Cost Calculation: Cost calculation for machined components, welding, casting and forged components illustrations -calculation of sales cost.

Cost Optimization Techniques: Analytical, Graphical and incremental methods Learningcurves.

10Hrs

Course outcomes:
At the end of the course the student will be able to:
1. Analyse the Selection of optimum process, standardization. Break even analysis- application and area of use -problems -multi - product analysis.
2. Understand the Steps in selection, analysis and implementation,Cost estimation.
3. Understand the different types ofcost.
4. Understand the different types VarianceAnalysis**.**
5. Analysethe various Cost OptimizationTechniques.

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20marks.
- There will be two full questions (with a maximum of four sub questions) from eachmodule.
- Each full question will have sub question covering all the topics under amodule.
- The students will have to answer five full questions, selecting one full question from each module.■

Textbook/ Textbooks

(1)Design and Marketing of New Products - Glen L Urban - John R Hauser- Prentice Hall. New Jersey, 1980.

(2)Production and Costing - Narang CBS & Kumar V - Khanna Publishers- 2001.

Reference Books

(1)Cost management in the New Manufacturing Age -Yasuhiro Monden, ProductivityPress- 1992

(2)Techniquefor Value Analysis And Engineering - Miles Lewrence.D- McGraw Hill, Newyork-1972

OPTIMISATION TECHNIQUES FOR DECISION MAKING			
Course Code	**20MPD321**	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Module-1

Introduction: Engineering application of optimization, multivariable optimization Statement of a optimization problem. Design Vector, Design constraints, objective function, classification of optimization problems.

Classical Optimization Technique: Single variable optimization, with equality Constraints solution by direct substitution, solution by the method of constrained Variation. Solution by the method of Lagrange multipliers, multivariable optimization with inequality constraints Kuhn – Tuckercondition

. **08Hrs**

Module-2

Non-linear Programming: (One Dimensional minimization method) Numerical method, Unimodal function, Unrestricted search, Exhaustive search. Dichotomous search, Fibonacci and Golden section method.

08Hrs

Module-3

Interpolation Method: Quadratic and Cubic Nonlinear programming (Unrestricted Optimization Technique) Random search methods, Univariate method, powels method, Simplex method.

08Hrs

Module-4

Descent Methods: Steepest descent, conjugate gradient, variable metricmethod.

Non Linear Programming: (Constrained Optimization problem) Characteristic of a constrained problem.

08Hrs

Module-5

Direct Methods: The complex method, cutting plane method, methods of Feasible directions.

Indirect Methods: Transformation technique, change variables and elimination of variables, penalty function methods- interior and exterior penaltyfunction.

08Hrs

Course outcomes:

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

1. Understand the concept of Classical OptimizationTechnique.

2. AnalyseNumerical method, Unimodal function, Unrestricted search, Exhaustivesearch.

3. Understand the concept of Quadratic and Cubic Nonlinear programming (Unrestricted OptimizationTechnique).

4. Understand the Steepest descent, conjugate gradient, variable metric method.

5. Understand the concept of Transformation technique, change variables and elimination ofvariables.

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20marks.
- There will be two full questions (with a maximum of four sub questions) from eachmodule.
- Each full question will have sub question covering all the topics under amodule.
- The students will have to answer five full questions, selecting one full question from each module.■

Textbooks

(1)Optimization, "Theory and Application" - S.S. Rao - Willey Eastern - 1984

Reference Books

(1)Optimization methods for Engg. Design - R.L Fox - Addison – Wesley – ISBN 0201020785 - 1971

(2)Optimisation Theory and Practice - GSG Beveridge and R.S. Schechter - McGraw Hill, New York – 1970.

(3)Optimisation and Probability in System Engg.- Ram - Van Nostrand – 1974

RAPIDPROTOTYPING			
Course Code	**20MPD322**	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Module-1

Introduction: Need for the compression in product development, history of RP systems, Survey of applications, Growth of RP industry, and classification of RP systems.

Stereo Lithography Systems: Principle, Process parameter, Process details, Data preparation, data files and machine details, Application.

08Hrs

Module-2

Selective Laser Sintering and Fusion Deposition Modeling: Type of machine, Principle of operation, process parameters, Data preparation for SLS, Applications, Principle of Fusion deposition modeling, Process parameter, Path generation,Applications.

08Hrs

Module-3

Solid Ground Curing: Principle of operation, Machine details, Applications.

Laminated Object Manufacturing: Principle of operation, LOM materials. Process details, application.

08Hrs

Module-4

Rapid Tooling: Indirect Rapid tooling -Silicone rubber tooling – Aluminum filled epoxy tooling Spray metal tooling, Cast kirksite, 3Q keltool, Direct Rapid Tooling Direct. AIM, Quick cast process, Copper polyamide, Rapid Tool, DMILS, Prometal, Sand casting tooling, Laminate tooling soft Tooling vs. hard tooling.

08Hrs

Module-5

RP Process Optimization: factors influencing accuracy. Data preparation errors, Part building errors, Error in finishing, influence of build orientation.

08Hrs

Course outcomes:

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

1. Describe product development, conceptual design and classify rapid prototyping systems; explain stereo lithography process and applications.
2. Explain direct metal laser sintering, LOM and fusion deposition modelingprocesses.
3. Demonstrate solid ground curing principle andprocess.
4. Discuss LENS, BPM processes; point out the application of RP system in medical field define virtual prototyping and identify simulationcomponents.
5. Understand the RP ProcessOptimizations.

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20marks.
- There will be two full questions (with a maximum of four sub questions) from eachmodule.
- Each full question will have sub question covering all the topics under amodule.
- The students will have to answer five full questions, selecting one full question from each module.■

Textbooks

(1)Stereo lithography and other RP & M Technologies -Paul F. Jacobs - SME, NY1996

(2)Rapid Manufacturing - Flham D.T &Dinjoy S.S - Verlog London2001.

(3)Rapid automated - Lament wood - Indus press NewYork

(4)Wohler's Report 2000 - Terry Wohlers - Wohler's Association -2000

VALUE ENGINEERING			
Course Code	**20MPD323**	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Module-1

INTRODUCTION TO VALUE ANALYSIS: Definition of Value, Value Analysis, Value Engineering, Value management, Value Analysis versus Value Engineering, Value Analysis versus Traditional cost reduction techniques, Symptoms to apply value analysis, Coaching of Champion concept.

TYPE OF VALUES: Reasons for unnecessary cost of product, Peeling cost Onion concept, unsuspected areas responsible for higher cost, Value Analysis Zone, attractive features of value analysis. Meaning of Value, types of value & their effect in costreduction.

08Hrs

Module-2

FUNCTIONAL COST AND ITS EVALUATION: Meaning of Function and Functional cost, Rules for functional definition, Types of functions, primary and secondary functions using verb and Noun, Function evaluation process, Methods of function evaluation. Evaluation of function by comparison, Evaluation of Interacting functions, Evaluation of function from available data, matrix technique, MISS technique, Numerical evaluation of functional relationships and case studies.

PROBLEM SETTING & SOLVING SYSTEM: A problem solvable stated is half solved, Steps in problem setting system, Identification, Separation and Grouping of functions. Case studies.

08Hrs

Module-3

VALUE ENGINEERING JOB PLAN: Meaning and Importance of Value Engineering Job plan. Phases of job plan proposed by different value engineering experts, Information phase, Analysis phase, Creative phase, Judgement phase, Development planning phase, and case studies. Cost reduction programs, criteria for cost reduction program, Value analysis change proposal.

08Hrs

Module-4

VALUE ENGINEERING TECHNIQUES: Result Accelerators or New Value Engineering Techniques, Listing, Role of techniques in Value Engineering, Details with Case examples for each of the Techniques.

ADVANCED VALUE ANALYSIS TECHNIQUES: Functional analysis system technique and case studies, Value analysis of Management practice (VAMP), steps involved in VAMP, application of VAMP to Government, University, College, Hospitals, School Problems etc., (service typeproblems).

08Hrs

Module-5

APPLICATION OF VALUE ANALYSIS: Application of Value analysis in the field of Accounting, Appearance Design, Cost reduction, Engineering, manufacturing, Management, Purchasing, Quality Control, Sales, marketing, Material Management Etc., Comparison of approach of Value analysis & other management techniques.**08Hrs**

Course outcomes:

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

1. To understand the concepts of value engineering, identify the advantages,applications.
2. To understand various phases of value engineering. Analyze the function, its approach andevaluation.
3. To learn queuingtheory.
4. To evaluate the value engineering operation in maintenance and repairactivities.
5. To create the value engineering team and discuss the value engineering casestudies.

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20marks.
- There will be two full questions (with a maximum of four sub questions) from eachmodule.
- Each full question will have sub question covering all the topics under amodule.
- The students will have to answer five full questions, selecting one full question from each module.■

Textbooks

(1)Techniquesof Value Analysis and Engineering– Lawrence D. Miles, McGraw – Hill Book Company,2ndEdn.

(2)Value engineering for Cost Reduction and Product Improvement – M.S. Vittal, Systems Consultancy Services Edn 1993

(3)Value Management, Value Engineering and Cost Reduction – Edward D Heller Addison Wesley Publishing Company 1971

Reference Books

(1)Value Analysis for Better Management – Warren J Ridge American Management Association Edn 1969

(2)Getting More at Less Cost (The Value Engineering Way) – G.Jagannathan Tata Mcgraw Hill Pub. Comp. Edn 1995

(3)Value Engineering – Arther E Mudge McGraw Hill Book Comp. Edn 1981

ADVANCED FLUID POWER SYSTEMS			
Course Code	**20MPD324**	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Module-1

Introduction: Pascal Law, Advantages of Fluid Power, Applications of Fluid Power, Components of a FluidPower.
Hydraulic Power Unit: Introduction, Pumping Theory, Pump Classification, Gear Pumps, (Vane Pumps- simple, balanced & pressure compensated vane pump, Vane design) Piston Pumps- Radial, Axial (Bent axis & Swash plate), Pump Performance, Pump Noise, Ripple in pumps.
Hydraulic Actuators: Linear actuator- cylinders, Mechanics of Hydraulic cylinder loading, limited rotation hydraulic actuator, cylinder cushioning, Gear, Vane & Piston motor, Motor performance, Hydrostatic transmission.**08Hrs**

Module-2

Power Controlling Elements – Valves :
i) Directional Control Valves – Classification, 2/2, 3/2,4/2 & 4/3 ways Dcv's, Different Centre configurations in 4/3 way valves, actuation of DCV's, Indirect actuation, Valve Lap – Lap during Stationary and duringswitching.
ii) Pressure Control Valves: Classification, opening & Closing Pressure difference, Cracking Pressure, Pressure Relief Valve – Simple & Compound type, Pressure reducing valve, sequence, unloading &Counter balance valve, Pressureswitches.
iii) Flow Control valves – Fixed throttle, Variable throttle, Pressure Compensation principles, pressure compensated Flow control valve – Reducing & Relieftype.
iv) Check valve, Pilot operated checkvalve.
. **08Hrs**

Module-3

Hydraulic Circuit Design & Analysis: Control of Single & double acting cylinder, Regeneration circuit, cylinder sequencing & Synchronizing circuit. Speed control of cylinder & Motors, Analysis of Hydraulic system with frictional losses, Accumulators &accumulator circuits.
Pneumatic System: Introduction, – Generation of compressed air, air receiver, servicing FRL unit, Air filter, pressure regulation, lubricator, Pneumatic cylinder & air motor – different types of cylinder, cushion assembly. Cylinder performance.
Pneumatic Valve: Directional control valves, impulse valve, Quick exhaust valve, shuttle valve, Twin pressure valve, Time delay valve. **08Hrs**

Module-4

Pneumatic Circuit & Logic Circuits:- Control of single and double acting cylinder, impulse operation, speed control, sequencing, Pneumatic Vacuum system AND,OR, NOT, NAND, NOR, YES Function, Logic circuits design using shuttle valve & twin pressure valve, Binary Arithmetic, logic & Boolean Algebra, use of kannaughveitch map for pneumatic circuit design.
08Hrs

Module-5

Electrical Control in Fluid Power: Contactors, & Switches, Relays, Limit switch, Electro hydraulic & Electro Pneumatic Circuits, Simple Cylinder reciprocation, interlocking using relays, Proximity switches, application of proximity switches, Time dependent will dependent and travel dependent circuits. **08Hrs**

Course outcomes:

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

1. Explain the working principle and performance parameters of various hydraulic and pneumatic components andsystems.
2. Design hydraulic and pneumatic circuits for mechanical engineering applications.
3. Analyze performance evaluation of fluid power systems and propose improvements.
4. Understand the Control of single and double acting cylinder, impulse operation, speed control, sequencing, Pneumatic Vacuum system AND,OR, NOT, NAND, NOR, YESFunctions.
5. Analysethe Electrical Control in Fluid Powersystems.

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20marks.
- There will be two full questions (with a maximum of four sub questions) from eachmodule.
- Each full question will have sub question covering all the topics under amodule.
- The students will have to answer five full questions, selecting one full question from each module.■

Textbooks

(1) Fluid Power with ApplicationAnthonyEspositoPeason Education 5th edition

(2) Oil hydraulics -Principles &maintenanceS.R. MajumdarTata M C Graw Hill

Reference Books

(1) Components &ApplicationBosch Rexroth didacticHydraulicsTrainervol 1

(2) Pneumatic System, Principles and MaintenanceS.R. MajumdarTata M C Graw Hill

(3) Pneumatics: Theory and Applications

(4)ElectroPneumaticsBosch Rexroth didacticVol. 2

ROBUST DESIGN			
Course Code	**20MPD331**	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Module-1

Quality by Experimental Design : Quality, western and Taguchi quality philosophy, Elements of cost, Noise factors causes of variation, Quadratic loss function and variation of quadratic loss functions.

Robust Design : Steps in robust design : parameter design and tolerance design, reliability improvement through experiments, illustration through numerical examples.

08Hrs

Module-2

Experimental Design: Classical experiments: factorial experiments, terminology, factors. Levels, Interactions, Treatment combination, randomization, 2-level experimental design for two factors and three factors. 3-level experiment deigns for two factors and three factors, factor effects, factor interactions, Fractional factorial design, Saturated design, Central composite designs, Illustration through numerical examples.

08Hrs

Module-3

Measures of Variability : Measures of variability, Concept of confidence level, Statistical distributions : normal, log normal and Weibull distributions. Hipothesis testing, Probability plots, choice of sample size illustration through numerical examples.

Analysis and interpretation of experimental data: Measures of variability, Ranking method, column effect method and ploting method, Analysis of variance (ANOVA), in factorial experiments : YATE's algorithm for ANOVA, Regression analysis, Mathematical models from experimental data, illustration through numerical examples.

08Hrs

Module-4

Taguchi's Orthogonal Arrays : Types orthogonal arrays, Selection of standard orthogonal arrays, Linear graphs and interaction assignment, dummy level technique, Compound factor method, modification of linear graphs, Column merging method, Branching design, Strategies for constructing orthogonal arrays.

Signal to Noise ratio (S-N Ratios) : Evaluation of sensitivity to noise, Signal to noise ratios for static problems, Smaller – the – better types, Nominal – the – better – type, larger – the- better – type. Signal to noise ratios for dynamic problems, Illustrations through numerical examples.

08Hrs

Module-5

Parameter Design and Tolerance Design : Parameter and tolerance design concepts, Taguchi's inner and outer arrays, Parameter design strategy, Tolerance deign strategy, Illustrations through numerical examples.

Reliability Improvement Through Robust Design : Role of S-N

ratios in reliability improvement ; Case study; Illustrating the reliability improvement of routing process of a printed wiring boards using robust design concepts**.**

08Hrs

Course outcomes:

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

1.Create designs that have a minimal sensitivity to input variation
2.Reduce design costs
3.Determine which design parameters have the largest impact on variation
4.Optimize designs with multipleoutputs.
5.Understand the Parameter Design and ToleranceDesign.

Question paper pattern:

The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20marks.
- There will be two full questions (with a maximum of four sub questions) from eachmodule.
- Each full question will have sub question covering all the topics under amodule.
- The students will have to answer five full questions, selecting one full question from each module.■

Textbooks

(1)Quality Engineering using Robust Design - Madhav S. Phadake: Prentice Hall, Englewood Clifts, New Jersey 07632, 1989.

(2)Design and analysis of experiments - Douglas Montgomery: Willey India Pvt. Ltd., V Ed., 2007

(3)Techniques for Quality Engineering - Phillip J. Ross: Taguchi 2nd edition. McGraw Hill Int. Ed., 1996

Reference Books

(1)Quality by Experimental Design - Thomas B. Barker - Marcel Dekker Inc ASQC Quality Press, 1985

(2)Experiments planning, analysis and parameter design optimization - C.F. Jeff Wu, Michael Hamada - John Willey Ed., 2002

(3)Reliability improvement by Experiments - W.L. Condra, - Marcel Dekker Inc ASQC Quality Press, 1985

SIMULATION AND MODELING OF MANUFACTURING SYSTEMS			
Course Code	**20MPD332**	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Module-1

Principles of Computer Modeling And Simulation: Monte Carlo simulation. Nature of computer- modeling and simulation. Limitations of simulation, areas of applications.

System and Environment: Components of a system -discrete and continuous systems, Models of a system -a variety of modeling approaches.

08Hrs

Module-2

Discrete Event Simulation: Concepts in discrete event simulation, manual simulation using event scheduling, single channel queue, two server queue, simulation of inventory problem.

08Hrs

Module-3

Random Number Generation: Techniques for generating random numbers- Mid square method -the mod product method -Constant multiplier technique -Additive congruential method -Linear congruential method -Tests for random numbers -The Kolmogorov-Smirnov test -the Chi-square test.

08Hrs

Module-4

Random Variable Generation: Inversion transforms technique-exponential distribution. uniform distribution, weibul distribution, continuous distribution, generating approximate normal variates-Erlang distribution.

08Hrs

Module-5

Input modeling, verification and validation of simulation models: Goodness of fit test, chi square test, steps in verification and validation of simulation modeling's, simple problems .

Simulation Software: Selection of simulation software, simulation packages. **08Hrs**

Course outcomes:

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

1. Describe the role of important elements of discrete event simulation and modelingparadigm.
2. Conceptualize real world situations related to systems development decisions, originating from source requirements andgoals.
3. Develop skills to apply simulation software to construct and execute goal-driven systemmodels.
4. Interpret the model and apply the results to resolve critical issues in a real worldenvironment.
5. Understand the Input modeling, verification and validation of simulationmodels.

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20marks.
- There will be two full questions (with a maximum of four sub questions) from eachmodule.
- Each full question will have sub question covering all the topics under amodule.
- The students will have to answer five full questions, selecting one full question from each module.■

Reference Books

(1)Discrete Event System Simulation - Jerry Banks & .John S Carson II - Prentice Hall Inc.-1984.

(2) Systems Simulation - Gordan. G - Prentice Hall India Ltd -1991

(3)System Simulation With Digital Computer - NusingDeo - Prentice Hall of India - 1979

(4)Computer Simulation and Modeling - Francis Neelamkovil - John Wilely& Sons -1987

(5)Simulation Modeling with Pascal - RathM.Davis& Robert M O Keefe - Prentice Hall Inc. – 1989.

COMPUTER APPLICATIONS IN DESIGN			
Course Code	**20MPD333**	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Module-1

Introduction to CAD/CAM/CAE Systems: Overview, Definitions of CAD. CAM and CAE, Integrating the Design and Manufacturing Processes through a Common Database-A Scenario, Using CAD/CAM/CAE Systems for Product Development.

Components of CAD/CAM/CAE Systems: Hardware Components ,Vector-Refresh (Stroke- Refresh) Graphics Devices, Raster Graphics Devices, Hardware configuration, Software Components.

08Hrs

Module-2

Basic Concepts of Graphics Programming: Graphics Libraries, Coordinate Systems, Window and Viewport, Output Primitives - Line, Polygon, Marker Text, Graphics Input, Display List, Transformation Matrix, Translation, Rotation, Mapping, Other Transformation Matrices, Hidden-Line and Hidden-Surface Removal, Back-Face Removal Algorithm, Depth-Sorting, or Painter.s, Algorithm, Hidden-Line Removal Algorithm, z-Buffer Method, Rendering, Shading, Ray Tracing, Graphical User Interface, X Window System.

08Hrs

Module-3

Representation and Manipulation of Curves: Types of Curve Equations, Conic Sections, Circle or Circular Arc, Ellipse or Elliptic Arc, Hyperbola, Parabola, Hermite Curves, Bezier Curve, Differentiation of a Bezier Curve Equation, Evaluation of a Bezier Curve, B-Spline Curve, Evaluation of a B-Spline Curve, Composition of B-Spline Curves, Differentiation of a B-Spline Curve, Non-uniform Rational B-Spline (NURBS) Curve.

Representation and Manipulation of Surfaces: Types of Surface Equations, Bilinear Surface, Coon's Patch, Bicubic Patch, Bezier Surface, Evaluation of a Bezier Surface.

08Hrs

Module-4

CAD and CAM Integration : Overview of the Discrete Part Production Cycle, Process Planning, Manual Approach, Variant Approach, Generative Approach, Computer-Aided Process Planning Systems, CAM-I CAPP, MIPLAN and Multi CAPP, Met CAPP, ICEM- PART, Group Technology, Classification and Coding, Existing Coding Systems, Product Data Management (PDM)Systems.

08Hrs

Module-5

Standards for Communicating Between Systems: Exchange Methods of Product Definition Data, Initial Graphics Exchange Specification, Drawing Interchange Format, Standard for the Exchange of Product Data. Tutorials, Computational exercises involving Geometric Modeling of components and theirassemblies.

. **08Hrs**

Course outcomes:
At the end of the course the student will be able to:
1. Analyse the Overview, Definitions of CAD. CAM and CAE, Integrating the Design andManufacturing.
2. Understand the concept of Basic Concepts of Graphics Programming.
3. Understand theRepresentation and Manipulation of Surfaces and Representation and Manipulation ofCurves.
4. Analyse the Variant Approach, Generative Approach, Computer-Aided ProcessPlanning.
5. Understand the concept of Standards for Communicating Between Systems.

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20marks.
- There will be two full questions (with a maximum of four sub questions) from eachmodule.
- Each full question will have sub question covering all the topics under amodule.
- The students will have to answer five full questions, selecting one full question from each module.■

Textbooks

(1)Principles of CAD/CAM/CAE systems – Kunwoo - Lee Addison Wesley -1999

(2)CAD/CAM/CIM - Radhakrishnan P. et al. - New Age International - 2008

Reference Books

(1)CAD/CAM – Theory & Practice - Ibrahim Zeid - McGraw Hill - 1998

(2)Computer Integrated Design and Manufacturing - Bedworth, Mark Henderson &Philip Wolfe - McGraw hill inc. - 1991.

(3)Part modeling Users Guide - Pro-Engineer - 1998

HUMAN RESOURCES MANAGEMENT			
Course Code	**20MPD334**	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Module-1

HRM in perspective, competitive challenges, uses of HR information, Demographics and employee concerns, social issues, diversity in. HRM,

Relationship of Job Requirements and HRM functions, Job Analysis, Job Description, Job Design, Designing work for groups, flexible work schedules, Industrial engineering and ergonomic consideration, HR Planning, Effective HRP, Forecasting and balancing supply and demand of HR, recruiting from inside and outside, Recruiting protected class, Recruiting older people. **08Hrs**

Module-2

Selection, Matching people and job, sources of information about job candidate, The US Employee Polygraph Protection Act, graphology, Medical examination, Drug test, Interview methods Guidelines for interviewers, appropriate and inappropriate interview questions, selectiondecision. **08Hrs**

Module-3

Developing effectiveness in HR, Investment in Training, System approach, Conducting the .needs assessment, designing training programs, trainee readiness and motivation, principles of learning, characteristics of trainees, training methods for non-managerial employees, OJT, Technology for training, training methods for MDP, Evaluating, benchmarking HR training. **08Hrs**

Module-4

Career development and Appraisal, identifying career opportunity and requirements, gauging employee potential, career development initiative, Mentor check list, career development for women and minorities, dual career couples, personal career development, Behavioural methods of appraisal, balanced score card, personal score card appraisal interviews;performancediagnosis. **08Hrs**

Module-5

International HRM, Managing across borders, International staffing, Skills of a global manager, content of training program. Non-verbal communications, developing local resources, compensation of host country employees, managers and expatriate managers. Case studies on appraisal system, developing a training session, evaluating a given training program. preparation of structured and unstructured interviews.**08Hrs**

Course outcomes:
At the end of the course the student will be able to:
1. Understand the basic concepts of HRM, Functions and role of HRM.
2. Know methodology of job selection process implemented in various sectors.
3. Analysethe effectiveness in training, evaluating and benchmarking HRtraining.
4. Understand the career development concept and methods of personal appraisal.
5. Understand International activities of HRM, Staffing, communication, appraisal training and interviewsystem.

Question paper pattern:
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 60.

- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20marks.
- There will be two full questions (with a maximum of four sub questions) from eachmodule.
- Each full question will have sub question covering all the topics under amodule.
- The students will have to answer five full questions, selecting one full question from each module.■

Textbooks

(1) Managing Human ResourcesWayne F CascioTata McGraw Hill, New Delhi

(2) Managing Human ResourcesGeorgeBohlander and Scot SnellThompson South

Reference Books

(1) Human Resource Management BiswajeetPattanayakPrentice Hall of India Pvt. Ltd.

(2) Human Resource Management K. Ashwathappa

(3) Personnel ManagementC.B.MemoriaHimalaya Publishing.

PROJECT WORK PHASE – 1			
Course Code	20MPD34	CIE Marks	100
Number of contact Hours/Week	2	SEE Marks	--
Credits	02	Exam Hours	--

Course objectives:

- Support independentlearning.
- Guide to select and utilize adequate information fromvaried resources maintainingethics.
- Guide to organize the work in the appropriate manner and present information (acknowledging the sources)clearly.
- Develop interactive, communication, organisation, time management, and presentationskills.
- Impart flexibility andadaptability.
- Inspire independent and teamworking.
- Expand intellectual capacity, credibility, judgement,intuition.
- Adhere to punctuality, setting and meetingdeadlines.
- Instil responsibilities to oneself andothers.
- Train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas.

Project Phase-1 Students in consultation with the guide/s shall carry out literature survey/ visit industries to finalize the topic of the Project. Subsequently, the students shall collect the material required for the selected project, prepare synopsis and narrate the methodology to carry out the project work.

Seminar: Each student, under the guidance of a Faculty, is required to

- Present the seminar on the selected project orally and/or through power pointslides.
- Answer the queries and involve indebate/discussion.
- Submit two copies of the typed report with a list of references.

The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and becomeself-confident.

Course outcomes:

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

- Demonstrate a sound technical knowledge of theirselected projecttopic.
- Undertake problem identification, formulation, andsolution.
- Design engineering solutions to complex problems utilising a systems approach.
- Communicate with engineers and the community at large in written an oralforms.
- Demonstrate the knowledge, skills and attitudes of a professionalengineer.

Continuous Internal Evaluation

CIE marks for the project report (50 marks), seminar (30 marks) and question and answer (20 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session by the student) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculty from the department with the senior most acting as the Chairperson.

MINI PROJECT			
Course Code	20MPD35	CIE Marks	40
Number of contact Hours/Week	2	SEE Marks	60
Credits	02	Exam Hours/Batch	03

Course objectives:

- To support independent learning and innovativeattitude.
- To guide to select and utilize adequate information from varied resources upholdingethics.
- To guide to organize the work in the appropriate manner and present information (acknowledging the sources)clearly.
- To develop interactive, communication, organisation, time management, and presentationskills.
- To impart flexibility andadaptability.
- To inspire independent and teamworking.
- To expand intellectual capacity, credibility, judgement, intuition.
- To adhere to punctuality, setting and meetingdeadlines.
- To instil responsibilities to oneself andothers.
- To train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas.

Mini-Project: Each student of the project batch shall involve in carrying out the project work jointly in constant consultation with internal guide, co-guide, and external guide and prepare the project report as per the norms avoiding plagiarism.

Course outcomes:

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

- Present the mini-project and be able to defendit.
- Make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the projecttask.
- Habituated to critical thinking and use problem solvingskills.
- Communicate effectively and to present ideas clearly and coherently in both the written and oralforms.
- Work in a team to achieve commongoal.
- Learn on their own, reflect on their learning and take appropriate actions to improveit.

CIE procedure for Mini - Project:

The CIE marks awarded for Mini - Project, shall be based on the evaluation of Mini - Project Report, Project Presentation skill and Question and Answer session in the ratio 50:25:25.The marks awarded for Mini - Project report shall be the same for all the batch mates.

Semester End Examination

SEE marks for the mini-project shall be awarded based on the evaluation of Mini-Project Report, Presentation skill and Question and Answer session in the ratio 50:25:25 by the examiners appointed by the University.

INTERNSHIP / PROFESSIONAL PRACTICE			
Course Code	20MPDI36	CIE Marks	40
Number of contact Hours/Week	2	SEE Marks	60
Credits	06	Exam Hours	03

Course objectives:

Internship/Professional practice provide students the opportunity of hands-on experience that include personal training, time and stress management, interactive skills, presentations, budgeting, marketing, liability and riskmanagement, paperwork, equipment ordering, maintenance, responding to emergencies etc. The objective are further,

To put theory intopractice.

To expand thinking and broaden the knowledge and skills acquired through course work in the field.

To relate to, interact with, and learn from current professionals in the field.

To gain a greater understanding of the duties and responsibilities of a professional.

To understand and adhere to professional standards in the field.

To gain insight to professional communication including meetings, memos, reading, writing, public speaking, research, client interaction, input of ideas, and confidentiality.

To identify personal strengths and weaknesses.

To develop the initiative and motivation to be a self-starter and work independently.■

Internship/Professional practice: Students under the guidance of internal guide/s and external guide shall take part in all the activities regularly to acquire as much knowledge as possible without causing any inconvenience at the place ofinternship.

Seminar: Each student, is required to

- Present the seminar on the internship orally and/or through power pointslides.
- Answer the queries and involve in debate/discussion.
- Submit the report duly certified by the externalguide.
- The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.■

Course outcomes:

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

- Gain practical experience within industry in which the internship isdone.
- Acquire knowledge of the industry in which the internship is done.
- Apply knowledge and skills learned to classroomwork.
- Develop a greater understanding about career options while more clearly defining personal careergoals.
- Experience the activities and functions ofprofessionals.
- Develop and refine oral and written communicationskills.
- Identify areas for future knowledge and skilldevelopment.
- Expand intellectual capacity, credibility, judgment,intuition.
- Acquire the knowledge of administration, marketing, finance and economics.■

Continuous Internal Evaluation CIE marks for the Internship/Professional practice report (20 marks), seminar (10 marks) and question and answer session (10 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer sessionby the student) by the committee constituted for the purpose by the Head of the Department. Thecommitteeshallconsistofthreefacultyfromthedepartmentwith
Semester End Examination SEE marks for the internship report (30 marks), seminar (20 marks) and question and answer session (10 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session) by the examiners appointed by the University.■

PROJECT WORK PHASE -2			
Course Code	20MPD41	CIE Marks	40
Number of contact Hours/Week	4	SEE Marks	60
Credits	20	Exam Hours	03

Course objectives:

- To support independentlearning.
- To guide to select and utilize adequate information from varied resources maintainingethics.
- To guide to organize the work in the appropriate manner and present information (acknowledging the sources)clearly.
- To develop interactive, communication, organisation, time management, and presentationskills.
- To impart flexibility andadaptability.
- To inspire independent and teamworking.
- To expand intellectual capacity, credibility, judgement, intuition.
- To adhere to punctuality, setting and meetingdeadlines.
- To instil responsibilities to oneself andothers.
- To train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas.■

Project Work Phase - II: Each student of the project batch shall involve in carrying out the project work jointly in constant consultation with internal guide, co-guide, and external guide and prepare the project report as per the norms avoiding plagiarism.■

Course outcomes:

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

- Present the project and be able to defend it.
- Make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the projecttask.
- Habituated to critical thinking and use problem solvingskills
- Communicate effectively and to present ideas clearly and coherently in both the written and oralforms.
- Work in a team to achieve commongoal.
- Learn on their own, reflect on their learning and take appropriate actions to improve it.■

Continuous Internal Evaluation:

Project Report: 20 marks. The basis for awarding the marks shall be the involvement of the student in the project and in the preparation of project report. To be awarded by the internal guide in consultation with external guide if any.

Project Presentation: 10 marks.

The Project Presentation marks of the Project Work Phase -II shall be awarded by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three faculty from the department with the senior most acting as the Chairperson.

Question and Answer: 10 marks.

The student shall be evaluated based on the ability in the Question and Answer session for 10marks.

Semester EndExamination

SEE marks for the project report (30 marks), seminar (20 marks) and question and answer session (10 marks) shall be awarded (based on the quality of report and presentation skill, participation in the question and answer session) by the examiners appointed by the University. ■