

# **M.Phil MATHEMATICS**

## **Course Structure and Syllabus**

(For the candidates admitted from the academic year 2020-2021 onwards)

# **CHOICE BASED CREDIT SYSTEM (CBCS)**



**THANTHAI HANS ROEVER COLLEGE (AUTONOMOUS)**

**(Nationally Re-Accredited by NAAC with B<sup>++</sup>)**

**(Affiliated to Bharathidasan University, Tiruchirappalli)**

**ELAMBALUR, PERAMBALUR – 621 220**



## **Vision**

To blossom as an institution of excellence, enabling, empowering and enlightening the youth and shaping them as fully developed human beings with the capacity to unfold their full mental potentiality resulting in the attainment of the wisdom to live constructively and meaningfully.

## **Mission**

- To provide congenial and stress- free environment and opportunities for the enhancement of knowledge and acquisition skills through the best exposure and training possible.
- To offer multifaceted and need-based academic programmes and to promote extension activities.
- To adopt technology-enabled new methods, approaches and techniques so that the teaching-learning process becomes learner-centred and learner-friendly.
- To maximize the participation of all the stakeholders in the development of the institution and the region.
- To sensitize the youth towards inclusive growth for socio-economic change, sustainable development, gender equality, eco-friendliness, etc.
- To enable the youth to experience the effects of globalization and facilitate them to grow as responsible citizens and leaders.
- To inspire them, through value-based education, to embrace the entire humanity while firmly rooted in the Indian ethos.
- To provide regular placement training and placement opportunities.
- To kindle the spirit of creativity and enhance research activities and enable them to attain international standards.

## **Programme Outcomes (POs)**

Upon completion of the programme, the scholar will be able to

1. Adopt self-learning through reviews of previously acquired knowledge
2. Implement research by focusing on newer thrust areas of knowledge
3. Engage in quality and efficient designing, implementing and evaluating of the gathered information
4. Demonstrate technical and analytical competence with local and global perspective
5. Have professional integrity with knowledge of appropriate code of ethics and standards displaying social responsibilities

## **Program Specific Outcomes (PSOs)**

1. Understanding of the fundamental axioms in mathematics and capability of developing ideas based on them.
2. Nurture problem solving skills, thinking, creativity through assignments, project work.
3. Inculcate mathematical reasoning.
4. Prepare and motivate students for research studies in mathematics and related fields.
5. Provide advanced knowledge on topics in pure mathematics, empowering the students to pursue higher degrees at reputed academic institutions.



**Thanthai Hans Roever College (Autonomous)**  
**Perambalur– 621220**

*M.Phil.Mathematics Courses structure Under CBCS Pattern 2020*

Semester	Course Code	Course	Course Title	No. of Hours	Credit	CIA Marks	SE Marks	Total Marks
I	20MPMA1CC1	Core-I	Research Methodology	6	4	40	60	100
	20MPMA1CC2	Core-II	Analysis and Applied Mathematics	6	4	40	60	100
	20MPMA1CC3	Core-III	Teaching and Learning Skills	6	4	40	60	100
	20MPMA1CC4	Core-IV	Paper on Topic on Research (To be Framed by the Guide)	6	4	40	60	100
<b>Total</b>				<b>24</b>	<b>16</b>	<b>160</b>	<b>240</b>	<b>400</b>
<b>II</b>	<b>20MPMA2DW</b>	<b>Project Work</b>	<b>Dissertation</b>	<b>-</b>	<b>8</b>	<b>-</b>	<b>-</b>	<b>200</b>
<b>Total</b>				<b>-</b>	<b>24</b>	<b>-</b>	<b>-</b>	<b>600</b>

- One Hour Library for each Course.
- Evaluation of the Dissertation shall be made jointly by the Research Supervisor and External Examiner.

**PROJECT:**

Maximum Marks            200

I Review                        : 20 Marks

II Review                        : 20 Marks

Evaluation of Project : 120 Marks

Viva Voce                        : 40 Marks

**SEMESTER – I**

Course Code: 20MPMA1CC1

Exam Hours: 3

Instruction Hours: 6

Internal Marks: 40

Credits: 4

External Marks: 60

**CORE-I - RESEARCH METHODOLOGY****COURSE OUTCOMES:**

1. Demonstrate and analyze creatively to propose research problem of research design.
2. Analyze the concept of Noetherian modules, Primary decomposition and Artinian modules
3. Apply domain knowledge of topological preliminaries and regularity properties of Borel measures.
4. Transcribe and concentrate on a total variation, Consequences of the Random Nikodym theorem and Riesz representation Theorem.
5. Adopt the results of the Fundamental group and Covering spaces

**UNIT – I****Research Methodology:** An introduction – Defining the research problem – Research design.**UNIT –II**

Noetherian modules – Primary decomposition – Artinian modules

**UNIT – III****Real Analysis:** Vector spaces – Integration as linear functional - Topological preliminaries – Regularity properties of Borel measures.**UNIT – IV****Complex Measures:** Total variation – Absolute – Continuity - Consequences of the Random Nikodym theorem - Bounded linear functional of  $L^p$ - Riesz representation Theorem.**UNIT – V**

Homotopy of paths – The Fundamental group – Covering spaces

**TEXT BOOK(S):**

1. C.R. Kothari, Research Methodology, New Age International Publishers, Second Revised Edition Reprint (2009).
2. N. S. Gopalakrishnan, Commutative Algebra, Oxonian Press Private Ltd, New Delhi, Second Edition(1988).
3. Walter Rudin, Real & Complex Analysis, Tata McGraw-Hill Publishing Company Limited, Third Edition (2006).
4. James R. Munkres, Topology a First Course, Prentice Hall of India Learning Private Ltd. (2009).

UNIT – I      Chapters– 1, 2 &amp; 3      Page No. 1 to 54 of [1]

UNIT – II      Chapter – 3      Sections 3.1 to 3.3 of [2]

UNIT – III      Chapter – 2      Sections 2.1 to 2.13, 2.15 to 2.18 of [3]

UNIT – IV      Chapter – 6      Sections 6.1 to 6.19 of [3]

UNIT – V      Chapter – 9      Sections 51 to 53 of [4]

**REFERENCE(S):**

1. David S. Dummit and Richard M. Foote, Abstract Algebra, Wiley-Student Edition, India, Second Edition (2009).
2. G. De. Barra, Measure Theory and Integration, New Age International (P) Ltd., New Delhi, Reprint(2009).
3. P. R. Halmos, Measure Theory, D. Van Nostrand Company Inc, Princeton N.J. (1950).
4. Serge Lang, Algebra, Addition- Wesley Publishing Company, Sydney, London, Second Edition (1970).
5. Tom M. Apostol, Mathematical Analysis, Narosa Publishing House, Second Edition(2002).

## Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	18MPMA1CC1	RESEARCH METHODOLOGY					6	4			
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO2	✓		✓		✓	✓	✓		✓	✓	
CO3		✓	✓	✓		✓		✓	✓		
CO4	✓	✓		✓	✓		✓	✓		✓	
CO5	✓	✓	✓		✓	✓	✓		✓	✓	
Number of Matches (✓) = 38						Relationship: <b>HIGH</b>					

<b>Mapping</b>	1-29%	30-59%	60-69%	70-89%	90-100%
<b>Matches</b>	1-14	15-29	30-34	35-44	45-50
<b>Relationship</b>	Very Poor	Poor	Moderate	High	Very High

**SEMESTER – I**

Course Code: 20MPMA1CC2

Instruction Hours: 6

Credits: 4

Exam Hours: 3

Internal Marks: 40

External Marks: 60

**CORE-II – ANALYSIS AND APPLIED MATHEMATICS****COURSE OUTCOMES:**

1. Examine the Gelfand mapping theorem and Gelfand – Neumark theorem
2. Analyze and distinguish the concepts of Linear and Non-Linear systems of Differential Equations.
3. Determine the domain knowledge on the Directed graphs and domination number of graph, Exploration and Stratification.
4. Illustrate the Nonlinear Programming Algorithms.
5. Illustrate the Fuzzy Graph: Paths and Connectedness- Fuzzy Bridges and Fuzzy Cut nodes- Fuzzy Forests and Fuzzy Trees

**UNIT – I**

**Functional Analysis:** General preliminaries on Banach Algebras: The definition and some Examples – Regular and singular elements – Topological divisors of zero. The Spectrum – The Formula for the spectral radius – the radial and semi – simplicity. The structure of commutative Banach Algebra: The Gelfand mapping – Application of the formula  $r(x) = \lim \|x^n\|^{1/n}$  - Involution in Banach Algebra. The Gelfand – Neumark theorem

**UNIT – II**

**Differential Equation (Linear and Non-Linear systems):** Uncoupled linear systems – Diagonalization – Exponential of operators – The fundamental theorem for linear systems – linear system in  $\mathbb{R}^2$ – Complex Eigen values - Multiple Eigen Values - Some preliminary concepts and definitions – The fundamental existence – Uniqueness theorem.

**UNIT – III**

**Graph Theory:** Directed Graphs – Independent Sets & Matching – Graph Coloring.

**UNIT – IV**

**Operations Research:** Nonlinear Programming Algorithms: Unconstrained Algorithms – Constrained Algorithms.

**UNIT - V**

**Fuzzy Graph:** Paths and Connectedness- Fuzzy Bridges and Fuzzy Cut nodes- Fuzzy Forests and Fuzzy Trees.

**TEXTBOOK(S):**

1. G.F.Simmons, Introduction to Topology and Modern Analysis, McGraw Hill International
2. L.Perko, Differential Equations and Dynamical Systems, Third Edition, Springer International Edition, (2009).
3. R.Balakrishnan & K.Ranganathan, A text Book of Graph Theory, Second Edition, Springer Science + Business Media, New York 2012.
4. Hamdy A. Taha, Operations Research an Introduction, Eighth Edition, Prentice Hall, Delhi.

5. A. NagoorGani and V. T. Chandrasekaran, A first look at Fuzzy Graph Theory, Allied Publishers Pvt. Ltd. Chennai, First Edition (2010).

- UNIT – I      Chapters – 12 & 13      Sections 64 to 69 & 70 to 73 of [1]
- UNIT – II      Chapters –1 & 2      Sections 1.1 to 1.7 & 2.1 to 2.2 [2]
- UNIT – III      Chapters – 2, 5 & 7      Sections 2.1 to 2.3, 5.1 to 5.4 & 7.1 to 7.5 of [3]
- UNIT – IV      Chapter – 19      Section 19.1 to 19.2.2 [4]
- UNIT – V      Chapter –3      Sections 3.1 to 3.3 [5]

**REFERENCE(S):**

1. Balmohan V Limaye, Functional Analysis, New Age International(P)Ltd.NewDelhi, SecondEdition (2009).
2. M.Murugan, Topics in Graph Theory and Algorithms, Muthali Publishing House, Annanagar, Chennai, First Edition (2003).
3. KantiSwaroop, Gupta.P.K,&Manmohan, Operations Research, Sultan Chand & Co, 16<sup>th</sup>Revised Edition.

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits				
I	18MPMA1CC2	ANALYSIS AND APPLIED MATHEMATICS					6	4				
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)						
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
CO2		✓	✓			✓	✓		✓	✓		
CO3	✓		✓	✓		✓		✓	✓			
CO4		✓		✓	✓		✓	✓		✓		
CO5	✓	✓	✓		✓	✓	✓		✓	✓		
Number of Matches (✓) = 37						Relationship: <b>HIGH</b>						

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

**SEMESTER – I**

Course Code: 20MPMA1CC3  
 Instruction Hours: 6  
 Credits: 4

Exam Hours: 3  
 Internal Marks: 40  
 External Marks: 60

**CORE-III – TEACHING LEARNING SKILLS****COURSE OUTCOMES:**

1. Develop skills of ICT and apply them in teaching learning context and Research and Appreciate the role of ICT in teaching, learning and Research.
2. Acquire the knowledge of communication skill with special reference to its elements, types, development and styles.
3. Understand the terms communication Technology and Computer mediated teaching and develop multimedia /e- content in their respective subject and the communication process through the web.
4. Acquire the knowledge of Instructional Technology and its Applications.
5. Develop different teaching skills for putting the content across to targeted audience.

**UNIT-I: Computer Application Skills**

Information and Communication Technology (ICT): Definition Meaning, Features, Trends – Integration of ICT in teaching and learning – ICT Applications: Using word processors, Spread sheets, Power point slides in the classroom – ICT for Research: On-line journals, e-books, Courseware, Tutorials, Technical reports, Theses and Dissertations -- **ICT for Professional Development**: Concept of professional development; institutional efforts for competency building; individual learning for professional development using professional networks, OERs, technology for action research, etc.

**UNIT-II: Communications Skills**

Communication: Definitions – Elements of Communication: Sender, Message, Channel, Receiver, Feedback and Noise – Types of Communication: Spoken and Written; Non-verbal communication – Intrapersonal, interpersonal, Group and Mass communication – Barriers to communication: Mechanical, Physical, Linguistic & Cultural – Skills of communication: Listening, Speaking, Reading and Writing – Methods of developing fluency in oral and written communication – Style, Diction and Vocabulary – Classroom communication and dynamics.

**UNIT-III: Pedagogy**

Instructional Technology: Definition, Objectives and Types – Difference between Teaching and Instruction – Lecture Technique: Steps, Planning of a Lecture, Delivery of a Lecture – Narration in tune with the nature of different disciplines – Lecture with power point presentation - Versatility of Lecture technique – Demonstration: Characteristics, Principles, planning Implementation and Evaluation – Teaching-learning Techniques: Team Teaching, Group discussion, Seminar, Workshop, Symposium and Panel Discussion.



#### **UNIT-IV: E- Learning, Technology Integration and Academic Resources in India**

Concept and types of e-learning (synchronous and asynchronous instructional delivery and means), m-learning (mobile apps); blended learning; flipped learning; E-learning tools (like LMS; software's for word processing, making presentations, online editing, etc.); subject specific tools for e-learning; awareness of e-learning standards- Concept of technology integration in teaching- learning processes; frameworks guiding technology integration (like TPACK; SAMR); Technology Integration Matrix- Academic Resources in India: MOOC, NMEICT; NPTEL; e-pathshala; SWAYAM, SWAYAM Prabha, National academic depository, National Digital Library; e-Sodh Sindhu; virtual labs; eYantra, Talk to a teacher, MOODLE, mobile apps, etc.

#### **UNIT-V : Skills of Teaching and Technology based assessment**

Teaching skills: Definition, Meaning and Nature- Types of Teaching Skills: Skill of Set Induction, Skill of Stimulus Variation, Skill of Explaining, Skill of Probing Questions, Skill of Black Board Writing and Skill of Closure – Integration of Teaching Skills – Evaluation of Teaching Skills- **Technology for Assessment:** Concept of assessment and paradigm shift in assessment; role of technology in assessment 'for' learning; tools for self & peer assessment (recording devices; rubrics, etc.); online assessment (open source software's; e-portfolio; quizmakers; e- rubrics; survey tools); technology for assessment of collaborative learning like blogs, discussion forums; learning analytics.

#### **References**

1. Bela Rani Sharma (2007), Curriculum Reforms and Teaching Methods, Sarup and sons, New Delhi
2. Brandon Hall , E-learning, A research note by Namahn, found in: [www.namahn.com/resources/.../note-e-learning.pdf](http://www.namahn.com/resources/.../note-e-learning.pdf), Retrieved on 05/08/2011
3. Don Skinner (2005), Teacher Training, Edinburgh University Press Ltd., Edinburgh
4. Information and Communication Technology in Education: A Curriculum for schools and programmed of Teacher Development, Jonathan Anderson and Tom Van Weert, UNESCO, 2002.
5. Jereb, E., & Šmitek, B. (2006). Applying multimedia instruction in elearning. *Innovations in Education & Teaching International*, 43(1), 15-27.
6. Kumar, K.L. (2008) Educational Technology, New Age International Publishers, New Delhi.
7. Learning Management system: [https://en.wikipedia.org/wiki/Learning\\_management\\_system](https://en.wikipedia.org/wiki/Learning_management_system), Retrieved on 05/01/2016
8. Mangal, S.K (2002) Essential of Teaching – Learning and Information Technology, Tandon Publications, Ludhiana.
9. Michael, D and William (2000), Integrating Technology into Teaching and Learning: Concepts and Applications, Prentice Hall, New York. 8

10. Pandey,S.K (2005) Teaching communication, Commonwealth Publishers,New Delhi.
11. Ram Babu,AabdDandapani,S (2006), Microteaching (Vol.1 & 2),Neelkamal Publications, Hyderabad.
12. Singh,V.K and Sudarshan K.N. (1996), Computer Education, DiscoveryPublishing Company, New York.
13. Sharma,R.A., (2006) Fundamentals of Educational Technology, SuryaPublications,Meerut
14. Vanaja,M and Rajasekar,S (2006), Computer Education, NeelkamalPublications, Hyderabad.

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits				
I	18MPMA1CC3	TEACHING LEARNING SKILLS					6	4				
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)						
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
CO2		✓	✓	✓		✓	✓		✓	✓		
CO3	✓		✓	✓		✓		✓	✓			
CO4	✓	✓		✓	✓		✓	✓		✓		
CO5	✓	✓	✓		✓		✓		✓	✓		
Number of Matches (✓) = 38						Relationship: <b>HIGH</b>						

<b>Mapping</b>	1-29%	30-59%	60-69%	70-89%	90-100%
<b>Matches</b>	1-14	15-29	30-34	35-44	45-50
<b>Relationship</b>	Very Poor	Poor	Moderate	High	Very High

**SEMESTER – I**

Course Code: 20MPMA1CC4  
 Instruction Hours: 6  
 Credits: 4

Exam Hours: 3  
 Internal Marks: 40  
 External Marks: 60

**CORE IV: OPERATIONS RESEARCH****COURSE OUTCOMES:**

1. The learner will be fall skillful in Solution of Linear programs by Dynamic programming.
2. Acquire essential concepts in Decision Theory and Games.
3. Demonstrate Inventory Models and Just-in-Time (JIT) manufacturing system.
4. Understand the concept of queuing theory and its Characteristics.
5. Acquire essential concepts in nonlinear programming

**UNIT - I: Dynamic Programming**

Elements of the DP Model: The Capital Budgeting - More on the Definition of, the state - Examples of DP models and computations - Problem of Dimensionality in Dynamic programming - Solution of Linear programs by Dynamic programming.

**UNIT - II: Decision Theory and Games**

Decisions under Risk - Decision Trees - Decisions Under Uncertainty - Game Theory.

**UNIT - III: Inventory Models**

The ABC Inventory System - Generalized Inventory Models – Deterministic Models – Just-in-Time (JIT) manufacturing system.

**UNIT - IV: Queuing Models**

Role of Poisson and Exponential Distribution - Processes Birth and Fousson and Death - Queues with Combined Arrival and Departures - Non-Poisson Queues - Queues with Priorities for Service - Random or Series Queues.

**UNIT - V: Nonlinear Programming**

Unconstrained Extremal Problems - Constrained Extremal Problems - Nonlinear Programming Algorithm - Unconstrained Nonlinear Algorithms - Constrained Nonlinear Algorithms.

UNIT – I	Chapter – 10
UNIT – II	Chapter – 12
UNIT – III	Chapter – 14
UNIT – IV	Chapter – 15
UNIT – V	Chapter – 19 & 20

**Text Book:**

1. Operations Research - An Introduction (Fifth Edition - 1996) H.A.Taha, Prentice Hall of India (P) Limited, New Delhi, 1996.

**Reference Books:**

1. D. Phillips, A. Ravindran, Solberg, Operations Research: Principals and Practice, JOHN WILEY & SONS (1976).
2. S.S.Rao, Engineering Optimization, (3rd Edition, 1996), New Age International (p) Ltd, New Delhi - 110 002

## Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	18MPMA1CC4	OPERATIONS RESEARCH					6	4			
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO2		✓	✓		✓	✓			✓	✓	
CO3	✓		✓	✓		✓		✓	✓		
CO4	✓	✓		✓	✓		✓	✓		✓	
CO5	✓	✓	✓		✓		✓		✓	✓	
Number of Matches (✓) = 37						Relationship: <b>HIGH</b>					

<b>Mapping</b>	1-29%	30-59%	60-69%	70-89%	90-100%
<b>Matches</b>	1-14	15-29	30-34	35-44	45-50
<b>Relationship</b>	Very Poor	Poor	Moderate	High	Very High