REVA UNIVERSITY
Bengaluru, India

SYLLABUS FOR PhD ENTRANCE EXAMINATION -2023

School of Mathematics

PART – A **Marks 50**

1. **Algebra:** Groups, subgroups, normal groups, homomorphism, cyclic groups, sets, relations, functions, composition functions. Vector spaces, subspaces, Linear dependence, basis, dimension, algebra of linear transformation, Algebra of matrices, Rank, Linear equations, Consistency, Eigen values and eigen vectors, Canonical forms, diagonal forms, Quadratics forms.

2. **Linear and non-linear Programming**: Simplex algorithm- Two phase, Big-M techniques, Duality theory, Non-linear programming-Constrained external problems, Lagranges multiplier method, Kuhn-Tucker conditions and solutions.

3. **Real and Complex analysis**: Continuity, differentiability, mean value theorem, Sequences and series, uniform convergence. Algebra of complex numbers, complex plane, Polynomials, Power series, transcendental functions such as exponential, trigonometric and hyperbolic functions, Cauchy's theorem, Cauchy's integral formula.

4. **Vector Calculus**:Curves in space, tangents and normal, Velocity and acceleration related problems, scalar and vector point functions-Gradient, Divergence and curl, directional derivatives. Solenoidal and irrotational vector fields. Line integral, Surface integral, Volume integrals.

5. **Graph theory**: Graphs, representation of graphs, directed graphs, regular graphs, complete graphs, null graphs, Bipartite graphs, Isomorphism, planar graphs, connected and disconnected graphs, Eulerian and Hamiltonian graph, Trees, spanning tree, rooted and binary tree.

6. **Statistics and Probability**: Correlation and regression, Conditional probability, Bayes theorem, Binomial distribution, Poisson distribution, exponential distribution, Random variables (discrete and continuous), Probability density function, probability distribution – Sampling distributions, Joint Probability distribution.

7. **Ordinary differential equations**: solutions of first order first degree and higher order ODE's, variation of parameters. Homogeneous and non homogeneous linear ODE's, Partial derivatives-Euler's theorem-problems, Total derivative and chain rule. Jacobians, Taylor's Expansion, Maxima and Minima.

8. **Transform method:** Fourier transforms, transform method for one dimensional wave equation, Fourier transform method for one dimensional heat conduction problems in finite and infinite rod, Laplace Transforms and inverse Laplace transforms, Laplace transform method for one dimensional wave equation, solution of linear differential equation using Laplace Transforms.

9. **Numerical Methods**: Solution of algebraic and Transcendental equation, Finite differences and Interpolation, Numerical Differentiation and Integration, Numerical solutions of ODE's and PDE's.

10. **Continuum Mechanics**: Co-ordinate transformations, calculus of tensor, continuum hypothesis, material derivative, stress tensor, Basic conservation of laws, momentum and energy. Applications to solid mechanics and fluid mechanics.

Reference Books:

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 43nd edition, 2015.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley Publications, 10th edition, 2015.
3. R.K.Jain and S.R.K.Iyengar, "Advanced Engineering Mathematics", Narosa Publishing House, 5th edition, 2014.
4. B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill Publications, 19th edition, 2013.
5. Hamdy A. Taha, "Operations Research- An Inroduction", Dorling KinderslyPvt. Ltd, Pearson edition, 2014
6. NarsinghDeo, "Graph Theory with Applications to Engineering and Computer Science", Prentice-Hall, 2014.

PART – B **Marks 50**

RESEARCH METHODOLOGY

Research and Types of research: Meaning of Research- Objectives of Research- Motivation in Research. Research methods *vs* Methodology. Types of research – Descriptive *vs*. Analytical, Applied *vs*. Fundamental, Quantitative *vs*. Qualitative, Conceptual *vs*. Empirical. Research Process. Criteria of good Research.

Research Formulation – Defining and formulating the research problem - Selecting the problem - Necessity of defining the problem - Importance of literature review in defining a problem – Literature review – Primary and secondary sources – reviews, treatise, monographs-patents – web as a source – searching the web - Critical literature review – Identifying gap areas from literature review - Development of working hypothesis.

Data Collection and analysis: Execution of the research - Observation and Collection of data - Methods of data collection – Modeling, Mathematical Models for research, Sampling Methods- Data processing and Analysis strategies. Data Analysis with Statistical Packages – Hypothesis-testing, Generalization-and-Interpretation.

Reference Books:

1. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. *An introduction to Research Methodology,* RBSA Publishers.

2. Kothari, C.R., 1990. *Research Methodology: Methods and Techniques*. New Age International. 418p.

3. Sinha, S.C. and Dhiman, A.K., 2002. *Research Methodology*, EssEss Publications. 2 volumes.

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