

Bharati Vidyapeeth Deemed University

Faculty of Engineering and Technology

Revised Structure of Ph. D. Coursework

Production Engineering

(With effect from Academic Year 2017-18)

Sr. No.	Subject	Teaching Scheme		Examination Scheme (marks)			Credits
		L	P/D	Theory Examination	Presentations	Total	
1	Paper –I: Research Methodology	4	-	100	-	100	04
2	Paper- II: Advances in Production Engineering	4	-	100	-	100	04
3	i) Literature survey presentation	-	02	--	50	50	02
	ii) Presentation of idea of research*	-	02	--	50	50	02
Total		08	04	200	100	300	12

Note: *- The student will have to give presentation based on the literature survey and idea of research and shall submit copy of the presentation to the respective Head of the Constituent Unit which is his/her place of research.

Ph.D. Course-work Syllabus for Production Engineering

Paper-I: Research Methodology		
<u>TEACHING SCHEME:</u>	<u>EXAMINATION SCHEME:</u>	<u>CREDITS ALLOTTED:</u>
Lectures: 4 Hours/Week	Theory Examination: 100 Marks	Total Credits: 04
	Duration : 3Hrs	
<p>Course Objectives:</p> <ul style="list-style-type: none"> • begin to formulate researchable problem in areas of research interest; • write a research proposal or report; • make appropriate choices about research strategies; • review literature judiciously and systematically; • understand and begin to apply the principles of collecting suitable data; • understand and begin to conduct appropriate analyses of data; • make appropriate choices about quantitative methods; • demonstrate sensitivity to ethical issues raised by researchers; 		
Topics Covered		
UNIT-I	<p>Types and Characteristics of Research Definition and objectives of research, Characteristics of research, Types of research- Descriptive <i>vs.</i> Analytical, Applied <i>vs.</i> Fundamental, Quantitative <i>vs.</i> Qualitative, Conceptual <i>vs.</i> Empirical, Overview of research methodology in various areas of engineering, Introduction to problem solving, basic research terminology such as proof, hypothesis, lemma etc., Role of information and communication technology (ICT) in research.</p>	(6 Hours)
UNIT-II	<p>Review of Literature Importance of literature review in defining a research problem, sources of literature, identifying the gap areas from the literature review Searching for publications: Publication databases, search engines and patent databases etc.</p>	(6 Hours)
UNIT-III	<p>Research Problem Formulation Research problem formulation, determine the scope, objectives, limitations and assumptions of the identified research problem, justify basis for assumption, developing the objectives Developing a research plan: Exploration, description, diagnosis and experimentation</p>	(6 Hours)
UNIT-IV	<p>Methods of Data Collection Static and dynamic characteristics of instruments used in experimental set up, calibration of various instruments, sampling methods, various methods of data collection, selection of appropriate method for data collection, data collection using a digital computer system, case studies of data collection.</p>	(6 Hours)
UNIT-V	<p>Inferential Statistics and Hypothesis Testing Data processing, data analysis strategies and tools, Basic concepts</p>	(6 Hours)

	concerning testing of hypotheses, procedures of hypothesis testing, generalization and interpretation, Hypothesis testing: Z-test, T-test, Chi Square test, Analysis of variance (ANOVA) etc.	
UNIT-VI	Quantitative Methods and Applied Statistics Measurement of central tendency and dispersion, Probability distribution, Regression analysis, Parameter estimation, Multivariate statistics, Principal component analysis, moments and response curve methods, probable errors in research, error analysis, Hidden Markov Model (HMM)	(6 Hours)
UNIT-VII	Computer Applications Role of computers in research, maintaining literature data using software tools such as Mendeley, Endnote2 etc., tabulation and graphical presentation of research data, use of statistical software tools such as Excel, R, SPSS, GRETL, MINITAB etc. in research, use of word processing tools such as Latex, software tools for making effective presentation.	(6 Hours)
UNIT-VIII	Developing Research Report: Structure and components of scientific reports, types of report, developing research report. Thesis Writing: Different steps and software tools in the design and preparation of thesis, layout, structure and language of typical reports, Illustrations and tables, bibliography, referencing and footnotes. Oral Presentation: Creating and making effective presentation, use of visual aids, importance of effective communication.	(6 Hours)
UNIT-IX	Research Ethics and IPR Ethics: ethical issues in research, plagiarism tools and its importance. IPR: intellectual property rights and patent law, techniques of writing a Patent, filing procedure, technology transfer, copy right, royalty, trade related aspects of intellectual property rights.	(6 Hours)
UNIT-X	Publishing of research work Design of conference and journal research paper, design of review paper, effective way of writing abstract, introduction, result and discussion and conclusion in research papers, answering the queries of reviewers. Importance of publication in standard databases such as Scopus, Web of science etc., understanding of h-index, citation index and impact factor.	(6 Hours)

Text Books/References:

1.	Wayne Goddard, Stuart Melville, Research Methodology: An Introduction, Juta and Company Ltd, 2004
2.	Ranjit Kumar, Research Methodology: A Step by Step Guide for Beginners, SAGE publications Ltd., 2011.
3.	C. R. Kothari ,Research Methodology: Methods and Trends, New Age International, 2004
4.	S.D. Sharma , Operational Research, Kedar Nath Ram Nath & Co.,1972

5.	B.L. Wadehra, Law relating to patents, trademarks, copyright designs and geographical indications, Universal Law Publishing, 2014.
6.	Donald Cooper, Pamela Schindler, Business Research Methods, McGraw-Hill publication, 2005.
7.	T. W. Anderson, An introduction to Multivariate Statistical Analysis, Wiley Eastern Pvt. Ltd. New Delhi.
8.	A. Fink, Conducting Research Literature Reviews: from the internet to paper, Sage Publications, 2009
9.	R. A. Day, How to write and publish a scientific paper, Cambridge University Press, 1992

Paper II: Advances in Production Engineering

Teaching Scheme: 4 Hrs/ week

Credits: 4

Theory Examination: 100 Marks

Unit 1: Optimization Methods

(6 Hrs)

Basic Concepts of Optimization- Convex and Concave Functions, Necessary and sufficient conditions for Stationary Points. Single Variable Optimization: Optimum problem formulation, Optimality Criteria, Bracketing methods, region-Elimination method, Multivariable optimization: Optimality criteria, Unidirectional search, Direct search method- Evolutionary optimization, Simplex search.

Unit 2: Robotics And Automation

(6 Hrs)

CAD / CAM, Rapid Prototyping, Flexible Manufacturing Systems And Group Technology (MICLASS, OPTIZ), Cell Formation in GT. Analysis of Vision System, online Inspection through Vision System, Design of Grippers, various sensors in robotics, Robot kinematics and dynamics, Trajectory Planning in robotics, Avoiding obstacles by robot.

Unit 3: Design of Experiments

(6 Hrs)

One factor at a time model, Fixed effects model, Estimation of the model parameters, Model adequacy checking, The normality assumption, Two-Factor factorial design, The general factorial design. Fractional factorial design. Response surface methodology. Taguchi method.

Unit 4: Reliability / Maintenance

(6 Hrs)

Fault Tree Analysis & Event Tree Analysis, Accelerated reliability testing, Nonparametric reliability evaluation, Failure Modes Effects Analysis & Failure Modes Effects and Criticality Analysis, HASS, HALT, reliability evaluation of complex system, Evaluation of system reliability, maintainability and availability, AGREE, ARINC, Mean & Median statistical methods, Fair & Kim's Algorithm.

Unit 5: Composites

(6 Hrs)

Definition of composite material, Classification based on matrix and topology, Constituents of composites, Interfaces and Interphases, Distribution of constituents, Composites Fabrication, Fracture & Safety of Composite and Introduction to Nanotechnology, Manufacturing and Characterization of Nano-composites.

Unit 6: Advanced Machine Tool Design

(6 Hrs)

Design of elements like Bed, Columns, Guide ways, Design of Guides using FEA, Lumped parametric method, Design of spindles based on deformation and rigidity, Reliability based design, static and dynamic rigidity, stability analysis, Vibrational study – Micro-displacement and error analysis Modular Concept in Machine tool structure.

Unit 7 : Advanced Machining / Non conventional Machining

(6 Hrs)

Theory and Numerical analysis of abrasive jet machine, Abrasive flow machining, Ultrasonic machining, Electrical Discharge Machining(EDM), Electro Chemical Machining, Electro Chemical Discharge Machining(ECDM) ,Vibro ECDM, Dry and Near dry EDM, thermal Energy Methods material pressing, LASER machining, Electron Beam Machining, Plasma arc machining, Physical vapour deposition and chemical vapour deposition, high energy rate forming and Electroforming.

Unit 8: Metrology and Quality Control

(6 Hrs)

Error due to Numerical Interpolation, displacement measurement technique, Error types and their evaluation, Image processing and its applications in metrology, Laser trackers, micro and nanometrology, Process capability- Process Capability Index. Advanced dimensional chain and tolerance stacking , Global management or six sigma management, methods of improving accuracy and surface finish. Quality Control, Statistical Quality Control, Quality assurance systems

Unit 9: Theory of plasticity

(6 Hrs)

Metal forming Analysis in drawing and extrusion of metals, theory and practice of Bulk forming processes, Plastic deformation in forging, rolling, Extrusion and Drawing process, Sheet metal forming. Theory of plastic deformation – Yield criteria - Work of plastic deformation Analysis of forming processes - Energy slab method- open die forging, plate drawing, Flat rolling , - Other methods of analysis like FEM, Upper and lower bound solution methods – slip line field.

Unit 10: Tribology

(6 Hrs)

Tribo-environment, contact theory of surface, Ergodicity and Stationarity of surface, Contact phenomenon & contact deformation of the surface, Parameters affecting friction and wear, Adhesive, Abrasive, Erosive wear, Dry friction, boundary friction, semi liquid and liquid friction under lubrication, Use of solid lubricants in extrusion and metal cutting, method of testing and Characterization of lubrication.

Reference Books:

- Gupta P. K. and Hira D. S. : Operations Research, S Chand & Company Ltd.
- Sharma J. K. : Mathematical Models in Operations Research, Tata McGraw – Hill Publishing Company Limited.
- Sharma S. D., KedarNath : Operations Research, Ram Nath & Co.
- Robotics Technology and Flexible Automation – S.R. Deb Tata McGraw Hill.
- Robotics for Engineers – Yoram Koren, Tata McGraw Hill.
- Industrial Robotics – Groover, Weiss, Tata McGraw Hill.
- Robotics – Control, Sensing, Vision and Intelligence – K. S. Fu, R. C. Gonzalez, C. S. G. Lee, McGraw Hill Int.
- Production Flow Analysis for Planning Group Technology – John L. Burbidge
- Just in Time – David Hutchins-Gower Publishing ISBN-0566077981
- Concepts in Reliability in Engineering – L. S. Srinath, Affiliated East West Press.