

# Ch. Bansi Lal University, Bhiwani.

(A State University established under Haryana Act No. 25 of 2014)



## DEPARTMENT OF MATHEMATICS Examination Scheme

Syllabi.  
For  
Pre-Ph. D Course Work  
(w. e. f. 2021-22)

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DEPARTMENT OF MATHEMATICS  
Scheme of Examination for Pre-Ph. D Course Work

Credits= 14

Marks=350

Paper Code	Paper Name	Mode of learning	Credits	Contact Hours Per Week	Examination Scheme		
					End Semester Examination Marks	Internal Assessment Marks	Total Marks
21MTPH-101	Research Methodology		4	4	80	20	100
21RPE-101	Research and Publication Ethics	GSL	2		40	10	50
21MTPH -102	Review of Literature	GSL	4	1	80	20	100
Choose one from 21MTPH -103 and 21MTPH -104							
21 MTPH-103	Advanced Solid Mechanics	CL	4	4	80	20	100
21MTPH-104	Regression Analysis and Bayesian Inference	CL	4	4	80	20	100

### Outline of Mode of Learning

- Self-Learning (SL): Self learning by students using prescribed open learning resource.
- Guided Self Learning (GSL): Guided Self learning-teachers to brief students about the open learning resources.
- Blended Learning (BL): Blended learning in the classroom-using traditional teaching combined with digital learning.
- Classroom Learning (CL): Only classroom, lab or field learning.

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## 21MTPH-101

### Research Methodology

#### Course Objectives

In this course, the students will learn some basic concepts of research and its methodologies. Also students will learn to Identify appropriate research topics, select and define appropriate research problem and parameters, prepare a project proposal (to undertake a project), organize and conduct research (advanced project) in a more appropriate manner. Also students will learn to write a research report, thesis and research proposal (grants).

Maximum Marks- 100

End Semester Examination -80

Internal Assessment-20 Time-3 hrs.

Credits: 4

**Note: There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each Question shall carry equal marks.**

#### Unit-I

**Introduction of Research Methodology:** Meaning of research, objectives of research, types of research, significance of research, research and scientific method, research process.

**Research Problem:** Definition, necessity and techniques of defining research problem.

Formulation of research problem. Objectives of research problem.

#### Unit-II

**Scientific Communications:** Publishing Research Papers: Selection of a journal; writing of paper's abstract, formulation of problem, discussion and references, submission and handling of reviewer's comment.

**Writing of thesis:** Format of a thesis, Review of literature, formulation, writing methods, results; preparation of tables, figures; writing discussion, writing conclusion, writing summary and synopsis, reference citing and listing/bibliography, Avoiding Plagiarism.

#### Unit-III

**Computer Applications in Research:** Practical aspects of Matlab, Introduction to latex. MS

Office 2007: Word Basics, Mail Merge, Macros, Math Type, Equation Editor MS Excel

2007: Excel Basics, Data Sort, Functions.

#### Unit-IV

**Presentation:** Poster and Oral. Presentation tools: Introduction to presentation tools, MS **Power Point:** features and functions, creating presentation, customizing presentation, showing presentation.

**Web Search:** Internet Basics, Internal Protocols, Pre-requisites, Search Engines, Searching Hints, Using advanced search techniques

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### Course Outcomes

At the end of this course, students will be familiar with some basic concepts of research and its methodologies. Also students will be able to identify appropriate research topics, select and define appropriate research problem and parameters, prepare a project proposal (to undertake a project), organize and conduct research (advanced project) in a more appropriate manner. Also students will be able to write a research report, thesis and research proposal (grants).

### Books Recommended:

1. Gurumani, N. (2010), Scientific Thesis Writing and Paper Presentation, MJP Publishers .
2. Kothari, C.R. and Garg Gourav (2014), Research Methodology (Methods and Techniques), 3rd edition New Age International Publishers.
3. Gerald, C.F. and Wheatley, P.O.: Applied numerical analysis, 6th Ed. Addison Wesley (2002)
4. Smith G.D.: Numerical solution of partial differential equations, Oxford University Press (1982)
5. Schwartz H.R., Stiefel: Numerical analysis of symmetric E & Rustishausar matrices, Prentice Hall (1976)

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## 21RPE-101

### Research and Publication Ethics

#### Course Objectives

This course is aimed to provide understanding of ethical issues related to Research and Publication, Patents and rights, IPR — Intellectual Property Rights. Also students will learn how to write research papers/thesis following publication ethics, related issues. Also students will know how to publish ethically and ways for avoiding plagiarism.

Maximum Marks-50  
End Semester Examination -40  
Internal Assessment- 10 Time-3 hrs.  
Credits: 2

**Note: There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.**

#### Unit-I

**Introduction to Philosophy:** Definition, nature, and scope, concept, branches.

**Ethics:** definition, moral philosophy, nature of moral judgements and reactions.

**Scientific Conduct:** Ethics with respect to science and research, Intellectual honesty and research integrity, Scientific misconducts: Falsification, Fabrication, and Plagiarism (FFP), .

**Redundant publications:** duplicate and overlapping publications, salami slicing, Selective reporting and misrepresentation of data.

#### Unit-II

**Publication Ethics:** Definition, introduction, and importance.

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

Conflicts of interest .

**Publication misconduct:** Definition, concept, problems that lead to unethical behaviour and vice-versa, types. Violation of publication ethics, authorship and contributor ship. • Identification of publication misconduct, complaints and appeals. Predatory publishers and journals.

open access publication and initiatives.

SHERPA/ ROMEO online resource to check publisher copyright & self-archiving policies.

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### Unit-III

Software tool to identify predatory publications developed by SPPU.

Journal finder/ journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggested, etc.

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

### Unit-IV

Indexing databases

**Citation databases:** Web of Science, Scopus', etc.

Impact Factor of Journal as per Journal Citation Report, SNIP, SJR, IPP, Cite Score.

**Metrics:** h-index, g-index, i 10 index, altimetry's.

### Course Outcomes

At the end of this course, students will be able to understand ethical issues related to Research and Publication, Patents and rights, IPR — Intellectual Property Rights. Also students will be familiar with writing of research papers/thesis following publication ethics, related issues. Also students will be able to publish ethically without plagiarism.

### References:

1. Bird, A. (2006). Philosophy of Science. Routledge.
2. MacIntyre, Alasdair (1967) A Short History of Ethics. London.
3. P. Chaddah, (2018) Ethics in Competitive Research: Do not get scooped; do not get plagiarized, ISBN:978-9387480865.
4. 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.
5. Resnik, D.B. (2011). What is ethics in research & why is it important. National Institute of Environmental Health Sciences, 1-10.
6. Beall, J. (2012). Predatory publishers are corrupting open access. Nature, 489(7415), 176179

Three handwritten signatures and dates in blue ink. The first signature is 'A. Chaddah' with the date '5/9/21'. The second signature is 'S. S. S.' with the date '04/9/2021'. The third signature is 'S. S. S.' with the date '04/09/2021'.

## 21MTPH-102

### Review of Literature

#### Course Objectives

This course is aimed for students to develop a protocol for a literature review of research topics, comprehensively search the literature using appropriate keywords & databases and critically appraise literature relevant to a research topic or question. Also students will learn to prepare a critically appraised review of the topic and implications of the report. Also students will learn to demonstrate competent verbal and written skills. Students Will also learn to endnote for citing and the management of references.

Maximum Marks-50

End Semester Examination -40

Internal Assessment-10

Credits: 4

**Note: The candidates are required to submit a copy of Review of Literature based on 20-25 research papers on the relevant research topic. The performance will be evaluated on the basis of submitted literature and the presentation given by the candidates before the evaluation committee.**

#### Course Outcomes

On successful completion of this course, students will be able to develop a protocol for a literature review of research topics, comprehensively search the literature using appropriate keywords & databases and critically appraise literature relevant to a research topic or question. Also students will be able to prepare a critically appraised review of the topic and implications of the report. Also students will demonstrate competent verbal and written skills. Students will use Endnote for citing and the management of references.

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## 21MTPH-103

### Advanced Solid Mechanics

#### Course Objectives

This course enables the students to understand the advanced concept of stress-strain behaviour of materials and the indicial notations. Also students will learn about different elastic functions. Also will be familiar with the concept of the mechanics of plate and shells. Also students will learn how to apply mathematical concept in practical solid mechanics problems

Maximum Marks- 100  
End Semester Examination- 80  
Internal Assessment- 20  
Max. Time- 3 hrs.  
Credits: 4

**Note: There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.**

#### Unit-I

**General solution of the equilibrium equations:** Papkovitch- Neuber solution, Lamé's strain potential, Galerkin Vector; Love's strain function, Applications to the solution of the Kelvin problem for an unbounded medium and the Boussinesq problem for a semi-infinite medium. Generalized Hooke's-law including the effect of thermal expansion, Navier's equation, thermal stresses in a long circular cylinder, linear constitutive equations for fiber-reinforced composites,

#### Unit-II

Airy's stress function in polar co-ordinates and its problems-(a) initial stresses in a welded ring, (b) the loaded semi-circular arch, (c) normal line load on a semi-infinite medium, solution of linear elastostatic problems by complex variable methods- (a) uniform pressure on a circular disc, (b) Concentrated force in an infinite medium.

#### Unit-III

**Seismic Waves:** Field equations of linear elastodynamics, Plane waves in unbounded media, P, SV and SH waves of seismology, wave propagation in two dimensions, Surface waves-Love & Rayleigh waves, Reflection of P, SV, SH waves at a free boundary, Reflection and transmission of SH-waves at a solid-solid interface.

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## Unit-IV

**Viscoelasticity:** Spring & Dashpot, Maxwell & Kelvin Models, Three parameter solid, Correspondence principle & its application to the Deformation of a viscoelastic Thick-walled tube in Plane strain.

### Course Outcomes

At the end of this course, the student will be able to understand the concept of tensor; analyse about advanced concept of stress and strain in structural problems. Also students will be learn how to apply the concept of different elastic functions to solve complex problems. Students will be able to evaluate the influence of various geometric and loading parameters in plane stress and plane strain problems. Learned about Implement of advanced concept of solid mechanics in torsion, plates and shells.

### Books suggested;

1. A.K. Mal & S.J. Singh, Deformation of Elastic Solids, Prentice Hall, New Jersey, 1991.
2. Bath, M.: Mathematical Aspects of Seismology, Elsevier
3. Bullen, K.E. and A. Bolt: An Introduction to the Theory of Seismology, Cambridge University Press
4. Fung, Y.C.: Foundations of Solid Mechanics, Prentice Hall.
5. Peter M. Shearer: Introduction to Seismology, Cambridge University Press
6. W. Flugge, Viscoelasticity, Springer Verlag.
7. Nield, A.D. and Bejan, A., Convection in Porous Media, Springer, Berlin, 1999
8. Schlichting H., Boundary-layer theory, McGraw Hill International, (1979).
9. Sherman F.S., Viscous Flow, McGraw Hill International, (1990)

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## 21MTPH-104

### Regression Analysis and Bayesian Inference

#### Course Objectives

The goal of this course is to teach students about general linear regression model. Also about Diagnostics for Leverage and Influence, Mixture Distributions, Exponential Family of distributions, Prior and Posterior distributions etc. Also students will learn about Non Informative and Improper priors, Jeffrey's Prior, Asymptotically Locally invariant prior. Maximum entropy priors, Bayes estimation.

Maximum Marks- 100  
End Semester Examination-80  
Internal Assessment-20  
Max. Time- 3  
Credits: 4

**Note: There shall be nine questions in all. Question no. 1 shall be compulsory, consisting of eight short answer type questions covering the entire syllabus. Two questions will be asked from each unit. Student will have to attempt one question from each unit. Each question shall carry equal marks.**

#### Unit-I

Simple Linear Regression, The General Linear Regression Model, Ordinary Least Squares Estimator and Its Properties, Inference in General Linear Regression Model. Generalized Least Squares Estimation, Estimation of parameters, Matrix Approach to Linear Regression,  $R^2$  and adjusted  $R^2$ . Weighted Least Squares. Model Adequacy Checking — Residual Analysis, methods of scaling residuals- Standardized and studentized residuals Press Residual, Residual Plots, PRESS Statistic.

#### Unit-II

Diagnostics for Leverage and Influence, Variable Selection and Model Building, Computational Techniques for Model Selection- Mallows's  $C_p$ , Stepwise Regression, Forward Selection, Backward Elimination. Elementary Ideas of Logistic and Poisson regression.

#### Unit-III

Mixture Distributions, Exponential Family of distributions, Prior and Posterior distributions, Baye's theorem and computation of posterior distribution, Natural conjugate family of priors for a model,

Conjugate families for exponential family models.

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## Unit-IV

Non — Informative and Improper priors, Jeffrey's Prior, Asymptotically Locally invariant prior. Maximum entropy priors, Bayes estimation.

### Course Outcomes

After completion of this course, students will be expected to know about general linear regression model. Also students will be familiar with Diagnostics for Leverage and •Influence, Mixture Distributions, Exponential Family of distributions, Prior and Posterior distributions etc. Also students will be able to illustrate about Non — Informative and Improper priors, Jeffrey's Prior, Asymptotically Locally invariant prior. Maximum entropy priors, Bayes estimation.

Books suggested:

1. Montgomery, D.C, Peck and Vining, G.G. (2002). Introduction to Linear Regression Analysis (John Wiley & Sons.)
2. Draper, N.R. and Smith, H. (1981) Applied Regression Analysis (John Wiley & Sons)
- Robert, C.P. (2001): The Bayesian Choice: A Decision Theoretic Motivation (Springer Verlag New York)
3. Sinha, S.K. (2004) Bayesian Estimation
4. Berger, J.O. (1985) Statistical Decision Theory and Bayesian Analysis (Springer)

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