

**VISVESVARAYA TECHNOLOGICAL UNIVERSITY,
BELGAUM
SCHEME OF TEACHING AND EXAMINATION FOR
BE.-Industrial Engineering and Management (IM)**

VSemester

CREDITBASED

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Field Work / Assignment/ Tutorials		I.A.	Exam		
15AL51	Management & Entrepreneurship	4	2	3	20	80	100	4
15IM52	Work study and Ergonomics	4	2	3	20	80	100	4
15IM53	Design of Machine Elements	4	2	3	20	80	100	4
15IM54	Statistics for Engineers	4	2	3	20	80	100	4
15IM55*	Professional Elective	4	2	3	20	80	100	4
15IM56*	Open Elective	4	2	3	20	80	100	3
15IIML57	Mechanical Lab	--	3	3	20	80	100	2
15IIML58	Work study and Ergonomics lab	--	3	3	20	80	100	2
Total		24	18	24	160	640	800	27

Professional Elective	
Sub. Code	Name of the Subject
15IM551	Engineering Economy
15IM552	Theory of metal forming
15IM553	Finite element method
15IM554	Hydraulics and pneumatics

Open Elective	
Sub. Code	Name of the Subject
15IM561	Professional communication and report writing
15IM562	Concurrent engineering
15IM563	Technology management
15IM564	Human resource management

**VISVESVARAYA TECHNOLOGICAL UNIVERSITY,
BELGAUM**
SCHEME OF TEACHING AND EXAMINATION FOR
BE.-Industrial Engineering and Management (IM)

VISemester

CREDITBASED

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Field Work / Assignment/ Tutorials		I.A.	Exam		
15IM61	Quality assurance and reliability	4	2	3	20	80	100	4
15IM62	Operations research	4	2	3	20	80	100	4
15IM63	Simulation modeling and analysis	4	2	3	20	80	100	4
15IM64	Materials management	4	2	3	20	80	100	4
15IM65*	Professional Elective	4	2	3	20	80	100	4
15IM66*	Open Elective	4	2	3	20	80	100	3
15IML67	CAD/CAM Lab	--	3	3	20	80	100	2
15IML68	Simulation lab	--	3	3	20	80	100	2
Total		24	18	24	160	640	800	27

Professional Elective	
Sub. Code	Name of the Subject
15IM651	Financial management
15IM652	Industrial automation
15IM653	Software engineering and management
15IM654	Composite materials

Open Elective	
Sub. Code	Name of the Subject
15IM661	Management information system
15IM662	Advanced machining processes
15IM663	Value engineering
15IM664	Development of enterprises

MANAGEMENT AND ENTREPRENEURSHIP

SEMESTER – V

Subject Code	15IM/IP51	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80

CREDITS – 04

Course Objectives:

This course will enable students to

1. Understand the basic concepts of management, planning, organizing and staffing.
2. Acquire the knowledge to become entrepreneur.
3. Comprehend the requirements towards the small-scale industries and project preparation.

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
<p>Module -1 MANAGEMENT:Introduction- Meaning- natureand characteristics of Management,ScopeandFunctional areasofmanagement -Management asa science,artofprofession -Management &Administration -Rolesof Management,LevelsofManagement,DevelopmentofManagementThought-earlymanagementapproaches-Modemmanagementapproaches. PLANNING:Nature,importanceandpurposeofplanningprocessObjectives -Types ofplans (Meaning Only) - DecisionmakingImportanceof planning - stepsinplanning&planningpremises-Hierarchyofplans</p>	10 Hours	L1, L2, L3
<p>Module -2 ORGANIZING ANDSTAFFING:Natureandpurposeoforganization Principlesoforganization-Typesoforganization-DepartmentationCommittees-CentralizationVsDecentralizationof authority.andresponsibility-Spanof control-MBOandMBE(MeaningOnly)Natureandimportanceofstaffing— :Process ofSelection& Recruitment. DIRECTING&CONTROLLING:Meaningandnatureofdirecting Leadershipstyles,MotivationTheories,Communication- Meaningand importance-coordination,meaning andimportanceandTechniquesof Co</p>	10 Hours	L1, L2,L3

Ordination.Meaningandsteps incontrolling- Essentialsofasoundcontrol system-Methodsofestablishingcontrol.		
Module -3 ENTREPRENEUR: MeaningofEntrepreneur;Evolutionof .theConcept; FunctionsofanEntrepreneur,TypesofEntrepreneur,Entrepreneur-anemerging. Class.ConceptofEntrepreneurship-EvolutionofEntrepreneurship, DevelopmentofEntrepreneurship;Stagesinentrepreneurialprocess;Roleof entrepreneursin EconomicDevelopmentt;Entrepreneurshipin India; Entrepreneurship-itsBarriers.	10 Hours	L2, L3, L4
Module -4 SMALL SCALE INDUSTRIES: Definition; Characteristics;Need and rationale;Objectives;Scope;roleofSSIinEconomicDevelopment. Advantages ofSSISTepstostartandSSI-GovernmentpolicytowardsSSI;DifferentPolicies ofSSI;GovernmentSupportforSSIduring5yearplans.ImpactofLiberalization, Privatization,Globalizationon SSIEffectofWTO/GATTSupportingAgencies of GovernmentforSSI,Meaning,Natureof support;Objectives;Functions; TypesofHelp;AncillaryIndustryandTinyIndustry.	10 Hours	L3,L4,L5
Module -5 INSTITUTIONALSUPPORT: DifferentSchemes;TECKSOK;KIADB; KSSIDC;KSIMC;DICSingle WindowAgency;SISI;NSIC;SIDBI;KSFC. PREPARATIONOFPROJECT: MeaningofProject;ProjectIdentification; ProjectSelection;ProjectReport;Needand SignificanceofReport;Contents; Formulation;GuidelinesbyPlanningCommissionforProjectreport;Network Analysis;ErrorsofProjectReport;ProjectAppraisal.Identificationofbusiness opportunities:MarketFeasibilityStudy;TechnicalFeasibilityStudy;Financial FeasibilityStudy&SocialFeasibilityStudy.	10 Hours	L2, L3
Course Outcomes :		
After studying this course, students will be able to:		
<ol style="list-style-type: none"> 1. Explain about the management and planning. 2. Apply the knowledge on planning, organizing, staffing, directing and controlling. 3. Describe the requirements towards the small-scale industries and project preparation. 		
Graduate Attributes :		

- Engineering Knowledge.
- Problem Analysis.
- Design / development of solutions
- Modern Tool Usage and Interpretation of data

Question paper pattern:

- The question paper will have ten questions.
- Each full question consists of 16 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Principles of Management – P.C. Tripathi, P.N. Reddy – Tata McGraw Hill,
2. Dynamics of Entrepreneurial Development & Management Vasant Desai - Himalaya Publishing House
3. Entrepreneurship Development – Poornima. M. Charantimath Small Business Enterprises - Pearson Education - 2006 (2 & 4).

Reference Books:

1. Management Fundamentals - Concepts, Application, Skill Development - Roberts Lusier - Thomson
2. Entrepreneurship Development - S.S. Khanka - S. Chand & Co.
3. Management - Stephen Robbins - Pearson Education / PHI - 17th Edition, 2003.

WORK STUDY AND ERGONOMICS

Subject Code	: 15IM/IP52	No. of Credits	: 4 - 0 - 0
No. of Lecture Hours / Week	: 04	Exam Hours	: 3

Total No. of Lecture Hours	: 50	Exam Marks	: 80
-----------------------------------	-------------	-------------------	-------------

COURSE OBJECTIVES

1. To develop concepts related to principles of productivity & work study as a tool for increasing the efficiency and effectiveness in organizational systems.
2. To study the existing method, compare and propose a new method.
3. To provide the usage of the various tools and techniques used in work measurement.
4. To develop basic ideas of ergonomics and its design.
5. To develop concepts related Man-Machine Interfaces and Design of Displays and controls.

COURSE CONTENT

UNIT – 1 Productivity and Work Study: Definition of productivity, task of management, productivity of materials, land, building, machine and power, factors affecting the productivity, work content, basic work content, excess work content, how manufacturing job is made up, work content due to excess product and process, ineffective time due to short comings on part of the management.

Definition, Objective and scope of Work Study: Work study and management, work study and worker

08 Hours

UNIT – 2.

Method Study: Definition, objective and scope of method study, activity recording and tools, **Recording tools:** Out Line Process Chart, Flow Process Chart, Flow diagram, String Diagram, Travel Chart, Multiple Activity Chart, Two- Handed process chart.

Principles of Motion Economy: Introduction, Classification of movements. Two- hand process chart, Micromotion study, Therbligs, SIMO Chart. Special Charts: Cyclegraph and Chronocycle graph - development, definition and installation of the improved method.

Work Measurement: Definition, objectives, work measurement techniques.

Work sampling – Need, confidence levels, and sample size determination, conducting study with problems

12 Hours

UNIT – 3 Time study - Definition, time study equipment, selection of job, steps in time study. Breaking jobs into elements, recording information.

Rating: Systems of rating, standard rating, standard performance, scales of rating.

Allowances: Standard time determination, predetermined motion time study (PMTS), factors affecting rate of working, problems on allowances.

08Hrs

UNIT – 4 Introduction to Ergonomics: Human factors and ergonomics, psychology, engineering, bio mechanics, industrial design, graphics design, statistics, operation research and anthropometry Morphology of design and its relationship with cognitive abilities of human being.

Physical Ergonomics : human anatomy, and some of the anthropometric, physiological and bio mechanical characteristics as they relate to physical activity. Cognitive: mental processes, such as perception, memory, reasoning, and motor response, mental workload, and decision-making. Organizational ergonomics: optimization of socio-technical systems, including their organizational structures, policies, processes. Communication, work design, design of working times, teamwork, cooperative work, and new work programs. Environmental ergonomics: human interaction with the environment- characterized by climate, temperature, pressure, vibration, light.

12 Hours

UNIT – 5 Man-Machine Interaction; Man-Machine interaction cycle, Man-machine interfaces, Displays : factors that control choice of display, visual displays- qualitative displays; moving pointer displays, moving scale displays, digital displays Indicators, auditory displays, tactile displays. Factors affecting effectiveness of displays. Quantitative displays, check- reading displays, representational displays. Types of controls and their integration with displays.

Design guidelines for displays and controls: viewing distance, Illumination, angle of view, reach etc., general design checklist for displays and controls. Standards for ergonomics in engineering and design, displays and controls.

08 Hours

COURSE OUTCOMES:

Upon completion of this course, students should be able to:

1. Recollect the basic concepts of productivity, work content and work study and define the objective and scope of Work Study.

2. Define the various charts and to construct the charts on the basis of present method and develop a new / proposed method and identify the unnecessary movements.
3. Explain the basic work measurement techniques and to gain knowledge of measurement of work, rating and imbibe the concept of allowance in estimating Standard Time
4. Determine the basic concepts of Ergonomics and demonstrate a sound knowledge of Ergonomics in engineering applications.
5. Demonstrate a sound knowledge of Man-Machine Interfaces and design of displays and controls in engineering systems

TEXT BOOKS

1. **Introduction to Work Study** – ILO, 4th edition 1992
2. **Mark. S. Sanders and Ernest. J McCornick.** “Human Factor in Engineering and Design”, McGraw-Hill Book Co., Inc., New York, 1993

REFERENCE BOOKS

1. S. Dalela and Sourabh, “**Work Study and Ergonomics**”. Standard publishers 2013
2. **Wesley Woodson, Peggy Tillman and Barry Tillman**, “Human Factors Design Handbook”, McGraw-Hill; 2nd edition, 1992
3. Ralph M. Barnes, “Motion and Time Study”, Wiley International, 7th Edition.
4. Mark S. Sanders and Ernest J. McCormick , “Human Factors in Engineering Design” 4th edition, 2013.
5. B. Niebel and Freivalds, Niebel’s Methods Standards and Work Design, McGraw-Hill, 12th Edition, 2009,

DESIGN OF MACHINE ELEMENTS			
Semester - V			
Subject Code: 15IM/IP53		IA Marks	20

Number of Lecture Hours/Week	04		Exam Marks	80
Total Number of Lecture Hours:	50		Exam Hours	03
CRIDITS – 04				

Module 1

DESIGN FOR STATIC STRENGTH: Design considerations; Codes and Standards, static loads and factor of safety. Theories of failure: Maximum Normal Stress Theory, Maximum Shear Stress Theory, Distortion energy theory. Failure of Brittle and Ductile materials. Stress concentration. Determination of stress concentration factor.
8 Hours

Module 2

DESIGN FOR FATIGUE STRENGTH: S – N Diagram, low cycle and High cycle fatigue. Endurance limit. Modifying factors: Load, Size and Surface finish effects. Fatigue stress concentration factor. Fluctuating stresses. Goodman and Soderberg Relationship. Stresses due combined loading, Cumulative fatigue damage.
8 Hours

Module 3

DESIGN OF SHAFTS: Design of shafts subjected to torsion, bending moment and combined torsion moment and axial loading. ASME and BIS Codes for design of transmission shafting. Design for strength and rigidity. Shafts under fluctuating loads and combined loads.
12 Hours

Module 4

DESIGN OF GEARS: Introduction to Spur, Helical and Bevel Gears. Design of Spur gear, Lewis equation, form factor, stresses in gear tooth, Dynamic load and wear load.
12 Hours

Module 5

RIVETED JOINTS AND WELDED JOINTS: Types of riveted joints, failures of riveted joints, Boiler joint, Efficiency. Types of welded joints, Strength of butt and fillet welds, eccentrically loaded welds. **5 Hours**
DESIGN OF SPRINGS: Types of springs, Stresses in Coil springs of circular and non-circular cross-sections. Tension and compression springs. Stresses in Leaf springs. **5 Hours**

TEXT BOOKS:

1. **Mechanical Engineering Design** - Joseph Edward Shigley – Tata McGraw Hill, New Delhi - 1986.
2. **Machine Design** - VL. Maleev and Hartman – CBS Publishers and Distributors, Delhi - 1983.
3. **Design of Machine Elements** - V. B. Bahandari– Tata McGraw Hill, New Delhi - 2000.

REFERENCE BOOKS:

1. Machine Design - Robert. L. Norton – Pearson Education Asia, New Delhi - 2001.
2. Theory and Problems of Machine Design - Hall, Holowinko, LaughlinSchaums - Outline Series - 2002.
3. Elements of Machine Design - N. C. Pandey and C. S. Shah – ChorotarPublishing house – 2002.

Question paper pattern: The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.

STATISTICS FOR ENGINEERS

Subject Code	:	15IM54	IA Marks	:	20
No. of Lecture Hrs./ Week	:	04	Exam Hours	:	03
Total No. of Lecture Hrs.	:	50	Exam Marks	:	80

MODULE	COURSE CONTENT	HOURS
1	<p>THE ROLE OF STATISTICS IN ENGINEERING: Statistical Thinking, Collecting data, Statistical Modelling Frame work.</p> <p>DATA SUMMARY AND PRESENTATION: Measure of central tendency and variance, Importance of Data summary and Display, Tabular and Graphical display</p>	08
2	<p>DISCRETE RANDOM VARIABLES AND PROBABILITY DISTRIBUTIONS: Discrete Random variables, Probability distributions and Probability mass functions, Cumulative distribution functions, Mean and Variance of a discrete random variable, Discrete uniform distribution, Binominal distribution, Hyper Geometric distribution, Poisson distribution.</p> <p>CONTINUOUS RANDOM VARIABLES AND PROBABILITY DISTRIBUTIONS: Continuous random variables, Probability distributions and probability density functions, cumulative distribution functions, Mean and Variance of a continuous random variable, uniform distribution, Normal distribution, Normal approximation to Binominal and Poisson distribution</p>	12
3	<p>ESTIMATION THEORY: Statistical Inference, Random sampling, Properties of Estimators, Sampling distribution, Sampling distribution of mean, variance and proportion. Introduction to confidence intervals.</p> <p>STATISTICAL INFERENCE FOR A SINGLE SAMPLE: Hypothesis testing, Inference on the mean of a population (variance known and unknown), Inference on the variance of a normal population, Inference on a population proportion.</p>	11
4	<p>STATISTICAL INFERENCE FOR TWO SAMPLES: Inference for a difference in 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 two population proportions.</p> <p>NON-PARAMETRIC TESTS- Chi-square tests, Goodness of fit and</p>	07

	Contingency table tests	
5	<p>SIMPLE LINEAR REGRESSIONS AND CORRELATION: Simple Linear Regression, Properties of Least square Estimators and Estimation of variances, Common abuses of regression, Prediction of new observations, Assessing the adequacy of regression model, Transformations to a straight line, Introduction to multiple regression (no problems), Correlation</p> <p>DESIGN OF EXPERIMENTS: Strategy of experimentation, completely randomized single - factor experiment, Tests on individual treatment means, the random effects model, the randomized complete block design, one way analysis of variance and two way analysis of variance.</p>	12

TEXT BOOKS:

1. **Applied statistics and Probability for Engineers** – Douglas C Montgomery, George C Runger, 2ndEdn, John Wiley and Sons, ISBN-0-471-17027-5
2. **Statistics for Management** - Richard I Levin, David S Rubin, 6thEdn, Prentice Hall India, ISBN-81-203-0893-X

REFERENCE BOOKS:

1. **Probability and Statistics in Engineering** - William W Hines, Douglas C Montgomery, 2ndEdn, John Wiley and Sons
2. **Business Statistics for Management and Economics** - Daniel, Terrell, 6thEdn, Houghton Mifflin Company, ISBN-0-395-62835-0
3. **Probability and Statistics** - Walpole & Mayer, MacMillan Publishing Company, 1989.

MECHANICAL LAB

Subject Code	: 15IML 57	IA Marks	: 20
No. of Practical/ Week	: 03	Exam Hours	: 03
Total No. of Lecture Hrs.	: 42	Exam Marks	: 80

PART - A

(Individual experiments)

Determination of Flash point and Fire point of lubricating oil using Abel Pensky Martins Apparatus

Determination of Calorific value of solid and gaseous fuels.

Determination of Viscosity of a lubricating oil using Redwoods and Say bolts – Viscometers.

PART - B

Group experiments

Performance Tests on Four stroke Petrol and Diesel Engines, Calculations of IP, BP, Thermal efficiencies, SFC, FP and heat balance sheet

Performance Test on Four stroke Petrol - Calculations of IP, BP, Thermal efficiencies, SFC. Multi cylinder petrol / diesel engine (Morse Test)

Calibration of Venturi meter, Flow through pipes

Performance test on centrifugal and reciprocating pumps

WORK STUDY AND ERGONOMICS LAB

Subject Code	: 15IML/IPL58	IA Marks	: 20
No. of Practical Hrs./ Week	: 03	Exam Hours	: 03
Total No. of Lecture Hrs.	: 42	Exam Marks	: 80

PART - A

METHOD STUDY

Recording Techniques: Preparing the following charts and diagrams (Minimum 3 Charts)

Outline process chart

Multiple Activity Chart

Flow process chart and Flow diagram

String diagram,

Experiments on the Application of principle of motion economy, Two handed process chart. Exercises on conducting method study for assembling simple components and office work. Development of Layout plans using SLP technique. Experiments on Line balancing.

PART - B WORK MEASUREMENT

1. Rating practice using: walking simulator, pin board assembly, dealing a deck of cards and marble collection activity
2. Determining the standard time for simple operations using stopwatch time study
3. Exercises on estimating standard time using PMTS.
4. Determination of standard time using PDA device and time study software
5. Measurement of parameters (heart beat rate, calorie consumption) using walking simulator
6. Measurement of parameters (heart beat rate, calorie consumption, revolutions per minute) using ergometer
7. Effect of Noise, Light, Heat on human efficiency in work environments.

REFERENCE BOOKS:

1. **ILO, Introduction to work study** - III Revised Edition, 1981
2. **Motion and Time study** - Ralph M Barnes; John Wiley, 8th Edition, 1985.
3. **Engineered work Measurement** - Wledon, ELBS , 1991
4. **Motion and Time study**- Marvin E. Mundel-, PHI, 1st edition

PROFESSIONAL ELECTIVES

ENGINEERING ECONOMY

Subject Code	: 15IM/IP551	No. of Credits	: 4 - 0 - 0
No. of Lecture Hours / Week	: 04	Exam Hours	: 3
Total No. of Lecture Hours	: 50	Exam Marks	: 80

COURSE OBJECTIVES

1. To acquire a clear understanding of the fundamentals of engineering economics.
2. To learn the concepts of decision making, problem solving, and comparison of the alternatives and elements of cost.
3. To inculcate an understanding of concept of money and its importance in the evaluation of projects.
4. To illustrate concept of money and its importance in evaluating the projects.
5. To evaluate the alternatives based on the present annual worth and equivalent annual worth methods.

COURSE CONTENT

MODULE 1

Introduction: engineering decision – makers, engineering and economics, problem solving, intuition and analysis, tactics and strategy with an example.

Interest and Interest Factors: Interest rate, simple interest compound interest, interest formulae, time value equivalence exercises, problems and discussion.

10Hrs.

MODULE 2

Present Worth Comparison: Conditions for present worth comparisons, rule 72, basic present worth comparisons, present worth equivalence, net present worth, assets with equal and unequal lives, comparison of assets assume to have infinite lives, exercises and problems.

10 Hrs

MODULE 3

Equivalent Annual Worth Comparisons: Situations for equivalent annual worth comparison, net annual worth of a single project, comparison of net annual worth's, definitions of asset life, comparison of assets with equal and unequal lives, exercises and problems.

10Hrs

MODULE 4

Depreciation: Introduction, methods of depreciation, problems.

Replacement Analysis: Reasons- Deterioration, obsolescence, inadequacy, replacement criteria problems

08 Hrs

MODULE 5

Estimating and Costing: components of costs such as direct material cost, direct labour cost, Fixed, over – heads, factory costs, administrative – over heads, first cost, selling price, calculation of the total cost of various components, mensuration, estimation of simple components.

10 Hrs.

COURSE OUTCOMES:

Upon completion of this course, students should be able to:

1. Recall the basic concepts of decision making, problem solving, tactics and strategy.
2. Defining the time value of money concept, interest formulae.
3. Explain the comparison by present worth method for different lives of the asset. Compare the asset on the basis of EAW comparison.
4. Explain the concepts of depreciation and replacement criteria.
5. Calculate the total cost of a component and explain the process for estimating simple components.

TEXT BOOKS

1. **Engineering economy** – Riggs J.L., McGraw Hill, 2002.
2. **Engineering economy** – Paul Degarmo, Macmillan Pub, Co., 2001

REFERENCE BOOKS

1. **Engineering Economy** – NVR. Naidu, KM Babu and G.Rajendra, New Age International Pvt. Ltd., 2006.
2. **Industrial Engineering and Management** - O.P Khanna, DhanpatRai and Sons, 2000.
3. **Financial Management** – I M Pandey, Vikas Publishing House, 2002.
4. **Engineering Economy** – Theusen. G. PHI, 2002.

THEORY OF METAL FORMING Common to (IM & IP)

Subject code	15IM/IP552		IA Marks	20
Number of Lecture Hrs / Week	Lectures	3	Exam Marks	80
Total Number of Lecture Hrs	40		Exam Hours	03
CREDITS - 04				

MODULE: 1

Basics of plastic deformation & Introduction to metal forming process

Concept of true stress and true strain. Flow stress and strain hardening. Tresca's and Von-Mise's yield criteria and yield surface. Factors affecting yield strength of materials. Forming properties of materials. Ductility and formability. Classification of forming processes. Importance of temperature in metal forming. Hot and cold working. Effect of strain rate. Friction and its role in metal forming. Different methods of analysis of metal forming.

9 Hrs

MODULE: 2

Forging & Rolling Processes

Open-die and close-die forging processes. Brief description of the forging machines, equipments and heating furnaces. Slab analysis of upset forging of rectangular slab under plane strain condition. Forging load calculation. Common forging defects. Different types of rolling mills. Geometrical considerations in rolling. Role of friction in rolling and neutral point location. Simplified methods for calculating rolling load, torque and power required for rolling. Effect of back and front tension on rolling force. Residual stresses in rolling and common rolling defects.

8 Hrs

MODULE: 3

Extrusion & drawing of rods, wires and tubes

Types of extrusion processes. Metal flow pattern in extrusion. Extrusion equipments and dies. Extrusion of hollow sections. Slab analysis of extrusion of strips and circular sections and calculation of force and power required for extrusion. Common extrusion defects. Drawing equipments and dies. Analysis of rod or wire drawing and calculation of draw force and power required. Maximum possible reduction in drawing. Tube drawing using different types of mandrels, residual stresses and defect in drawn products.

8 Hrs

MODULE: 4

Sheet metal working, sheet metal drawing

Classification of sheet metal working and equipments used, Blanking and Piercing operation – Die design, cutting force required, slitting, trimming and shaving operations. Bending operation – Types of bending. Bend angle, bend radius, bend allowance and force required for bending. Spring back effect in bending. Roll bending process. Brief description of spinning and stretch forming processes. Die design, Number of draws required, Blank size calculation, and drawing force necessary. Drawability and defects in drawn products.

8 Hrs

MODULE: 5

High Energy Rate Forming (HERF)

Introduction, advantages, limitations and applications of HERF: Process description, parameters of Explosive forming, Electro discharge forming, Electromagnetic forming and Electro Hydraulic Forming. Newer forming processes: laser beam and plasma arc. Die less forming of sheet metal

7 Hrs

TEXT BOOKS:

1. Mechanical Metallurgy - Dieter G.E – McGraw Hill publication.
2. Fundamentals of Metal Forming Processes – Juneja B.L - New age International
3. Principle of Industrial Metal Working Processes – Rowe Edward - CBS Publication

REFERENCE BOOKS:

1. Materials and Processes in Manufacturing – E.Paul, DeGarmoetal - PHI publication.
2. Fundamentals of Working of Metals – Sach G. - Pergamon press.
3. Mechanics of sheet metal forming - Z.Marciniak, J.L.Duncanand S.J. Hu – Elsevier-Butterworth-Heinemann-2006

FINITE ELEMENT METHODS

Subject Code : 15IM/IP553
Hours/Week : 03
Total Hours : 40

IA Marks : 20
Exam Hours : 03
Exam Marks : 80

Course Objectives

The course objectives of Finite Element Methods are to teach the students and gain knowledge of:

CO1: Basic fundamentals of continuum and structural mechanics and numerical Technique.

CO2: Finite Element Method (FEM) as a Numerical Technique for engineering analysis of continuum and structures using variational and weighted residual approaches

CO3: Finite element formulation for one, two and three dimensional continuum and structural mechanics problems subjected to static, thermal and dynamic loads

CO4: Solving continuum and structural mechanics problems using finite element method.

CO5: Formulating, analyzing, error detecting, solution and interpretation of results for practical Problems using commercial software.

MODULE-1

Introduction. General description of Finite Element Method, application and limitations. Types of elements based on geometry. Node numbering, Half band width. Gauss-Elimination technique for solving linear algebraic equations. Numerical integration : 1, 2 and 3 gaussian point for 1D and 2D cases.

08 hrs

MODULE-2

Principle of virtual work, principle of minimum potential energy, Raleigh's Ritz method. Direct approach for stiffness matrix formulation of bar element. Galerkin's method.

Interpolation Models: Interpolation polynomials- Linear, quadratic and cubic. Shape functions Iso-parametric, Sub parametric and Super parametric elements and Jacobian matrix. **08 Hours**

MODULE-3

Formulation of 1-D element: Bars, tapered and stepped bars. 2D and 3D Truss element subjected to concentrated, distributed, body forces and thermal loading. Problems of 1D members for displacements, reactions and stresses by using penalty approach and elimination approach.

Beams: Hermite shape functions for beam element, Derivation of stiffnessmatrix. Numerical problems of beams carrying concentrated, UDL and linearly varying loads. **08 Hours**

MODULE-4

Formulation of 2D and 3D elements: Triangular, quadrilateral, tetrahedron and hexahedron elements, shape function formulation.

Dynamics: Determination of natural frequency and mode shape for 1D bar and beams only. **08 Hours**

MODULE-5

Heat Transfer: Steady state heat transfer, 1D heat conduction governing equations. Functional approach for heat conduction. Galerkin's approach for heat conduction. 1D heat transfer in thin fins.

08 Hours

TEXT BOOKS:

1. **Finite Elements in Engineering**, T.R.Chandrupatla, A.D Belegunde, 3rd Ed PHI.
2. **Finite Element Method in Engineering**, S.S. Rao, 4th Edition, Elsevier, 2006.

REFERENCE BOOKS:

1. **"Finite Element Methods for Engineers"** U.S. Dixit, Cengage Learning, 2009
2. **Concepts and applications of Finite Element Analysis**, R.D. Cook, D.S. Maitis, M.E. Plesha, R.J. Witt, Wiley 4th Ed, 2009
3. **Finite Element Methods**, Daryl L. Logon, Thomson Learning 3rd edition, 2001.
4. **Finite Element Method**, J.N.Reddy, McGraw -Hill International Edition.

Course Outcome:

On completion of the course the student will be

CO1: Knowledgeable about the FEM as a numerical method.

CO2: Able to formulate any solid mechanics, structural mechanics and thermal problems

CO3: Able to solve and interpret the results of solid, structural and thermal problems

CO4: Developing skills required to use commercial FEA software

HYDRAULICS and PNEUMATICS

Subject Code	: 15IM54	No. of Credits	: 4 - 0 - 0
No. of Lecture Hours / Week	: 04	Exam Hours	: 3
Total No. of Lecture Hours	: 50	Exam Marks	: 80

COURSE OBJECTIVES

1. To Study the fundamentals of Hydraulic Power Pumps, Actuators and Motors.
2. To develop a sound knowledge of control components in Hydraulic Systems.
3. To have basic skills to design Hydraulic Circuits and analyze them.
4. To acquire the fundamental knowledge on pneumatic control.
5. To develop skill sets to handle Pneumatic Actuators , Valves, Pneumatic circuits and logic circuits

COURSE CONTENT

MODULE 1

Introduction to Hydraulic Power and Pumps: review of fluid mechanics, Pascal's Law, structure of hydraulic control system. pumps: pumping theory, pump classification, gear pumps- external and internal type, vane pumps- simple, balanced, pressure compensated types, piston pumps- radial and axial (both swash plate and bent axis type), pump performance.

Hydraulic Actuators and Motors: Linear hydraulic actuators - single acting, double acting, tandem cylinder, telescopic rod cylinder, mechanics of hydraulic cylinder loading, cylinder cushioning, hydraulic rotary actuators, hydrostatic transmission – open and close circuit, performance of hydraulic motor.

12Hrs

MODULE 2

Control Components in Hydraulic Systems: directional control valves (DCV), constructional features, 2/2,3/2,4/2,4/3 DCV, center configuration in 4/3 DCV- open, closed, tandem, regenerative, floating centre configuration, actuation of DCVs- manual, mechanical, solenoid, and indirect actuation, relays for the solenoid operation, check valve, pilot check valve, pressure control valves – direct and pilot operated types, pressure reducing valve, flow control valves- fixed throttle, and variable throttle, throttle check valve, pressure compensated flow control valve- relief and reducing type.

12Hrs

MODULE 3

Hydraulic Circuit Design and Analysis: control of single and double acting hydraulic cylinder, regenerative circuit, counter balance valve application, cylinder sequencing circuits, cylinder synchronizing circuits, speed control of hydraulic cylinder – meter in and meter out, speed control of hydraulic motors, relay circuit design for the operation of solenoid directional control valve- single and double solenoid relay circuit

08Hrs

MODULE 4

Introduction To Pneumatic Control: choice of working medium, characteristics of compressed air, structure of pneumatic control system , supply, signal generators, signal processor, final control elements , actuators, production of compressed air – compressors - reciprocating and rotary type, preparation of compressed air – driers, filters, regulators, lubricators, distribution of compressed air – piping layout.

08Hrs.

MODULE 5

Pneumatic Actuators , Valves: linear cylinder – types, conventional type of cylinder – working, directional control valve, shuttle valve, quick exhaust valve, twin pressure valve, direct and indirect actuation of pneumatic cylinder, memory valve, time delay valve.

Pneumatic circuits and logic circuits: supply air and exhaust air throttling, will dependent circuits, travel dependent controls – types – construction – practical applications, cylinder sequencing circuits, travel step diagrams, practical examples involving two or three cylinders, use of logic functions – OR, AND, NOR, NAND, YES, NOT functions in pneumatic applications, practical examples involving the use of logic functions.

10Hrs

COURSE OUTCOMES:

Upon successful completion of this course, the students will be able to

1. Recall the basic concept of fluid mechanics; identify different components of hydraulic system.
2. Analyze the requirement of control components and their selection.

OPEN ELECTIVES

PROFESSIONAL COMMUNICATION AND REPORT WRITING

Subject Code	: 15IM/IP561	No. of Credits	: 4 - 0 - 0
No. of Lecture Hours / Week	: 03	Exam Hours	: 3
Total No. of Lecture Hours	: 40	Exam Marks	: 80

COURSE OBJECTIVES

1. To know the nuances and importance of professional communication.
2. To demonstrate the capability of explaining and making others understand.
3. To plan and prepare Technical Reports for documentation and analysis.
4. To appreciate the use of appropriate channel to maximize the reach of any Communication channel.
5. To manage the organizational communication in very effective manner.

COURSE CONTENT

UNIT – 1 Communication: Importance of communication, oral and written communication, role of oral and written communication in effectiveness, communication process with basic model, formal and informal communication in management , barriers to communication, feedback and its effectiveness, conflict communication.

08 Hours

UNIT – 2 Oral communication: factors: factors influencing effective oral communication, role of trust self confidence motivational factors, styles of oral communication, importance of listening, grapevine and its role, role of visual aids, advantages and disadvantages over written communication , informative and persuasive communication.

08 Hours

UNIT – 3 Written communication: Writing style, importance of writing skills, books review and its importance. **Letter writing:** Personal correspondence, formal and informal letters, official and Demi-official letters, business and commercial letter and other technical correspondence , choice of stationary. **Technical report writing:** Synopsis writing, formats for reports, report types- introductory report, progress report, incident report, feasibility report, marketing report, field report laboratory test report. **Project report:** Reference work, synopsis, general objective, specific objective, introduction, body, tabular and graphical representation, use of visual aids, conclusion, bibliography.

08 Hours

UNIT – 4 Effective Meetings: Meeting as a decision making body, psychology of member, chairmanship-outside meeting, , chairmanship control of progress, chairmanship control of the member, behavior in meeting, effective secretary and his role, Types of meetings, symposia, conference, convections.

Effective interviews: Interviewing, types of interview, selection interview, grievance interview, employee appraisal interview, informational interview, interrogational interview, organizing interview, types of question, effective questioning in the interview, responsibilities of an interviewer and an interviewee, interview assessment form and its importance.

08 Hours

UNIT – 5 Problem Solving In Communication: periodic training, role of conflicts, evaluation through possible solutions.

Individual Tasks: business correspondence, restructuring/reforming of some business correspondence, preparation of synopsis, role play, case studies, seminar on selected topics, other oral and written communication exercise. **Group Tasks:** preparation of project report, meeting, interviews, seminars, role play.

08MODULE Hours

COURSE OUTCOMES:

Upon completion of this course, students should be able to:

1. Make effective presentations.
2. Demonstrate good skills in handling oral communication.
3. Comfortably draft letters and reports for various agencies and stakeholders.
4. Handle meetings and interviews from both the sides.
5. Comfortably handle conflict situations and resolve the same through effective communication.

TEXT BOOKS

1. **Effective Communication-** Made Simple Series, Rupa and co., 1985.

2. **Urmila raj and S.M Rai**, Business Communication, Himalaya publishing house, 1989.

CONCURRENT ENGINEERING				
Semester - V				
Subject Code: 15IM/IP562			IA Marks	20
Number of Lecture Hours/Week	03		Exam Marks	80
Total Number of Lecture Hours:	40		Exam Hours	03
CREDITS – 03				

MODULE 1

MANUFACTURING COMPETITIVENESS: Review, Product and Services, Process and Methodologies, performance, the need for change, Sequential versus concurrent Engg.

4 Hours

PROCESS REENGINEERING: Managing change, Reengineering approaches, Enterprise models, concurrent process reengineering.
4 Hours

MODULE 2

CONCURRENT ENGINEERING: Introduction, Basic principles, components of CE models.

8 Hours

MODULE 3

CONCURRENT ENGINEERING ORGANIZATIONS: Benefits, cooperative concurrent teams, Types of CE organisations.

4 Hours

SYSTEM ENGINEERING: Introduction, System thinking, System complexity, System Integration, Angle virtual company.
4 Hours

MODULE 4

INFORMATION MODELLING: Methodology, foundation of information modelling.
4 Hours

C. E. PROCESS: Concurrent engineering process invariant enterprise model class, product mode class, cognitive models.
4 Hours

MODULE 5

CE METRICS FOR IT: Based manufacturing – process efficiency metrics, Process effectiveness metrics.
8 Hours

TEXT BOOKS:

1. **Concurrent Engineering Fundamentals** - Prasad. B – Integrated Product and process organization Vol. 1 & 2, Prentice Hall Englewood, Cliffs, New Jersey -1996.

2. **Concurrent Engineering** - Hartely R John– Shortening lead times, raising quality & Lowering costs, Productivity press, Portland, Oregon - 1992.

REFERENCE BOOK:

Concurrent Engineering - Carter DE & Baker BS, - The product development environment for the 1990's. Addison – Wesley Publishing company, Reading MA -1992.

Question paper pattern: The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.

TECHNOLOGY MANAGEMENT

Sub Code	15IM/IP563	IA Marks	20
No. of Lecture Hrs/week	03	Exam Hours	03
Total Lecture Hrs	40	Exam Marks	80

COURSE OBJECTIVES:

1. To understand the fundamentals Concepts of Technology
2. To apply the economics of technology to real world problems
3. To Analyze & adopt the Technology for Service and Manufacturing sectors.

MODULE 1

THE CONCEPT OF TECHNOLOGY: Introduction, The nature of knowledge, Aspects of classification, Concept and Meaning of technology, the character of a specific technology, Scope of technology, Examples of classification of technology, Scale of technology information, Levels of technology, Technology portfolios, Technology as an environment. **8 Hours**

MODULE 2

THE NATURE OF TECHNOLOGICAL CHANGE: Introduction, Meaning of technological change, Concept of invention, Nature of innovation, Emergence of new technologies, Life cycle of a technology, Motivation for technological change, Nature of technological progress, Nature of mature technology, Nature of diffusion, Technological convergence. **8 Hours**

MODULE 3

THE ECONOMICS OF TECHNOLOGY & CORPORATE TECHNOLOGY STRATEGY: Introduction, Meaning of technological economics,

Examples of technological economics, Scope of technological economics, Engineering economics, Production economics, Concept of economy of scale, Concept of optimum size, Technology as a commodity, The Business Mission, Concept Of Business Strategy, Capability For Strategic Planning, Corporate Technology Strategy, Competitive Technology, Technological Alliances, , Technology Crisis.

8 Hours

MODULE 4

ANALYSIS FOR TECHNOLOGY STRATEGY&THE REALIZATION OF NEW TECHNOLOGY: Introduction, Technology assessment, Technology forecasting, Main techniques of technology forecasting, Technology forecasting system, Yield of technology forecasting, Concept of R&D policy, Stimuli for innovation, Sources of innovation, Intelligence function of R&D, Management of R&D, R&D team, Effectiveness of R&D, Marketing aspects of R&D, Finance for Design, Development, Manufacture and Marketing, Patterns for new technology development.

8 Hours

MODULE 5

THE ADOPTION OF NEW MANUFACTURING TECHNOLOGY& TECHNOLOGICAL COMPETITION ANALYSIS: Introduction, manufacturing strategy, Introduction of new technology, Challenges of factory automation, Stages of factory automation, Manufacturing FMS, CIM, CAD/CAM, Intelligent manufacturing systems, operation of new technology, Change management, People and technology at work, Work structures, securing competitive advantage, Technological competition analysis, Technological leadership, Adoption of new technology, marketing a new technology product, Retention of competitive advantages.

8 Hours

TEXT BOOK:

1. The Management of Technology Perceptions & Opportunities - Paul Lowe -Chapman & Hall, London - 1995.

REFERENCE BOOKS:

1. Strategic Management of Technology -Frederick Betz - McGraw- Hill Inc -1993.
2. Management of Technology & Innovation competing Through Technological Excellence - Rastogi P.N - Sage Publications – 1995.
3. Mastering the dynamics of innovation – J Utterback

HUMAN RESOURCE MANAGEMENT

Subject Code :15IM/IP564
 No. of Lecture Hrs./ Week : 03
 Total No. of Lecture Hrs. : 40

IA Marks : 20
 Exam Hours : 03
 Exam Marks :80

Module	Course content	Hours
1	<p>INTRODUCTION: Evolution of HRM, Objectives, Functions and Policies.</p> <p>HUMAN RESOURCE PLANNING: Uses and benefits, Man Power Inventory, Man Power Forecasting, Methods of Man Power Forecasting, job Description, Job Specification</p>	09
2	<p>RECRUITMENT: Sources of Man power, Advertisement, Short Listing of Candidates calling Candidates for selection Process.</p> <p>SELECTION: Selection procedure – Written Test, Group Discussion. Interview – Different methods, advantages and limitations, Psychological testing – Advantages and limitations, Induction procedure, transfers, promotion, exit interview, (Tutorial on written test, Group Discussion, Interviews)</p>	09
3	<p>TRAINING AND DEVELOPMENT: Identification of Training needs, Training Evaluation, Training Budget, Executive Development – Different Approaches, Non-executive development – Different methods.</p> <p>PERFORMANCE APPRAISAL: Components (all round performance appraisal), Methods. Advantages and limitations of different methods, Personal Counselling based on Annual Confidential Reports.</p>	10
4	<p>COUNSELLING AND HUMAN RESOURCE ACCOUNTING: Characteristics, Need, Function, Types, Suggestions for personnel development, communication function, communication process, effective communication. Human resource records, Advantages of HR accounting, Various methods of accounting.</p>	6
5	<p>INDUSTRIAL RELATIONS: Indian trade union act, standing orders act, Indian factories act</p> <p>INDUSTRIAL DISPUTES AND SETTLEMENT: Indian Industrial Disputes act, Industrial disputes settlement machinery. Works committee, Board of Conciliation, Voluntary Arbitration, Compulsory arbitration, Court</p>	6

of inquiry, Industrial tribunal, Adjudication.	
--	--

TEXT BOOKS

1. **Human Resources Management** – Dr. K Ashwathappa – Tata McGraw Hill - Edition 1999.
2. **Management of Human Resources** – CB Mamoria – Himalaya Publication House – 2003.

REFERENCES BOOKS:

1. **Personnel / Human resource Management** – Decenzo and Robbins- PHI - 2002
2. **Industrial Relations** – Arun Monappa – TMH - ISBN – 0-07-451710-8.
3. **Human Resources Management** – VSP Rao
4. **Human Resources Management** – Ravi Dharma Rao

VI SEMESTER

QUALITY ASSURANCE & RELIABILITY
15IM61

Sub Code

IA Marks

20

No. of Lecture Hrs/week	04	Exam Hours	03
Total Lecture Hrs	50	Exam Marks	80

COURSE OBJECTIVES:

1. To understand the fundamentals of Quality tools and techniques
2. To apply the quality and reliability tools and techniques to real world problems
3. To Interpret the results of quality and reliability study for decision making

MODULE 1:

Introduction: Definition of Quality, Quality function, Dimensions of Quality, Quality Engineering terminology, Brief history of quality methodology, Statistical methods for quality improvement, Quality costs – four categories costs and hidden costs. Brief discussion on sporadic and chronic quality problems.

Quality Assurance: Definition and concept of quality assurance, departmental assurance activities. Quality audit concept, audit approach etc. structuring the audit program, planning and performing audit activities, audit reporting, ingredients of a quality program. **12 Hours**

MODULE 2

Statistical Process Control: Introduction to statistical process control – chance and assignable causes variation. Basic principles of control charts, choice of control limits, sample size and sampling frequency, rational subgroups. Analysis of patterns of control charts. Case Studies on application of SPC. Process capability – Basic definition, standardized formula. **08 Hours**

MODULE 3

Control Charts for Variables: Controls charts for X bar and Range \bar{R} , statistical basis of the charts, development and use of X bar and R charts, interpretation of charts. Control charts for X bar and standard deviation (S), development and use of X bar and S chart. Brief discussion on – Pre control X bar and S control charts with variable sample size, control charts for individual measurements, cusum chart, moving-range charts

Control Charts for Attributes: Controls chart for fraction non- conforming (defectives) development and operation of control chart. **10 Hours**

MODULE 4

Sampling Inspection: Concept of accepting sampling, economics of inspection, Acceptance plans – single, double and multiple sampling. Operating characteristic curves – construction and use. Determinations of average outgoing quality, average outgoing quality level, average total inspection, producer risk and consumer risk, published sampling plans. **10 Hours**

MODULE 5

Statistical Theory of Tolerances: Application of statistical theory of tolerances to design of tolerances in random assemblies and application in other areas.

Reliability and Life Testing: Failure models of components, definition of reliability, MTBF, Failure rate, common failure rate curve, types of failure, reliability evaluation in simple cases of exponential failures in series, paralleled and series-parallel device configurations. **10 Hours**

TEXT BOOKS

1. **Introduction to statistical Quality Control** - D C Montgomery 3rd Edition, John Wiley and Sons.
2. **Quality Planning & Analysis** - J M Juran, Frank M Gryna; Tata McGraw Hill, 3rd edition,
3. **Total Quality Management** – NVR Naidu, KM Babu and G. Rajendra – New Age International Pvt. Ltd - 2006

REFERENCE BOOKS.

1. **Statistical Quality Control** - Grant and Leavenworth, McGraw Hill, 6th Edition
2. **The QS9000 Documentation Toolkit** - Janet L Novak and Kathleen C Bosheers,” Prentice Hall PTR, 2nd Edition
3. **ISO 9000 a Manual for Total Quality Management** - Suresh Dalela and Saurabh, S Chand and Co. 1st Edition
4. **Total Quality Management** - Kesavan R, I.K. International, New Delhi – 2007.

OPERATION RESEARCH

<i>Course Title: Operations Research</i>	<i>Total Contact Hours: 50</i>	<i>Lecture hours/week: 04</i>	<i>Credits: 04</i>
<i>Course Code: 15IM/IP62</i>	<i>Total I.A. Marks: 20</i>	<i>SEE Duration:03 hours</i>	<i>SEE Marks: 80</i>

Module	Contents	Hours
1	Introduction: Evolution of OR, definition of OR, scope of OR, application areas of OR, steps (phases) in OR study, characteristics and limitations of OR, models used in OR, linear programming (LP) problem-formulation and solution by graphical method. Solution of Linear Programming Problems: The simplex method, canonical and standard form of an LP problem, slack, surplus and artificial variables, big M method and concept of duality, dual simplex method.	10
2	Transportation Problem: Formulation of transportation problem, types, initial basic feasible solution using different methods, optimal solution by MODI	10

	method, degeneracy in transportation problems, application of transportation problem concept for maximization cases. Assignment Problem: Formulation, types, application to maximization cases and travelling salesman problem, flight scheduling problem.	
3	Project Management using Network Techniques: Introduction, network construction - rules, Fulkerson's rule for numbering the events, AON and AOA diagrams; Critical path method to find the expected completion time of a project, floats; PERT for finding expected duration of an activity and project, determining the probability of completing a project, predicting the completion time of project; crashing of simple projects (network construction by AOA approach can be used for all the cases).	10
4	Queuing Theory: Queuing systems and their characteristics, Pure-birth and Pure-death models (only equations), empirical queuing models – M/M/1 and M/M/C models (no derivations) and their steady state performance analysis. Game Theory: Formulation of games, types, solution of games with saddle point, graphical method of solving mixed strategy games, dominance rule for solving mixed strategy games.	10
5	Sequencing: Basic assumptions, sequencing 'n' jobs on single machine using priority rules, sequencing using Johnson's rule-'n' jobs on 2 machines, 'n' jobs on 3 machines, 'n' jobs on 'm' machines. Sequencing 2 jobs on 'm' machines using graphical method. Introduction to Integer Programming: Pure and mixed integer programming problems, solution of simple Integer programming problems using Gomory's all integer cutting plane method and mixed integer method.	10

Texts:

1. **Operations Research - Theory and Applications** - J K Sharma, Pearson Education Pvt Ltd., Recent edition.
2. **Operations Research** -P K Gupta and D S Hira, S Chand Publications, New Delhi, Recent edition.

References:

1. **Introduction to Operation Research** -Taha H A – PHI / Pearson Publications, Recent edition.

2. **Operations Research** -Paneerselvan, PHI
3. **Operations Research** -S.D. Sharma – Kedarnath, Ramnath& Co – Recent edition.

SIMULATION MODELLING AND ANALYSIS			
[As per Choice Based Credit System (CBCS) scheme]			
SEMESTER – VI			
Subject Code	15IM63	IA Marks	20
Number of Lecture Hours/Week	04	Exam Hours	03
Total Number of Lecture Hours	50	Exam Marks	80
CREDITS – 04			
<p>Course Objectives: This course will enable students to</p> <ol style="list-style-type: none"> 4. Understand the basic concepts and applicability of discrete event simulation 5. Acquire the knowledge to model and analyze the systems using discrete event simulation technique. 6. Acquire the knowledge to validate the model 			
Modules		Teaching Hours	Revised Bloom's Taxonomy Level
<p>Module -1 INTRODUCTION:Methods of analyzing systems, Simulation-meaning, advantages & disadvantages. Situations in which simulations can be used as an appropriate tool. Components of a system, Model of a system, Types of models. Steps in simulation study, Simulation software packages, Selection of simulation software</p>		8 Hours	
<p>Module -2 SIMULATION EXAMPLES:Simulation of Queuing systems, Simulation of inventory problems without backorder, Simulation of inventory problems with backorder, Simulation using normal random numbers. GENERAL PRINCIPLES OF SIMULATION:Concepts in discrete event simulation, Event Scheduling/ Time advance algorithm,</p>		10 Hours	

simulation using event scheduling.		
<p>Module -3 RANDOM NUMBERS: Properties of random numbers, Linear congruential method to generate random numbers. Tests for random numbers – Frequency test, Runs up and down test, Runs above and below mean test, Auto correlation test. RANDOM VARIATE GENERATION: Inverse transform technique for exponential and uniform distributions, Direct transformation for normal distribution, Acceptance – Rejection technique for poisson distribution.</p>	12Hours	
<p>Module -4 INPUT DATA MODELLING: Steps in input data modeling. Data collection, Identification of distribution, Parameter estimation for exponential and gamma distributions, Goodness of fit test for uniform, poisson and exponential distributions. Selection of input models without data, multivariate and time series analysis</p>	10 Hours	
<p>Module -5 VERIFICATION AND VALIDATION : Model building, verification, calibration and validation of models. Phases of validation test, Numerical problems. OUTPUT ANALYSIS: Measures of performance, estimation – point estimation and interval estimation, output analysis of terminating simulation, output analysis of steady state simulation.</p>	10 Hours	
<p>Course Outcomes :</p> <p>After studying this course, students will be able to:</p> <ol style="list-style-type: none"> 4. Explain the usefulness of discrete event system simulation in analyzing real time systems. 5. Analyze and model basic discrete event systems. 6. Generate random numbers and random variates and test random numbers. 		

7. Analyze input data and output data for model building , verification and validation

Graduate Attributes :

- Engineering Knowledge.
- Problem Analysis.
- Design / development of solutions
- Modern Tool Usage and Interpretation of data

Question paper pattern:

- The question paper will have ten questions and one full question to be answered from each module .
- Each full question consists of 16 marks.
- There will be 2full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

4. Discrete Event System simulation – Jerry Banks, John S Carson, Berry L Nelson, David M Nicol – Pearson Edition – IV edition , ISBN0-13-144679-7

Reference Books:

4. Simulation Modelling & Analysis – Averll M Law, W David Kelton – McGraw Hill International Editions – Industrial Engineering Series, ISBN 0-07-100803-9
5. System Simulation with Digital Computer. – NasinghDeo – PHI publication (EEE) ISBN 0-07-100803-9

MATERIALS MANAGEMENT

Subject Code	: 15IM/IP64	IA Marks	: 20
No. of Lecture Hrs./ Week	: 04	Exam Hours	: 03
Total No. of Lecture Hrs.	: 50	Exam Marks	: 80

MODULE - 1

Introduction: Dynamics of Materials Management - Materials Management at Micro-level, Materials Management at Macro-level. Definition of Material

Management

Systems Approach to Materials Management: Systems Approach - The Process of Management and the Materials Function, The Materials Function, Interfaces. Benefits of the Integrated Systems Approach.

8 Hours

MODULE - 2

Forecasting, Objectives and the Materials Organization: Systems Design, Integral Control of the Flow of Materials, Forecasting and Planning, Forecasting Methods, Objectives of Materials Management - Organization of Materials Management, Functional Organization Model for Materials Management. Materials Planning: Making the Materials Plan Work, The Materials Cycle and Flow Control System.

Purchasing: Purchasing Principles, Procedures and Practices, Fundamental Objectives of Purchasing - Scope, Responsibility and Limitations, Sources of Supply and Supplier Selection, Purchasing Policy and Procedures.

12 Hours

MODULE -3

Purchasing in Materials Management System Concept: Price Determination, Price Forecasting, Price-Cost Analysis, Negotiation, Reciprocity, Cost-Plus Contracts, Hedging, Forward Buying, Buying Ethics, Principles and Standards of Purchasing, Make-or-Buy, Information, Documentation and Purchasing Library, Legal Aspects of Purchasing, Law of Agency, Law of Contract, Legal Status of the Buyer, Warranties and Conditions, Right of Inspection, Right of Rejection, Vendor-Vendee Relations, Vendor Development, Vendor Rating.

Purchasing and Procurement Activities under Materials Management: Supplier Quality Assurance Programme, Buyer-Supplier Relationship.

Incoming Material Quality Control: Significance of Inspection, Metrology or Engineering Measurement, Purchase Inspection, Sampling Inspection, Sampling Technique, Different Types of Population, Different Types of Sampling.

10 Hours

MODULE - 4

Purchasing Capital Equipment, Plant and Machinery: Responsibility and Decision, Purchasing v/s Leasing,

International Buying, Import Purchasing, and Governmental Purchasing: Industrial Needs, Import Procedure and Documents, Basis of Licensing, Import Purchasing Procedures, Letter of Credit, Income-Tax Clearance, Customs Tariff-Registration of Licenses at Port. Governmental Purchasing: Policy and Procedures, Tenders.

Registration of Firms, Procedure for Registration, Terms of Registration, Removal of the Firms from the List, Blacklisting of Firms, Banning of Firms,

Suspension of Firms.

Inventory Management and Control Systems: Definition of Inventories, The Need for Inventory Audits Control, Types of Inventories, Inventory Control, Max-Min System, Inventories and Demand Uncertainty, Determining Safety Stock.

10 Hours

MODULE-5

Q-system or Quantity Control System or Re-order Point System-Effect of Quantity Discounts, P-system or Periodic Review or Periodic Count System or Replenishment System, Optional Replenishment System or "S, s" Policy. Discussion on ABC Analysis, advantages and disadvantages. MRP system and MPS system

Stores Management and Operation: Storage System, Stores Location and Layout,

Materials Management Information System and Computer: MIS - Management and MM, Computer System for MIS and MM, In-process Materials and Management Control.

10 Hours

Text Book:

A.K. Datta., **Materials Management**, PHI Pvt. Ltd, New Delhi, 2001.

Reference Book:

P. Gopalakrishnan, **Handbook of Materials Management**, PHI Pvt. Ltd, New Delhi, 2002.

CAD/CAM LAB

Subject Code	: 15IML 67	IA Marks	: 20
No. of Lecture Hrs./ Week	: 03	Exam Hours	: 03
Total No. of Lecture Hrs.	: 42	Exam Marks	: 80

PART - A

Modelling of simple machine parts using Graphics Package like Solid Works,

Uni Graphics, Catia etc. – Minimum 5 Exercises.

Study of Finite Element Analysis Package - 1D, 2D, Structural problems, Evaluation of displacement (Strain) and Stress. Problems involving Beams and Trusses. - Minimum 7 Exercises.

.PART - B

Modelling and Simulation of Machining process of simple machine parts using CAM packages. - Minimum 7 Exercise

SIMULATION LAB

Subject Code	: 15IML 68	IA Marks	: 20
No. of Lecture Hrs./ Week	: 03	Exam Hours	: 03
Total No. of Lecture Hrs.	: 42	Exam Marks	: 80

PART - A

Introduction to Simulation Packages
Understanding theSimulation Package
Identifying probability distributions for given data
Building simulation models for manufacturing operations (Electronic assembly – With Basic templates)
Building simulation models for manufacturing operations (Electronic assembly – With Common templates)
Building simulation models for manufacturing operations with transport System
Building simulation models for manufacturing operations with layout

PART - B

Building simulation models for manufacturing operations with layout and transport System

Building simulation Models for Banking service (Bank teller problem)
Building simulation Models for Mortgage application problem
Building simulation Models for food processing problem
Building simulation Models for Post office animation
Statistical Analysis of Simulation models (input analysis)
Statistical Analysis of Simulation models (output analysis)

Suggested Software Packages

Promodel, Arena, Quest, Witness, Extend

PROFESSIONAL ELECTIVES

FINANCIAL MANAGEMENT

Sub Code	15IM 651	IA Marks	20
No. of Lecture Hrs/week	03	Exam Hours	03
Total Lecture Hrs	40	Exam Marks	80

Course objectives:

1. To provide the concepts and foundations of managing finance in business enterprises.
2. To equip students with tools and techniques for managing finance.
3. To orient students regarding financial management practices in Indian companies and Global enterprises.

MODULE – 1

Introduction: Evolution of Financial Management, Goals, Forms of Business.

Risk and Required Return: Risk and return relationship, Business risk, financial risk, and risk in portfolio context, expected rate of return, Capital asset pricing model.

Capital Budgeting: Risk analysis in Capital Budgeting, Cost of Capital – Debt, Preference Equity forms of capital
08 Hours

MODULE – 2.

Capital Structure and Firm Value: Assumption, Definition and approaches, Modigliani and Miller Mode, Capital Structure decisions – EBIT, EPS analysis, ROI, REI analysis and Cash Flow comparative Analysis.

Working Capital Management: Factors influencing working capital requirement, determination of operating cycle and working capital.
08 Hours

MODULE-3

Long Term Financing: Raising of finance form primary and secondary markets, Valuation of securities, features of convertibility securities and warrants, SEBI guide lines on capital issues, stock market in India, Venture capital, Initial Public Offering.

Merger Acquisition and Restructuring: Reasons, Mechanics, Cost and benefits of a merger, Evolution, terms and purchase of a division, Takeovers, Acquisitions, Portfolio and financial restructuring
08 Hours

MODULE – 4

Securities and Portfolio Analysis: Derivatives, Futures Trading,

Financial Statement Analysis: Ratio analysis, time series analysis, Du pont analysis, funds flow analysis
08 Hours

MODULE– 5

International Financial Management: World Monitoring system, Foreign Exchange Markets, International Parity Relationships, International Capital budgeting, Financing Foreign Operations, Raising Foreign Currency Finance, Financing Exports, Documents in International Trade.

Financial Management in Sick Units: Definition of sickness, Causes of sickness, Symptoms of sickness, Prediction of sickness, Revival of a sick unit
08 Hours

TEXT BOOKS:

1. Financial Management Theory and practice – Prasanna Chandra – TMH – ISBN– 007-044501-X, 5th edn.
2. Financial accounting – B.S. Raman – United publication – VoI II

REFERENCE BOOKS:

1. Financial Management Text & Problems – Khan & Jain – TMH – ISBN 0—07-460208-X.
2. Financial management – IM Pandey – Vikas Pub. House – ISBN 0- 7069-5435-1.

INDUSTRIAL AUTOMATION

Sub Code	15IM 652	IA Marks	20
No. of Lecture Hrs/week	03	Exam Hours	03
Total Lecture Hrs	40	Exam Marks	80

COURSE OBJECTIVES:

- 1.To identify potential areas for automation and justify need for automation
- 2.To select suitable major control components required to automate a process or an activity
- 3.To identify suitable automation hardware for the given application.

MODULE- 1

Introduction: Automation in Production System, Principles and Strategies of Automation, BasicElements of an Automated System, Advanced Automation Functions, Levels of Automations. Flow lines & Transfer Mechanisms, Fundamentals of Transfer Lines. **08Hours**

MODULE 2

Material handling and Identification Technologies: Overview of Material Handling Systems, Principles and Design Consideration, Material Transport Systems, Storage Systems, Overview of Automatic Identification Methods. **08Hours**

MODULE 3

Automated Manufacturing Systems: Components, Classification and Overview of Manufacturing Systems, Manufacturing Cells, GT and Cellular Manufacturing, FMS, FMS and its Planning and Implementation

Quality Control Systems: Traditional and Modern Quality Control Methods, SPC Tools, Inspection Principles and Practices, Inspection Technologies. **08 Hours**

MODULE 4

Control Technologies in Automation: Industrial Control Systems, Process Industries Versus Discrete-Manufacturing Industries, Continuous Versus Discrete Control, Computer Process and its Forms. **08Hours**

MODULE 5

Computer Based Industrial Control: Introduction & Automatic Process Control,

Building Blocks of Automation Systems: LAN, Analog & Digital I/O Modules, SCADA Systems & RTU.

Distributed Control System: Functional Requirements, Configurations & some popular Distributed Control Systems. **08 Hours**

Text Books:

1. Automation, Production Systems and Computer Integrated Manufacturing- M.P. Groover, Pearson Education. 5th edition, 2009.

References:

1. Computer Based Industrial Control- Krishna Kant, EEE-PHI,2nd edition,2010
2. An Introduction to Automated Process Planning Systems- Tiess Chiu Chang & Richard A. Wysk
3. Performance Modeling of Automated Manufacturing Systems,-Viswanandham, PHI, 1st edition,2009.

SOFTWARE ENGINEERING & MANAGEMENT				
Semester - V				
Subject Code: 15IM653			IA Marks	20
Number of Lecture Hours/Week	03		Exam Marks	80
Total Number of Lecture Hours:	40		Exam Hours	03
CREDITS – 03				

MODULE 1

THE PRODUCT AND THE PROCESS: The product - Characteristics, Components, and Applications. The Process -Software process, Models - Linear, sequential, Prototype, RAD, ProcessTechnology, Software Development Life cycle.

4 Hours

SOFTWARE PROJECT MANAGEMENT CONCEPTS: TheManagement Specification, People, Problem, Process, project

4 Hours

MODULE 2

SOFTWARE PROJECT PLANNING: Objectives, Scope, Resource,Project estimation, Decomposition Techniques, Empirical EstimationModels. Make-buy decision, Automated estimation tools.

8 Hours

MODULE 3

RISK MANAGEMENT: Reactive v/s Proactive Risk Strategies, SoftwareRisks, Risk identification, Risk projection, Monitoring.

4 Hours

SOFTWARE PROJECT SCHEDULING AND TRACKING: Basicconcepts, defining a task set selection, Defining Scheduling, Project Plan

4 Hours

MODULE 4

SOFTWARE QUALITY ASSURANCE: Quality assurance concept, Cost impact of software defects, Technical review, statistical Quality assurance, software reliability, ISO 9000 Quality standards. **6 Hours**

SOFTWARE TESTING: Objectives, Principles, Testability . **2 Hours**

MODULE 5

SOFTWARE QUALITY AND RELIABILITY: Introduction, software modularity, language, Data reliability, Fault tolerance, software checking and software testing. **4 Hours**

OBJECT ORIENTED CONCEPT AND PRINCIPLES: Object Oriented Concepts, Identifying the elements of an object model, Examples. **4 Hours**

TEXT BOOK:

Software Engineering – Pressman - Computer Science Series - TATA McGraw-Hill Publications - 6th edition.

REFERENCE BOOKS:

Software Engineering – Somerville - Pearson Education,

Question paper pattern: The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.

COMPOSITE MATERIALS Common to (IM & IP)

Subject code	15IM654		IA Marks	20
Number of Lecture Hrs / Week	Lectures	3	Exam Marks	80
Total Number of Lecture Hrs	40		Exam Hours	03
CREDITS - 04				

MODULE: 1

Introduction to composite materials

Definition, classification and characteristics of composite materials: Fibrous, laminate, particulate, flake composites. Properties and types of reinforcement and matrix materials. Fibre reinforced plastic processing: basic steps in manufacturing of a composite, impregnation, lay-up, consolidation and solidification. Open and closed mould process, hand lay-up techniques, structural laminate vacuum bag and autoclave processing, filament winding, pultrusion, pulforming, thermo-forming, injection molding, resin transfer molding.

9Hrs

MODULE: 2

Fabrication of composites

Cutting: machining, drilling, mechanical fasteners and adhesive bonding: design guidelines for adhesive bonding. mechanical joining: design parameters for bolted joints, waterjet and laserjet cuttings. Challenge during machining of composites, failure mode during machining. Cutting tools and fabrication equipment. Ceramic matrix composites and their fabrication technologies.

7Hrs

MODULE: 3

Structural application of composites

Aerospace, air craft and military, medical, sporting goods and recreation, automotive. Marine, infrastructure. Micro analysis of a uni-directional lamina: definition of volume and mass fractions, density and void content. Derivation for longitudinal, transverse and shear modulus. Major and minor Poisson's ratio's. Numerical problems.

8Hrs

MODULE: 4

Study properties of MMC's

Physical Mechanical, wear, machinability and other properties. Effect of size, shape and distribution of particulate on properties. Advanced composites such as Polymer based Sandwich structures. Introduction to shape memory alloys.

8 Hrs

MODULE: 5

Study of composite materials from natural resources

Introduction to natural composites: classification of natural fibers: plant, animal, mineral fibers and their sources; silk, human, feather, jute, sisal, flax, cotton, bamboo fibres. Advantages and disadvantages of natural fibres.Characteristics of natural fibres.Extraction of plant fibres.Recent developments in natural fibre composites, feature potential of natural fibre composites.

8 Hrs

TEXT BOOKS:

1. Composite Science and Engineering - K.K.Chawla - Springer Verlag - 1998.
2. Introduction to composite materials - Hull and Clyne - Cambridge University Press - 2ndEdition, 1990.
3. Composites Manufacturing: materials, product and process engineering - Sanjay K. Mazumdar CRC press - Firstedition 2010.

REFERENCE BOOKS:

1. Composite Materials hand book - MeingSchwaitz - McGraw Hill Book Company - 1984.
2. Forming Metal hand book - 9th edition, ASM handbook, V15, 1988, P327-338.
3. Mechanics of composites - Autar K kaw - CRC Press - 2002.
4. Fiber-Reinforced Composites – P.K. Mallick – Third Edition.

OPEN ELECTIVES

MANAGEMENT INFORMATION SYSTEMS

Sub Code	15IM/IP661	IA Marks	20
No. of Lecture Hrs/week	03	Exam Hours	03
Total Lecture Hrs	40	Exam Marks	80

Course objectives:

1. To elevate students' awareness of information Technology and develop an in-depth and systematic understanding of key aspects of IT management.
2. To help students gain a strategic perspective on business.
3. To evaluate the value of emerging technologies and their competitive advantage.

Course content:

MODULE– 1

Fundamentals of Information Systems: Information systems in business, fundamentals of information systems solving business problems with information systems. **7 Hours**

MODULE– 2

Information Systems for Business Operations: Business information systems, Transaction processing systems, management, information systems and decision support systems. Artificial intelligence technologies in business, information system for strategic applications and issues in information technology.

9 Hours

MODULE–3

Issues in Managing Information Technology: Managing information resources and technologies global information technology, management, planning and implementing change, integrating business change with IT, security and ethical challenges in managing IT, social challenges of information technology.

8 Hours

MODULE-4

E-Business Model: E-commerce frame work, Architectural frame work for e-commerce, Application services and transaction, Models – B2C Transactions, B2B Transactions, Intra-Organizational Transactions, WWW Architecture: Client server structure of the web, e-Commerce architecture, Technology behind the web.

8 Hours

MODULE-5

Consumer Oriented E-Commerce: Consumer oriented Application: Finance and Home Banking, Home shopping, Home Entertainment, Mercantile Process Models, Consumers perspective, Merchants perspective.

Electronics Data Interchange (EDI): EDI Concepts, Applications in business – components of international trade, Customs Financial EDI, Electronic fund transfer, Manufacturing using EDI, Digital Signatures and EDI.

8 Hours

TEXT BOOKS:

1. Management Information systems – managing information technology in the internet worked enterprise – jams. A O’Brien – Tata McGraw Hill publishing company limited – 2002.
2. Management Information Systems – Laaudon&Laudon – PHI – ISBN 81-203-1282-1.1998.

REFERENCE BOOKS:

1. Management Information systems – S. Sadogopan. – PHI – 1998Edn. ISBN 81-203-1180-9.
2. Information systems for modern management – G.R. Murdick – PHI – 2nd Edition.

ADVANCED MACHINING PROCESSES

Subject Code	: 15IM/IP662	No. of Credits	: 4 - 0 - 0
No. of Lecture Hours / Week	: 03	Exam Hours	: 3
Total No. of Lecture Hours	: 40	Exam Marks	: 80

COURSE OBJECTIVES

1. To learn the fundamental concepts of Non-Traditional Machining and their Mechanical Processes
2. To have a good knowledge of Abrasive Jet Machining and its application
3. To learn the fundamental principles of Electrochemical Machining Process (ECM)
4. To have basic exposure to Chemical Machining (CHM) and Chemical Milling
5. To imbibe a the basic principles of Thermal Metal Removal Processes, Plasma Arc Machining (PAM)and Laser Beam Machining (LBM)

COURSE CONTENT

Unit 1

Introduction: History, need for non-traditional machining processes, classification, process selection.

Mechanical Process: Ultrasonic Machining (USM): Introduction, equipment, tool material and tool size, abrasive slurry, magnetostriction assembly, tool cone (concentrator), exponential concentrator of circular cross section and rectangular cross sections, effect of parameters, amplitude, frequency, grain diameter, applied static load and slurry,tool and work material. USM process characteristics: material removal rate, tool wear, accuracy, surface finish, applications, advantages and disadvantages of USM.

08Hrs

Unit 2

Abrasive Jet Machining (AJM): Introduction, equipment, variables in AJM: carrier gas, size of abrasive grain, velocity of the abrasive jet, mean no. abrasive particles per unit volume of the carrier gas, work material, stand-off distance (SOD), process characteristics-material removal rate, nozzle wear, Accuracy and surface finish, Applications, advantages and disadvantages of AJM.

08Hrs

Unit 3

Electrochemical Machining Process (ECM): Introduction, elements of ECM process: Cathode tool, anode work piece, source of DC power, electrolyte, chemistry of the process, ECM process characteristics - material removal rate, accuracy, surface finish, tool and insulation materials, tool size, electrolyte flow arrangement, applications, simple problems.

08Hrs

Unit 4

Chemical Machining (CHM): Introduction, elements of the process, chemical blanking process: preparation of work piece, preparation of masters, masking with photo resists, etching for blanking, accuracy of chemical blanking.

Chemical Milling (Contour machining):- Process steps-masking, etching, etc. process characteristics of CHM: - material removal rate, accuracy, surface finish, application of CHM.

08Hrs

Unit 5

Thermal Metal Removal Processes: Electrical Discharge Machining (EDM) - Introduction, mechanism of metal removal, dielectric fluid, spark generator, EDM tool (electrode), electrode material selection, machining time, flushing: suction flushing, side flushing, pulsed flushing synchronized with electrode movement, EDM process characteristics: metal removal rate, accuracy, surface finish, heat affected zone, machine tool selection, applications, electric discharge grinding, traveling wire EDM.

Plasma Arc Machining (PAM): Principle of generation of plasma, equipment, non-thermal generation of plasma, selection of gas, mechanism of metal removal, PAM parameters, process characteristics.

Laser Beam Machining (LBM): Principle of generation of lasers, equipment and machining procedure, types of lasers, process characteristics, applications.

08Hrs

COURSE OUTCOMES:

Upon completion of this course, students should be able to:

1. Understand the need for advanced manufacturing process and explain the principle of operation of ultrasonic machining process.
2. Explain the characteristic features of Abrasive Jet Machining (AJM)
3. Define the process parameters influence the material removal rate with the help of characteristics curves.
4. Explain the principle of chemical machining and chemical milling process.
5. Summarize the various aspects of Electric discharge machining (EDM). Explain the principle of generation plasma and laser and their application in machining

Text Books:

1. **Modern Machining Process** by P C Pandey and H S Shan, Tata McGraw Hill,2008
2. **New Technology** by Bhattacharaya, Institution of Engineering Publication.

References:

1. **Production Technology**, by HMT Tata McGraw Hill.
2. **Modern Machining Methods** by Dr. M.Adithan, Khanna Publishers, 2008.
3. **Non-conventional Machining** by P K Mishra, Reprint 2006, Narosa publishing House, New – Delhi.

VALUE ENGINEERING

Subject Code	: 15IM/IP663	IA Marks	: 20
No. of Lecture Hrs./ Week	: 03	Exam Hours	: 03
Total No. of Lecture Hrs.	: 40	Exam Marks	: 80

MODULE – 1

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

TYPE OF VALUES: Reasons for unnecessary cost of product, Peeling cost Onion concept, unsuspected areas responsible for higher cost, Value Analysis Zone, attractive features of value analysis. Meaning of Value, types of value & their effect in cost reduction. Value analysis procedure by simulation. Detailed case studies of simple products.

9 Hours

MODULE – 2

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

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

PROBLEM SETTING & SOLVING SYSTEM: Goods system contains everything the task requires. Various steps in problem solving, case studies.

10 Hours

MODULE - 3

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

7 Hours

MODULE- 4

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

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

TOTAL VALUE ENGINEERING: Concepts, need, Methodology and benefits.

8 Hours

MODULE- 5

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

6 Hours

TEXT BOOKS:

Techniques of Value Analysis and Engineering– Lawrence D. Miles, McGraw – Hill Book Company, 2ndEdn.

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

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

REFERENCE BOOKS:

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

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

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

DEVELOPMENT OF ENTERPRISES				
Semester - V				
Subject Code: 15IM/IP664			IA Marks	20
Number of Lecture Hours/Week	03		Exam Marks	80
Total Number of Lecture Hours:	40		Exam Hours	03
CREDITS – 03				

MODULE 1

DEFINITION AND CONCEPT OF ENTERPRISE: Profile of an entrepreneur-need scope and characteristics of entrepreneurs. Attitude development, creativity–stress management-positive reinforcement. **8 Hours**

MODULE 2

METHODOLOGY OF PROJECT IDENTIFICATION: Short listing and zeroing on to product/service-project in outline project planning-technical and feasibility analysis-evaluation of project report. Project appraisal technical, commercial and financial appraisal - problems in project equation - legal, financial and environmental aspects. **8 Hours**

MODULE 3

MARKETING: Market share-distribution-sale strategies-certification agencies-term finance-source and management working capital-coating and cost control (basic principles only) need analysis-product design (basic principles only)- developing operational expertise- innovation and change. **8 Hours**

MODULE 4

SMALL INDUSTRIES DEVELOPMENT: Small Industries development in India and its concepts- ancillary industries-starting a small scale industry steps involved-role of financing and other institutions providing assistance to small industries- preparation of project (case study). **8Hours**

MODULE 5

ACCOUNTING PRINCIPLES: Conventions and concepts-balance sheet, profit and loss account.Accounting rate of return, pay back period, SSI duty practice. **8 Hours**

TEXT BOOK:

1. **Developing Entrepreneurship** -UdaiPareek and T.V. VenkateswaraRao, – A Hand Book Learning systems - ND. 1978.

REFERENCE BOOKS:

1. **EDI - 1 Faculty and External Experts**, A handbook for new entrepreneurs, Entrepreneurship development institute of India -1986.

2. **Entrepreneurship Development** - P. Saravanavel - Ess Pee Kay publishing house -1st Edition.

3. **Entrepreneurship and Small Business** - Anil Kumar - I K International Publishing house Pvt. Ltd - 1st Edition.

Question paper pattern: The question paper will have TEN questions. There will be TWO questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer FIVE full questions, selecting ONE full question from each module.