

Visvesvaraya Technological University, Belagavi.
PhD Coursework Courses – 2018 (Industrial and Production Engineering)
As per 2017 Regulation

GROUP-1		
Sl. No.	Course Code	Course Name
1	16MEM11	Marketing Management
2	16MEM22	Organizational Behaviour
3	16MEM152	Managerial Economics
4	16MEM24	Project Management
5	16MEM41	Human Resources Management
6	16MEM253	Supply Chain Management
7	16MEM13	Operations Management
8	16MEM424	Advertising and Publicity

GROUP-2		
Sl. No.	Course Code	Course Name
1	16MEM422	Robust Design
2	16MPE12	Advanced Materials & Processing
3	16MPD23	Design for Manufacturing
4	16MPD153	Computer Application in Design
5	16MPY153	Theory of Metal Cutting
6	16MPY12	Advanced Foundry Technology
7	16MPY152	Composite Materials
8	16MPM425	Nano Technology

GROUP-3		
Sl. No.	Course Code	Course Name
1	16MEM423	Modern Trends in Management
2	16MPM151	Quality and Reliability Engineering
3	16MPE421	Industrial Design and Ergonomics
4	16MPM152	Tool Engineering
5	16MPM251	Non-Destructive Testing
6	16MPY422	Smart Materials & Structures
7	16MPM12	Quantitative Techniques In Decision Making
8	16MPE41	Maintenance Engineering & Management

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GROUP-4		
Sl. No.	Course Code	Course Name
1	16MPE253	Product Data Management
2	16MPD424	Product Analysis and cost optimization
3	16MPD421	Optimization Techniques for Decision Making
4	16MPD255	Financial Management
5	16MPE252	Simulation & Modeling of Manufacturing Systems
6	16MPT13	Operation Management
7	16MEM421	Industrial Marketing
8	16MPD11	Product Design and Development

GROUP-5		
Sl. No.	Course Code	Course Name
1	16MPT41	Advanced Manufacturing Practices
2	16MPD252	Virtual Design and Manufacturing
3	16MEM151	Lean Manufacturing System
4	16MPE14	Computer Integrated Manufacturing & Automation
5	16MPE21	Industrial Robotics
6	16MPE254	Agile Manufacturing
7	16MPE423	Rapid Prototyping
8	16MSE423	Advanced Fluid Power systems

GROUP-6		
Sl. No.	Course Code	Course Name
1	16MPE21	Industrial Robotics
2	16MEM252	Product Life Cycle Management
3	16MPE23	Surface Treatment & Finishing
4	16MPE13	Theory of Metal Forming
5	16MPE151	Applied Probability & Statistics
6	16MPE153	Quality and Reliability Engg.
7	16MEM23	Total Quality Management
8	16MPD254	Non Traditional Machining Process

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01	16MEM11	Group-1	MARKETING MANAGEMENT
Exam Hours:03		Exam Marks:100	
Module -1			
<p>Introduction: Role of marketing in today's organizations – core concepts of marketing-management -the evolution of marketing management concept.</p> <p>Marketing Environment – Marketing system – actors in the company's Micro and Macro Environment.</p>			
Module -2			
<p>Consumer Markets and Buying Behaviors – a Model of consumer behavior – Major factors influencing consumer behavior – the buying decision process.</p>			
Module -3			
<p>Organizational Markets and Buying Behavior – the industrial market – the reseller market – the government market.</p>			
Module -4			
<p>Market Segmentation – Market testing – market positioning – the marketing plan. Concept of Product life cycle and new Product development process.</p>			
Module -5			
<p>Pricing Decisions and Channel decisions, Product branding, packing and service, advertisement and media management, Communication and promotion mix decision.</p>			
Question paper pattern:			
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 20 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. <p>The students will have to answer 5 full questions, selecting one full question from each module.</p>			
REFERENCE BOOKS:			
<ol style="list-style-type: none"> 1. Marketing Management, Analysis, Planning and Control - Philip Kotler – PHI -1999. 2. Marketing Management– Willam J Stanton – John Wiley - Sales Force Chicago, Irwin - 1993. 			

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02	16MEM22	Group-1	ORGANIZATIONAL BEHAVIOUR
Exam Hours:03		Exam Marks:100	
Module -1			
The Foundations of Organizational Behavior: Historical Background, Research Methodology, Theoretical, Frameworks. OB in global context, Role of Information Technology, TQM, Learning Organizations.			
Module -2			
Individual Behavior: Biographical Characteristics, Ability, Personality, Learning, Implications for Performance and Satisfaction. Perception and Individual Decision –Making Values, Attitudes and Job Satisfaction.			
Module -3			
Basic Motivation Concepts: Work Motivation Approaches – Content and Process Theories of Work Motivation – Contemporary Theories of Work Motivation – Motivation through Job Design, Quality of Work Life, Goal Setting.			
Module -4			
Foundations of Group Behavior: Communication and Group Decision Making – Leadership Styles and Skills – Power and Politics – Conflict and Inter – group behavior.			
Module -5			
Organization Culture: Organizational Change – Organizational Development Organizational Climate – Work Stress.			
Question paper pattern:			
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 20 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.			
Reference books:			
1. Organizational Behavior – Fred Luthans – McGraw Hill – 1997.			
2. Human Behavior at work – Keith Davis – Prentice Hall India – 2007.			
3. Organizational Behavior – Stephen. P. Robbins – Prentice Hall, India. - 9th edition 2001.			
4. Organizational Psychology – Robin, Kolb, etc – 1996			

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03	16MEM152	Group-1	MANAGERIAL ECONOMICS
Exam Hours:03		Exam Marks:100	
Module -1			
<p>Demand Analysis: Demand Theory, Preference and Choice, Empirical Demand Curves, Goods Characteristics Approach.</p> <p>Production & Cost: Production Theory and Estimation: Organization of Production and the Production Function, Production Function with two variable inputs, optimal combination of inputs returns to scale. Empirical production functions. Cost Components – Cost functions, Empirical Cost functions.</p>			
Module -2			
<p>Market Structures: Perfect Competition: Meaning characteristics and importance, price and output determination in the short run and long run. Derived demand for inputs, shortcomings of perfect competition.</p>			
Module -3			
<p>Monopoly: Meaning, characteristics and importance, comparison with perfect competition, short run and long run analysis evaluation. Monopolistic Competition: Meaning, Characteristics and Importance short run and long run analysis.</p> <p>Oligopoly: Meaning, characteristics and importance, Non-Collusive Oligopoly and the kinked demand curve, Collusive Oligopoly, efficiency implications of oligopoly.</p>			
Module -4			
<p>Pricing in Practice: Cost-plus pricing, Evaluation of cost plus pricing, Incremental Analysis in pricing.</p>			
Module -5			
<p>Capital Budgeting: Meaning and Importance, Protecting Cash Flows, Present Value and Internal Rate of Return, Comparison of NPV and IRR.</p> <p>Economic Growth, Development and planning economic aggregates and economic relationships.</p>			
Question paper pattern:			
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 20 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. <p>The students will have to answer 5 full questions, selecting one full question from each module.</p>			
REFERENCE BOOKS:			
<ol style="list-style-type: none"> 1. Economics: Principles, Problems and Policies – Campbell R. McConnell - McGraw Hill – 2005. 2. Theory and Problems of Micro Economic Theory – Dominic Salvator, McGraw Hill – 1991. 3. Managerial Economics – Joel Dean – PHI – 2005. 4. Managerial Economics – Dominic Salvator, McGraw Hill – 1995. 			

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04	16MEM24	Group-1	PROJECT MANAGEMENT
Exam Hours:03		Exam Marks:100	
Module -1 Introduction: Projects, types of projects- public and private projects, project organization, structure and processes. Identification of Investment Opportunities, Market and Demand Analysis – Technical Analysis – Investment Outlay.			
Module -2 Means of Financing: Profitability and Breakeven Analysis – Cash Flows of Projects – Tax factor in investment Analysis – Interest – Compounding and Discounting.			
Module -3 Appraisal Criteria and Selection of Investment: Cost of Capital – Analysis of Risk – Financial Projection, Social Cost Benefit Analysis.			
Module -4 Manpower Management in Projects: Functional Approach to Manpower Management – The Element of decision Process – Project Team Concepts – Field Autonomy – Policies Governing Projects.			
Module -5 Networks Technique in Project Management: PERT/CPM Analysis – Administrative aspects of Capital Investment.			
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 20 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. <p>The students will have to answer 5 full questions, selecting one full question from each module.</p>			
Reference books: <ol style="list-style-type: none"> 1. Projects – Appraisal, preparation, budgeting and implementation Prasanna chandra – Tata McGraw Hill. 2. Hand book of Project Management– Dennis Lock. 3. Project Management – Dennis lock. 			

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05	16MEM41	Group-1	HUMAN RESOURCE MANAGEMENT
Exam Hours:03		Exam Marks:100	
Module -1			
Introduction to Human Resources: Importance of Human Resources – Human Resource Planning, Job Analysis and Methods.			
Recruitment – Recruiting Sources: Recruiting Efforts with possible constraint – ability to attract incumbents.			
Module -2			
The Selection Process: Cost of Selection – Discrete Selection Process – The Comprehensive Approach – Key Elements in successful Predictors – Selection Devices – Employment Tests and Interviews – Job ‘Previews and Background Investigation – Socializing the New Employee.			
Employee Training: Determination of Training Needs and Priorities – Formal Employee Training Methods –Methods for Training Managers Evaluating Training Effectiveness.			
Module -3			
Career Development: Value of Effective Career Development – External versus Internal Dimensions to a career – Career Stages.			
Motivating the Employees: Different Theories and Approaches to work Motivation – Job Design. Work scheduling and Motivation – Performance Appraisals – Rewarding the Productive Employee.			
Module -4			
Compensating the Work Force: Compensation Administration – Factors influencing the Compensation Administration – Job Evaluation and Pay Structure – Incentive Compensation Plans – Benefits and Services.			
Module -5			
Maintaining the Work Force: Labor Relations – some Legislation governing Labor Relations – Safety and Health of Workers – Combating Stress and Burnout Problems – Employee Discipline – disciplinary Actions – collective bargaining process.			
Question paper pattern:			
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 20 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.			
REFERENCE BOOKS:			
1. Principles of personnel management – Flippo – Mc Graw Hill.			
2. Personnel principles and policies for modern manpower – Yoder Prentice Hall India.			
3. Personnel/Human Resource Management – Terry Leap & Michael Crinocollier Macmillan publishers.			
4. Personnel and Human Resource Management – Memoria Himalaya publishing Company.			

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06	16MEM253	Group-1	SUPPLY CHAIN MANAGEMENT
Exam Hours:03		Exam Marks:100	
Module -1			
<p>Building a Strategic Frame Work to Analyze Supply Chains: Supply chain stages and decision phases process view of a supply chain. Supply chain flows. Examples of supply chains, Competitive and supply chain strategies. Achieving strategic fit. Expanding strategic scope. Drivers of supply chain performance. Framework for structuring drivers – Inventory, Transportation, Facilities, Information. Obstacles to achieving fit.</p> <p>Designing the Supply Chain Network: Distribution Networking – Role, Design. Supply Chain Network (SCN) – Role, Factors, Framework for Design Decisions.</p>			
Module -2			
<p>Facility Location and Network Design: Models for facility location and capacity allocation. Impact of uncertainty on SCN.</p> <p>Planning and Managing Inventories in a Supply Chain: Review of inventory concepts. Trade promotions, managing multi-echelon cycle inventory, safety inventory determination. Impact of supply uncertainty aggregation and replenishment policies on safety inventory. Optimum level of product availability; importance factors. Managerial levers to improve supply chain profitability.</p>			
Module -3			
<p>Sourcing, Transportation and Pricing Products: Role of sourcing, supplier – scoring & assessment, selection and contracts. Design collaboration.</p> <p>Sourcing, Transportation and Pricing Products: Role of transportation, Factors affecting transportation decisions. Modes of transportation and their performance characteristics. Designing transportation network. Trade - off in transportation design. Tailored transportation, Routing and scheduling in transportation. International transportation. Analytical problems. Role Revenue Management in the supply chain.</p>			
Module -4			
<p>Coordination and Technology in the Supply Chain: Co-ordination in a supply chain: Bullwhip effect. Obstacles to coordination. Managerial levers to achieve co-ordination, Building strategic partnerships.</p>			
Module -5			
<p>Coordination and Technology in the Supply Chain: The role of IT supply Chain, The Supply Chain IT framework, CRM, Internal SCM, SRM. The role of E-business in a supply chain, The E-business framework, E-business in practice.</p> <p>Emerging Concepts: Reverse Logistics; Reasons, Activities, Role. RFID Systems; Components, applications, implementation. Lean supply chains, Implementation of Six Sigma in Supply Chains.</p>			
Question paper pattern:			
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 20 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. <p>The students will have to answer 5 full questions, selecting one full question from each module.</p>			
Reference books:			
<ol style="list-style-type: none"> 1. Supply Chain Management– Strategy, Planning & Operation. Sunil Chopra & Peter Meindl; Pearson Education Asia, ISBN: 81-7808-272-1. – 2001 2. Supply Chain Redesign – Transforming Supply Chains into Integrated Value Systems -Robert B Handfield, Ernest L Nichols - Jr., 2002, Pearson Education Inc, ISBN: 81-297-0113-8 3. Modeling the Supply Chain -Jeremy F Shapiro, Duxbury -Thomson Learning -2002, ISBN 0-534-37363. 4. Designing & Managing the Supply Chain -David Simchi Levi, Philip Kaminsky& Edith Simchi Levi - McGraw Hill. 5. Going Backwards Reverse Logistics Trends and Practices -Dr. Dale S. Rogers,Dr. Ronald S. Tibben-Lembke, University of Nevada, Reno, Center for Logistics Management. 			

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07	16MEM13	Group-1	OPERATIONS MANAGEMENT
Exam Hours:03		Exam Marks:100	
Module -1			
<p>Operations Planning Concepts: Introduction, Operations Functions in Organizations, Historical development, Framework for managing operations, The trend: Information and Non-manufacturing systems, Operations management, Factors affecting productivity, International dimensions of productivity, The environment of operations, Production systems decisions- a look ahead. Introduction to ERP.</p>			
Module -2			
<p>Operations Decision Making : Introduction, Management as a science, Characteristics of decisions, Framework for decision making, Decision methodology, Decision Tree Problems, Economic models-Break Analysis in operations, P/V ratio, Statistical models.</p> <p>System Design and Capacity: Introduction, Manufacturing and service systems, Design and systems capacity, Capacity planning.</p>			
Module -3			
<p>Forecasting Demand: Forecasting objectives and uses, Forecasting variables, Opinion and Judgmental methods, Time series methods, Moving Average methods, Exponential smoothing, Trend adjusted Exponential Smoothing, Regression and correlation methods, Application and control of forecasts-Mean Absolute Deviation, BIAS, and Tracking Signal.</p>			
Module -4			
<p>Aggregate Planning and Master Scheduling: Introduction- planning and scheduling, Objectives of aggregate planning, Three Pure Strategies, Aggregate planning methods, Master scheduling objectives, Master scheduling methods.</p> <p>Material and Capacity Requirements Planning: Overview: MRP and CRP, MRP: Underlying concepts, System parameters, MRP logic, System refinements, Capacity management, CRP activities.</p> <p>Scheduling and Controlling Production Activities: Introduction, PAC, Objectives and Data requirements, Loading – Finite and Infinite Scheduling methodology, priority sequencing, capacity control.</p>			
Module -5			
<p>Single Machine Scheduling: Concept, measures of performance, SPT rule, Weighted SPT rule, EDD rule.</p> <p>Flow – Shop Scheduling: Introduction, Johnson’s rule for ‘n’ jobs on 2 and 3 machines, CDS heuristic.</p> <p>Job-Shop Scheduling: Types of schedules, Heuristic procedure, scheduling 2 jobs on ‘m’ machines.</p>			
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Text Books:			
<ol style="list-style-type: none"> 1. Monks, J.G., Operations Management, McGraw-Hill International Editions, 1987. 2. Productions & operations management by Adam & Ebert. 3. Pannerselvam. R., Production and Operations Management, PHI. 4. Chase Jacobs Aquilano, Operations Management for Competitive Advantages,10th Edition, TMH 			
References:			
<ol style="list-style-type: none"> 1. Buffa, Modern Production/Operations Management, Wiely Eastern Ltd. 2. Chary, S.N., Production and Operations Management, Tata-McGraw Hill. 3. Operations management by James Dilworth. 4. Lee J Karjewski and Larry P Ritzman, Operations Management – strategy and Analysis, 6th Edn, Pearson Education Asia 5. B J Ranganath , System Dynamics by - I K International Publishing house Pvt. Ltd. 			

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08	16MEM424	Group-1	ADVERTISEMENT & PUBLICITY
Exam Hours:03		Exam Marks:100	
Module -1 Need, Importance and Scope: Advertisibility, advertisibility goals, legal, ethical and social aspects of advertising and public relations. Types of advertising and communications in advertising.			
Module -2 Advertisement Design: Copy Design, mechanics of copy preparations, essentials of a good copy, layout design and visualization effects, advertising theme. Media Decisions: Types of media, Media mix decisions, Criteria for evaluation of media effectiveness.			
Module -3 Rural Advertising: Characteristics, Problems and Prospects. Advertising Aids: Trade Marks, Slogan package, point of purchase, displays etc.			
Module -4 Measurement of Advertising Effectiveness: Methods and problems. Advertising Agency: Functions and Usefulness, Types, Dealing with agency, advertising Agency versus own, advertising department, advertising agencies in India.			
Module -5 Industrial and consumer goods and services advertising. Advertising Planning: Timing and Scheduling, Advertisement Budget, Types and sizes. Approaches to determining advertising budgets, limitations, and advertising research.			
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 20 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.			
REFERENCE BOOKS: <ol style="list-style-type: none"> 1. Advertising Management – David A. Aaker. 2. The Systematic Approach to Advertising Creativity – Bake. 3. Advertising: The Process and Practice – Engel. 4. Advertising in Business and Society – William M, Weil Bacher. 			

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01	16MEM422	Group-2	Robust Design
Exam Hours:03		Exam Marks:100	
<p>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.</p> <p>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 designs for two factors and three factors, factor effects, factor interactions, Fractional factorial design, Saturated design, Central composite designs, Illustration through numerical examples.</p>			
<p>Module -2 Measures of Variability: Measures of variability, Concept of confidence level, Statistical distributions: normal, log normal and Weibull distributions. Hypothesis testing, Probability plots, choice of sample size illustration through numerical examples.</p> <p>Analysis and interpretation of experimental data: Measures of variability, Ranking method, column effect method and plotting method, Analysis of variance (ANOVA), in factorial experiments: YATE's algorithm for ANOVA, Regression analysis, Mathematical models from experimental data, illustration through numerical examples.</p>			
<p>Module -3 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.</p>			
<p>Module -4 Signals 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.</p>			
<p>Module -5 Parameter Design and Tolerance Design: Parameter and tolerance design concepts, Taguchi's inner and outer arrays, Parameter design strategy, Tolerance design strategy, Illustrations through numerical examples.</p> <p>Reliability Improvement Through Robust Design : Role of S-N ratios in reliability improvement ; Case study; Illustrating the reliability improvement of routing process of printed wiring boards using robust design concepts.</p>			
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 20 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. 			
<p>TEXT BOOKS:</p> <ol style="list-style-type: none"> 1. Quality Engineering using Robust Design - Madhav S. Phadake: Prentice Hall, Englewood Clifts, New Jersey 07632, 1989. 2. Design and analysis of experiments - Douglas Montgomery: Willey India Pvt. Ltd., V Ed., 2007. 3. Techniques for Quality Engineering - Phillip J. Ross: Taguchi 2nd edition. McGraw Hill Int. Ed., 1996. 			
<p>REFERENCE BOOKS:</p> <ol style="list-style-type: none"> 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. 			

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02	16MPE12	Group-2	Advanced Materials & Processing
Exam Hours:03		Exam Marks:100	
<p>Module -1 Classification and characteristics: Metals, Ceramics, Polymers and composites. General properties and structure: Atoms, molecules bonds in solids, Crystalline - Defects in Metallic structure, Dislocations and plastic deformation - Strengthening mechanism - grain size, dislocation - Cold work, precipitation hardening, dispersion hardening - phase reactions, fatigue and Creep behavior.</p>			
<p>Module -2 Ferrous Alloys: iron carbon equilibrium diagrams - Steels and cast irons - properties, structure, composition and applications transformation hardening in steels - TIT diagrams - Heat treatment processes - Effect of alloying elements - High alloy steels, Stainless steel types, tool Steels, Manganese steels, heat resistant steels, HSLA, Maraging steels.</p>			
<p>Module -3 Non Ferrous alloys: Alloys of copper, Aluminum, nickel, magnesium, titanium, lead, tin, Zinc - composition, heat treatment, structure, properties and application.</p>			
<p>Module -4 Polymers and polymerizations: Structure and properties of thermoplastics and thermo sets – Engineering Applications - property modifications - Mechanical and thermal behavior – processing methods. Ceramics: Nature and structure of Ceramics - Refractory Abrasives glasses - glass ceramics - Advanced ceramics - processing methods.</p>			
<p>Module -5 Composites : Definition - classification and characteristics of composite materials - Volume fraction – laminated composites particulate composites, fibrous composites - Types of reinforcements, their shape and size – production and properties of fiber reinforced plastics, Metal Matrix composites and ceramic matrix composites - Applications. Processing of Polymers: composites, ceramics - thermal spraying - Ion beam machining diamond coating techniques tribological Applications.</p>			
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 20 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. 			
<p>REFERENCE BOOKS:</p> <ol style="list-style-type: none"> 1. Engineering Metallurgy - Raymond and Higgins - ELBS/EA 2. Introduction to Material Science and Engineering - James.F.Shackelford - Mc Millan, NY - 7th edition. 3. Powder Metallurgy-Metals Hand Book -ASM, USA - Vol.7, 1974. 4. Composite Materials - Science and Engineering - Chawla K.K. , Springer - Verlag, Newyork - 2nd edition, 1998. 5. Cast Metal Matrix Composites ASM Metals Hand Book - P.K. Rohagti - VI5. 6. Elements of Material science and Engineering - Van Vlack L.H. - Addison Wesley, NY - 1989. 			

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03	16MPD23	Group-2	Design for Manufacturing
Exam Hours:03		Exam Marks:100	
<p>Module -1 Material and process selection – Introduction, Advantages of applying DFMA, General requirements of early materials and process selection, Selection of Manufacturing processes, Selection of materials.</p> <p>Engineering Design features. – Dimensioning, Tolerances, General Tolerance, Geometric Tolerances, Assembly limits, achieving larger machining tolerances, Datum features.</p>			
<p>Module -2 Component design – Machining Considerations – Drills, Milling cutters, Drilling, Keyways, Dowels, Screws, Reduction in machining areas, Simplification by separation and amalgamation, work piece holding, surface grinding, Examples.</p>			
<p>Module -3 Component design – Casting Considerations – Pattern, Mould, parting line, cast holes, machined holes, identifying parting line, special sand cores, designing to obviate sand cores. Examples.</p>			
<p>Module -4 Design for Injection molding and Sheet metal working – Injection molding materials, Molding cycle, Systems, molds, machine size, cycle time, Cost estimation, Insert molding, Design guidelines, Introduction to sheet metalworking, Dedicated Dies and Press working, Press selections, Design Rules.</p>			
<p>Module -5 Design for Die casting and Powder metal processing – Die casting alloys, cycle, machines, dies, finishing, Assembly techniques, Design principles, Powder metallurgy processing, stages, compaction characteristics, Tooling, Sintering, Design guidelines.</p>			
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 20 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. 			
<p>REFERENCE BOOKS:</p> <ol style="list-style-type: none"> 1. Product Design for Manufacture and Assembly – Geoffrey Boothroyd - Peter Dewhurst - Winston Knight – Marcel Dekker, Inc. – Newyork - Second Revision, ISBN 0-8247-0584-X. 2. Designing for Manufacturing – Harry Peck - Pitman Publications – 1983. 3. Dimensioning and Tolerancing for Quantity Production – Merhyle F Spotts –Inc. Englewood Cliffs – New Jersey - Prentice Hall, 5th edition. 			

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04	16MPD153	Group-2	Computer Application in Design
Exam Hours:03		Exam Marks:100	
<p>Module -1 Introduction to CAD/CAM/CAE Systems: Overview, Definitions of CAD. CAM and CAE, Integrating the Design and Manufacturing Processes through a Common Database-A Scenario, Using CAD/CAM/CAE Systems for Product Development</p> <p>Components of CAD/CAM/CAE Systems: Hardware Components ,Vector-Refresh (Stroke- Refresh) Graphics Devices, Raster Graphics Devices, Hardware configuration, Software Components.</p>			
<p>Module -2 Basic Concepts of Graphics Programming: Graphics Libraries, Coordinate Systems, Window and Viewport, Output Primitives - Line, Polygon, Marker Text, Graphics Input, Display List, Transformation Matrix, Translation, Rotation, Mapping, Other Transformation Matrices, Hidden-Line and Hidden-Surface Removal, Back-Face Removal Algorithm, Depth-Sorting, or Painter's, Algorithm, Hidden- Line Removal Algorithm, z-Buffer Method, Rendering, Shading, Ray Tracing, Graphical User Interface, XWindow System.</p>			
<p>Module -3 Representation and Manipulation of Curves: Types of Curve Equations, Conic Sections, Circle or Circular Arc, Ellipse or Elliptic Arc, Hyperbola, Parabola, Hermite Curves, Bezier Curve, Differentiation of a Bezier Curve Equation, Evaluation of a Bezier Curve, BSpline Curve, Evaluation of a B-Spline Curve, Composition of B-Spline Curves, Differentiation of a B-Spline Curve, Nonuniform Rational B-Spline (NURBS) Curve.</p> <p>Representation and Manipulation of Surfaces: Types of Surface Equations, Bilinear Surface, Coon's Patch, Bicubic Patch, Bezier Surface, Evaluation of a Bezier Surface,</p>			
<p>Module -4 CAD and CAM Integration : Overview of the Discrete Part Production Cycle, Process Planning, Manual Approach, Variant Approach, Generative Approach, Computer-Aided Process Planning Systems, CAM-I CAPP, MIPLAN and Multi CAPP, Met CAPP, ICEM-PART, Group Technology, Classification and Coding, Existing Coding Systems, Product Data Management (PDM) Systems.</p>			
<p>Module -5 Standards for Communicating Between Systems: Exchange Methods of Product Definition Data, Initial Graphics Exchange Specification, Drawing Interchange Format, Standard for the Exchange of Product Data. Tutorials, Computational exercises involving Geometric Modeling of components and their assemblies</p>			
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 20 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. 			
<p>Text Book:</p> <ol style="list-style-type: none"> 1 Principles of CAD/CAM/CAE systems – Kunwoo - Lee Addison Wesley -1999 2. CAD/CAM/CIM - Radhakrishnan P. et al. - New Age International - 2008 <p>Reference Books:</p> <ol style="list-style-type: none"> 1. CAD/CAM – Theory & Practice - Ibrahim Zeid - McGraw Hill - 1998 2. Computer Integrated Design and Manufacturing - Bedworth, Mark Henderson & Philip Wolfe - McGraw hill inc. - 1991. 3. Part modeling Users Guide - Pro-Engineer - 1998 			

Visvesvaraya Technological University, Belagavi.

PhD Coursework Courses – 2018 (Industrial and Production Engineering)

As per 2017 Regulation

05	16MPY153	Group-2	Theory of Metal Cutting
Exam Hours:03		Exam Marks:100	
<p>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, co-efficient of friction, power & energy relationship, velocity relationship, shear-strain, factors affecting forces and power, problems.</p> <p>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.</p>			
<p>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.</p>			
<p>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, and milling, Calibration of dynamometers.</p>			
<p>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.</p> <p>Thermal Aspects in Metal Cutting: Heat sources in metal cutting, temperature in chip formation, temperature distribution, and experimental determination of tool temperatures.</p>			
<p>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.</p> <p>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.</p>			
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 20 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. 			
<p>REFERENCE BOOKS</p> <ol style="list-style-type: none"> 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. 3. Metal Cutting - V. C.Venkatesh & S. Chandrasekhanan - Pantice Hall – 1991. 4. Metal Cutting - Dr. B. J. Ranganath -Vikas Publications 			

Visvesvaraya Technological University, Belagavi.
PhD Coursework Courses – 2018 (Industrial and Production Engineering)
As per 2017 Regulation

06	16MPY12	Group-2	Advanced Foundry Technology
Exam Hours:03		Exam Marks:100	
<p>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.</p> <p>Principles of Casting and Riser: Purpose of the gating system. Components of the gating System and its functions. Design of the gating System. Different 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.</p>			
<p>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.</p> <p>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.</p>			
<p>Module -3 Furnace Technology: Study of various furnaces used in foundry, construction and operation of crucible and hearth furnaces. Resistance, Arc and Induction furnaces-their construction. Operation and application. Heat treatment furnaces and drying ovens used in foundry.</p> <p>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.</p> <p>Malleable Cast Iron: Chemical composition and structure of White-heart and black-heart malleable cast iron. Melting malleabilisation heat treatment and application of malleable cast iron.</p> <p>Ductile Cast Iron: Chemical composition and structure of ductile cast iron. Melting and spheroidisation treatment. Inoculation of 'ductile' iron Properties and application of ductiles iron casting.</p>			
<p>Module -4 Steel Casting Practice: Common steel casting, their composition, structure and properties. Melting and refining of steel. Gating and risering of steel castings cleaning of steel castings.</p> <p>Aluminium Foundry Practice: Composition, properties and application of common aluminium alloy casting. Melting and casting of Al-alloys. Gating and risering of Al-alloy casting.</p>			
<p>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.</p> <p>Foundry Mechanization and Modernization: Introduction to modernization. Mechanization of foundry and its advantages. Mechanization of sand plant, moulding and core making mechanization in melting, pouring and shakeout units. Material handling equipments and conveyor systems. Brief sketches and description of layouts of job. Captive and mechanized foundries.</p>			
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 20 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. 			
<p>REFERENCE BOOKS:</p> <ol style="list-style-type: none"> 1. Principle of metal casting - Heine, et. al - Tata-McGraw-Hill Publication - 2003. 2. A test book of Foundry Technology - Lal, M. Khanna, P.O - Dhanpat Rai & Sons Publication. 3. Foundry Technology - Beeley, P.R. – Butterworth. 			

Visvesvaraya Technological University, Belagavi.
PhD Coursework Courses – 2018 (Industrial and Production Engineering)
As per 2017 Regulation

07	16MPY152	Group-2	Composite Materials
Exam Hours:03		Exam Marks:100	
<p>Module -1 Introduction to Composite Materials: Definition, Classification, Types of matrices & reinforcements, characteristics & selection, Fiber composites, laminated composites, particulate composites, prepregs, sandwich construction.</p>			
<p>Module -2 Micro Mechanical Analysis of a Lamina: Introduction, Evaluation of the four elastic moduli – Rule of mixture, Macro mechanics of a lamina: Hooke’s law for different types of materials, number of elastic constants, Laminate code, Failure criterion.</p>			
<p>Module -3 Manufacturing: Lay Up and Curing – open and closed mould processing – Hand lay up techniques Bag moulding and filament winding. Pultrusion, Pulforming, Thermoforming, Injection moulding, Cutting, Machining and joining, tooling, Quality assurance Introduction, material qualification, types of defects, NDT methods.</p>			
<p>Module -4 Fabrication of Composites: Cutting, machining, drilling, mechanical fasteners & adhesive bonding joining computer aided design manufacturing tooling fabrication equipment Design of Fibre Reinforced Composite Structures: Introduction, Composite structural design, Design criteria, Laminate design, Mathematical analysis of the laminate, Design of composite stiffeners.</p>			
<p>Module -5 Application Developments – Aircrafts, missiles, space hardware, automobile, electrical and electronics, marine, recreational and sports equipment-future potential of composites. Metal Matrix Composites: Re-inforcement materials, types, Characteristics & Selection, base metals-selection, applications. Powder metallurgy technique, liquid metallurgy technique.</p>			
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 20 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. 			
<p>TEXT BOOKS:</p> <ol style="list-style-type: none"> 1. Composite Materials Handbook - Mein Schwartz - Mc Graw Hill Book Company - 1984. 2. Mechanics of Composite Materials - Autar K.Kaw - CRC Press New York - 1st edi, 1997. 			

Visvesvaraya Technological University, Belagavi.
PhD Coursework Courses – 2018 (Industrial and Production Engineering)
As per 2017 Regulation

08	16MPM425	Group-2	Nano Technology
Exam Hours:03		Exam Marks:100	
Module -1 METAL BASED NANOCOMPOSITES - Metal-Oxide or Metal-Ceramic composites, Different aspects of their preparation techniques and their final properties and functionality. Metal-metal nanocomposites, some simple preparation techniques and their new electrical and magnetic properties.			
Module -2 DESIGN OF SUPER HARD MATERIALS- Super hard nanocomposites, its designing and improvements of mechanical properties.			
Module -3 MECHANICS OF POLYMER NANOCOMPOSITES- Interfacial adhesion and characterization, factors influencing the performance of nanocomposites, physical and functional properties.			
Module -4 POLYMER-CARBON NANOTUBES BASED COMPOSITES- Processing methods and characterization using SEM, XRD, TEM.			
Module -5 CHARACTERIZATION OF POLYMER NANOTUBES BASED COMPOSITES -Mechanical, Electrical and Thermal Properties and their applications - Polymer / nanofillers (metallic nanopowders) systems, Rheological measurements, processing characteristics. TESTING OF NANOCOMPOSITES- Thermal analysis such as TGA, TMA, DSC, DMTA Biggest Obstacle to Business Breakthrough, Integration of Ideas.			
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 20 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: <ol style="list-style-type: none"> 1. Edward L. Wolf, "Nanophysics and Nanotechnology -An Introduction to Modern Concepts in Nano science" Second Edition, John Wiley & Sons, 2006. 2. K.W. Kolasinski, "Surface Science: Foundations of Catalysis and Nano science", Wiley, 2002. 3. G.A Ozin and A.C. Arsenault "Nano chemistry: A chemical approach to nanomaterials", Royal Society of Chemistry, 2005. 4. Nanostructures and Nanomaterials synthesis, properties and applications, G. Cao, Imperial college press 2004. 			

Visvesvaraya Technological University, Belagavi.
PhD Coursework Courses – 2018 (Industrial and Production Engineering)
As per 2017 Regulation

01	16MEM423	Group-3	MODERN TRENDS IN MANAGEMENT
Exam Hours:03		Exam Marks:100	
Module -1 Just in Time Ideas: Introduction of JIT Concepts, Difference between Conventional Material Control technique and IIT, Steps in implementing JIT, J.I.T. as a management Kaizen concept, Feasibility of JIT concepts to Indian Industries.			
Module -2 Implementing a Program for continuous Improvement: Japanese concept of continuous Improvement. (KAIZEN mean continuous Improvement), Innovation concept of Improvement, Need for continuous improvement, Steps in implementing continuous improvement.			
Module -3 Quality Circles: Definition of quality circles, Quality circles as a tool for problem solving, Q.C. as a group oriented KAIZEN.			
Module -4 Kanban System: Definition of KANBAN, Difference between PULL & PUSH Systems of Material Control, KANBAN as a Push System, KANBAN as JIT concept.			
Module -5 Concurrent Engineering: Definition of Concurrent Engineering. Design for Manufacturing and Assembly (DFMA), Concurrent Engineering, Team, Advantages of concurrent Engineering.			
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 20 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. <p>The students will have to answer 5 full questions, selecting one full question from each module.</p>			
REFERENCE BOOKS: <ol style="list-style-type: none"> 1. Just in Time Manufacturing - Amaldo Hernandez - PH International. 2. Just in Time - Productivity Process - David Hutehins - Jaco Publications. 			

Visvesvaraya Technological University, Belagavi.
PhD Coursework Courses – 2018 (Industrial and Production Engineering)
As per 2017 Regulation

02	16MPM151	Group-3	QUALITY AND RELIABILITY ENGINEERING
Exam Hours:03		Exam Marks:100	
Module -1 Basic Concepts: Definitions of quality and Reliability, Parameters and Characteristics, Quality control, statistical Quality Control, Reliability concepts. Concepts in Probability and Statistics : Events, Sample Space, Probability rules, Conditional probability, Dependent and Independent Events, Application of Probability concepts in Quality Control, Problems.			
Module -2 Statistical Aspects and Probability Distributions: Statistical Tools in Quality Control, The concept of Variation, Graphical Tools for data representation and analysis, Discrete and Continuous Distributions, Normal, Poisson, Binomial, Weibul Distribution, Problems. Control Charts: Variable charts X chart, R chart, s chart, Attribute charts, P chart, NP chart, C hart.			
Module -3 Failure Data Analysis : Introduction, Failure Data, Quantitative measures, MTTF, MTBF, Bathtub Curve, Mean Life, Life Testing, Problems, Introduction to Failure Mode and Effect Analysis. Acceptance Sampling: Fundamentals of acceptance sampling, types of acceptance sampling, O.C Curve, AQL, LTPD, AOQL.			
Module -4 System Reliability: Series, parallel and mixed configuration, Block diagram concept, r-out-of-n structure solving problems using mathematical models. Maintainability and Availability: Introduction, Formulas, Techniques available to improve maintainability and availability trade-off among reliability, maintainability and availability, Simple problems.			
Module -5 Reliability Improvement and Allocation: Difficulty in achieving reliability, Methods for improving reliability during design, Different techniques available to improve reliability, Optimization: Optimization, Reliability-Cost trade off, Prediction and Analysis, Problems.			
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 20 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. <p>The students will have to answer 5 full questions, selecting one full question from each module.</p>			
Text Books: <ol style="list-style-type: none"> 1. The Assurances Sciences - Halpern, Seigmund - Prentice Hall International, New Jersey, U.S.A -1978. 2. Quality Planning and Analysis - Juran, J.M and Gryna, F.M. - Tata McGraw Hill publishing Coimpany Ltd., New Delhi, India – 1982. 3. Logistics Engineering and Management - Blanchard, Bejamin S. - Prentice Hall International, New Jersey, U.S.A – 1986. 4. Maintainability and Reliability Handbook of Reliability Engineering and Management - Kraus, John W Editors – Ireson. W.G. and Cooms, C.F. - McGraw Hill Book Company Inc. U.S.A – 1988. 5. Concepts in Reliability Engineering - Srinathm K.S. - Affiliated East-West Press Private Limited, New Delhi, India - 1985. 			

Visvesvaraya Technological University, Belagavi.
PhD Coursework Courses – 2018 (Industrial and Production Engineering)
As per 2017 Regulation

03	16MPE421	Group-3	INDUSTRIAL DESIGN & ERGONOMICS
Exam Hours:03		Exam Marks:100	
<p>Module -1 Introduction: An approach to industrial design - elements of design structure for industrial design in engineering application in modern manufacturing systems.</p> <p>Ergonomics and Industrial Design: Introduction - general approach to the man-machine relationship-workstation design-working position.</p>			
<p>Module -2 Control and Displays: shapes and sizes of various controls and displays-multiple displays and control situations - design of major controls in automobiles, machine tools etc., - design of furniture design of instruments.</p>			
<p>Module -3 Ergonomics and Production: Ergonomics and product design ergonomics in automated systems-expert systems for ergonomic design, Anthropomorphic data and its applications in ergonomic design limitations of anthropomorphic data - use of computerized database.</p>			
<p>Module -4 Visual Effects of Line and Form: The mechanics of seeing psychology of seeing, general influences of lined and form.</p> <p>Colour: colour and light - colour and objects - colour and the eye colour consistency - colour terms - reactions to colour and colour continuation - colour on engineering equipments.</p>			
<p>Module -5</p> <p>Aesthetic Concepts: Concept of unity - concept of order with variety - concept of purpose style and environment - Aesthetic expressions. Style-components of style - house style, observations style in capital goods.</p> <p>Industrial Design in Practice: General design - specifying design equipments - rating the importance of industrial design – industrial design in the design process.</p>			
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 20 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. <p>The students will have to answer 5 full questions, selecting one full question from each module.</p>			
<p>TEXT BOOKS:</p> <ol style="list-style-type: none"> 1. Industrial design for Engineers - Mayall W.H. - London Cliffee Books Ltd. - 1988. 2. Applied Ergonomics Hand Book - Brien Shakel (Edited) - Butterworth Scientific, London – 1988. 			

Visvesvaraya Technological University, Belagavi.
PhD Coursework Courses – 2018 (Industrial and Production Engineering)
As per 2017 Regulation

04	16MPM152	Group-3	TOOL ENGINEERING
Exam Hours:03		Exam Marks:100	
<p>Module -1 Cutting Tool Materials Introduction and desirable properties ,Carbon and Medium-Alloy Steels ,High-Speed Steels ,Cast-Cobalt Alloys ,Carbides ,Coated Tools, Alumina-Based Ceramics ,Cubic Boron Nitride, Silicon-Nitride Based Ceramics ,Diamond ,Reinforced Tool Materials ,Cutting-Tool Reconditioning.</p> <p>Design of Cutting Tools Basic Requirements ,Mechanics and Geometry of Chip Formation , General Considerations for Metal Cutting ,Design of single point Cutting Tools , Design of Milling Cutters ,Design of Drills and Drilling , Design of Reamers, Design of Taps, Design of Inserts , Determining Shank Size for Single-point Carbide Tools, Numerical Problems</p>			
<p>Module -2 Gages and Gage Design Limits fits and tolerances, Geometrical tolerances-specification and measurement., Types of gages ,Gage design, gage tolerances ,Material for Gages.</p> <p>Work Holding Devices Basic requirements of work holding devices, Location: Principles, methods and devices, Clamping : Principles, methods and devices.</p>			
<p>Module -3 Drill Jigs Definition and types of Drill Jigs ,Chip Formation in Drilling ,General Considerations in the Design of Drill Jigs, Drill Bushings ,Drill Jigs, and Modern Manufacturing</p> <p>Design of Fixtures Fixtures and Economics , Types of Fixtures , Milling Fixtures , Boring Fixtures , Broaching Fixtures , Lathe Fixtures , Grinding.</p>			
<p>Module -4 Design of Press Tools Introduction to press tools and related terminology, effect of clearances, theory of deformation, stages of cutting operation, center of pressure, strap strip layout , die and punch design, design of simple, compound and progressive dies, methods of mounting punches and dies, design of drawing dies, bend allowances, bending and forming dies, Dies for diecasting and forging operations.</p>			
<p>Module -5 Dies and moulds Bending: Types, Parts and functions of bending die, Definition, calculations and factors affecting bend radii, bend allowance and spring back, Method to compute bending pressure, Types, sketch, working and applications of bending dies, Drawing dies-types and method to determine blank size for drawing operation, Types, sketch, working and applications of drawing dies (embossing, curling, bulging, coining, swaging and hole flanging),Forging dies-terminology, types, sketch, working and applications.</p>			
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 20 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. <p>The students will have to answer 5 full questions, selecting one full question from each module.</p>			
<p>Text Books :</p> <ol style="list-style-type: none"> 1. JOSHI P .H, “Jigs & Fixtures”, New Delhi -Tata McGraw Hill Pub. Co. Ltd., 11th print 1999. 2. D. Eugene Ostergaard,”Basic die design”, McGraw-Hill, 1963 3. P.C. Sharma, “A Text Book Of Production Engineering”, S. Chand Publisher, 2010 <p>Reference Books:</p> <ol style="list-style-type: none"> 1. ASTM E, “Fundamentals of Tool Design”, Prentice Hall of India, 1983. 2. Donaldson, “Tool Design”, Tata-McGraw Hill, 3rd Edition, 2000. 3. An Introduction to Jig & Tool Design -KEMPSTER M.H.A.- Bristol- ELBS 3rd Ed.1974. 			

Visvesvaraya Technological University, Belagavi.
PhD Coursework Courses – 2018 (Industrial and Production Engineering)
As per 2017 Regulation

4. Die Design Hand Book -SMITH A. DAVID.SME 3rd edition, 1990.

05	16MPM251	Group-3	NON - DESTRUCTIVE TESTING
Exam Hours:03		Exam Marks:100	
Module -1			
MAGNETIC PARTICLE INSPECTION: Methods of generating magnetic field, types of magnetic particles and suspension liquids steps in inspection – application and limitations.			
Module -2			
EDDY CURRENT INSPECTION: principles, operation variables, procedure, inspection coils, and detectable discounts by the method.			
MICROWAVE INSPECTION: Microwave holography, applications and limitations.			
Module -3			
ULTRASONIC INSPECTION: Basic equipment characteristics of ultrasonic waves, variables inspection, inspection methods pulse echo A,B,C scans transmission, resonance techniques, transducer elements couplets, search units, contact types and immersion types inspection standards-standard reference blocks.			
Module -4			
RADIOGRAPHY INSPECTION: Principles, radiation source X-rays and gamma rays, X-ray tube, radiographic films, neutron radiography, Thermal inspection principles, equipment inspection methods applications.			
Module -5			
OPTICAL HOLOGRAPHY: Basics of Holography, recording and reconstruction Acoustical Holography: systems and techniques applications. Indian standards for NDT.			
Question paper pattern:			
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 20 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.			
Reference Books:			
1. Non Destructive Testing Mc Gonnagle 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. The Testing instruction of Engineering materials Davis H.E Troxel G.E wiskovil C.T McGraw hill.			

Visvesvaraya Technological University, Belagavi.
PhD Coursework Courses – 2018 (Industrial and Production Engineering)
As per 2017 Regulation

06	16MPY422	Group-3	SMART MATERIALS & STRUCTURES
Exam Hours:03		Exam Marks:100	
Module -1 Overview of Smart Materials, Structures and Products Technologies.			
Module -2 Smart Materials (Physical Properties) Piezoelectric Materials, Electrostrictive Materials, Magnetostrictive Materials, Magnetolectric Materials. Magnetorheological Fluids, Electrorheological Fluids, Shape Memory Materials, Fiber-Optic Sensors.			
Module -3 Smart Sensor, Actuator and Transducer Technologies: Smart Sensors: Accelerometers; Force Sensors; Load Cells; Torque Sensors; Pressure Sensors; Microphones; Impact Hammers; MEMS Sensors; Sensor Arrays Smart Actuators: Displacement Actuators; Force Actuators; Power Actuators; Vibration Dampers; Shakers; Fluidic Pumps; Motors Smart Transducers: Ultrasonic Transducers; Sonic Transducers.			
Module -4 Measurement, Signal Processing, Drive and control Techniques Quasi-Static and Dynamic Measurement Methods; Signal Conditioning Devices; Constant Voltage, Constant Current and Pulse Drive Methods; Calibration Methods; Structural Dynamics and Identification Techniques; Passive, Semi-Active and Active Control; Feedback and Feed forward Control Strategies.			
Module -5 Design, Analysis, Manufacturing and Applications of Engineering Smart Structures and Products: Case studies incorporating design, analysis, manufacturing and application issues involved in integrating smart materials and devices with signal processing and control capabilities to engineering smart structures and products. Emphasis on structures, automation and precision manufacturing equipment, automotives, consumer products, sporting products, computer and telecommunications products, as well as medical and dental tools and equipment.			
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 20 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: <ol style="list-style-type: none"> 1. Smart Materials and Structures - M. V. Gandhi and B. So Thompson - Chapman & Hall, London; New York - 1992 (ISBN: 0412370107). 2. Smart Structures and Materials - B. Cui shaw - Artech House, Boston, - 1996 (ISBN :0890066817). 3. Smart Structures: Analysis and Design - V. Srinivasan - Cambridge University Press, Cambridge; New York - 2001 (ISBN: 0521650267). 4. Materials, Properties, Applications Electroceramics - A. J. Moulson and J. M. Herbert, - John Wiley & Sons, Chichester, West Sussex; New York - 2nd Edition, 2003 (ISBN: 0471497479). 5. Materials and Amplifiers Sensories: Force, Strain, Pressure, Acceleration and Acoustic Emission Sensors - G. Gautschi, Piezoelectric - Springer, Berlin; New York – 2002 (ISBN: 3540422595). 6. Piezoelectric Actuators and Ultrasonic Motors - K. Uchino - Kluwer Academic Publishers, Boston - 1997 (ISBN: 0792398114). REFERENCE BOOKS: <ol style="list-style-type: none"> 1. Handbook of Giant Magnetostrictive Materials - G. Engdahl - Academic Press, San Diego, Calif.; London - 2000 (ISBN: 012238640X). 2. Shape Memory Materials - K. Otsuka and C. M. Wayman - Cambridge University Press, Cambridge; New York - 1998 (ISBN: 052144487X). 3. Fiber Optic Sensors: An Introduction for Engineers and Scientists - Eric Udd - John Wiley & Sons, New York - 1991 (ISBN:0471830070). 4. Vibration Control of Active Structures: An Introduction - Andre Preumont - Kluwer Academic Publishers, Dordrecht; Boston - 2nd Edition, 2002 (ISBN: 1402004966). 			

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PhD Coursework Courses – 2018 (Industrial and Production Engineering)
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07	16MPM12	Group-3	QUANTITATIVE TECHNIQUES IN DECISION MAKING
Exam Hours:03		Exam Marks:100	
<p>Module -1 Introduction: Statistics and managerial decisions, statistical data and Operations Research techniques. Fundamentals of Statistics, probability and probability distributions: Measures of central tendency and location, Measure of dispersion, skewness and kurtosis, Probability and rules of probability, Random variables and probability distributions - Binomial, Poisson, Hyper geometric and Normal.</p>			
<p>Module -2 Linear Programming Problem: Formulation of L.P.P., Solution of L.P.P. by graphical method, Solution of L.P.P. by simplex method, Concept of duality and solution of dual problems, Solution of L.P.P. by dual simplex method.</p>			
<p>Module -3 Transportation Problems: Structure of transportation problem finding Initial Basic feasible solution by North-West Corner method, Least-Cost Method and Vogel's Approximation method(VAM)., Optimality test of transportation problems by MODI method, Solution of degeneracy and unbalanced transportation problems, Assignment Problems: Assignment problems and solution by Hungarian method and Traveling Salesman problem.</p>			
<p>Module -4 Theory of Games: Two person zero sum game, Minimax & maximin strategies, Solution of game by dominance rules, arithmetic and algebraic methods, Solution of game by graphical method and method of matrices, Solution of game by Linear programming approach and approximate method to solve game problems. Waiting Line: Basic structure of queuing systems and characteristics, Expressions for M/M/1 queuing model.</p>			
<p>Module -5 Network Analysis: PERT and CPM, Network construction and determination of critical path, Calculation of ES, EF, LS, LF, TF, FF and IF, Crashing of a project, Scheduling of a project and resource leveling. Simulation of Management systems: Simulation and Monte Carlo method, Waiting line and inventory simulation models.</p>			
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 20 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. <p>The students will have to answer 5 full questions, selecting one full question from each module.</p>			
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Quantitative Techniques for managerial decisionsm - Srivastava U.K. - New Age International Private Limited - ISBN Number: 8122401899. 2. Operations Research - H. Taha- Prentice Hall India – 8 Edition. <p>Reference Books:</p> <ol style="list-style-type: none"> 1. Operations Research: An Introduction - Gupta and Heera - S.Chand and Company - 2002 2. Introduction to Operations Research - Hillier and Liberman- McGraw Hill International. - ISBN 10: 0072321695. 			

Visvesvaraya Technological University, Belagavi.
PhD Coursework Courses – 2018 (Industrial and Production Engineering)
As per 2017 Regulation

08	16MPE41	Group-3	MAINTENANCE ENGINEERING & MANAGEMENT
Exam Hours:03		Exam Marks:100	
Module -1 Failure Statistics: Breakdown time distributions, Poisson, Exponential and Normal Distributions.			
Module -2 Maintenance Planning: Overhaul and Repair: Meaning and Difference, optimal overhaul /Repair/ Replace maintenance policy for equipment Course to breakdown.			
Module -3 Replacement Decisions: Optimal interval between preventive replacements of equipment Course to breakdown, group replacement.			
Module -4 Maintenance Systems: Fixed Time Maintenance, Condition based Maintenance, Operate to Failure, opportunity maintenance, Design out maintenance, total productive maintenance.			
Module -5 Inspection Decision: Optimal Inspection frequency, (for maximization of profit and minimization of downtime), Nondestructive Inspection, Lubrication program development, CPM and PERT in maintenance. Scheduling techniques. Spare parts Management. Repair cycle, Repair Complexity and Maintenance Control Indices. Concept of Terrotechnology.			
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 20 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. <p>The students will have to answer 5 full questions, selecting one full question from each module.</p>			
TEXT BOOKS: <ol style="list-style-type: none"> 1. Management of Industrial Maintenance - Kelly and M.J. Harris - Butterworth and Company Limited. 2. Maintenance, Replacement and Reliability - AKS Jardine - Pitman Publishing. 3. Preventive Maintenance - Joseph D. Patton - Instrument Society of America. 4. Maintenance and Spare Parts Management - P. Gopala Krishnan and AX. Bannerjee . 5. Industrial Maintenance - H.P. Garg - ISBN – 8121901685. 			
REFERENCE BOOKS <ol style="list-style-type: none"> 1. Plant Engineering Hand Book - Stainer - McGraw Hill. 2. Maintenance Engineering Hand Book - Lindley R. Higgins 3. Maintenance Engineering Hand Book - L.C. Morrow 			

Visvesvaraya Technological University, Belagavi.
PhD Coursework Courses – 2018 (Industrial and Production Engineering)
As per 2017 Regulation

01	16MPD253	Group-4	PRODUCT DATA MANAGEMENT
Exam Hours:03		Exam Marks:100	
Module -1			
<p>Introduction: Introduction to PDM-present market constraints need for collaboration- Internet and developments in server-client computing.</p> <p>Components of PDM: Components of a typical PDM set-up hardware and software- document management creation and viewing of documents -creating parts-version control of parts and documents –case studies.</p>			
Module -2			
Configuration Management: Base lines-product structure configuration management -case studies.			
Module -3			
Projects and Roles: Creation of projects and roles -life cycle of a product- life cycle management - automating information flow -work flows-Creation of work flow templates -life cycle -work flow integration -case studies.			
Module -4			
Change Management: Change issue -change request-change investigation- change proposal-change activity-case studies.			
Module -5			
Generic Products and Variants: Products configuration comparison between sales configuration mild products generic-generic product modeling in configuration modeler-use of order generator for variant creation -registering of variants in product register-case studies.			
Question paper pattern:			
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 20 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. <p>The students will have to answer 5 full questions, selecting one full question from each module.</p>			
REFERENCE BOOKS:			
<ul style="list-style-type: none"> • Computer Integrated Design and Manufacturing - David Bed worth. Mark Henderson &. Philips Wolfe - McGraw Hill Inc. - 1991. • Visual Modeling with Rational Rose and UML - Terry Quatrain - Addison Wesley - 1998. • Wind-chill - RS.O Reference manuals - 2000. 			

Visvesvaraya Technological University, Belagavi.
PhD Coursework Courses – 2018 (Industrial and Production Engineering)
As per 2017 Regulation

02	16MPD424	Group-4	Product Analysis and cost optimization
Exam Hours:03		Exam Marks:100	
Module -1			
<p>Introduction: New products, new product strategy -market definition Idea generation introduction to the design process -forecasting sales potential -product engineering and markets-monopoly competitive.</p> <p>Manufacturing Planning: Selection of optimum process, standardization. Break even analysis- application and area of use -problems -multi - product analysis.</p>			
Module -2			
<p>Value Analysis: Steps in selection, analysis and implementation, Selection of cutting speed for optimum cost -problems.</p> <p>Cost Accounting: Cost estimation -difference -types -steps involved in cost estimation.</p>			
Module -3			
<p>Types of Cost: Cost Centres, Direct –indirect, material cost -direct indirect material cost Overhead cost, Elements in overheads: Preparation of cost sheet, machine hour rate, apportioning methods.</p>			
Module -4			
<p>Variance Analysis – Labour variance, Material variance and Overhead variance, Activity based costing - Introduction to target costing.</p>			
Module -5			
<p>Cost Calculation: Cost calculation for machined components, welding, casting and forged components illustrations - calculation of sales cost.</p> <p>Cost Optimization Techniques: Analytical, Graphical and incremental methods Learning curves.</p>			
Question paper pattern:			
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 20 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. <p>The students will have to answer 5 full questions, selecting one full question from each module.</p>			
TEXT BOOKS:			
<p>1. Design and Marketing of New Products - Glen L Urban - John R Hauser- Prentice Hall. New Jersey, 1980.</p> <p>2. Production and Costing - Narang CBS & Kumar V - Khanna Publishers- 2001.</p>			
REFERENCE BOOKS:			
<p>1. Cost management in the New Manufacturing Age -Yasuhiro Monden, ProductivityPress-1992.</p> <p>2. Technique for Value Analysis And Engineering - Miles Lawrence.D - McGraw Hill, New york-1972.</p>			

Visvesvaraya Technological University, Belagavi.
PhD Coursework Courses – 2018 (Industrial and Production Engineering)
As per 2017 Regulation

03	16MPD421	Group-4	OPTIMISATION TECHNIQUES FOR DECISION MAKING
Exam Hours:03		Exam Marks:100	
Module -1 problem. Design Vector, Design constraints, objective function, classification of optimization problems. Classical Optimization Technique: Single variable optimization, with equality Constraints solution by direct substitution, solution by the method of constrained Variation. Solution by the method of Lagrange multipliers, multivariable optimization with inequality constraints Kuhn – Tucker condition.			
Module -2 Non-linear Programming: (One Dimensional minimization method) Numerical method, Unimodal function, Unrestricted search, Exhaustive search. Dichotomous search, Fibonacci and Golden section method.			
Module -3 Interpolation Method: Quadratic and Cubic Nonlinear programming (Unrestricted Optimization Technique) Random search methods, Univariate method, powels method, Simplex method.			
Module -4 Descent Methods: Steepest descent, conjugate gradient, variable metric method. Non Linear Programming: (Constrained Optimization problem) Characteristic of a constrained problem.			
Module -5 Direct Methods: The complex method, cutting plane method, methods of Feasible directions. Indirect Methods: Transformation technique, change variables and elimination of variables, penalty function methods- interior and exterior penalty function.			
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 20 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. Optimization, “Theory and Application” - S.S. Rao - Willey Eastern - 1984 REFERENCE BOOKS: 1. Optimization methods for Engg. Design - R.L Fox - Addison – Wesley – ISBN 0201020785 -1971 1. Optimization Theory and Practice - GSG Beveridge and R.S. Schechter - McGraw Hill, New York – 1970. 2. Optimization and Probability in System Engg. - Ram - Van Nostrand – 1974.			

Visvesvaraya Technological University, Belagavi.
PhD Coursework Courses – 2018 (Industrial and Production Engineering)
As per 2017 Regulation

04	16MPD255	Group-4	FINANCIAL MANAGEMENT
Exam Hours:03		Exam Marks:100	
Module -1			
<p>Introduction to Financial Management: Objectives, functions & scope, evolution interface of Financial Management with other functional areas, environment of corporate finance.</p> <p>Indian Financial System: Financial Markets – money market, capital market, Govt., Securities market, All India Financial Institutions.</p>			
Module -2			
<p>Time Value of money: Future value of a single cost flow, multiple flows and annuity, present value of a single cash flow.</p> <p>Risk & Return: Risk & Return concepts, risk in a portfolio, context, relationship between risk & return.</p> <p>Valuation of Securities: Concept of valuation, equity valuation Dividend: Dividend capitalization approach & ratio approach.</p>			
Module -3			
<p>Financial Statement Analysis: Ratio analysis, time series analysis, Du pont analysis, funds flow analysis.</p> <p>Leverage: Concept of leverage, opening leverage, financial leverage, total leverage.</p> <p>Sources of long term finance: Equity capital & preference capital, Debenture capital, term loan & deferred credit, Govt Subsidies, Sales Tax Deferrals & Exception, leasing and hire purchase.</p>			
Module -4			
<p>Cost of Capital and Capital Structure: Cost of debentures, Term loans, Equity capital & retained earning, Weighted average cost of capital, Systems of weighing. Introduction to capital structures, factors affecting capital structure, feature of an optimal capital structure, capital structures, Capital Structure theories, tradition position, MM Position and its critique imperfections.</p>			
Module -5			
<p>Dividend Policy: Traditional position, water model, golden model, Miller and Modigliani position, rational expectations model.</p> <p>Estimation of working capital – Objectives of working capital (Conservative Vs Aggressive policies) static Vs Dynamic view of W.C. Factors affecting the composition of W.C., interdependence among Components of W.C., operating cycle approach to W.C.</p>			
Question paper pattern:			
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 20 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. <p>The students will have to answer 5 full questions, selecting one full question from each module.</p>			
REFERENCE BOOKS:			
<ol style="list-style-type: none"> 1. Fundamentals of Financial Management – James C. Van Home - ISBN – 8177587862. 2. Financial Management – I.M. Panday – Vikas Publishing House Pvt - 2009. 3. Management Accounting & Financial Management – M.Y. Khan & P.K. Jain - Mcgraw Hill – Tata - ISBN: 0471477613. 			

Visvesvaraya Technological University, Belagavi.
PhD Coursework Courses – 2018 (Industrial and Production Engineering)
As per 2017 Regulation

05	16MPE252	Group-4	SIMULATION AND MODELING OF MANUFACTURING SYSTEMS
Exam Hours:03		Exam Marks:100	
Module -1 Principle of Computer Modeling And Simulation: Monte Carlo simulation. Nature of computer modeling and simulation. Limitations of simulation, areas of applications. System and Environment: Components of a system -discrete and continuous systems, Models of a system -a variety of modeling approaches.			
Module -2 Discrete Event Simulation: Concepts in discrete event simulation, manual simulation using event scheduling, single channel queue, too server queue, simulation of inventory problem. Statistical Models in Simulation: Discrete distributions, continuous distributions.			
Module -3 Random Number Generation: Techniques for generating random numbers- Mid square method –the mod product method -Constant multiplier technique -Additive congruential method -Linear congruential method -Tests for random numbers -The Kolmogorov-Smimov test -the Chi-square test. Random Variable Generation: Inversion transforms technique-exponential distribution. Uniform distribution, weibul distribution, continuous distribution, generating approximate normal variates-Erlang distribution.			
Module -4 Empirical Discrete Distribution: Discrete uniform -distribution poisson distribution –geometric distribution - acceptance -rejection technique for Poisson distribution gamma distribution.			
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.			
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 20 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. <p>The students will have to answer 5 full questions, selecting one full question from each module.</p>			
TEXT BOOKS: <ul style="list-style-type: none"> • Discrete Event System Simulation - Jerry Banks & .John S Carson II - Prentice Hall Inc.-1984. • Systems Simulation - Gordan. G. - Prentice Hall India Ltd - 1991. REFERENCE BOOKS: <ul style="list-style-type: none"> • System Simulation with Digital Computer - NusingDeo - Prentice Hall of India - 1979. • Computer Simulation and Modeling - Francis Neelamkovil - John Wilely& Sons - 1987. 			

Visvesvaraya Technological University, Belagavi.
PhD Coursework Courses – 2018 (Industrial and Production Engineering)
As per 2017 Regulation

06	16MPT13	Group-4	OPERATIONS MANAGEMENT
Exam Hours:03		Exam Marks:100	
Module -1			
<p>Understanding Operations: Introduction to operations management, manufacturing trends in India, Service as a part of operations management, operations as a key functional area, operations management: a systems perspective, operations management functions, challenges in operations management. Operational strategy: relevance of operations strategy, strategy formulation process, measure for operational excellence, options for strategic decisions in operations, break even analysis, cost versus flexibility trade off in operations strategy, related problems.</p>			
Module -2			
<p>Process and capacity analysis: process flow charting, planning premises and process implications, analyzing processes, business process Re Engineering, defining capacity, measure of capacity, time horizon in capacity planning, capacity planning framework, alternatives for capacity augmentation, decision tree for capacity planning, related problems.</p> <p>Design of manufacturing process: Determinant of process characteristics in operations, types of process and operations systems, process product matrix, layout planning, types of layouts, performance measure for layout design, design of process layouts, design of product layouts, approaches to layout design, technology issues in process design, complexity in operations management, related problems.</p>			
Module -3			
<p>Inventory planning and control: inventory planning for independent demand items, types of inventory, cost of inventory, inventory control for deterministic demand items, handling uncertainty in demand, inventory control systems, selective control of inventory, inventory planning for single period demand, related problems.</p>			
Module -4			
<p>Demand forecasting: forecasting time horizon, design of forecasting system, developing forecasting logic, sources of data, and models for forecasting, extrapolative methods using time series, causal methods of forecasting, accuracy of forecasts, using forecasting system, related problems.</p> <p>Aggregate production planning: planning hierarchies in operations, aggregate production planning, need, frame work for aggregate planning, alternatives for managing supply, basic strategies for aggregate production planning, aggregate production planning methods, OR tools for production planning, Master production scheduling, related problems.</p>			
Module -5			
<p>Resource planning: Dependent demand attributes, planning a framework, MRP Logic, MRP system, CRP, DRP, MRP II, ERP, Resources planning in services, related problems.</p> <p>Scheduling of operations: need for scheduling, loading of machines, scheduling context, scheduling flow shops, scheduling of job shops, input output control, operational control issues in mass production systems, operations planning and control based on the theory of constrains, related problems.</p>			
Question paper pattern:			
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 20 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. <p>The students will have to answer 5 full questions, selecting one full question from each module.</p>			
Reference Books:			
<ul style="list-style-type: none"> • Operations Management: Theory and Practice,- B. MAHADEVAN, Pearson Education India, 2010, ISBN 8131730700, 9788131730706 • Production And Operations Management: Edition 3 R. PANNEERSELVAM- PHI Learning Pvt, Ltd- 			

Visvesvaraya Technological University, Belagavi.
PhD Coursework Courses – 2018 (Industrial and Production Engineering)
As per 2017 Regulation

07	16MEM421	Group-4	INDUSTRIAL MARKETING
Exam Hours:03		Exam Marks:100	
Module -1			
<p>Introduction: The Industrial Marketing Concept Marketing System: Participant, Channels, Contracts of Sale, Franchise Agreements Loyalty, Confidence and Reciprocity.</p> <p>Demand and Product Characteristics: Market levels and product type. Derived demand; Influence of ultimate buyer, business conditions, Financial conditions, Influence of price.</p>			
Module -2			
<p>Industrial Customer: Buyer Motives: The core variables, Quality, Service, Price, Savings assurance of supply and buyer temperament, Buyer characteristics, Customer types.</p> <p>Marketing Strategy: The concept of strategy Mission Strategy, Operating, plans, Organizational Plan and logistical plans; choice of strategy components.</p>			
Module -3			
<p>The Channel Component: Industrial Distributors, Geographical Distributions, Size, Characteristics. Condition influencing channel structure, Intensive versus selective strategy.</p> <p>The Price Component: Condition affecting price: Condition affecting price: Competition, firm size product type, Direct and Indirect Costs. The nature of demand. Pricing decisions, New Markets versus established markets pricing policies; Net pricing; Discount pricing, trades discount, Quantity discounts and cash discounts. Legal considerations and pricing methods.</p>			
Module -4			
<p>The Promotional Component: Advertising functions, motivating distributions sales and message case of advertising agencies. Sales promotion and public relations promotional letters and novelties personal selling and selling support.</p>			
Module -5			
<p>Marketing Control: Strategic goals. Identifying market opportunity. Short-term goals expense based goals. The market and sales budget. Budgetary Control, the process of control. Comprising standards and performance. Corrective action.</p>			
Question paper pattern:			
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 20 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. <p>The students will have to answer 5 full questions, selecting one full question from each module.</p>			
TEXT BOOKS:			
<ol style="list-style-type: none"> 1. Industrial Marketing -Richard M. Hill.Ralph. S. Alexander and James S. Cross. Published by AITBS, New Delhi. 2. Industrial Marketing - Phadtare, PHI Pvt., Ltd. 3. Industrial Marketing - A process of creating and maintaining exchanges- Krishnamachryuly Csg, Lalitha R - Jaico Book House. 			

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PhD Coursework Courses – 2018 (Industrial and Production Engineering)
As per 2017 Regulation

08	16MPD11	Group-4	PRODUCT DESIGN AND DEVELOPMENT
Exam Hours:03		Exam Marks:100	
Module -1			
<p>Introduction: Characteristics of successful product development, Design and development of products, duration and cost of product development, the challenges of product development.</p> <p>Development Processes and Organizations: A generic development process, concept development: the front-end process, adopting the generic product development process, the AMF development process, product development organizations, the AMF organization.</p> <p>Product Planning: The product planning process, identify opportunities. Evaluate and prioritize projects, allocate resources and plan timing, complete pre project planning, reflect all the results and the process.</p>			
Module -2			
<p>Identifying Customer Needs: Gather raw data from customers, interpret raw data in terms of customer needs, organize the needs into a hierarchy, establish the relative importance of the needs and reflect on the results and the process.</p> <p>Product Specifications: What are specifications, when are specifications established, establishing target specifications, setting the final specifications.</p> <p>Concept Generation: The activity of concept generation clarify the problem, search externally, search internally, explore systematically, and reflect on the results and the process.</p>			
Module -3			
<p>Concept Selection: Overview of methodology, concept screening, and concept scoring,</p> <p>Concept Testing: Define the purpose of concept test, choose a survey population, choose a survey format, communicate the concept, measure customer response, interpret the result, reflect on the results and the process.</p> <p>Product Architecture: What is product architecture, implications of the architecture, establishing the architecture, variety and supply chain considerations, platform planning, related system level design issues.</p>			
Module -4			
<p>INDUSTRIAL DESIGN: Assessing the need for industrial design, the impact of industrial design, industrial design process, managing the industrial design process, assessing the quality of industrial design.</p> <p>Design for Manufacturing: Definition, estimation of manufacturing cost, reducing the cost of components, assembly, supporting production, impact of DFM on other factors.</p> <p>Prototyping: Prototyping basics, principles of prototyping, technologies, planning for prototypes.</p>			
Module -5			
<p>Product Development Economics: Elements of economic analysis, base case financial mode. Sensitive analysis, project trade-offs, influence of qualitative factors on project success, qualitative analysis.</p> <p>Managing Projects: Understanding and representing task, baseline project planning, accelerating projects, project execution, postmortem project evaluation.</p>			
Question paper pattern:			
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 20 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. <p>The students will have to answer 5 full questions, selecting one full question from each module.</p>			
TEXT BOOK:			
1. Product Design and Development - Karl.T.Ulrich, Steven D Eppinger - Irwin McGrawHill - 2000.			
REFERENCE BOOKS:			
1. Product Design and Manufacturing - A C Chitale and R C Gupta, PH1, - 3rd Edition, 2003.			
2. New Product Development - Timjones. Butterworth Heinmann -Oxford. UCI -1997			
3. Product Design for Manufacture and Assembly - GeofferyBoothroyd, Peter Dewhurst and Winston Knight - 2002			

Visvesvaraya Technological University, Belagavi.
PhD Coursework Courses – 2018 (Industrial and Production Engineering)
As per 2017 Regulation

01	16MPT41	Group-5	ADVANCED MANUFACTURING PRACTICES
Exam Hours:03		Exam Marks:100	
<p>Module -1: Need of CPC for a company, what CPC can do, CPC-getting the right tool. JIT – Introduction – The spread of JIT Movement, some definitions of JIT, core Japanese practices of JIT, Creating continuous Flow Manufacture, Enabling JIT to occur, Basic elements of JIT, Benefits of JIT. Just in Time Production – Primary purpose, profit through cost reduction, Elimination of over production, Quality control, Quality Assurance, Respect for Humanity, Flexible work Force, JIT Production Adapting to changing production Quantities, process layout for shortened lead Times, Standardization of operation, Automation. Sequence and scheduling used by suppliers: Monthly and daily Information. Sequenced withdrawal system by sequenced schedule table, problems and counter measures in applying the Kanban system to sub contractors.</p>			
<p>Module -2: Toyota Production System-The philosophy of TPS, Basic Frame work of TPS, Kanbans. Determining the Number of Kanbans in Toyota Production System. a) Kanban Number under Constant Quantity Withdrawal System. b) Constant Cycle, Non-constant Quantity Withdrawal System. Supplier Kanban and the Sequence Schedule for Use by Suppliers. a) Later Replenishment System by Kanban. a) Sequenced Withdrawal System. b) Circulation of the Supplier Kanban within Toyota. Production Smoothing in TPS Production Planning Production Smoothing Adaptability to Demand Fluctuations Sequencing Method for the Mixed Model Assembly Line to Realize Smoothed Production of Goal.</p>			
<p>Module -3: Just-in-Time Production with Total Quality Control just in time concept, cutting lot sizes, cutting set-up times, cutting purchase order costs, the JIT cause-Effect chain, Scrap/Quality Improvements, Motivational effects, Responsibility effects, small Group improvement Activities, withdrawal of Buffer Inventory, the total Quality Control Concept.</p>			
<p>Module -4: Total Quality Control-Introduction-Total Quality Control concepts, responsibility, learning from the west, TQC concepts categorized, Goals, Habit of improvement, perfection, Basics, process control, Easy to see Quality control as facilitator, small lot sizes, Housekeeping, Less than full capacity scheduling, Daily machine checking, Techniques and Aids, Exposure of problems, Fool proof Devices, Tools of Analysis, QC Circles, TQC in Japanese-owned US Electronics plant, TQC in Japanese-owned Automotive plants.</p>			
<p>Module -5: Plant Configurations: Introduction-ultimate plant configuration, job shop Fabrication, Frame Welding, Forming, Frame parts from Tubing, Dedicated production lines, overlapped production, the daily schedule, Forward Linkage by means of Kanban, physical merger of processes, Adjacency, mixed Models, Automated production Lines, Pseudo Robots, Robots, CAD and Manufacturing, Conveyors and stacker Cranes, Automatic Quality Monitoring.</p>			
<p>Question paper pattern:</p> <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 20 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. <p>The students will have to answer 5 full questions, selecting one full question from each module.</p>			
<p>TEXT BOOKS:</p> <ol style="list-style-type: none"> 1. Japanese Manufacturing Techniques - Richard Schonberger - Pearson Higher Education - ISBN: 0029291003 1982 2. Just In Time Manufacturing – Kargoanker (manual). 3. Wind-chill reference manual. <p>REFERENCE BOOKS:</p> <ol style="list-style-type: none"> 1. An Integrated Approach To Just In Time - Yasuhiro Monden - Toyota Production system. 2. Lean Thinking - James Womack - Simon & Schuster Adult - ISBN: 0743249275, 2003. 3. The machine that changed the World - James P. Womack, Daniel T Jones, and Daniel Roos - The story of Lean 			

Visvesvaraya Technological University, Belagavi.
PhD Coursework Courses – 2018 (Industrial and Production Engineering)
As per 2017 Regulation

production – by– Harper Perennial edition published -1991.

Visvesvaraya Technological University, Belagavi.
PhD Coursework Courses – 2018 (Industrial and Production Engineering)
As per 2017 Regulation

02	16MPD252	Group-5	VIRTUAL DESIGN AND MANUFACTURING
Exam Hours:03		Exam Marks:100	
Module -1			
Review of Computer Graphics: Review of computer graphics, 2D graphics.2D primitives and transformations. Algorithm to digitize the graphic entities, rasterization, 3D graphics. 3D primitives and transformations, projections and viewing, algorithms for hidden line removals, lighting. Shading and ray tracing.			
Module -2			
VR Devices: Input devices-track balls, 3D Mouse, data gloves, Virtual hand and trackers, output devices graph terminal, stereo glasses, head mounting devices, vision dome, caves.			
Module -3			
Applications: Virtual prototyping, behavior simulation, digital mockup, walk through/flythrough. Virtual training/simulation, micro electro mechanical systems and nanotechnology.			
Module -4			
Virtual Modeling language: History, Concepts, syntax, basic nodes-group, transform switch, LOD etc, geometry nodes-indexed face set, indexed line set, coordinate, coordindwx, textures etc. sensor nodes-time sensor touch sensor, sphere sensor, cylinder sensor and proximity sensor, scriping- VRML Script and JAVA Script.			
Module -5			
Tutorials and samples: VRML authoring tools-3D studio MAX, cosmo World, VRML Pad (editor) VRML Viewing tools-cosmo player, auto Vue, SGI's open inventor, virtual collaborative tools.			
Question paper pattern:			
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 20 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.			
REFERENCE BOOKS:			
1. Computer Graphics-Principles and practice - Janes D,Foley et al., - Second edition. in C,Addision –Wesley 1997.			
2. The VRML- 2.0 Hand book - Jed Hartman and Josie wernecke - Addision-Wesley -1997.			
3. The Annocated VRML 2.0 hand book Addision - R Carey and G Bell -Wesley 1997.			

Visvesvaraya Technological University, Belagavi.
PhD Coursework Courses – 2018 (Industrial and Production Engineering)
As per 2017 Regulation

03	16MEM151	Group-5	LEAN MANUFACTURING SYSTEMS
Exam Hours:03		Exam Marks:100	
Module -1			
<p>Just in time production system. JIT Logic -Pull system Japanese approach to production elimination of waste - JIT implementation requirements JIT application for job shops, Case studies</p> <p>Kanban system:-Kanban rules, supplier Kanban and sequence schedule used by supplier, Monthly information & daily information. Later replenish system by Kanban sequenced withdrawal P system by sequence schedule table -problems & counter measures in applying Kanban system to subcontractors - Supplier Kanban circulation in the paternal manufacturer -structure of supplier Kanban sorting office.</p>			
Module -2			
<p>The rise & fall of Mass Production Mass production, work force, organization, tools, product –logical limits of mass production, Sloan as a necessary compliment to Ford. Case study:- Rouge Production Plant.</p> <p>The rise of lean production: - Birth place, concrete example, company as community, Final assembly plant, product development and engineering. Changing customer demand, dealing with the customer and future of lean production.</p>			
Module -3			
<p>Shortening of production lead times -reduction of setup times, practical procedures for reducing setup time.</p> <p>Standardization of operations. Machine layout, multi-function workers and job rotation. Improvement activities to reduce work force and increase worker morale -foundation for improvements.</p>			
Module -4			
<p>Elements of lean production viz G M Framingharn -Toyota Takaoka Mass Production V /s lean production, diffusing lean production</p> <p>Managing lean enterprise:- Finance, Career ladders, geographic spread and advantages of global enterprise.</p>			
Module -5			
<p>Six sigma concepts: History, definitions, Statistical definitions, quality levels, Technical aspects, Six sigma for all: benefits to organizations, customers, suppliers and employers, Design for Six Sigma, DMAIC principles, DMADV principles, merits and demerits.</p>			
Question paper pattern:			
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 20 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. <p>The students will have to answer 5 full questions, selecting one full question from each module.</p>			
REFERENCE BOOKS:			
<ol style="list-style-type: none"> 1. Productions and Operations Management - Chasel Aquilino - 10th Edition. 2. Toyota Production System -An integrated approach to Just in Time - Yasuhiro Monden, - Engineering aild Management Press -Institute of Industrial Engineers – 1983. 3. James P Womack, Daniel T Jones, and Daniel Roos, “The Machine that changed the World. The Story of Lean Production -Harper Perennial edition published 1991. 4. Quality Function Development - James Bossert - ASQC Press 1991. <p>Straight talk on design of experiments - Launshy and Weese</p>			

Visvesvaraya Technological University, Belagavi.
PhD Coursework Courses – 2018 (Industrial and Production Engineering)
As per 2017 Regulation

04	16MPE14	Group-5	COMPUTER INTEGRATED MANUFACTURING AND AUTOMATION
Exam Hours:03		Exam Marks:100	
Module -1 Production Development Through CIM: Computers in Industrial manufacturing, Product cycle & Production development cycle, Introduction of CAD/CAM & CIM, sequential and concurrent engineering, soft and hard prototyping. Computer Process Monitoring: Process control methods, direct digital control, supervisory computer control, steady state optimal control, on line search strategies, adaptive control.			
Module -2 inspection methods, non-contact inspection methods, machine vision system, optical inspection method, sensors, coordinate, measuring machine, Computer-Aided testing, Integration of CAQL with CAD/CAM.			
Module -3 Computer Integrated Manufacturing: Fundamentals of CAD/CAM, Computerized Manufacturing planning systems, shop floor control & automatic identification techniques. Computer Network for manufacturing and the future automated factor.			
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 storage buffer single stage, Double stage, Multistage with problems, Automated assembly systems, Design for automated assembly, parts feeding devices, analysis of Multi station assembly machine, Analysis of Single stage assembly machine.			
Module -5 Automated Material Handling Storage: Material functions, types of material handling equipment, analysis of material handling systems, design of system, conveyor system, automated guided vehicle systems, automated storage/retrieval systems, caroused storage systems work in process storage, interfacing handling & storage with manufacturing.			
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 20 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. <p>The students will have to answer 5 full questions, selecting one full question from each module.</p>			
REFERENCE BOOKS: <ol style="list-style-type: none"> 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. Robot vision & Sensory Controls - Rooks B. - North Holland. - (ed) vol-3 			

Visvesvaraya Technological University, Belagavi.
PhD Coursework Courses – 2018 (Industrial and Production Engineering)
As per 2017 Regulation

05	16MPE21	Group-5	INDUSTRIAL ROBOTICS
Exam Hours:03		Exam Marks:100	
Module -1			
<p>FUNDAMENTAL CONCEPTS OF ROBOTICS: History, present status and future trends, Robotics. Robot, Definition. Robotics Systems and Robot Anatomy, Specification of Robotics. Resolution, Repeatability and Accuracy of a Manipulator</p> <p>ROBOT DRIVES: Power transmission systems and control Robot drive mechanisms, hydraulic-electric pneumatic drives. Mechanical transmission method – Rotary-to-Rotary motion conversion. Rotary-to-linear motion conversion end effectors – types-grip pind problem Remote-Centered compliance Devices-Control of Actuators in Robotic Mechanisms.</p>			
Module -2			
<p>SENSORS AND INTELLIGENT ROBOTS: Sensory devices – Non-optical-Position sensors – Optical position sensors – velocity sensors – proximity sensors: Contact and non-contact type-Touch and slip sensors – Force and Torque Sensors – AI and Robotics.</p> <p>COMPUTER VISION FOR ROBOTICS SYSTEMS: Robot vision systems – Imaging components –Image representation – Hardware aspects-Picture coding – Object Recognition and Categorization- Visual inspection – software considerations – applications – commercial – Robotics vision systems.</p>			
Module -3			
<p>COMPUTER CONSIDERATIONS FOR ROBOTIC SYSTEMS: Computer architecture for robots, hardware, Computational elements in robotic applications – Robot programming – sample programs path planning – Robot’s computer system.</p>			
Module -4			
<p>TRANSFORMATIONS AND KINEMATICS: Homogeneous Co-ordinates – Co-ordinate Reference Frames – Homogeneous Transformations for the manipulator – the forward and inverse problem of manipulator kinematics – Motion generation – Manipulator dynamics – Jacobian in terms of D.H.Matrices controller architecture.</p>			
Module -5			
<p>ROBOT CELL DESIGN AND CONTROL: Specifications of Commercial Robots – Robot Design and Process specifications – motor selection in the design of a robotic joint – Robot Cell layouts – Economic and Social aspects of robotics.</p> <p>APPLICATIONS OF ROBOTS: Capabilities of Robots – Robotics Applications – Obstacle avoidance – Robotics in India – The future of Robotics</p>			
Question paper pattern:			
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 20 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. <p>The students will have to answer 5 full questions, selecting one full question from each module.</p>			
TEXT BOOKS:			
<ul style="list-style-type: none"> • Robotics Engineering An integrated approach - Richard D Klafter, Thomas A Chmielewski, Michael Negin – Prentice Hall of India Pvt. Ltd. - Eastern Economy Edition, 1989. • Robotics: Control Sensing, Vision, intelligence - Fu KS Gomaler R C, Lee C S G – McGraw Hill Book Co. - 1987. 			
REFERENCE BOOKS:			
<ul style="list-style-type: none"> • Handbook of Industrial Robotics - Shuman Y. Nof - John Wiley & Sons, New York - 1985. • Robotics Technology and Flexible Automation - Deb SR - McGraw Hill BookCo. - 1994. 			

Visvesvaraya Technological University, Belagavi.
PhD Coursework Courses – 2018 (Industrial and Production Engineering)
As per 2017 Regulation

06	16MPE254	Group-5	AGILE MANUFACTURING
Exam Hours:03		Exam Marks:100	
Module -1 Introduction - What is agile Manufacturing? - Competitive environment of the future the business case for agile manufacturing conceptual frame work for agile manufacturing.			
Module -2 Four Core Concepts: Strategy driven approach - integrating organization, people technology interdisciplinary design methodology.			
Module -3 Agile Manufacturing and Change Management: The change implications. Post failures in advanced manufacturing, changes on the way, traditional management accounting, paradigm, investment appraisal, product costing - performance, measurement and control systems, Traditional organization, control technological and design paradigms traditional problems in workplace- organizational issues - role of technology.			
Module -4 Agile Manufacturing Enterprise Design: Agile manufacturing - enterprise design.. system concepts as the basic manufacturing theory - joint technical & organizational design and a model for the design of agile manufacturing enterprise, enterprise design process insights into design processes, what is interdisciplinary design, Main issues - simple design example.			
Module -5 Skill & Knowledge Enhancing Technologies for Agile Manufacturing: Skill and Knowledge enhancing Technologies - scheduling - technology design strategic-Design Concepts. Design and Skill of Knowledge enhancing Technologies for machine tool systems - Historical overview, Lessons, problems and Future development.			
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 20 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.			
REFERENCE BOOKS: <ul style="list-style-type: none"> • Agile manufacturing - Forging new Frontiers - Paul T. Kidd - Addison Wesley Publication - 1994. • Agile Manufacturing – Proceedings of International Conference - Dr. M.P Chowdiah (Editor) – Tata McGraw Hill Publications - 1996. • On agile manufacturing - Tata McGraw Hill Publications -1996 • Agile manufacturing - Forging Neat Furniture's - Paul T Kidd – Addition Wesley Pub – 1994. • World Class Manufacturing - Paul T Kidd - Washington: National - 1994 			

Visvesvaraya Technological University, Belagavi.
PhD Coursework Courses – 2018 (Industrial and Production Engineering)
As per 2017 Regulation

07	16MPE423	Group-5	RAPID PROTOTYPING
Exam Hours:03		Exam Marks:100	
Module -1			
<p>Introduction: Need for the compression in product development, history of RP systems, Survey of applications, Growth of RP industry, and classification of RP systems.</p> <p>Stereo Lithography Systems: Principle, Process parameter, Process details, Data preparation, data files and machine details, Application.</p>			
Module -2			
<p>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</p> <p>Solid Ground Curing: Principle of operation, Machine details, Applications.</p>			
Module -3			
<p>Laminated Object Manufacturing: Principle of operation, LOM materials. Process details, application.</p> <p>Concepts Modelers: Principle, Thermal jet printer, Sander's model market, 3-D printer. Genisys Xs printer HP system 5, object Quadra systems.</p>			
Module -4			
<p>Rapid Tooling: Indirect Rapid tooling -Silicone rubber tooling –Aluminum filled epoxy tooling Spray metal tooling, Cast kirksite, 3Q keltool, etc >Direct Rapid Tooling Direct. AIM, Quick cast process, Copper polyamide, Rapid Tool, DMILS, Prometal, Sand casting tooling, Laminate tooling soft Tooling vs. hard tooling.</p>			
Module -5			
<p>RP Process Optimization: factors influencing accuracy. Data preparation errors, Part building errors, Error in finishing, influence of build orientation.</p>			
Question paper pattern:			
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 20 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. Stereo lithography and other RP & M Technologies - Paul F. Jacobs - SME, NY 1996. 2. Rapid Manufacturing - Flham D.T & Dinjoy S.S - Verlog London 2001. 3. Rapid automated - Lament wood - Indus press New York			
REFERENCE BOOKS:			
1. Wohler's Report 2000 - Terry Wohlers - Wohler's Association -2000.			

Visvesvaraya Technological University, Belagavi.
PhD Coursework Courses – 2018 (Industrial and Production Engineering)
As per 2017 Regulation

08	16MSE423	Group-5	ADVANCED FLUID POWER SYSTEMS
Exam Hours:03		Exam Marks:100	
Module -1			
<p>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) Piston Pumps- Radial, Axial (Bent axis & Swash plate), Pump Performance, Pump Noise, Ripple in pumps. Hydraulic Actuators: Linear actuator- cylinders, Mechanics of Hydraulic cylinder loading, limited rotation hydraulic actuator, cylinder cushioning, Gear, Vane & Piston motor, Motor performance, Hydrostatic transmission.</p>			
Module -2			
<p>Power Controlling Elements – Valves : i) Directional Control Valves – Classification, 2/2, 3/2,4/2 & 4/3 ways Dcv’s, Different Centre configurations in 4/3 way valves, actuation of DCV’s, Indirect actuation, Valve Lap – Lap during Stationary and during switching. ii) Pressure Control Valves: Classification, opening & Closing Pressure difference, Cracking Pressure, Pressure Relief Valve – Simple & Compound type, Pressure reducing valve, sequence, unloading & Counter balance valve, 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.</p>			
Module -3			
<p>Hydraulic Circuit Design & Analysis: Control of Single & double acting cylinder, Regeneration circuit, cylinder sequencing & Synchronizing circuit. Speed control of cylinder & Motors, Analysis of Hydraulic system with frictional losses, Accumulators & accumulator circuits. Pneumatic System: Introduction, – Generation of compressed air, air receiver, servicing FRL unit, Air filter, pressure regulation, lubricator, Pneumatic cylinder & air motor – different types of cylinder, cushion assembly. Cylinder performance. Pneumatic Valve: Directional control valves, impulse valve, Quick exhaust valve, shuttle valve, Twin pressure valve, Time delay valve.</p>			
Module -4			
<p>Pneumatic Circuit & Logic Circuits:- Control of single and double acting cylinder, impulse operation, speed control, sequencing, Pneumatic Vacuum system AND,OR, NOT, NAND, NOR, YES Function, Logic circuits design using shuttle valve & twin pressure valve, Binary Arithmetic, logic & Boolean Algebra, use of kannough veitch map for pneumatic circuit design.</p>			
Module -5			
<p>Electrical Control in Fluid Power: Contactors, & Switches, Relays, Limit switch, Electro hydraulic & Electro Pneumatic Circuits, Simple Cylinder reciprocation, interlocking using relays, Proximity switches, application of proximity switches, Time dependent will dependent and travel dependent circuits.</p>			
Question paper pattern:			
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 20 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. <p>The students will have to answer 5 full questions, selecting one full question from each module.</p>			
REFERENCE BOOKS:			
<ol style="list-style-type: none"> 1. Fluid Power with Application - Anthony Esposito - Peason Education - 5th edition. 2. Oil hydraulics -Principles & maintenance - S.R. Majumdar - Tata M C Graw Hill 3. Components & Application - Bosch Rexroth didactic - Hydraulics Trainer - vol 1. Publication 4. Pneumatic System, Principles and Maintenance - S.R. Majumdar - Tata M C Graw Hill Publication. 5. Pneumatics: Theory and Applications - Bosch Rexroth didactic - Publication 6. Electro Pneumatics - Bosch Rexroth didactic - Vol. 2, Publication. 			

Visvesvaraya Technological University, Belagavi.
PhD Coursework Courses – 2018 (Industrial and Production Engineering)
As per 2017 Regulation

01	16MPE21	Group-6	INDUSTRIAL ROBOTICS
Exam Hours:03		Exam Marks:100	
Module -1			
<p>FUNDAMENTAL CONCEPTS OF ROBOTICS: History, present status and future trends, Robotics. Robot, Definition. Robotics Systems and Robot Anatomy, Specification of Robotics. Resolution, Repeatability and Accuracy of a Manipulator</p> <p>ROBOT DRIVES: Power transmission systems and control Robot drive mechanisms, hydraulic-electric pneumatic drives. Mechanical transmission method – Rotary-to-Rotary motion conversion. Rotary-to-linear motion conversion end effectors – types-grip pind problem Remote-Centered compliance Devices-Control of Actuators in Robotic Mechanisms.</p>			
Module -2			
<p>SENSORS AND INTELLIGENT ROBOTS: Sensory devices – Non-optical-Position sensors – Optical position sensors – velocity sensors – proximity sensors: Contact and non-contact type-Touch and slip sensors – Force and Torque Sensors – AI and Robotics.</p> <p>COMPUTER VISION FOR ROBOTICS SYSTEMS: Robot vision systems – Imaging components –Image representation – Hardware aspects-Picture coding – Object Recognition and Categorization- Visual inspection – software considerations – applications – commercial – Robotics vision systems.</p>			
Module -3			
<p>COMPUTER CONSIDERATIONS FOR ROBOTIC SYSTEMS: Computer architecture for robots, hardware, Computational elements in robotic applications – Robot programming – sample programs path planning – Robot’s computer system.</p>			
Module -4			
<p>TRANSFORMATIONS AND KINEMATICS: Homogeneous Co-ordinates – Co-ordinate Reference Frames – Homogeneous Transformations for the manipulator – the forward and inverse problem of manipulator kinematics – Motion generation – Manipulator dynamics – Jacobian in terms of D.H.Matrices controller architecture.</p>			
Module -5			
<p>ROBOT CELL DESIGN AND CONTROL: Specifications of Commercial Robots – Robot Design and Process specifications – motor selection in the design of a robotic joint – Robot Cell layouts – Economic and Social aspects of robotics.</p> <p>APPLICATIONS OF ROBOTS: Capabilities of Robots – Robotics Applications – Obstacle avoidance – Robotics in India – The future of Robotics</p>			
Question paper pattern:			
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 20 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. <p>The students will have to answer 5 full questions, selecting one full question from each module.</p>			
TEXT BOOKS:			
<ul style="list-style-type: none"> • Robotics Engineering An integrated approach - Richard D Klafter, Thomas A Chmielewski, Michael Negin – Prentice Hall of India Pvt. Ltd. - Eastern Economy Edition, 1989. • Robotics: Control Sensing, Vision, intelligence - Fu KS Gomaler R C, Lee C S G – McGraw Hill Book Co. - 1987. 			
REFERENCE BOOKS:			
<ul style="list-style-type: none"> • Handbook of Industrial Robotics - Shuman Y. Nof - John Wiley & Sons, New York - 1985. • Robotics Technology and Flexible Automation - Deb SR - McGraw Hill BookCo. - 1994. 			

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PhD Coursework Courses – 2018 (Industrial and Production Engineering)
As per 2017 Regulation

02	16MEM252	Group-6	PRODUCT LIFE CYCLE MANAGEMENT
Exam Hours:03		Exam Marks:100	
Module -1 Product life cycle management – Need for PLM, Components of PLM, Product Data and Product workflow, Drivers for Change, The PLM Strategy, Developing a PLM Strategy, a Five-step Process.			
Module -2 Strategy Identification and Selection, Strategy Elements, Implications of Strategy Elements, Policies, Strategy Analysis, Communicating the Strategy.			
Module -3 Change Management for PLM, Configuration management, and cost of design changes, schemes for concurrent engineering, Design for manufacturing and assembly, robust design.			
Module -4 Modeling, Current concepts, part design, sketching, use of datum's construction features, free ovalation, patterning, copying, and modifying features, reference standards for datum specification, Standards for Engineering data exchange.			
Module -5 Tolerance mass property calculations, rapid prototyping and tooling, finite modeling and analysis, general procedure, analysis techniques, Finite element modeling. Applicability of FEM, Static analysis, dynamic analysis.			
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 20 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.			
Reference books: <ol style="list-style-type: none"> 1. Product Lifecycle Management Paradigm for century Product Realization - John Stark, Springer-Verlag, 21st, London, 3rd printing -2006. 441 pp., ISBN: 1-85033-810-5. 2. CAD/CAM Theory and Practice -Zeid, McGraw Hill.- 1991. 3. Computer Integrated Design and Manufacturing, - Mark Henderson & Philip Wolfe, Bedworth McGraw hill inc.- 1991. 4. Part modeling Users Guide, Engineer - 1998. 			

Visvesvaraya Technological University, Belagavi.
PhD Coursework Courses – 2018 (Industrial and Production Engineering)
As per 2017 Regulation

03	16MPE23	Group-6	SURFACE TREATMENT & FINISHING
Exam Hours:03		Exam Marks:100	
Module -1 Fundamentals of Electro plating , galvanizing, Hot dip metal coating, thin coating, thin coating, chromium plating, Nickel plating.			
Module -2 Vacuum coating, FVD & CVD metal spraying - Methods, surface preparation, mechanical Properties of sprayed metals, plasma coating.			
Module -3 Plastic coating of metal - PVC coating Spherodising process details, phosphate coating - mechanism of formation. Testing of surface coating -methods.			
Module -4 Heat treatment methods , Annealing, Normalizing, Tempering, Case hardening methods, flame hardening sub zero treatment. Heat treatment methods for gears, spindles, cutting tools.			
Module -5 Advanced coating technologies: Hard facing, electro deposition technique, nanocoatings, coating Characterization.			
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 20 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.			
REFERENCE BOOKS: <ul style="list-style-type: none"> • Surface preparations & finishes for Metals - James A Murphy - McGraw Hill. • Principles of metal surface treatment and protection - Pergamon Press Gabe, David Russell -Description, Oxford ; New York - 2d ed., 1978. • Handbook of metal treatment and testing - John wiley& sons. 			

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PhD Coursework Courses – 2018 (Industrial and Production Engineering)
As per 2017 Regulation

04	16MPE13	Group-6	THEORY OF METAL FORMING
Exam Hours:03		Exam Marks:100	
Module -1			
Introduction to Forming process: Introduction to metal forming, Effect of temperature on forming process-hot working, cold working. Effect of Metallurgical structure, Effect of speed of deformation work of Plastic deformation, Friction in forming operation			
Module -2			
Forging: Classification, various stages during forging, Forging equipment, brief description, deformation in compression, forging defects. Residual stresses in forging.			
Module -3			
Rolling of Metals: Classification, forces and geometrical relationships in rolling. Variables in Rolling: Deformation in rolling, Defects in rolled products, Residual stresses in rolled products. Torque and Horsepower.			
Module -4			
Extrusion: Classification, Extrusion equipment, variables in extrusion, Deformation in extrusion, Extrusion defects, Work done in extrusion. Drawing: Principles of Rod and wire drawing, variables in wire drawing, Residual stresses in rod, wire and tube drawing, Defects in Rod and wire drawing.			
Module -5			
Sheet Metal Forming: Introduction, Forming methods, shearing and Blanking, Bending, stretch forming, Deep drawing, redrawing operations, Defects in formed products.			
Question paper pattern:			
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 20 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.			
REFERENCE BOOKS:			
1. Mechanical Metallurgy - Dieter G.E. - Mc Graw Hill Publications.			
2. Principles of Metal Working - R.Rowe - Arnold London – 1965.			
3. Metals Handbook – ASM - Volume II -.ASM			
4. Fundamentals of working of Metals - Sach G. - Pergamon Press.			

Visvesvaraya Technological University, Belagavi.
PhD Coursework Courses – 2018 (Industrial and Production Engineering)
As per 2017 Regulation

05	16MPE151	Group-6	APPLIED PROBABILITY AND STATISTICS
Exam Hours:03		Exam Marks:100	
Module -1			
Introduction to statistics: Statistical Thinking, Collecting data, Statistical Modeling Frame work, measure of central tendency and variance, Importance of Data summary and Display, Tabular and Graphical display.			
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, Binominal distribution, Hyper Geometric distribution, Poisson distribution, Applications.			
Module -3			
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, Exponential distribution.			
Module -4			
Testing of Hypothesis: Estimation theory, 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, Testing for Goodness of Fit, 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.			
Module -5			
Simple Linear Regressions and Correlation: Simple Linear Regression, Properties of Least square Estimators and Estimation of variances, Transformations to a straight line, Correlation.			
Multiple linear regressions: Multiple linear regressions model, least square estimation of parameters, Matrix approach to multiple linear regression, properties of least square estimators and estimation of variance.			
Question paper pattern:			
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 20 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. 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. Statistics for Management, Richard I Levin, David S Rubin, 6th Edn, Prentice Hall India, ISBN-81-203-0893- X.			
REFERENCES:			
1. Probability and Statistics in Engineering - William W Hines, Douglas C Montgomery - John Wiley and Sons - 2nd Edn.			
2. Business Statistics for Management and Economics - Daniel, Terrell - Houghton Mifflin Company - 6 th Edn, ISBN-0-395-62835-0.			
3. Probability and Statistics - by Walpole & Mayer - MacMillan Publishing Company - 1989.			

Visvesvaraya Technological University, Belagavi.
PhD Coursework Courses – 2018 (Industrial and Production Engineering)
As per 2017 Regulation

06	16MPE153	Group-6	QUALITY AND RELIABILITY ENGINEERING
Exam Hours:03		Exam Marks:100	
Module -1 Quality Control, Reliability concepts. Concepts in Probability and Statistics : Events, Sample Space, Probability rules, Conditional probability, Dependent and Independent Events, Application of Probability concepts in Quality Control, Problems			
Module -2 Introduction to Probability Distributions: Normal, Poisson and Binomial distribution. Control Charts: Variable Chart – X Bar chart, R-chart and Sigma chart. Attribute Chart: P – Chart, nP -Chart, C-Chart and U – Chart.			
Module -3 Acceptance Sampling: Fundamentals of acceptance sampling, types of acceptance sampling, O.C Curve, AQL, LTPD, AOQL. Failure Data Analysis : Introduction, Failure Data, Quantitative measures, MTTF, MTBF, Bathtub Curve, Mean Life, Life Testing, Problems, Introduction to Failure Mode and Effect Analysis.			
Module -4 System Reliability: Series, parallel and mixed configuration, Block diagram concept, r- out-of-n structure solving problems using mathematical models. Reliability Improvement and Allocation : Difficulty in achieving reliability, Methods for improving reliability during design, Different techniques available to improve reliability, Optimization, Reliability-Cost trade off, Prediction and Analysis, Problems.			
Module -5 Maintainability and Availability: Introduction, Formulas, Techniques available to improve maintainability and availability trade-off among reliability, maintainability and availability, Simple problems.			
Question paper pattern: <ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 20 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. <p>The students will have to answer 5 full questions, selecting one full question from each module.</p>			
REFERENCE BOOKS: <ol style="list-style-type: none"> 1. Quality Planning and Analysis - Tata McGraw - Juran, J.M and Gryna, F.M. - Hill publishing Company Ltd., New Delhi, India – 1982. 2. Maintainability and Reliability Handbook of Reliability Engineering and Management - Editors –Ireson. W.G. and Cooms - C.F. McGraw - Hill Book Company Inc. – 1988. 3. Concepts in Reliability Engineering- Srinath L S - Affiliated East-West Press Private Limited, New Delhi, India. – 1985. 4. An Introduction to Reliability and Maintainability Engineering - TMH Charles Ebeling - Tata Mcgraw Hill – 2000. 5. Reliability Engineering - A K Govil - Prentice Hall – 1981. 			

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PhD Coursework Courses – 2018 (Industrial and Production Engineering)

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07	16MEM23	Group-6	TOTAL QUALITY MANAGEMENT
Exam Hours:03		Exam Marks:100	
Module -1			
<p>Introduction: BUSINESS EVOLUTION The Evolution of the Customer Satisfaction Concept: Evolution of Customer Satisfaction Methods, Evolution of Company Integration, Continuing Evolution Survival in a Rapidly Changing World: Practice Systematic Development of Skill, Treat Management as a Coherent System, Focus on People and Their Purposes, Integrate Best Practices, Financial Benefit Developing a Unique Organizational Capability: Four Practical Revolutions in Management, Evolution of Our Understanding, Four Levels of Practice.</p>			
Module -2			
<p>The First Revolution: CUSTOMER FOCUS Change in the Work Concept: Market-in, Customers, Philosophy-in and Philosophy-out Evolution of Customer Focus and Its Challenges: Three Stages of Customer Focus, Customer Concerns, Integration of Concerns, Individualizing Customers.</p>			
Module -3			
<p>The Second Revolution: CONTINUOUS IMPROVEMENT Improvement as a Problem-Solving Process: Management by Process, WV Model of Continuous Improvement, Continuous Improvement of Processes for All Types of Work, Continuous Improvement and the Scientific Method Managing Existing Processes Process Discovery and Management: Thinking In Terms of Process, Process Discovery Process Control and Variation: A Typical Example of (Mishandling) Variation, Making the Most of Variation, Process Control and Process Improvement Reactive Improvement and the 7 Steps Method; Identifying the Problem, Standard Steps and Tools, The 7 Steps: A Case Study, The 7 QC Tools Management Diagnosis of the 7 Steps of Reactive Improvement: General Guidelines for Managers Diagnosing a QI Story, Step-by-Step Guidelines for Managers Diagnosing a QI Story. Process Management Mobilization Case Study, Planning Projects or Tasks: The 9 Steps Compared with the 7 Steps, the 9 Steps Mobilization at Teradyne, A Teradyne Illustration of the 9 Steps Use, Relationship of the 9 Steps to Other Methods Proactive Improvement: Collecting Data for Proactive Improvement, Language Data and Use of Semantics, Toward Standard Tools and Steps for Proactive Improvement, Customer Visitation as a Method of Collecting Proactive Improvement Data, Applying Proactive Improvement to Develop New Products.</p>			
Module -4			
<p>The Third Revolution: TOTAL PARTICIPATION Engagement and Alignment of Organization Members: Engaged Employees for a Rapidly Changing World, Explicit Joining of Improvement and Routine Work, Processes and People Coordinating Behavior: Societal Networking Case Study of the CQM Study Group on Conversation, Expansion of the Principles of Semantics, Some Types and Models of Conversations Leading Change: Technical Skill, Human Skill, Conceptual Skill Self-Development, Team Skill Development, Initiation Strategies; CEO Involvement, Infrastructure for Mobilization: Create Explicit Structures for Mobilization, A General Model for Mobilization: The 7 Infrastructures, Phase-In: Orientation Phase, Empowerment Phase, Alignment Phase, Evolution of the Parallel Organization, Common Patterns of Phase-In U.S. Focused Strategies for Phase-In: Benchmarking, Six Sigma, Cycle-Time Reduction Hoshin Management: Hoshin Management and Its Parts, Management by Objectives and Conventional Business Planning, Hoshin Management at Analog Devices Leading Process Improvement: Modeling Personal Improvement, Employee Development at NIMS, Company Strategies, Individual Practice of CAPD by Managers.</p>			
Module -5			
<p>The Fourth Revolution: SOCIETAL NETWORKING Networking and Societal Diffusion: Regional and National Networking the Japanese Model, Taking a Lesson from Japan—CQM, Comparison of National Methods, Use of Indirect Influence Ongoing Integration of Methods: Applying Idealized Design to Hoshin Management, Structural Process Improvement Case Study, SerVend Case Study.</p>			
Question paper pattern:			
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 20 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 Book:			
1 “Four Practical Revolutions in Management systems for creating unique organizational capability” -Shoji Shiba and			

Visvesvaraya Technological University, Belagavi.
PhD Coursework Courses – 2018 (Industrial and Production Engineering)
As per 2017 Regulation

David Walden,–Productivity Press & Center for Quality Management, (USA) , 2001, ISBN-9781563273889/9781563272172/ 9781563272318

Reference Books

1. “Management for Total Quality”-N Logothetis-Prentice Hall of India, New Delhi, 2003,ISBN-81-203-1137-X
2. “Total Quality Management”-Besterfield, Pearson Education, 2011. ISBN, 817758410X, 9788177584107

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08	16MPD254	Group-6	NON-TRADITIONAL MACHINING PROCESS
Exam Hours:03		Exam Marks:100	
Module -1			
<p>Introduction: Need for non-traditional machining processes.</p> <p>Mechanical Process: Ultrasonic Machining-Definition-Mechanism of metal elements of the process- Tool feed mechanism. theories of mechanics of causing effect of parameter applications.</p>			
Module -2			
<p>Abrasive Jet Machining: Principles - parameters of the process applications-advantages and disadvantages.</p> <p>Thermal Metal Removal Process: Electric discharge machining Principle of operation – mechanism of metal removal basic EDM circuitry-spark erosion get Analysis of relaxation type of circuit material removal rate in relaxation.</p>			
Module -3			
<p>Electro chemical and chemical processes: Electro chemical machining (ECM) Classification ECM process-principle of ECM Chemistry of the ECM parameters of the processes-determination of the metal removal rate - dynamics of ECM process-Hydrodynamics of ECM process-polarization-.Tool Design-advantages and disadvantages - applications. Electro Chemical Grinding-Electro Chemical holding Electrochemical deburring.</p>			
Module -4			
<p>Chemical Machining: Introduction-fundamental principle types of chemical machining Maskants- Etches-Advantages and disadvantages-applications.</p> <p>Plasma arc Machining: Introduction-Plasma-Generation of Plasma and equipment Mechanism of metals removal, PAN parameters-process characteristics - type of torches applications.</p>			
Module -5			
<p>Electron Beam Machining (EBM): Introduction-Equipment for production of Electron beam - Theory of electron beam machining Thermal & Non thermal types characteristics - applications.</p> <p>Laser Beam Machining (LBM): Introduction-principle of generation of lasers Equipment and Machining procedure-Types of Lasers-Process characteristics-advantages and limitations-applications</p> <p>Ion Beam Machining: Introduction-Mechanism of metal removal and associated equipment-process characteristics applications</p>			
Question paper pattern:			
<ul style="list-style-type: none"> • The question paper will have ten questions. • Each full question consists of 20 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. <p>The students will have to answer 5 full questions, selecting one full question from each module.</p>			
REFERENCE BOOKS:			
<ol style="list-style-type: none"> 1. New technology Institution of Engineers - Bhattacharya - India 2. Production Technology - HMT - Tata Mc Graw Hill - ISBN-10; 0070964432 3. Modern Machining Process - P.C Pandy & H.S. Shan - Tata McGraw Hill - ISBN: 0070965536 - Publishing Date: Feb-80 4. Metals Hand Book - ASM - Vol-3. 5. Modern Manufacturing Method - Adithan - New Age International (p) Limited - ISBN: 8122408176, 2007. 6. Modern Machining Processes - P.K. Mishra - Narosa Publishing House, New Delhi - 1997. 			