**Mathematics &Statistics**

**Pre Ph.D. Syllabus**

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**Department of MATHEMATICS**

**CHAITANYA DEEMED TO BE UNIVERSITY**

**(Approved u/s 3 of UGC Act 1956 by MHRD Govt. of India)**

**Department of Mathematics & Statistics**

 **Pre Ph .D Mathematics**

**Syllabus contents and Scheme of Examination**

**For the candidates admitted from the academic Year 2023-2024**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Paper** | **Paper****Code** | **Title of Paper** | Credits | Total |
| **I** | **RPE** | **Reseach and Publication Ethics**  | 2 | 50 |
| **II**  | **General**  | **Research Methodology**  | 4 | 100 |
| **III** | **Special**  | **Fluid Mechanics/ Mathematical Modelling** | 4 | 100 |
| **IV** |  | **Analysis of Published research papers / Scientific literature** | 2 | 50 |

**Pre Ph .D in Statistics**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Paper** | **Paper****Code** | **Title of Paper** | Credits | **Total** |
| **I** | **RPE** | Reseach and Publication Ethics  | 2 | 50 |
| **II**  | **General**  | Research Methodology  | 4 | 100 |
| **III**  | **Special**  | Operations Research | 4 | **100** |
| **IV** |  | Analysis of Published research papers / Scientific literature | 2 | **50** |

**Course structure:**

The course comprises of six modules listed in table below .

|  |  |  |
| --- | --- | --- |
| Modules | Unit title | Teaching hours |
| Theory | **Reseach and Publication Ethics** |  |
| RPE 01 | Philosophy and Ethics | 3 |
| RPE 02 | Scientific Conduct | 5 |
| RPE 03 | Publication Ethics | 7 |
| Practice |  |  |
| RPE 04 | Open Access Publishing | 4 |
| RPE 05 | Publication Misconduct | 4 |
| RPE 06 | Databases and Research Metrics | 7 |
|  | Total | 30 |

RPE 01: PHILOSOPHY AND ETHICS (3 hrs)

1. Introduction to philosophy: definition nature and scope, concept, branches

2. Ethics: Definition, moral philosophy, nature of moral judgments and reactions

RPE 02: SCIENTIFIC CONDUCT (5 hrs)

1. Ethics with respect to science and research

2. Intellectual honesty and research integrity

3. Scientific misconducts: Falsification, Fabrication ,and Plagiarism (FFP)

4. Redundant publications :duplicate and overlapping publications, salami slicing

5. Selective reporting and misrepresentation of data

RPE 03: PUBLICATION ETHICS ( 7 hrs)

1. Publication ethics: Definition, introduction and importance

2. Best practices/standards setting initiatives and guidelines: COPE,WAME, etc,

3. Conflicts of interest

4.Publication misconduct :definition, concept, problems that lead to unethical behavior and vice versa, types

5. Violation of publication ethics , authorship and contributor ship

6. Identification of publication misconduct, complaints and appeals

7. Predatory publishers and journals

RPE 04 :OPEN ACCESS PUBLISHING (4 hrs )

1. Open access publications and in initiatives

2. SHERPA-RoMEO online resource to check publisher copyright and self – achieving policies

3. Software tool to identify predatory publications developed by SPPU

4. Journal finder/ journal suggestion tools viz.JANE Elsevier journal finder, Springer journal suggester etc.

RPE 05: PUBLICATION MISCONDUCT (4 Hrs)

1. Group discussions (2 hrs)
2. Subject specific ethical issues , FFP, authorship
3. Conflicts of interest
4. Complaints and appeals: examples and fraud from India and abroad

B: Software tools (2 hrs)

Use of plagiarism software like Turnitin, Urkund and other open source software tools.

RPE 06: DATABASES AND RESEARCH METRICS( 7 hrs)

1. Databases (4 hrs)
2. Indexing databases
3. Citation databases : web of science, scopus, etc.
4. Research Metrics( 3 hrs)
5. Impact factor of journal as per journal citation report, SNIP, SJR, IPP, cite score.
6. Metrics ;h-index, g-index, i10 index, almetrics

**References:**

Bird, A.(2006).philosophy of science. Routledge.

Maclntyre, Alasdair (1967) A short History of Ethics London.

p. chaddah, (2018)Ethics in competitive Research; Do not get scooped:do not get plagiarized,ISBN:978-9387480865

National Academy of sciences, National Academy of Engineering and institute of Medicine, (2009),on Being a Scientist :A Guide to Responsible Conduct in Research: Third Edition National Academies Press

Resnik, D.B.(2011).What is ethics in research & why is it important. National Institute of Environmental Health Sciences,1-10,Retrieved from https//www.niehs.nih.gov/research/resourses/bioethics/whatis/index.cfm Bcall,j.(2012).predatory publishers are corrupting open access. Nature, 489(7415), 179-179.

<https://doi.org/10.1038/4891179a>

Indian National Science Academy (INSA),Ethics in Science Education ,Research and Governance(2019),ISBN:978-81-939482-1-7, <http://www.insaindia> rcs.in/pdf/Ethics \_ Book.pdf

**Paper II: Research Methodology**

**UNIT I :** Meaning and Research, Objectives of Research, Types of Research, Research Approaches, Significance of Research, Research Methods verses Methodology, Research and Scientific Method, Research process, Selecting the problem, Necessity of defining the problem, Techniques involved in defining a problem.

**UNIT II :** Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs.

**UNIT III :** Preparation of the Title, Listing of the Authors and Addresses, Preparation of the Abstract, Writing the Introduction, Writing the Materials and Methods Section, Writing the Results, Writing the Discussion, Stating the Acknowledgements, Citing the References.

**UNIT IV :** Language skills for writing scientific articles. Preparation of manuscript, format of research paper, submission is hard copy and online submission of the journals. Writing projects proposals, preparation of curriculum vitae. Presentation of research findings: Visual, oral, poster presentation, power point presentation, Dos and Donts of the oral presentation.

**References**

Kothari C. R. and Gaurav Garg (2014 – Third Edition), *Research Methodology* –

 *Methods and Techniques*, New Age International Publishers.

Mangal S.K. and Shubhra Mangal (2013), *Research Methodology in Behavioural*

 *Sciences*, PHI Learning Private Limited.

Robert A. Day and Barbara Gastel (Sixth Edition), *How to Write and Publish a*

 *Scientific Paper*, Cambridge University Press.

**Additional References**

Das. M. N. and Giri. N. (1979) *Design and Analysis of Experiments*, Wiley Eastern

 Ltd.

John. W. C. (2009) *Research Design, Qualitative, Quantitative and Mixed Methods*

 *Approaches*, Sage Publication.

Kumar. R. (1996) Research Methodology: *A Step-by-Step Guide for Beginners*, Stage

 Publication.

Oliver. P. (2010) *The Student’s Guide to Research Ethics*, Open University Press.

Rohatgi. V. K. (1984) *Statistical Inference*, John Wiley and Sons.

Rohatgi. V. K. (1993) *An Introduction to Probability Theory and Mathematical*

 *Statistics*, Wiley Eastern Ltd.

**Paper III FLUID MECHANICS**

**Unit-1:** Basics in Fluid Mechanics:

The continuum hypothesis-Newtonian and Non-Newtonian fluids-Continuity equation- Navier-Stokes equations of motion –Energy equation, steady and unsteady flows.

**Unit-2:** Navier-Stokes equations:

Parallel flow through a straight channel and Couette flow-The Hagen-Poiseuille flow-The suddenly accelerated plane wall-Stokes first problem. The flow near an oscillating flat plate-Stokes second problem- Flow near a rotating disk. Parallel flow past a sphere.

**Unit-3:** Boundary Layer Theory:

Derivation of Boundary Layer equations for two dimensional flow-The separation of a Boundary Layer, Skin friction-The Boundary Layer on a flat plate.

**Unit-4:** Thermal Boundary Layers in Laminar flow:

Exact solution for the problem of temperature distribution in a viscous flow: (i)couette fiow, (ii)Poiseuille flow through a channel with flat walls. Forced and natural flows-Thermal Boundary Layer in forced flow-Parallel flow past a flat plate at zero incidence. Thermal Boundary Layers in natural flow (free convection).

**Text Books:**

1) Boundary Layer Theory- Dr.Herman Schlicting, Mc.GrawHill Book Company

2) Fluid Mechanics and Fluid Machines-S.K Som & G. Biswas

**Reference Book:**

 Textbook of fluid dynamics- F. Chorlton, Van Nostrand, 1963

# PAPER III MATHEMATICAL MODELLING

**UNIT – 1:**

What is Mathematical modelling? Simple situations requiring Mathematical Modeling, The technique of Mathematical Modeling, Classification of Mathematical Models, Some characteristics of Mathematical Models, Mathematical Modeling through Geometry, Mathematical Modeling through Algebra, Limitations of Mathematical Modeling.

**UNIT –2:**

Growth and Decay Models, Dynamics of Tumour growth Models, Radioactivity and Carbon Dating, Belt or Cable Friction, Temperature Rate of Change (Newton’s Law of Cooling), Diffusion, Biological Growth Models, Problems on Epidemiology, The Spread of Technological Innovations, Mixture Problem, Chemical Reactions – Law of Mass Action.

**UNIT – 3:**

Single Species Population Models, Prey-Predator, Commensalism and Mutualism Models, Multispecies Model, A Model for Growth of Population inhibited by Cumulative Effects of Pollution, Prey- Predator Model in terms of Integro – Differential Equations, Stability of the Prey – Predator Model, Differential – Differences Equations Models in Relation to other Models.

**UNIT – 4:**

Deterministic Models without Removal, General Deterministic Models with Removal, General Deterministic Models with Removal and Immigration, Control of an Epidemic, Stochastic Epidemic Model without Removal, Other Stochastic Epidemic Models.

**TEXT BOOKS:**

1. Mathematical Modeling, J. N. Kapur, New Age International (P) Ltd., Publishers Reprint 2003.

2. Differential Equations and Their Applications, Zafar Ahsan ,Prentice Hall of India , Delhi

3. J.N. Kapur, Mathematical Models in Biology and Medicine, Affiliated East-West Pvt. Ltd., 2010.

**REFERENCE BOOKS:**

1. Mathematical Modeling, J.G. Andrews and R. R. Mclone (1976). Butterwerths London.

2. Mathematical Modeling Techniques, R. Aris (1978), Pitman.

3. Differential Equation Models, Martin Braun, C. S. Coleman, D.A.Drew , Vol. 1.

4. Political and Related Models, Steven J. Drams, Kl. F Lucas, P. D. Straffin (Eds),Vol. 1.

5. Discrete and System Models, W. F. Lucas, F. S. Roberts, R. M. Thrall, Vol. 3.

 **STATISTICS SYLLABUS**

**PAPER III OPERATIONS Research**

**Unit I**

**Operation Research:** Review of linear programming and its applications to zero-sum two person game. Parametric programming and sensitivity analysis. Separable programming.

**Non- linear programming:** Convex programming, Kuhn-Tucker conditions, quadratic programming. Wolfe’s, Gradient and Rosen’s Gradient projection methods.

**Unit II**

**Integer programming:** Gomory’s solution for all integer programming method.Linear fractional programming and sensitivity analysis on the same. Goal programming, Concepts and method of finding the solution. Elementary concepts of stochastic programming.

**Unit III**

**Inventory models:** Introduction to deterministic models: Multi-item deterministic problem. Probabilistic models. Inventory control with certain demand.

**Queuing theory:** birth and Death Process in queuing theory.M/G/K and M/Ek/1 models. Priority queue.

**Unit IV**

**Reliability:** Life time distributions. Hazard function-some important models. Type I and Type II concord data. System reliability in terms of component reliability: K out of N “systems” with series and parallel systems as special case. Reliability of M out of N system with repair facilities (Analogous to machine interference problem).

 **References:**

1. Nonlinear programming by H.P Kunz and W. Krelle.
2. Goal programming by P. Ignizio.
3. Mathematical theory of reliability by R.E. Barlow and Proschon.
4. Linear programming by S.I. Gass.
5. Statistical Models and Methods for life time data by Lawless, J.F.

 6. Operations Research by Hillier and Liberman.

 7. Operations Research by Hadley and Wittin.

**Ph.D. Paper-IV**

Analysis of Published research papers / scientific literature

Hours per week: 02 Credits: 02

A research scholar should submit analysis of published research papers / scientific literature in the form of dissertation.