Syllabus for Ph.D. Entrance Test in Production Engineering

SECTION-I: Research Methodology

∗The syllabus of Research Methodology will be common for all the subject except Law

Syllabus	
Introduction to Research: The concept of research, characteristics of good research, Application of Research, Meaning and sources of Research problem, characteristics of good Research problem, Research process, outcomes, application of Research, Meaning and types of Research hypothesis, Importance of Review of Literature, Organizing the Review of Literature.	
Types of Research: Types of research, pure (basic, fundamental) and applied research, qualitative and quantitative.	
Research Design: Meaning, need, types of research design – Exploratory, Descriptive, Casual research Design, Components of research design, and Features of good Research design. Experiments, surveys and case study Research design.	
Sampling, Data Collection and analysis: Types and sources of data – Primary and secondary, Methods of collecting data, Concept of sampling and sampling methods – sampling frame, sample, characteristics of good sample, simple random sampling, purposive sampling, convenience sampling, snowball sampling, classification and tabulation of data, graphical representation of data, graphs and charts – Histograms, frequency polygon and frequency curves, bell shaped curve and its properties. Statistical Methods for Data Analysis : Applications of Statistics in Research, measures of central tendency and dispersion	
Research Report: Research report and its structure, journal articles – Components of journal article. Explanation of various components. Structure of an abstract and keywords. Thesis and dissertations. components of thesis and dissertations. Referencing styles and bibliography.	
Ethics in Research - Plagiarism-Definition, different forms, consequences, unintentional plagiarism, copyright infringement, collaborative work. Qualities of good Researcher.	
ICT Tools for Research: Role of computers in research, maintenance of data using software such as Mendeley, Endnote, Tabulation and graphical presentation of research data and software tools. **Web search**: Introduction to Internet, use of Internet and WWW, using search engines and advanced search tools.	

RECOMMENDED BOOKS

1	Donald Cooper and PS Schindler (2009)	Business Research Methods, 9th edition, Tata McGraw Hill.
2	Kothari C. R	Research Methodology
3	Uma Sekaran (2010)	Research Methods for Business, 4th edition, Wiley.
4	Ranjit Kumar (2009)	Research Methodology, 2nd edition, Pearson Education
5	Naresh Malhotra and S Dash (2009)	Marketing Research, 5th edition, Pearson Prentice Hall.
6	Michael V. P	Research Methodology.
7	Fred N. Kerlinger :	Foundations of Behavioral Research.

SECTION-II: Production Engineering

UNIT-I	**Quantitative techniques**
	Optimization techniques, Simulation Using Software, Non-linear Programming, Goal Programming, Inventory Management , Supply Chain Management, Project Management, Resource Optimization.
UNIT-II	**Robotics And Automation**
	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-III	**Manufacturing Analysis:**
	Sources of errors in manufacturing; process capability; tolerance analysis in manufacturing and assembly; process planning; parameter selection and comparison of production alternatives; time and cost analysis; manufacturing technologies – strategies and selection.
UNIT-IV	**Advanced Machining / Non-conventional Machining**
	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-V	**Metrology and Quality Control**
	Error due to Numerical Interpolation, displacement measurement technique, Error types and their evaluation, Image processing and its applications in metrology, Laser trackers, micro and nano-metrology, 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

Text Books/References:	
1	Gupta P. K. and Hira D. S.: Operations Research, S Chand & Company Ltd.
2	Sharma J. K.: Mathematical Models in Operations Research, Tata McGraw – Hill Publishing Company Limited.
3	Sharma S. D., Kedar Nath: Operations Research, Ram Nath & Co.
4	R. Panneerselvam: Operations Research, Prentice Hall of India Pvt. Ltd
5	S.R. Deb, Robotics Technology and Flexible Automation Tata McGraw Hill.
6	Yoram Koren, Robotics for Engineers Tata McGraw Hill.

7	Groover, Weiss, Industrial Robotics Tata McGraw Hill.
8	B. Wu, Manufacturing Systems Design and Analysis, Springer