COURSE STRUCTURE & SYLLABUS

Ph.D. Programme

Department of Mechanical Engineering

COURSE STRUCTURE & SYLLABUS

CREDIT COURSES

COMPULSORY SUBJECT

PMG-1001 Research Methodology

DISCIPLINE / SPECIALIZATION SUBJECTS

Mechanical Engineering

(Any two of the following)
PME-1001 Competitive Manufacturing Strategies and Group Technology.
PME-1002 Numerical Techniques and Soft Computing.
PME-1003 Metal Working Tribology.
PME-1004 Production Toolings.
PME-1005 Accuracy Inspection and Measurements.
PME-1006 Value Engineering & Cost Control
PME-1007 Optimization Techniques

Computer Engineering & Applications

PCS-901 Image Processing and Computer Vision.
PCS-902 Advances in Software Engineering.

Business Management

PBA-902 Computer Applications in Research.
PBA-903 Research Methodology in Management Science.

English

(Any two of the following)
PAE-902 20th Century Critical Approaches to Literature.
PAE-903 World Literature Through Translation.
PAE-904 Indian Writing in English.

Physics

PAP-902 Solid Earth Geophysics and Seismo Electromagnetics.
PAP-903 Instrumentation and Signal Processing.

Biotechnology, Pharmacy & Chemistry

(Any two of the following)
PBS-902 Bioinformatics & Instrumentation
PBS-903 Basic Biological Chemistry
PPS-903 Advanced Organic Chemistry

AUDIT COURSES

PME 1081 Computer Programming/Soft Computing Laboratory
PME 1082 Creativity and Innovation

COMPULSORY SUBJECT

PMG-1001 RESEARCH METHODOLOGY

Module No.	Contents	Teaching Hours
I	**Unit-I** Introduction of research, types of research, research process, research design research approaches, criteria of good research. Plagiarism – definition, forms of plagiarism, consequences of plagiarism, unintentional plagiarism, copyright infringement, collaborative work.	15
II	**Unit-II** Data collection, sampling & sampling design-probability sampling, non probability sampling. Statistical tools and techniques: Measures of dispersion, correlation, regression, hypothesis testing parametric tests, construction of control charts. Simulation and numerical methods. Experimental designs and analysis. Development of theory and linkages and interpretation of results. Concepts of Artificial intelligence and associated techniques.	15
III	**Unit-III** Identifying and Defining Research problems, Setting feasible goals & objectives, Improving reading, writing and speaking skills. Principles of research paper, report and thesis writing. Guidelines according to style manuals, report format- writing and presentation of preliminary, main body and references section of report, Bibliography and Annexure in the Report. Development of research proposals and patents.	15

BOOKS/ REFERENCES:

1. Panneer Selvam – Research Methodology, Prentice Hall of India, Edition 2008.
2. Kothari V.R. – Research Methodology Methods & Techniques, New Age International Publishers, 2nd Edition, 2006.
3. Gupta and Singh – Research Methodology, Vayu Education of India, New Delhi.
4. Bhattacharya, D.K. (2004) – Research Methodology, New Delhi, Excel Books.
5. R. Pannerselvam – Research Methodology, Prentice Hall of India Pvt. Ltd., New Delhi, 2004.
6. Cooper and Schindler – Business Research Methods, Tata McGraw Hill, 9th Edition.
7. Srivastava and Shailaja – Business Research Methodology, Tata McGral Hill, New Delhi.
8. R.S. Dwivedi – Research Methodology in Behavioural Science, McMillan India Ltd. New Delhi, 2005.

DISCIPLINE / SPECIALIZATION SUBJECTS

PME-1001 COMPETETIVE MANUFACTURING STRATEGIES AND GROUP TECHNOLOGY

Module No.	Contents	Teaching Hours
I	**Unit-I** Manufacturing Strategy: Conceptual framework and competitive environment, manufacturing problems, Manufacturing Audit and strategy formulation, Diagnostic review and opportunity assessment Technological strategy: Strategic planning, product and process design for improved Manufacturability and producibility, identification and assessment of new technologies.	15
II	**Unit-II** Value Engineering: Concept of Value & function, reasons for unnecessary cost, methodology & techniques, acceptance problems, value engineering effectiveness, profit impact of value engineering, industrial and business applications. Lean Manufacturing: concept, goals, components, tools and techniques, JIT, KANBAN system, waste reduction.	15
III	**Unit-III** Cellular manufacturing and Group technology: Part family, part classification and grouping, classification and coding systems, benefits and economics of grouping, cell formation. Six sigma as manufacturing strategy: Concept, methodology and applications SIPOC analysis, focused manufacturing, agile manufacturing, intelligent manufacturing, digital manufacturing and factories of future.	15

BOOKS/ REFERENCES:

1. Skimmar,Wickham, Manufacturing in the corporate Strategy, John Wiley and sons, NewYork.
2. Hearm Buck and Butler, D.M. “Economic product Design”, Colhins, London.
3. Cluttarbuck, “JIT – A Global Status Report, IFS publications.

PME-1002 NUMERICAL TECHNIQUES AND SOFT-COMPUTING

Credits: 04 **L–T–P: 3–1–0**

Module No.	Contents	Teaching Hours
I	**Unit-I** Numerical Techniques: Interpolation & extrapolation, Finding roots of equation & optimization. Least-square-fitting. Laplace-Transform as (non-numerical) solution of differential equations. Numerical Differentiation and Integration, Solving Differential Equations numerically. FDM introduction & applications.	15
II	**Unit-II** Artificial Neural Network: Concept of Artificial-Neural-Network (ANN), supervised, unsupervised learning & reinforced learning, types of activation function. Back-propagation algorithm for ANN and possible applications.	15
III	**Unit-III** Fuzzy set theory, Fuzzy relation, Operation on Fuzzy Relation, α-Cuts of Fuzzy Relation, Composition of Fuzzy Relations, Fuzzy Logic & Controller: Concept of Fuzzy-Logic, Fuzzy Inference System with Fuzzy Application. Basic concepts, working principle & procedures of Genetic Algorithm (GA), flow chart of GA, Genetic representations, (encoding) Initialization and selection, Genetic operators Cross over - Mutation – Reproduction, Generational Cycle, Fitness Computations, applications.	15

BOOKS/ REFERENCES:

1. Yaswant Kanetkar, Let us C, BPB Publications
2. Balaguruswamy, C++ with OOPs'
3. Rajaraman, Numerical Methods,
4. Kalyanmoy Deb, Optimization Methods, Prentice Hall of India
5. Rao & Rao, C++ Neural Network and Fuzzy Logic, BPB Publications
6. Rajasekaran and Vijayalakshmi Pai, Neural Network, Fuzzy Logic and Genetic Algorithm, PHI Learning

PME-1003 METAL WORKING TRIBOLOGY

Module No.	Contents	Teaching Hours
I	**Unit-I** Basic concepts, Definition and scope of tribology in engineering applications. Work die interface, interaction between lubricant, workpiece and die, Hydrodynamic action at work-die interface. Interfacial friction: mechanisms of friction applicable to forming processes, effect on pressure and die loads. Wear and wear prevention techniques, wear and its classification, Adhesive wear, Abrasive wear, Erosive wear, Corrosive wear, Cavitation wears, Fatigue wear, Fretting wear. Altering the surface chemistry, Adding a layer of material to the surface.	15
II	**Unit-II** Lubrication in metal working: Different regimes of lubrication, Stribeck curve for lubrication regime, attributes of a good lubricant, properties, composition and characteristics. Lubricants for industrial processes, e.g. rolling, forging, extrusion, sheet metal etc.	15
III	**Unit-III** Analysis of basic processes under different tribological conditions, governing equations, yield criteria & flow rules, Reynold's equation. Analysis of pressure distribution & die loads for rolling, forging, wire drawings, extrusion. Hydrostatic extrusion, hydrodynamic wire drawing, water hammer forming, melt spin process.	15

BOOKS/ REFERENCES:

1. Metal Deformation Processes, Friction and lubrication J.A. Schey, Marcel Debber, INC, New York
2. Principles of Metal Working Surender Kumar, PHI
3. Tribology in Metal Working John A. Schey, ASME ,OMIO

PME-1004 PRODUCTION TOOLINGS

Module No.	Contents	Teaching Hours
I	**Unit-I** Jigs & Fixtures: Types and applications. Principle of design and constructions, Location and clamping. Design of turning, Milling, Drilling & Indexing Jigs and fixtures. Hydraulic, Pneumatic and pneumohydraulic devices for jigs and fixtures.	15
II	**Unit-II** Press Dies: Classification of dies, components of dies assembly, Simple dies, compound dies, combination dies and progressive dies. Punch and die clearance, centre of pressure, calculation of blank diameter. Design of cutting dies, forming dies and progressive dies. Dies for metal powder performs, design considerations, Basic models of flow & preform design.	15
III	**Unit-III** Cutting Tools: Design of tools for the production of holes, surfaces of revolution, and flat surfaces like single point tools, form tools, drills, milling cutters. Materials for cutting tools, cutting dies and forming dies, Economics of Tooling. Plastics as a tooling material.	15

BOOKS/ REFERENCES:

1. Production Engineering Design (Tool Design) Umesh Chandra & Surender Kumar, Satya Prakashan, New Delhi.
2. Tool Design by C. Donaldson G.H.Lecain and V.C.Goold, Tata McGraw Hill
3. Jigs & Fixtures Fred H. Colvin
4. Basic Die Making Osterguard E., Mc-Graw Hill Book Co.
5. Metal Cutting & Tool Design V.Arshinov, Mir Publication.
6. Properties and Selection of Tool Material Kortesoja, Victor A., ASM.

PME-1005 ACCURACY, INSPECTION & MEASUREMENT

Module No.	Contents	Teaching Hours
I	**Unit-I** Product and its elements, component parts and units, classification of units as assemblies and sub-assemblies, assembly flow charts – content and purpose. Concept of precision, accuracy and measurement, accuracy and manufacturing errors, control of process variability. Errors and their measurement, general characteristics of errors occurring in manufactured parts and assemblies, concept of dimension chain and its application.	15
II	**Unit-II** Manufacturing and assembly line practices, types of manufacturing process and their accuracy. Measurement system – calibration, uncertainty of measurement, traceability, repeatability and reproducibility, standards of measurement. Gauges, limits, fits and tolerances. Taylor's principle of gauging.	15
III	**Unit-III** Surface quality of workpieces, surface, surface microgeometry, effect of surface quality on the functional properties. Surface finish and its measurement. Application of sensor and transducer technology in measurement.	15

BOOKS/ REFERENCES:

1. W Grant and E L Grant. **Handbook of Industrial Engineering and Management**. Prentice Hall of India (P) Ltd. New Delhi.
2. R K Jain. **Engineering Metrology.** Khanna Publishers (P) Ltd., Delhi.
3. K J Hume. **Engineering Metrology.** McDonald & Co.
4. I C Gupta. **Engineering Metrology.** Dhanpat Rai & Sons, Delhi.

PME-1006 VALUE ENGINEERING AND COST CONTROL

Module No.	Contents	Teaching Hours
I	**Unit-I** Concept and utility milestones of VE value and function, value ratio, Value determination and value assessment, Reasons for poor value and unnecessary cost, major principles and commandants of VA/VE, leader thoughts in VE, Value analysis team, VE and standardization. Methodology and techniques used in VE/VA, waste and its elimination, procedural model and different phases, DARSIRI method, creative and judicial mind.	15
II	**Unit-II** Exchange process between customer and industry, product life cycle, modular products and size ranges, product profit planning, product improvement and development, product design for competitive advantage. Need analysis and generation of ideas preparation of specifications. Cost reduction and Cost control, Cost system, elements of cost, standard cost, calculation of selling price, total life cycle costing objectives and techniques of cost control creativity and brainstorming, requirements of creativity, process of creativity characteristics of creative people.	15
III	**Unit-III** VE as a decision support system, Acceptance problems, effectiveness measurement and profit impact of VE/VA. Applications in Industrial and Business operations, making VE projects more cost effective, design of worksheets for VE projects, situational case studies and industrial problems.	15

BOOKS/ REFERENCES:

1. Iyer, K.S., "Value Engineering".
2. Kumar S. and Agrawal A., "Value Engineering & Cost Control", Dhanpat Rai & Co., New Delhi.
3. R.S. Dwivedi – Research Methodology in Behavioural Science, McMillan India Ltd. New Delhi, 2005.

PME-1007 OPTIMIZATION TECHNIQUES

Module No.	Contents	Teaching Hours
I	**Unit-I** **Introduction:** Introduction to optimization, Classical Optimization techniques, unconstrained optimization, constrained optimization. **Interpolation and Approximation:** Lagrange's and Newton-divided difference formula, Newton interpolation formula for finite differences, Gauss's forward and backward interpolation formula, Stirling's and Bessel's formula, Curve fitting- Method of Least squares. **Numerical Differentiation and Integration**: Numerical differentiation using different operators, Trapazoidal rule, Simpon's 1/3 and 3/8 rules, Boole's rule and Weddle's rule.	15
II	**Unit-II** **Solution of algebraic and transcendental Equation:** Newton-Raphson method, Bisection method, False-Position method and Graeffe's root square method. **Solution of Linear simultaneous Equations:** Cholesky's (Crout's) method, Gauss elimination method, Gauss-Seidel iteration and relaxation method. **Finite Element Method (FEM):** Introduction and Applications of FEM	15
III	**Unit-III** **Artificial Neural Network (ANN):** Concept of Artificial Neural Network (ANN) supervised & unsupervised learning. Back propagation algorithm (computer program) for ANN and possible applications. **Fuzzy Logic**: Concept of fuzzy logic. **Non-Traditional Optimization (Genetic-Algorithm and simulated-Annealing):** Introduction to global optimization techniques such as Genetic-Algorithm (GA) and Simulated-Annealing.	15

BOOKS/ REFERENCES:

1. 'Engineering Optimization' by S.S. Rao, New Age publishers
2. 'Numerical Methods by B.S. Grewal, Khanna Publications
3. 'Numerical Methods by A.D. Booth, Academic Press, NY
4. 'Numerical Methods for Engineers' by S.K. Gupta, Willy Eastern Ltd.
5. 'Neural Network, Fuzzy Logic and Genetic Algorithm' by Rajasekaran and Vijayalakshmi pai, PHI Learning.
6. 'C++ Neural Network and Fuzzy Logic', by Rao and Rao, BPB Publications.