

**M.Phil., Programme in Mathematics  
(CBCS)**

**Courses, Syllabi & Scheme of Examinations**

**(For the candidates admitted from the Academic year 2019-2020 onwards)**



**DEPARTMENT OF MATHEMATICS  
NEHRU MEMORIAL COLLEGE (AUTONOMOUS)  
PUTHANAMPATTI  
TIRUCHIRAPPALLI-621 007**

**COURSES (CC)**

<b>S.No</b>	<b>Code</b>	<b>Title of the Course</b>	<b>Credits</b>
<b>Sem I</b>			
<b>1.</b>	<b>19MM11</b>	<b>Research Methodology</b>	<b>4</b>
<b>2.</b>	<b>19MM12</b>	<b>Advanced Real and Complex Analysis</b>	<b>4</b>
<b>3.</b>	<b>19MM13</b>	<b>Paper on the Topic of Research (Guide Paper)</b>	<b>4</b>
<b>4.</b>	<b>19MM14</b>	<b>Teaching and Learning Skills</b>	<b>4</b>
<b>Sem II</b>		<b>Dissertation</b>	<b>8</b>

**Scheme of Examinations**

**Semester I**

**Courses I, II, III (Elective) & IV: CIA : 25 Marks**

**FE : 75 Marks**

**Total : 100 Marks**

**Duration: 3 hours**

**CIA Components : Two Tests : 20 Marks (2×10 = 20)**

**Seminar : 5 Marks**

**Total : 25 Marks**

**Semester II**

**Dissertation: 200 Marks**

**(Thesis 150 + Viva-Voce 50)**

**(Credits: 8)**

**Final Examination (F.E)**

**Semester I**

**Semester II**

**(Submission of Dissertation)**

**Full time (1 year) : Jan/Feb**

**July to August**

**Part time(2 years) : April/May**

**March to May**

**Question paper pattern**

**2 Marks : 10x2=20**

**5 Marks : 5 x 5=25**

**10 Marks : 3x10=30**

**Total Marks: 75marks**

## COURSE I – RESEARCH METHODOLOGY

**Semester: I**

**Code:19MM11**

**Credit:4**

### **Unit –I: Writing your thesis**

The preliminary pages and the introduction – The literature review – Ethics of research - The conclusion –Publishing findings during preparation of the thesis.

### **Unit –II: Linear system of differential equations**

Uncoupled linear systems – Diagonalization – Exponentials of operators- The fundamental theorem for linear systems- Linear systems in  $R^2$ - Complex Eigen values- Multiple Eigen values –Jordan forms- Stability theory- Non –homogeneous linear systems.

### **Unit –III: MATLAB**

Starting with MATLAB- Creating arrays- Mathematical operations with arrays- Using script files and managing data- Two –dimensional plots.

### **Unit- IV: MATLAB (Contd...)**

Programming in MATLAB- User –defined functions and Function files – Polynomials, Curve fitting and Interpolation – Application in numerical Analysis – Three - Dimensional plots – Symbolic math.

### **Unit – V: LaTeX**

The Basics – The document – Bibliography – Bibliographic databases – Table of content, Index and Glossary – Displayed Text rows and columns – Typesetting mathematics – Typesetting Theorems – Several kinds of Boxes – Floats – Cross References in LATEX – Footnotes, Margin pars, and Endnotes.

### **Text books:**

- 1 . Paul Oliver, Writing Your Thesis, Sage Publications, 2<sup>nd</sup> edition (2008).
2. Lawrence Perko, Differential Equations and Dynamical systems, Springer – Verlag, Third Edition 2001.
3. Amos Gilat ,An Introduction with applications ,Wiley student edition – 2014.
4. Leslie Lampert, Latex – Users guide and References manual, Pearson Education (2003).

## **COURSE II – ADVANCED REAL AND COMPLEX ANALYSIS**

**Semester: I**

**Code :19MM12**

**Credit: 4**

### **Unit I**

Sequences: Problems and solutions – Limits of Functions: Problems and solutions – Continuity : Problems and solutions.

### **Unit II**

Differentiability: Problems and solutions- Integration: Problems and solutions.

### **Unit III**

Series – Problems and solutions – Sequence and series of Functions: Problems and solutions.

### **Unit IV**

Complex and Integral calculus: Singularities-Calculus of residues.

### **Unit V**

Complex and integral calculus: Computation of integrals- Harmonic function.

### **Text Books:**

1. A Problem Book in Real Analysis ,Asuman G. Aksoy, Mohamed A. Khamsi, Springer, 2010
- 2.V.Karunakaran,ComplexAnalysis,CRCPress,Secondedition2005.

### **References:**

1. Robert G. Bartley, Donald R.Sherbert, Introduction to Real Analysis, 3rd Edition, Wiley student edition, 2007.
2. W. Rudin, Real and Complex Analysis, 3rd edition, McGraw Hill International,1987

## Course III- Elective II - Advanced Stochastic Processes

Semester: I

Code:19MM13a

Credit: 4

### Unit-I :Poisson processes

Poisson processes and its Extensions (Markov processes with discrete Poisson process – properties of Poisson process – Generalizations of Poisson process: Poisson process in higher dimensions – Poisson cluster process – pure birth process: Yule-Furry process –Birth Immigration process – Time- dependent Poisson process.

### Unit- II : Markov process with continuous state space

Introduction – Brownian Motion – Wiener process – Differential Equations for a Wiener process – Kolmogorov Equations – First passage Time distribution for Wiener process – Ornstein – Uhlenbeck process.

### Unit III : Renewal processes

Renewal processes – Renewal process in continuous Time – Renewal equation – stopping time: Wald's Equation – Renewal Theorems – Delayed and Equilibrium Renewal processes – Residual and Excess lifetimes – Renewal Reward (cumulative Renewal) process.

### Unit IV: Reliability

The study of reliability and maintainability – concepts, Terms and definitions – Application – A brief history – The reliability function – Mean time to failure – Hazard rate function – Bathtub curve – conditional Reliability.

### Unit V:Analysis of failure data

Data collection and Empirical methods: Data collection – Empirical methods – Static life estimation – Reliability Testing: product testing – Reliability life Reliability Testing – Reliability life Testing – Test time calculations – Burn – In – Testing – Acceptance Testing – Accelerated life testing – Experimental Design – Competing Failure Modes – Reliability Growth Testing: Reliability Growth process – Idealized Growth curve – Duane Growth Model – AMSAA Model – Other Growth Models.

### Text Books:

1. J. Medhi , Stochastic processes, New Age Science, Second edition – 2002.
2. Charles E. Ebeling , Reliability and Maintainability Engineering, TATA McGraw Hill Edition , 2007.

### Reference Books:

1. Sheldon M. Ross, Stochastic processes, John Wiley, Second Edition 2012.
2. S.Karlin and M.Taylor ,A first course in Stochastic Processes, Academic Press, Second edition, 1975

## Course III- Elective II - Graphs and Networks

Semester: I

Code:19MM13e

Credit: 4

### Unit I : Matching , Algorithms and Applications

Matchings and covers: Maximum matchings-Hall's Matching condition-Min-Max Theorems-Independent Sets and Covers-Dominating Sets. Algorithms and Applications-Maximum Bipartite Matching – Weighted Bipartite Matching.

### Unit II: Connectivity

Cuts and Connectivity : Connectivity, Edge – connectivity, Blocks.  $K$  – connected Graphs : 2- Connected Graphs , Connectivity of Digraphs ,  $K$  – connected and  $K$  – edge – connected Graphs, Application of Menger's theorem.

### Unit III: Coloring, Structure of $k$ -chromatic Graphs

Definition and Examples-Upper Bounds – Brook's Theorem – Graphs with Large Chromatic number – External problems and Turan's Theorem – color – Critical Graphs – Forced subdivisions

### Unit IV: Edges and Cycles

Edge-colorings-Characterization of Line Graphs.Hamiltonian Cycles :Necessary Conditions –Sufficient Conditions-Tait's Theorem-Grinberg's Theorem

### Unit V: Perfect Graphs

The Perfect Graph Theorem-chordal Graphs Revisited-Imperfect Graphs-The Strong Perfect Graph Conjecture

### Text Book

**B.W.Douglas , Introduction to Graph Theory , Second edition ,  
Prentice-Hall of India, New Delhi , 2006**

### References

- 1.Frank Harary, Graph Theory ,Narosa Publishing House, New Delhi,1997.
- 2.J.A.Bondy and U.S.R.Murthy, Graph Theory and Applications, Mamillan, London,1976.

## Course III- Elective II - THEORY OF DOMINATION IN GRAPHS

**Semester: I**

**Code:19MM13g**

**Credit :4**

### **UNIT I**

Domination number-Independent, Total & Connected Domination numbers.

### **UNIT II**

Edge, Total edge and Connected edge domination numbers-Domatic, Edge domatic numbers and related parameters.

### **UNIT III**

Matrix representation of a graph-Incident matrix,Adjacency matrix and Cycle matrix-Rank of a matrix –Cut set matrix.

### **UNIT IV**

Digraphs –Types of Digraphs-directed paths and connected digraphs Incidence matrix of a digraph.

### **UNIT V**

Digraphs with special properties-Seating arrangement problem-street-sweeping (or)snow-Removing problem-Tele printer's problem-Project scheduling-Huls scheduling Algorithm-Users of graphs in Markov processes.

### **TEXT BOOKS**

- 1) V.R.Kulli, College graph theory ,Vishwa International Publications,2012.
- 2) V.R.Kulli,Theory of Domination in Graph, Vishwa International Publications,2012.
- 3) V.R.Kulli, Advances in Domination Theory ( Vol.I,II ), ,Vishwa International Publications,2012.
- 4) M.Murugan, Applications of Graph Theory,Muthali Publishing House, Chennai 2003.
- 5) T.W.Haynes, S.T.Hedetniemi,P.J.Slaler, Fundamentals of Dominations in Graphs, Marcel Dekker,Inc.,New York,1998.
- 6) K.R.Parthasarathy,Basic Graphs Theory, Tata Mc.Graw- Hill Publishing co.Ltd,New Delhi,1994.

## **Course IV – TEACHING AND LEARNING SKILLS**

**Semester : I**

**Code:19MM14**

**Credit:4**

### **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.

3

### **UNIT- II : COMMUNICATIONS SKILLS**

Definition – 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; e-rubrics, etc.); online assessment (open source software’s; e-portfolio; quiz makers; 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 e-learning. *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.
10. Pandey, S.K (2005) Teaching communication, Commonwealth Publishers, New Delhi.
11. Ram Babu, A abdDandapani, S (2006), Microteaching (Vol.1 & 2), Neelkamal Publications, Hyderabad.
12. Singh, V.K and Sudarshan K.N. (1996), Computer Education, Discovery Publishing Company, New York.
13. Sharma, R.A., (2006) Fundamentals of Educational Technology, Surya Publications, Meerut
14. Vanaja, M and Rajasekar, S (2006), Computer Education, Neelkamal Publications, Hyderabad.