VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI.

Scheme of Teaching and Examinations and Syllabus

M.Tech **Production Technology (MPY)**

(Effective from Academic year 2020 - 21)

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examinations – 2020 - 21
M.Tech Production Technology (MPY)

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	20MPY11	Mathematical Methods In Engineering	03	--	02	03	40	60	100	4
2	PCC	20MPY12	Theory of Metal Cutting	03	--	02	03	40	60	100	4
3	PCC	20MPY13	Advance Materials and Processing	03	--	02	03	40	60	100	4
4	PCC	20MPY14	Advanced Foundry Technology	03	--	02	03	40	60	100	4
5	PCC	20MPY15	Computer Integrated Manufacturing & Automation	03	--	02	03	40	60	100	4
6	PCC	20MPYL16	Laboratory - 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 application skills.
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 and algorithms.
(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 technical talent.
(4) Involve in case studies and field visits/ field work.
(5) Accustom with the use of standards/codes etc., to narrow the gap between academia and industry.
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 – Learning process.
(iii) Two credit courses are designed for 25 hours Teaching – Learning process.

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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		Total Marks	
				L	P	SDA					
1	PCC	20MPY21	Industrial Robotics	03	--	02	03	40	60	100	4
2	PCC	20MPY22	Advance Joining Processes	03	--	02	03	40	60	100	4
3	PCC	20MPY23	Simulation Modeling of Manufacturing Science	03	--	02	03	40	60	100	4
4	PEC	20MPY24X	Professional elective 1	04	--	--	03	40	60	100	4
5	PEC	20MPY25X	Professional elective 2	04	--	--	03	40	60	100	4
6	PCC	20MPYL26	Laboratory - II	--	04	--	03	40	60	100	2
7	PCC	20MPY27	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 20MPY24X	**Course title**	**Course Code under 20MPY25X**	**Course title**
20MPY241	Agile Manufacturing	20MPY251	Product Data Management
20MPY242	Non Destructive Testing	20MPY252	Industrial Design & Ergonomics
20MPY243	Surface Treatment &Finishing	20MPY253	Advanced Fluid Power Systems
20MPY244	Human Resources Management	20MPY254	Organizational Behaviour

Note:

1. Technical Seminar: CIE marks shall be awarded by a committee comprising of HoD as 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 ratio 50:25:25.

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 satisfying the 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		Total Marks	
				L	P	SDA					
1	PCC	20MPY31	Tool Design	03	--	02	03	40	60	100	4
2	PEC	20MPY32X	Professional elective 3	03	--	--	03	40	60	100	3
3	PEC	20MPY33X	Professional elective 4	03	--	--	03	40	60	100	3
4	Project	20MPY34	Project Work phase -1	--	02	--	--	100	--	100	2
5	PCC	20MPY35	Mini-Project	--	02	--	--	100	--	100	2
6	Internship	20MPYI36	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**
20MPY321	Applied Probability & Statistics	20MPY331	Maintenance Engineering & Management
20MPY322	Composite Materials	20MPY332	Operations Research
20MPY323	Quality & Reliability Engineering	20MPY333	Project Management
20MPY324	Robust Design	20MPY334	Rapid Prototyping

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 a seminar.

CIE marks shall be awarded by a committee comprising of HoD as 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 ratio 50:25:25.

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

2. Internship: Those, who have not pursued /completed the internship shall be declared as fail in internship course and 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	20MPY41	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 HoD as 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 ratio 50:25:25.

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	**20MPY11**	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, round off 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 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

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.

THEORY OF METAL CUTTING			
Course Code	20MPY12	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Mechanics of Metal Cutting: Mechanism of chip formation, Orthogonal & Oblique cutting, types of chips, built-up edge, Determination of shear plane angle, forces on the chips, forces in orthogonal cutting, Merchant circle diagram and analysis, Theory of Lee & Shaffer, coefficient of friction, power & energy relationship, velocity relationship, shear-strain, factors affecting forces and power, problems.

Geometry of Cutting Tools: Single point and multi point cutting tools, tools nomenclature, tool point reference systems, tool angle specifications –ISO and ASA systems, conversion from one system to another. Recommended tool angles, Effect of cutting parameters on tool geometry.**10 Hrs**

Module-2

Tool Materials and Their Properties: Characteristics of tool materials, types of tool materials – carbon tool steels, high speed steels, cast alloys, cemented carbides, ceramics, diamonds, SIALON, CBN, UCON, recommended cutting speeds for the above tools, discussion on steels, air, water, oil hardening of tools and their applications.**10 Hrs**

Module-3

Measurement of Cutting Forces: Reasons for measuring cutting forces, Classification of cutting force dynamometers – mechanical, hydraulic, pneumatic, optical, inductance,piezoelectric, and strain gage type dynamometers, Dynamometers for lathe, drilling, andmilling, Calibration of dynamometers. **10 Hrs**

Module-4

Tool Wear, Tool Life: Mechanisms of tool wear, Sudden & gradual wear, crater wear, flank wear, tool failure criteria, tool life equations, effect of process parameters on tool life, tool life tests, conventional & accelerated tool wear measurement, machinability index.

Thermal Aspects in Metal Cutting: Heat sources in metal cutting, temperature in chip formation, temperature distribution, experimental determination of tool temperatures.**10 Hrs**

Module-5

Cutting fluids: Basic actions of cutting fluids, properties of cutting fluids, selection of cutting fluids, application of cutting fluids, filtration of fluids, recommended cutting fluids.

Economics of Machining: Introduction, elements of total production cost, optimum cutting speed and tool life for minimum cost, optimum cutting speed and tool life for maximum production, problems. **10 Hrs**

Course outcomes:

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

1. Understand and analyze the fundamentals of different cutting tool and materials.
2. Understand and analyze Mechanics of metal cutting.
3. Understand and analyze cutting force and its measurements using dynamometers and temperature distrubution during metal cutting.
4. Understand and analyze tool wear and tool life- mechanisms and effects.
5. Understand and analyze the Thermal Aspects and selection of cutting fluids and Optimum cutting speed and cost. techniques.

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

Reference Books

1. Metal Cutting Principles - M.C. Shaw - Oxford Publication – 1985.

2. Fundamentals of metal cutting & Machine Tools - by B.L.Juneja& G.S – Sekhar - Wiley Eastern.

ADVANCED MATERIALS AND PROCESSING			
Course Code	20MPY13	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 – Defectsin Metallic structure, Dislocations and plastic deformation - Strengthening mechanism – grainsize, dislocation - Cold work, precipitation hardening, dispersion hardening - phase reactions,fatigue and Creep behavior. **10 Hrs**

Module-2

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

Module-3

Non Ferrous alloys: AlIoys of copper, Aluminum, nickel, magnesium, titanium, lead, tin,Zinc - composition, heat treatment, structure, properties and application.**10 Hrs**

Module-4

Ceramics: Nature and structure of Ceramics - Refractory Abrasives glasses - glass ceramics -Advanced ceramics processing methods.
Composites : Definition - classification and characteristics of composite materials – Volumefraction - laminated composites particulate composites, fibrous composites - Types ofreinforcements, their shape and size production and properties of fiber reinforced plastics,Metal Matrix composites and ceramic matrix composites Applications.**10 Hrs**

Module-5

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

Course outcomes:
At the end of the course the student will be able to:
1. Classify materials and physical characteristics.
2. Understand iron carbon equilibrium diagram, TTT diagram, heat treatment process of various steels.
3. Understand alloys of various nonferrous metals.
4. Understand polymers, ceramics and their mechanical – thermal properties.
5. Identify the composites and their structure and Understand applications of ceramics.

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

Reference Books

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

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

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

ADVANCED FOUNDRY TECHNOLOGY			
Course Code	20MPY14	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Solidification of Casting: Concept of solidification of metals, Homogenous and heterogeneous nucleation, Growth mechanism, Solidification of pure metals and alloys, Mechanism of columnar and dendritic growth, Coring or Segregation, Solidification time and Chvorinov's rule, Concept of progressive and directional solidifications.

Principles of Casting and Risering: Purpose of the gating system, Components of the gating System and its functions, Design of the gating System, types of gates, Gating ratio and its functions, Definition and functions of the riser, Types of risers and their application,

Design of the riser - its shape, Size and location. Use of insulating material and exothermic compounds in risers. **10 Hrs**

Module-2

Design of Casting: Factors to be considered in casting design, Design consideration in pattern making, moulding techniques and core making and assembly, Cooling stresses and hot spots in casting and modification in casting geometry to overcome them.

Casting Quality Control: Casting defects and factors responsible for them, Different inspection and testing methods to evaluate the casting, Quality control activities in a foundry, Salvaging methods of defective casting. **10 Hrs**

Module-3

Furnace Technology: Study of various furnaces used in foundry, construction and operation of crucible and hearth furnace, Resistance, Arc and Induction furnaces - their construction, Operation and application. Heat treatment furnaces and drying ovens used in foundry.

Gray Cast - Iron Foundry Practice: Chemical Composition and structure of gray cast iron, Moulding, gating and risering techniques, melting of gray cast iron in Cupola and induction furnace, Inoculation of gray cast iron, Application of gray cast iron castings.

Ductile Cast Iron: Chemical composition and structure of ductile cast iron, Melting and spherodization treatment, Inoculation of ductile iron, Properties and application of ductile iron casting. **10 Hrs**

Module-4

Steel Casting Practice: Common steel casting, their composition, structure and properties.Melting and refining of steel, Gating and risering system of steel castings cleaning of steel castings.

Aluminum Foundry Practice: Composition, properties and application of common aluminum alloy casting, Melting and casting of AI-alloys, Gating and risering system of AI alloy casting. **10 Hrs**

Module-5

Copper alloy Foundry Practice: General characteristics of common cast copper alloys,Melting and casting of copper alloys, Gating and risering of cu-alloy castings.

Foundry Mechanization and Modernization: Introduction to modernization,Mechanization of foundry and its advantages, Mechanization of sand plant,mouldingandcore making mechanization in melting, pouring and shake out units, Material handlingequipments and conveyor systems, Brief sketches and description of layouts of job, Captiveand mechanized foundries. **10 Hrs**

Course outcomes:

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

1. Understand the concept of solidification and design of gates and riser in casting.
2. Design casting and apply quality control techniques.
3. Understand and design moulding for grey cast, malleable cast iron and ductile cast iron.
4. Understand and design steel, aluminium and copper alloy casting.
5. Modernize the casting techniques improving the efficient quality.

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

Reference Books

1. Principle of metal casting - Heine, et. al - Tata-McGraw-HiII Publication - 2003.

COMPUTER INTEGRATED MANUFACTURING AND AUTOMATION			
Course Code	20MPY15	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Production Development Through CIM: Computers in Industrial manufacturing, Productcycle & Production development cycle, Introduction of CAD/CAM & CIM, sequential andconcurrent engineering, soft and hard prototyping. **10 Hrs**

Module-2

Computer Process Monitoring: Process control methods, direct digital control, supervisorycomputer control, steady state optimal control, on line search strategies, adaptive control.

Computer Aided Quality Control: The computer in Q.C, automated inspection principlesand methods, Contact inspection methods, non-contact inspection methods, machine visionsystem, optical inspection method, sensors, coordinate, measuring machine, Computer-Aidedtesting, Integration of CAQL with CAD/CAM. **10 Hrs**

Module-3

Computer Integrated Manufacturing: Fundamentals of CAD/CAM, ComputerizedManufacturing planning systems, shop floor control & automatic identification techniques.Computer Network for manufacturing and the future automated factor. **10 Hrs**

Module-4

Detroit type of Automation: Flow lines, Transfer Mechanisms, work pattern transfer,Different methods& Problems.

Analysis of Automated flow lines: Analysis of transfer lines without storage with storagebuffer single stage,Double stage, Multistage with problems, Automated assembly systems,Design for automated assembly, parts feeding devices, analysis of Multi station assemblymachine, Analysis of Single stage assembly machine.

10 Hrs

Module-5

Automated Material Handling Storage: Material functions, types of material handlingequipment, analysis of material handling systems, design of system, conveyor system,automated guided vehicle systems, automated storage / retrieval systems, caroused storagesystems work in process storage, interfacing handling & storage with manufacturing.

10 Hrs

Course outcomes:

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

1. Understand the effect of manufacturing automation strategies.
2. Analyze computer aided quality control methods and techniques.
3. Analyse CIM planning system and computer network for manufacturing.
4. Understand and analyse the flow lines and transfer mechanisms.
5. Understand and analyse Automated material Handling Storage system.

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

Reference Books

(1) CAD/CAM - Zimmers& Grover – PHI.

(2) CAD/CAM/CIM - P.Radhakrishna - New Age International - 2nd edition.

(3) Automation, Production systems & Computer Aided Manufacturing - M.P. Grover -Prentice Hall - 1984.

Laboratory - I			
Course Code	20MPYL16	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	0:4:0	SEE Marks	60
Credits	02	Exam Hours	03

Sl. NO	Experiments
1	Determination of Chip reduction co-efficient (reciprocal of chip thickness ratio) during single point turning.
2	Forces measurements during orthogonal turning.
3	Estimation of Power required during orthogonal turning.
4	Torque and Thrust measurement during drilling.
5	Determination of cutting forces during milling using Milling tool dynamometer
6	Measurement of Chip tool Interface temperature during turning using thermocouple technique.
7	Study the variation of surface roughness with different speed and feed during plain milling operation on flat surface.
8	Study of capstan lathe and its tooling and prepare a tool layout & job as per given drawing.
9	To prepare metallic samples for metallographic examination and to study the principle & construction
10	Study of Microstructure and Hardening of steel in different medium and cooling rates.
11	Effect of Carbon percentage on the hardness of Steel.
12	CNC milling- Writing and execution of part program for contour milling.

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, An Illustration. **05 Hrs**

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. **05 Hrs**

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, Case Study Method. **05 Hrs**

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 of Hypothesis. **Chi-square Test:** Test of Difference of more than Two Proportions, Test of Independence of Attributes, Test of Goodness of Fit, Cautions in Using Chi Square Tests. **05 Hrs**
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 Right Holder, Layout-Designs of Integrated Circuits, Protection of Undisclosed Information, Enforcement of Intellectual Property Rights, UNSECO. **05 Hrs**

Course outcomes:

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

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

Question paper pattern:

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

Textbooks

(1) Research Methodology: Methods and Techniques, C.R. Kothari, GauravGarg,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, September 2013.

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 ROBOTICS			
Course Code	20MPY21	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

FUNDAMENTAL CONCEPTS OF ROBOTICS: History, present status and future trends,Robotics, Robot, Definition, Robotics Systems and Robot Anatomy, Specification ofRobotics, Resolution, Repeatability and Accuracy of a Manipulator.

ROBOT DRIVES: Power transmission systems and control Robot drive mechanisms,hydraulic-electric-pneumatic drives, and Mechanical transmission method – Rotary-to-Rotarymotion conversion. Rotary-to-linearmotion conversion end effectors – types-griping problemRemote-Centered compliance Devices, Control of Actuators in Robotic Mechanisms.

10 Hrs

Module-2

SENSORS AND INTELLIGENT ROBOTS: Sensory devices – Non-optical-Positionsensors – Optical position sensors – velocity sensors – proximity sensors: Contact and noncontacttype Touch and slip sensors – Force and Torque Sensors – AI and Robotics.

COMPUTER VISION FOR ROBOTICS SYSTEMS: Robot vision systems – Imagingcomponents – Image representation – Hardware aspects-Picture coding – Object Recognitionand Categorization-Visual inspection – software considerations – applications – commercial– Robotics vision systems.**10 Hrs**

Module-3

COMPUTER CONSIDERATIONS FOR ROBOTIC SYSTEMS: Computer architecturefor robots, hardware, Computational elements in robotic applications – Robot programming –sample programs path planning – Robot's computer system.**10 Hrs**

Module-4

TRANSFORMATIONS AND KINEMATICS: Homogeneous Co-ordinates – Co-ordinateReference Frames – Homogeneous Transformations for the manipulator – the forward andinverse problems of manipulator kinematics – Motion generation – Manipulator dynamics –Jacobian in terms of D.H.Matrices controller architecture.**10 Hrs**

Module-5

ROBOT CELL DESIGN AND CONTROL: Specifications of Commercial Robots – RobotDesign and Process specifications – motor selection in the design of a robotic joint – RobotCell layouts – Economic and Social aspects of robotics.

APPLICATIONS OF ROBOTS: Capabilities of Robots – Robotics Applications – Obstacleavoidance – Robotics in India – The future of Robotics.**10 Hrs**

Course outcomes:
At the end of the course the student will be able to:
1. Understand the concept of robotics and its drives.
2. Understand the sensors applications and images recognition mechanism.
3. Program robot and analyse the computational element of robot computer system.
4. Transform robot manipulator using knowledge kinematics and mathematical methods.
5. Design and control robot cells and understand the application of robots.

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

Textbooks

(1) Robotics engineering an integrated approach - Richard D Klafter, Thomas A Chmielewski,Michael Negin – Prentice Hall of India Pvt. Ltd. - Eastern Economy Edition, 1989.

(2) Robotics: Control Sensing, Vision, intelligence - Fu KS Gomaler R C, Lee C S G –McGraw Hill Book Co. - 1987.

Reference Books

(1) Handbook of Industrial Robotics - Shuman Y. Nof - John Wiley & Sons, New York -1985.

(2) Robotics Technology and Flexible Automation - Deb SR - McGraw Hill Book Co. - 1994

ADVANCE JOINING PROCESSES			
Course Code	20MPY22	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Distortion- methods to avoid distortion, Stresses in Joint Design. **Electro Slag**, Welding Electron Beam Welding, Plasma arc Welding, Laser Beam Welding,Explosion Welding, Diffusion Welding, Ultrasonic Welding, Friction welding and Thermitwelding.**10 Hrs**

Module-2

Welding and cladding of dissimilar materials, overlaying and surfacing.Advanced soldering and brazing processes -different types. Welding of plastics.**10 Hrs**

Module-3

Inspection of Welds: Destructive techniques like Tensile, Bend, and Nick break, Impact &Hardness. Non-Destructive techniques like 'X' rays, Ultrasonic, Magnetic particle, DyePenetrant, Gamma ray inspection.

Welding Symbols- Need for, Representing the welds, Basic weld symbols, Location ofWeld, Supplementary symbols, Dimensions of welds, Examples.**10 Hrs**

Module-4

Welding Design - Introduction, Principles of sound welding design, Welding joint design.Welding positions, Allowable strengths of welds, under steady loads.

Quality Control in Welding - Introduction, Quality assurance v/s Quality control, Weldquality, Discontinuities in welds, their causes and remedies and Quality conflicts.**10 Hrs**

Module-5

Computer-Aided Welding Design – Introduction, Principles of sound welding design, Welding joint design, Welding positions, Allowable strengths of welds. Idler steady loads,Weld throat thickness, Solved and um solved examples.**10 Hrs**

Course outcomes:

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

1. Understand the concept of joining processes for various materials and methods to avoid distortion.
2. Understand various non-conventional welding process.
3. Inspect the welds using DT and NDT techniques and learn the weld symbols.
4. Design the welding and applying quality control techniques.
5. Apply computer software for weld design.

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

Reference Books
(1) **Welding Engineering Handbook** - A.W.S.
(2) **Welding Engineering** - Rossi - McGraw Hill.
(3) **Advanced Welding processes** – Nikodaco&Shansky - MIR Publications.

SIMULATION MODELLING OF MANUFACTURING SYSTEMS			
Course Code	20MPY23	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Principle of Computer Modelling and Simulation: Monte Carlo simulation. Nature ofcomputer- 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.**10 Hrs**

Module-2

Discrete Event Simulation: Concepts in discrete event simulation, manual simulation usingevent scheduling, single channel queue, too server queue, simulation of inventory problem.
Statistical Models in Simulation: Discrete distributions, continuous distributions.**10 Hrs**

Module-3

Random Number Generation: Techniques for generating random numbers- Mid squaremethod - the mod product method -Constant multiplier technique -Additive congruentialmethod - Linear congruential method -Tests for random numbers -The Kolmogorov-Smirnovtest -the Chi-square test, IvicaCmkovic, Ulfaskluna and AnnitaborsenDohlgvistPublisherArtech house.**10 Hrs**

Module-4

Random Variable Generation: Inversion transforms technique-exponential distribution.Uniform distribution, weibul distribution, continuous distribution, generating approximatenormal variates-Erlang distribution.
Empirical Discrete Distribution: Discrete uniform -distribution Poisson distribution -geometric distribution - acceptance - rejection technique for Poisson distribution gammadistribution.**10 Hrs**

Module-5

Design and Evaluation of Simulation Experiments: variance reduction techniques -antithetic variables, variables-verification and validation of simulation models.
Simulation Software: Selection of simulation software, simulation packages.**10 Hrs**

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 modeling paradigm.
2. Conceptualize real world situations related to systems development decisions, originating from source requirements and goals.
3. Develop skills to apply simulation software to construct and execute goal-driven system models.
4. Interpret the model and apply the results to resolve critical issues in a real world environment.
5. Understand the Empirical Discrete Distribution, Design and Evalution of Simulation Experiments**.**

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

Textbooks

(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.

Reference Books

(1) **System Simulation with Digital Computer** – NusingDeo - Prentice Hall of India - 1979.

(2) **Computer Simulation and Modeling** - Francis Neelamkovil - John Wilely& Sons - 1987.

(3) **Simulation Modeling with Pascal** - RathM.Davis& Robert M O Keefe - Prentice HallInc. - 1989.

AGILE MANUFACTURING			
Course Code	20MPY241	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Introduction - What is agile Manufacturing? - Competitive environment of the future thebusiness case for agile manufacturing conceptual frame work for agile manufacturing.**10 Hrs**

Module-2

Four Core Concepts: Strategy driven approach - integrating organization, people technologyInterdisciplinary design methodology. **.** **10 Hrs**

Module-3

Agile Manufacturing and Change Management: The change implications. Post failures inadvanced manufacturing, changes on the way, traditional management accounting, paradigm,investment appraisal, product costing - performance, measurement and control systems,Traditional, control technological and design paradigms traditional problems in workplaceorganizationalissues - role of technology.**10 Hrs**

Module-4

Agile Manufacturing Enterprise Design: Agile manufacturing - enterprise design. Systemconcepts as the basic manufacturing theory - joint technical & organizational design and amodel for the design of agile manufacturing enterprise, enterprise design process insights intodesign processes, what is interdisciplinary design, Main issues - simple design example.**10 Hrs**

Module-5

Skill & Knowledge Enhancing Technologies for Agile Manufacturing: Skill and Knowledgeenhancing Technologies - scheduling - technology design strategic-Design Concepts. Designand Skill of Knowledge enhancing Technologies for machine tool systems – Historicaloverview, Lessons, problems and Future development.
10 Hrs

Course outcomes:

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

1. Understand the agile manufacturing and conceptual frame work.
2. Analyse the four core concept of agile manufacturing.
3. Study the implication of advanced manufacturing system.
4. Understand and design the agile manufacturing enterprises.
5. Design skill and knowledge enhancing technology for agile manufacturing.

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

Reference Books

(1) 1. Agile manufacturing - Forging new Frontiers - Paul T. Kidd - Addison Wesley Publication1994.
(2) 2. Agile Manufacturing – Proceedings of International Conference - Dr. M.P Chowdiah(Editor)–TataMcGraw Hill Publications - 1996.
(3) 3. on agile manufacturing - Tata McGraw Hill Publications -1996

NON DESTRUCTIVE TESTING			
Course Code	20MPY242	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Introduction to ND testing: selection of ND methods, visual inspection, leak testing, Liquidpenetration inspection, its advantages and limitation, Magnetic particle inspection: Methodsof generating magnetic field, types of magnetic particles and suspension liquids steps ininspection –application and limitations.**10 Hrs**

Module-2

Eddy current inspection: principles, operation variables, procedure, inspection coils, anddetectable discounts by the method. Microwave inspection: Microwave holography,applications and limitations..
10 Hrs

Module-3

Ultrasonic inspection: Basic equipment characteristics of ultrasonic waves, variablesinspection, inspection methods pulse echo A,B,C scans transmission, resonance techniques,transducer elements couplets, search units, contact types and immersion types inspectionstandards-standard reference blocks.**10 Hrs**

Module-4

Radiography inspection: principles, radiation source X-rays and gamma rays, X-ray-tube,radio graphic films, neutron radiography, Thermal inspection principles, equipmentinspection methods applications.**10 Hrs**

Module-5

Optical Holography: Basics of Holography, recording and reconstruction – AcousticalHolography: systems and techniques applications. Indian standards for NDT.**10 Hrs**

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 current test.
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 defect detection.

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

Reference Books

1. Non Destructive Testing – McGonnagle JJ – Garden and reach New York.
2. Non Destructive Evolution and Quality Control - volume 17 of metals hand book 9 edition Asia internal 1989.
(3) 3. The Testing instruction of engineering materials - Davis H.E Troxel G.E wiskovil C.T -McGraw hill.

SURFACE TREATMENT & FINISHING			
Course Code	20MPY243	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Fundamentals of Electro plating, galvanizing, hot dip metal coating, thin coating, thincoating, chromium plating, Nickel plating. Vacuum coating, FVD & CVD metal spraying -Methods, surface preparation, mechanical**10 Hrs**

Module-2

Properties of sprayed metals, plasma coating. Plastic coating of metal - PVC coating, Spherodising process details, phosphate coating - mechanism of formation.**10 Hrs**

Module-3

Testing of surface coating-methods. Heat treatment methods, Annealing, Normalizing,Tempering, Case hardening methods, flame hardening subzero treatment.**10 Hrs**

Module-4

Heat treatment methods for gears, spindles, cutting tools.**10 Hrs**

Module-5

Advanced coating technologies: Hard facing, electro deposition technique, Nano-coatings,coating characterization.**10 Hrs**

Course outcomes:

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

1. Understand the basic concept of coating, plating and metal spray methods in electroplates.
2. Understand the mechanism of coating formation and their properties.
3. Test coated and spray metal surfaces using suitable heat treatment methods.
4. Heat treat gears, spindle and cutting tools.
5. Understand electro deposition and Nano coating technique.

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

Reference Books

(1)Surface preparations & finishes for Metals - James A Murphy - McGraw Hill.

(2)Principles of metal surface treatment and protection - Pergamon Press Gabe, David Russell Description, Oxford; New York - 2d ed., 1978.

(3)Handbook of metal treatment and testing - John wiley& sons.

HUMAN RESOURCES MANAGEMENT			
Course Code	**20MPY244**	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	4:0:0	SEE Marks	60
Credits	04	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. **10 Hrs**

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, selection decision. **10 Hrs**

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. **10 Hrs**

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; performance diagnosis. **10 Hrs**

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. **10 Hrs**

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. Analyse the effectiveness in training, evaluating and benchmarking HR training.
4. Understand the career development concept and methods of personal appraisal.
5. Understand International activities of HRM, Staffing, communication, appraisal training and interview system.

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

Textbooks

(1)Managing Human Resources - Wayne F Cascio - Tata McGraw Hill, New Delhi

(2)Managing Human Resources - George Bohlander and Scot Snell - Thompson South western.

Reference Books

(1)Human Resource Management - BiswajeetPattanayak - Prentice Hall of India Pvt. Ltd.

(2)Human Resource Management - K. Ashwathappa,

(3)Personnel Management - C.B.Memoria - Himalaya Publishing.

PRODUCT DATA MANAGEMENT			
Course Code	20MPY251	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. **10Hrs**

Module-4

Creating Product Structures: Part centric approach, CAD centric approach, Product Structure configuration, Managing Product Structures, PDM Tools: Matrix One, Team Center, 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. . **10Hrs**

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 Sun Microsystems, Inc., Mentor Graphics Corporation and ABB.

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

Textbooks

(1)Computer Integrated Design and Manufacturing - David Bed worth. Mark Henderson &. Philips Wolfe - McGraw Hill Inc

(2)Visual Modeling with Rational Rose and UML - Terry Quatrain - Addison Wesley

Reference Books

(1)Wind-chill - RS.O Reference manuals - 2000..

INDUSTRIAL DESIGN & ERGONOMICS			
Course Code	20MPY252	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Introduction: An approach to industrial design - elements of design structure for industrialdesign in engineering application in modem manufacturing systems.

Ergonomics and Industrial Design: Introduction - general approach to the man-machinerelationship-workstation design-working position.. **10 Hrs**

Module-2

Control and Displays: shapes and sizes of various controls and displays-multiple displaysand control situations - design of major controls in automobiles, machine tools etc., - designof furniture design of instruments.**10 Hrs**

Module-3

Ergonomics and Production: Ergonomics and product design ergonomics in automatedsystems-expert systems for ergonomic design, anthropomorphic data and its applications inergonomic design limitations of anthropomorphic data - use of computerized database. **10 Hrs**

Module-4

Visual Effects of Line and Form: The mechanics of seeing psychology of seeing, generalinfluences of lined and form.

Colour: colour and light - colour and objects - colour and the eye colour consistency –colourterms - reactions to colour and colour continuation - colour on engineering equipment's.**10 Hrs**

Module-5

Aesthetic Concepts: Concept of unity - concept of order with variety - concept of purposestyle and environment - Aesthetic expressions. Style-components of style - house style,observations style in capital goods.

Industrial Design in Practice: General design - specifying design equipments - rating theimportance of industrial design – industrial design in the design process.**10 Hrs**

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 ergonomic design.
4. Understanding the visual effects of lines, form and color on engineering equipments.
5. Choosing appropriate aesthetic aspects for design of industrial machinery and devices.

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

Textbooks

(1) 1. **Industrial design for Engineers** - Mayall W.H. - LondonCliffee Books Ltd. - 1988.

(2) 2. **Applied Ergonomics Hand Book** - Brien Shakel (Edited) - Butterworth Scientific, London – 1988

ADVANCED FLUID POWER SYSTEMS			
Course Code	20MPY253	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Introduction: Pascal Law, Advantages of Fluid Power, Applications of Fluid Power,Components of a Fluid Power.

Hydraulic Power Unit: Introduction, Pumping Theory, Pump Classification, Gear Pumps,(Vane Pumps- simple, balanced & pressure compensated vane pump, Vane design) PistonPumps- Radial, Axial (Bent axis & Swash plate), Pump Performance, Pump Noise, Ripple inpumps.

Hydraulic Actuators: Linear actuator- cylinders, Mechanics of Hydraulic cylinder loading,limited rotation hydraulic actuator, cylinder cushioning, Gear, Vane & Piston motor, Motorperformance, Hydrostatic transmission**10 Hrs**

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 ofDCV's, Indirect actuation, Valve Lap – Lap during Stationary and during switching.

ii) Pressure Control Valves: Classification, opening & Closing Pressure difference, CrackingPressure, Pressure Relief Valve – Simple & Compound type, Pressure reducing valve,sequence, unloading & counter balance valve, Pressure switches.

iii) Flow Control valves – Fixed throttle, Variable throttle, Pressure Compensation principles,pressure compensated Flow control valve – Reducing & Relief type

iv) Check valve, Pilot operated check valve. **.**
10 Hrs

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 &accumulatorcircuits.

Pneumatic System: Introduction, – Generation of compressed air, air receiver, servicingFRL 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, shuttlevalve, Twin pressure valve, Time delay valve. **.** **10 Hrs**

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 pressurevalve, Binary Arithmetic, logic & Boolean Algebra, use of kannaughveitch map forpneumatic circuit design.**10 Hrs**

Module-5

Electrical Control in Fluid Power: Contactors, & Switches, Relays, Limit switch, Electrohydraulic & Electro Pneumatic Circuits, Simple Cylinder reciprocation, interlocking usingrelays,Proximity switches, application of proximity switches, Time dependent willdependent and travel dependent circuits. **10 Hrs**

Course outcomes:
At the end of the course the student will be able to:
1. Understand the basic concepts of fluid power and applications like pump and actuators.
2. Obtain the knowledge of appropriate selection of control for specific application.
3. Design hydraulic and pneumatic circuital system.
4. Design the pneumatic and logic circuits based on mathematical technique.
5. Understand the application of electric elements in controlling the fluid power.

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

Textbooks

(1)Fluid Power with Application - Anthony Esposito - Peason Education - 5th edition.

(2)Oil hydraulics -Principles & maintenance - S.R. Majumdar - Tata M C Graw Hill

Reference Books

(1)Components & Application - Bosch Rexroth didactic - Hydraulics Trainer - vol 1. Publication

(2)Pneumatic System, Principles and Maintenance - S.R. Majumdar - Tata M C GrawHillPublication.

(3)Pneumatics: Theory and Applications - Bosch Rexroth didactic – Publication

(4) Electro Pneumatics - Bosch Rexroth didactic -Vol. 2, Publication.

ORGANISATIONAL BEHAVIOUR			
Course Code	**20MPY254**	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	4:0:0	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

OrgnanizationalBehavior – Definition, Need for studying Organizational Behavior, Disciplines involved in the study of Organizational Behavior, -Contributing disciplines and area like psychology, social psychology, economics, anthropology etc. Application of Organizational Behavior in Business. . . . **10 Hrs**

Module-2

Individual behaviour – personality, perception, learning, attitudes inter-personal behaviour – Group and inter-group behaviour. . **10 Hrs**

Module-3

Group Dynamics – Formal and Informal Group, Group Norms, Group Cohesiveness, Group Behaviour and Group Decision – making. . **10 Hrs**

Module-4

Motivation and morale, leadership-nature, styles and approaches, development of leadership including laboratory training. Power and Authority – Definition of Power – Types of Power. **10 Hrs**

Module-5

Management of change- Conflict Management- Organisation Health, Development and Effectiveness. Management of culture, Cross Cultural Management. **10 Hrs**

Course outcomes:

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

1. Define organisational behaviour, analyse discipline and area of application in business.
2. Understand personality, interpersonal and intergroup behaviour.
3. Understand group types, norms and decision making.
4. Understand nature and development of leadership and types of power.
5. Learn the management of conflict, development, effectiveness and cross cultural management

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 20 marks. • There will be two full questions (with a maximum of four sub questions) from each module. • Each full question will have sub question covering all the topics under a module. • The students will have to answer five full questions, selecting one full question from each module.
Textbooks
1. Define organisational behaviour, analyse discipline and area of application in business.
2. Understand personality, interpersonal and intergroup behaviour.
3. Understand group types, norms and decision making.
4. Understand nature and development of leadership and types of power.
5.Learn the management of conflict, development, effectiveness and cross cultural management

LABORATORY - II			
Course Code	20MPYL26	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	0:4:0	SEE Marks	60
Credits	02	Exam Hours	03

Sl. NO	Experiments
1	To become familiar with the use of a kinematics graphics simulator in order to perform robot motion and programming.
2	To use trajectory planning concepts on the model of a single-link robotic manipulator.
3	To familiarize students with the use of a vision system.
4	Simulation of Cutting/Milling operations on a computer using CAM packages.
5	To simulate a manufacturing system using discrete-event simulation techniques. To enable students to have a Systems-Wide View of manufacturing systems. A 3-D graphics manufacturing-oriented simulation software on a PC-type computer should be used. A simple manufacturing system is modelled first and the effects of local changes examined.. Then, students make changes to the manufacturing system in order to increase throughput, reduce in-process inventories, and so on. The effects of resource failure and repair times are also examined.

Question paper pattern:

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

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

Reference Books:

1. CAD/CAM - Zimmers& Grover – PHI.
2. CAD/CAM/CIM - P.Radhakrishna - New Age International - 2nd edition.
3. Automation, Production systems & Computer Aided Manufacturing - M.P. Grover - Prentice Hall - 1984.
4. CAD/CAM - Zeid – Mc-Graw Hill - 2005.
5. CAD/CAM - P.N.Rao - TMH.- 2 nd edition, 2004.
6. Robotics for Engineering - Koren.Y - Mc-Graw Hill - 1985.
7. Robert vision & Sensory Controls - Rooks B. - North Holland. - (ed) vol-3

TECHNICAL SEMINAR			
Course Code	20MPY27	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 of Specialization.
- Carryout literature survey, organize the Course topics in a systematic order.
- Prepare the report with own sentences.
- Type the matter to acquaint with the use of Micro-soft equation and drawing tools or any such facilities.
- Present the seminar topic orally and/or through power point slides.
- Answer the queries and involve in debate/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 become self-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 the Chairperson.

Marks distribution for CIE of the course 20MPY27 seminar:

Seminar Report: 30 marks

Presentation skill:50 marks

Question and Answer:20 marks

*** END OF II SEMESTER***

TOOL DESIGN			
Course Code	20MPY31	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	60
Credits	04	Exam Hours	03

Module-1

Tool-design Methods: Introduction, the design procedure, drafting and design techniques intooling drawing

Tool-making Practices: Introduction, tools of the tool maker, hand finishing and polishing,screws and dowels,hole location, jig-boring practice, installation of drilling bushings, punchand die bushings, punch and diemanufacture, EDM, EDM for cavity applications, tracer andduplicating mills for cavity applications, low-melting tool materials.

Tooling Materials and Heat Treatment: Introduction, properties of materials, ferroustooling materials, non-ferrous tooling materials, non-metallic tooling materials, heattreatment and tool design.**10 Hrs**

Module-2

Design of Cutting Tools: Introduction, the metal cutting process, revision of metal cuttingtools-single point cutting tools, milling cutters, drills and drilling, reamers, taps. Selection ofcarbide tools, determining the insert thickness for carbide tools.

Design of Tools for Inspection and Gauging: Introduction, work piece quality criteria,principles of gauging, types of gages and their applications, amplification and magnificationof error, gage tolerances, selection of material for gages, indicating gages, automatic gages,gauging positionally tolerance parts, problems.**10 Hrs**

Module-3

Design of Drill Jigs: Introduction, types of drill jigs, general considerations in the design ofdrill jigs, drill bushings, methods of construction, drill jigs and modem manufacturing.

Design of Fixtures: Introduction, types of fixtures, fixtures and economics.

Design of Press-working Tools: Power presses, cutting operations, types of die-cuttingoperations - and their design, evolution of blanking and progressive blanking**10 Hrs**

Module-4

Design of Sheet Metal Bending, Forming and Drawing Dies: Introduction, bending dies,forming dies, drawing dies. Evolution of a draw die, progressive dies and selection ofprogressive dies. Strip development for progressive dies, evolution of progressive dies,examples of progressive dies. Extrusion dies, drop forging dies and auxiliary tools, problems.

Tool Design for Joining Processes: Introduction, tooling for physical joining processes,tooling for soldering and brazing, tooling for mechanical joining processes, problems.**10 Hrs**

Module-5

Tooling for Casting: Introduction, tooling for sand casting, shell moulding, metal mouldingand die-casting, problems.

Tool Design for NC Machine Tools: Revision of NC control, fixture design for NC machinetools, cutting tools and tool-holding methods, automatic tool changers and tool positioners.

Plastics as Tooling Materials: Introduction, plastics commonly used as tooling materials,application of epoxy plastic tools, construction methods, metal forming operations withUrethane dies, calculating forces for Urethane pressure pads, problems.**10 Hrs**

Course outcomes:
At the end of the course the student will be able to:
1. Understand the tool design concept and design the single point cutting tool.
2. Design the mill cutters, broach and clamping devices.
3. Understand the application of jigs and fixtures, gauges and design them.
4. Understand the concept of press tools and its dies.
5. Design forming dies and understand the classification and application of automats

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

Textbooks

(1) 1. **Tool Design** - Cyril Donaldson, GH Lecain and VC Goold - TMH Publishing Co Ltd., New Delhi, - 3rd editions, 2000.

(2) 2. **Fundamentals of Tool Design** – ASTME - PHI (P) Ltd., New Delhi -1983.

Reference Books

(1) 1. **Cutting Tool Design** - Rodin - Mir publications -1968.

(2) 2. **Metal cutting & Tool Design** - Arshinov -Mir Publishers, Moscow – 1970.

(3) 3. **Press working of metals** – Hinman -McGraw Hill – 1950.

APPLIED PROBABILITY AND STATISTICS			
Course Code	20MPY321	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Module-1

Introduction to statistics: Statistical Thinking, Collecting data, Statistical Modeling Framework, measure of central tendency and variance, Importance of Data summary and Display,Tabular and Graphical display.**08 Hrs**

Module-2

Discrete Random Variables and Probability distribution: Discrete Random variables,Probability distributions and Probability mass functions, Cumulative distribution functions,Mean and Variance of a discrete random variable, discrete uniform distribution, Binominaldistribution, Hyper Geometric distribution, Poisson distribution, Applications. **08 Hrs**

Module-3

Continuous Random Variables and Probability Distributions: Continuous randomvariables, Probability distributions and probability density functions, cumulative distributionfunctions, Mean and Variance of a continuous random variable, uniform distribution, Normaldistribution, Normal approximation to Binominal and Poisson distribution, Exponentialdistribution. **08 Hrs**

Module-4

Testing of Hypothesis: Estimation theory, Hypothesis testing, Inference on the mean of apopulation (variance known and unknown), Inference on the variance of a normal population,Inference on a population proportion, Testing for Goodness of Fit, Inference for a differencein Means, Variances known, Inference for a difference in means of two normal distributions,Variances unknown, Inference on the Variances of two normal populations, Inference on twopopulation proportions. **08 Hrs**

Module-5

Simple Linear Regressions and Correlation: Simple Linear Regression, Properties of Leastsquare Estimators and Estimation of variances, Transformations to a straight line,Correlation.

Multiple linear regressions: Multiple linear regressions model, least square estimation ofparameters, Matrix approach to multiple linear regression, properties of least squareestimators and estimation of variance. **08 Hrs**

Course outcomes:

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

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

Textbooks
(1) 1. Applied statistics and Probability for Engineers – Douglas C Montgomery, George C Runger, 2nd Edn, John Wiley and Sons, ISBN-0-471-17027-5, 1999.
(2) 2. Statistics for Management, Richard I Levin, David S Rubin, 6thEdn, Prentice Hall India, ISBN-81-203-0893X.
Reference Books
(1) 1. Probability and Statistics in Engineering - William W Hines, Douglas C Montgomery - John Wiley and Sons – 2ndEdn,
(2) 2. Business Statistics for Management and Economics - Daniel, Terrell - Houghton Mifflin Company – 6Edn, ISBN-0-395-62835-0.
(3) 3. Probability and Statistics - by Walpole & Mayer - MacMillan Publishing Company - 1989.

COMPOSITE MATERIALS			
Course Code	20MPY322	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Module-1

INTRODUCTION TO COMPOSITE MATERIALS: Definition, classification and characteristics of composite materials – fibrous composites, laminated composites, particulate composites. Properties and types of reinforcement and matrix materials. **08 Hrs**

Module-2

FIBRE REINFORCEMENT PLASTIC PROCESSING: Layup and curing, fabricatingprocess – open and closed mould process – hand layup techniques – structural laminate bagmolding, production procedures for bag molding – filament winding, pultrusion, pulforming,thermo–forming, injection, injection molding, liquid molding, blow molding**08 Hrs**

Module-3

FABRICATION OF COMPOSITES: Cutting, machining, drilling, mechanical fastenersand adhesive bonding, joining, computer aided design and manufacturing, tooling, fabricationequipment. Ceramic Matrix composites and their fabrication technologies. **08 Hrs**

Module-4

Application of composites: Characterization of composites, computer aided design andanalysis of composites, Application of industrial experimentation for fabrication and testingof composites. **08 Hrs**

Module-5

STUDY PROPERTIES OF MMC'S: Physical Mechanical, wear, machinability and otherproperties. Effect of size, shape and distribution of particulate on properties.Advanced composites such as Polymer based Sandwich structures of Nano composites.Introduction to shape memory alloys. **08 Hrs**

Course outcomes:

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

1. Identify, describe and evaluate the properties of fibre reinforcements, polymer matrix materials and commercial composites.
2. Identify, describe rule of mixture and failure criteria for composites.
3. Develop competency in one or more common composite manufacturing techniques, and be able to select the appropriate technique for manufacture of composite materials.
4. Understand and analyse fabrication of composites and design of structure of composites.
5. Understand and recommend composites for different applications and MMCs

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

Textbooks

(1) 1. Composite Science and Engineering - K.K.Chawla - Springer Verlag - 1998.

(2) 2. Introduction to composite materials - Hull and Clyne - Cambridge University Press – 2nd Edition, 1990

Reference Books

(1) 1. Composite Materials hand book - MeingSchwaitz - McGraw Hill Book Company -1984.

(2) 2. Forming Metal hand book – 9th edition, ASM handbook, V15, 1988, P327-338.

(3) 3. Mechanics of composites - Autar K kaw - CRC Press - 2002

QUALITY AND RELIABILITY ENGINEERING			
Course Code	20MPY323	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Module-1

Introduction and Process Control for Variables: Introduction, definition of quality, basicconcept of quality, definition of SQC, benefits and limitation of SQC, Quality assurance,Quality cost-Variation in process- factors - process capability - process capability studies andsimple problems -Theory of control chart- uses of control chart-Control chart for variables -X chart, R chart and s chart. **08 Hrs**

Module-2

Process Control for Attributes: Control chart for attributes –control chart for proportion orfraction defectives - p chart and np chart - control chart for defects - C and U charts, State ofcontrol and process out of control identification in charts. **08 Hrs**

Module-3

Acceptance Sampling: Lot by lot sampling - types - probability of acceptance in single,double, multiple sampling techniques-O.C. curves - producer's Risk and consumer's Risk.AQL, LTPD, AOQL concepts-standard sampling plans for AQL and LTPD- uses of standardsampling plans. **08 Hrs**

Module-4

Life Testing - Reliability: Life testing - Objective - failure data analysis, Mean failure rate,mean time to failure, mean time between failure, hazard rate, system reliability, series,parallel and mixed configuration - simple problems, Maintainability and availability-simpleproblems. Acceptance sampling based on reliability test - O.C Curves. **08 Hrs**

Module-5

Quality and Reliability: Reliability improvements -techniques- use of Pareto analysis -design for reliability - redundancy unit and standby redundancy - Optimization in reliability -Product design - Product analysis - Product development - Product life cycles. **08 Hrs**

Course outcomes:

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

1. Understand the quality and basic probability concept.
2. Construct the control chart for variables.
3. Construct the control chart for attributes and analyse failure data.
4. Construct OC curve for determining the probability of lot acceptance.
5. Understand the basic concept of reliability and calculate maintainability and availability of resources.

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

Textbooks

(1) Statistical Quality Control – Montgomery D.C. John Wiley & Sons, Inc
(2) Statistical Quality Control – Grant and Leavenworth
Reference Books
(1) Quality Planning and Analysis - Juran, J.M and Gryna, F.M. - Tata McGraw Hill publishing Coimpany Ltd., New Delhi, India – 1982.
(2) Concepts in Reliability Engineering – Srinath K.S. - Affiliated East-West Press Private Limited, New Delhi, India -1985.

ROBUST DESIGN			
Course Code	**20MPY324**	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.

08 Hrs

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.

08 Hrs

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.

08 Hrs

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.

08 Hrs

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**.**

08 Hrs

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 multiple outputs.
5. Understand the Parameter Design and Tolerance Design.

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 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- 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

(3)Techniques for Quality Engineering - Phillip J. Ross: Taguchi 2nd

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

MAINTENANCE ENGINEERING & MANAGEMENT			
Course Code	20MPY331	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Module-1

MAINTENANCE CONCEPT: Need for maintenance-Challenges in maintenance-Objectives of maintenance-Maintenance organization-Scope of maintenance department-Maintenance management-Tero Technology- Five zero concept-Maintenance performancemeasurement- Maintenance costs-Maintenance audit. **08 Hrs**

Module-2

MAINTENANCE POLICIES: Planned vs unplanned maintenance-Preventive maintenancevs Breakdown maintenance-Predictive maintenance-Corrective maintenance-Opportunisticmaintenance-Design out maintenance-Condition Based Maintenance (CBM) - Analysis ofdowntime-Repair time distribution (exponential, lognormal) - MTTR-System repair time-Maintainability prediction. . **08 Hrs**

Module-3

MAINTENANCE LOGISTICS: Proactive and Reactive maintenance-Minimum vsExtensive maintenance-Work order form-Maintenance planning-Maintenance scheduling-Spare parts control & inventory management- Human factors in maintenance-Maintenancecrew size-Replacement models. **08 Hrs**

Module-4

FAULT DIAGNOSIS: Nondestructive and destructive testing-Shock pulse monitoring-Condition monitoring-Lubrication practices-Wear Debris Monitoring (WDM)-Vibrationmonitoring-Corrosion control-Signature analysis- Computerized Maintenance ManagementSystem-Use of Fault Trees. **08 Hrs**

Module-5

TOTAL PRODUCTIVE MAINTENANCE: TPM Philosophy-Chronic and sporadiclosses- Six big losses- Overall Equipment Effectiveness- Autonomous Maintenance-TPMPillars-Reliability prediction-MTBF, MTTF-Reliability of series & parallel systems-Reliability Centered Maintenance. **08 Hrs**

Course outcomes:

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

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

Textbooks

(1) 1. Tanmoy Deb, "Maintenance Management and Engineering", Ane Books Pvt.Ltd. 2011.

Reference Books
(1) 1. Charles E.Ebeling, "An Introduction to Reliability and Maintaibaility Engineering", McGraw Hill Education (India) Pvt.Ltd, 2013.
(2) 2. Seiichi Nakajima, "Introduction to Total Productive Maintenance", Productivity Press,1988.
(3) 3. MasajiTajiri and Fumio Gotoh, "Autonomous Maintenance in seven steps", ProductivityInc., Oregon, 1999.

OPERATIONS RESEARCH			
Course Code	20MPY332	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Module-1

Introduction: OR Methodology, Definition of OR, Application of OR to Engineering andManagerial Problems, Features of OR models, Limitation of OR.

LINEAR PROGRAMMING: Definition, Mathematical formulation, Standard form,solution space, Solution – Feasible, basic feasible, Optimal, Infeasible, Multiple, Optimal,Redundancy, Graphical Method. **08 Hrs**

Module-2

Linear programming: Simplex method, variants of simplex algorithm – Artificial basistechniques, Duality, Economic interpretation of Dual, Solution of LPP using duality concept**08 Hrs**

Module-3

Transportation problem: Formulation of transportation model, Basic feasible solution usingdifferent methods (North-West corner, Least Cost, Vogel's Approximation Method)Optimality Methods. Unbalanced transportation problem, Variants in TransportationProblems, Applications of Transportation problems**.**

Assignment problem: Formulation of the Assignment problem, unbalanced assignmentproblem, travelling salesman problem. **08 Hrs**

Module-4

Queuing theory: Queuing system and their characteristics, The M/M/1 Queuing system,Steady state performance analyzing of M/M/1 queuing model.

Game theory: Formulations of games, Two person zero sum game, games with and without saddle point, graphical solutions (2xn, mx2 game), and dominance property. **08 Hrs**

Module-5

Project management using network analysis: Network construction, determination ofcritical path and duration, CPM Structured approach, Calculations of schedules and floats,Network crashing. PERT-Estimation of project duration and variance. **08 Hrs**

Course outcomes:

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

1. Provide greater insight into decision-making processes, with strong fundamentals.
2. Understand better how people perceive and decide about risk and transform domain situation to LPP and solve it.
3. Formulate as Transportation, Assignment, and Travelling salesman problems and derive Optimum solutions.
4. Formulate game theory problems and obtain solutions using different methods. Understand the fundamentals of Queues.
5. Develop an appropriate network diagram for the given problem.

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

Textbooks

(1)Introduction to Operation Research -Taha H A - Prentice Hall of India - 6th edition, 1999.

(2)Principles of Operations Research theory and Practice -Philips, Ravindran and SolebergWiley India Pvt Ltd.

Reference Books

(1)Introduction to Operation Research - Hamdy A Taha

(2)Introduction to Operation Research -Hiller and Libermann – McGraw Hill - 5th edn.

(3)Operations Research - S.D. Sharma – Kedarnath, Ramnath& Co -

(4) Operations Research Theory and Application - J K Sharma – Pearson EducationPvt Ltd - 2ndEdn, ISBN-0333-92394-4. **4.** Operations Research Theory and Application - J K Sharma – Pearson Education Pvt Ltd - 2ndEdn, ISBN-0333-92394-4.

PROJECT MANAGEMENT			
Course Code	20MPY333	CIE Marks	40
Teaching Hours/Week (L:P:SDA)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Module-1

Introduction: Identification of Investment Opportunities, Market and Demand Analysis –Technical Analysis - Investment Outlay. **08 Hrs**

Module-2

Means of Financing -Profitability and Breakeven Analysis -Cash Flows of Projects -Taxfactor in investment Analysis -Interest Compounding and Discounting. **08 Hrs**

Module-3

Appraisal Criteria and Selection of Investment -cost of capital analysis of Risk –FinancialProjection, social Cost Benefit Analysis. **. . 08 Hrs**

Module-4

Manpower Management in Projects -Functional Approach to Manpower Management,the Element of decision Process Project Team Concepts - Field Autonomy- PoliciesGoverning Projects. **08 Hrs**

Module-5

Networks Techniques in Project Management -PERT/CPM Analysis – Administrativeaspects of Capital Investment. **08 Hrs**

Course outcomes:

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

1. Understand the relation between investment opportunities, market, and demand analyses.
2. Analyse the project cash flow, interest and tax factor.
3. Understand the cost capital analysis of risk, financial project, social cost and benefit analysis.
4. Understand the man power management and project team concept.
5. Optimise the project management by PERT and CPM.

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

Textbooks

(1) 1. **Projects - appraisal, preparation, budgeting and implementation** – Prasannachandra - Tata McGraw Hill.

Reference Books

(1) 1. **Handbook of Project Management** - Dennis lock.

(2) 2. **Project Management** - Dennis lock - Gower Publishing Ltd - 8th revised edition

RAPID PROTOTYPING			
Course Code	**20MPY334**	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.

08 Hrs

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.

08 Hrs

Module-3

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

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

08 Hrs

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.

08 Hrs

Module-5

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

08 Hrs

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 modeling processes.
3. Demonstrate solid ground curing principle and process.
4. Discuss LENS, BPM processes; point out the application of RP system in medical field define virtual prototyping and identify simulation components.
5. Understand the RP Process Optimizations.

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 20 marks.
- There will be two full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- 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

PROJECT WORK PHASE – 1			
Course Code	20MPY34	CIE Marks	100
Number of contact Hours/Week	2	SEE Marks	--
Credits	02	Exam Hours	--

Course objectives:

- Support independent learning.
- Guide to select and utilize adequate information from varied resources maintaining ethics.
- Guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly.
- Develop interactive, communication, organisation, time management, and presentation skills.
- Impart flexibility and adaptability.
- Inspire independent and team working.
- Expand intellectual capacity, credibility, judgement, intuition.
- Adhere to punctuality, setting and meeting deadlines.
- Instil responsibilities to oneself and others.
- 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 point slides.
- Answer the queries and involve in debate/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 become self-confident.

Course outcomes:

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

- Demonstrate a sound technical knowledge of their selected project topic.
- Undertake problem identification, formulation, and solution.
- Design engineering solutions to complex problems utilising a systems approach.
- Communicate with engineers and the community at large in written an oral forms.
- Demonstrate the knowledge, skills and attitudes of a professional engineer.

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	20MPY35	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 innovative attitude.
- To guide to select and utilize adequate information from varied resources upholding ethics.
- 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 presentation skills.
- To impart flexibility and adaptability.
- To inspire independent and team working.
- To expand intellectual capacity, credibility, judgement, intuition.
- To adhere to punctuality, setting and meeting deadlines.
- To instil responsibilities to oneself and others.
- 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 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 project task.
- Habituated to critical thinking and use problem solving skills.
- Communicate effectively and to present ideas clearly and coherently in both the written and oral forms.
- Work in a team to achieve common goal.
- Learn on their own, reflect on their learning and take appropriate actions to improve it.

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	20MPYI36	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 risk management, paperwork, equipment ordering, maintenance, responding to emergencies etc. The objective are further,

To put theory into practice.

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 of internship.

Seminar: Each student, is required to

- Present the seminar on the internship orally and/or through power point slides.
- Answer the queries and involve in debate/discussion.
- Submit the report duly certified by the external guide.
- 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 is done.
- Acquire knowledge of the industry in which the internship is done.
- Apply knowledge and skills learned to classroom work.
- Develop a greater understanding about career options while more clearly defining personal career goals.
- Experience the activities and functions of professionals.
- Develop and refine oral and written communication skills.
- Identify areas for future knowledge and skill development.
- 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 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
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	20MPY41	CIE Marks	40
Number of contact Hours/Week	4	SEE Marks	60
Credits	20	Exam Hours	03

Course objectives:

- To support independent learning.
- To guide to select and utilize adequate information from varied resources maintaining ethics.
- 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 presentation skills.
- To impart flexibility and adaptability.
- To inspire independent and team working.
- To expand intellectual capacity, credibility, judgement, intuition.
- To adhere to punctuality, setting and meeting deadlines.
- To instil responsibilities to oneself and others.
- 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 project task.
- Habituated to critical thinking and use problem solving skills
- Communicate effectively and to present ideas clearly and coherently in both the written and oral forms.
- Work in a team to achieve common goal.
- 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 10 marks.

Semester End Examination

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. ■