SAKTHI COLLEGE OF ARTS AND SCIENCE FOR WOMEN, ODDANCHATRAM

(Recognized Under Section 2(f) and 12(B) of UGC Act 1956)

(Affiliated to Mother Teresa Women's University, Kodaikanal)

PG & RESEARCH DEPARTMENT OF MATHEMATICS

CURRICULUM FRAMEWORK AND SYLLABUS FOR

OUTCOME BASED EDUCATION IN

SYLLABUS FOR

M.Phil., MATHEMATICS

FRAMED BY

MOTHER TERESA WOMEN'S UNIVERSITY,

KODAIKANAL

UNDER

CHOICE BASED CREDIT SYSTEM

2018-2021

REGULATIONS

Eligibility:

A candidate with postgraduate degree in Mathematics or any related discipline with minimum of 55% marks.

Duration:

One year

Medium of Instruction:

English only

Examinations:

The M.Phil, program in Mathematics comprises of Theory courses (3 in the 1st Semester and 1 in the 2nd Semester) and one Dissertation cum Viva – Voce. Paper I, II, III and IV are common for all the candidates.

Attendance:

- Normally a student must secure a minimum of 80% attendance to become eligible to take the End – Semester Examination (ESE) in a course. However, condonation of shortage of attendance may be granted on genuine medical grounds upto a maximum of 10% of the contact days. For this purpose, the student must, immediately upon returning to class after the period of illness, apply for the condonation, submitting valid medical certificate (s) from registered medical practitioner (s) through his/her advisor to the Head of the Department (HOD), who will decide upon the application for condonation of shortage of attendance. Medical certificates submitted on the eve of the ESE will not be accepted.
- If a student who has no genuine medical grounds and has earned 70% or more but less than 80% of attendance in a course in a semester that student will be debarred from the ESE in that course in that course in that semester. However the student may take the ESE when offered in later semester.
- If a student has earned less than 70% attendance, that student will be debarred from the ESE in the course and the statement of grades will read IA (Inadequate Attendance) against that course. Such a student must repeat that course when offered in a later semester. Attendance in a course will always be reckoned from the days of joining the course to the last day of the course.

Redoing of the Programme

A student who has been debarred from the ESE for lack of attendance must repeat the course at the later semester, paying the prescribed fees for the course. No student will be permitted to repeat a course or reappear for a CIA test or an ESE for

improvement of Grade Points. A student, who has fulfilled all the course requirements but has not been able to take the ESE alone, can take the same at a later semester. A student who has failed in an ESE need take only the ESE in that course when it is next offered. Such students need take only the fee for ESE of the course.

Students interested in redoing of course(s) have to get prior official permission for the same by applying to the Registrar through the HOD on before 5th June (of redoing of old semester courses) or 5th November (for redoing Even Semester Courses) every year.

A student may be permitted to break his/her study on valid grounds. Such break of study is entertained only if the student has completed at least two semesters of student. For availing break of study, the student has to apply to the Registrar along with the recommendations of the Class Advisor and the HOD in the format prescribed enclosing documentary evidences(s) as a proof for his/her claim for break of study and after paying prescribed fee. Unauthorized break of study will not be permitted under any circumstance. Break of study will be permitted subject to the formalities of readmission as well as the availability of courses to be completed and the examination norms.

Assessment:

Assessment of the students will be two-fold consisting of Continuous Internal Assessment (CIA) and End Semester Examination (ESE). The ratio between CIA and ESE will normally be 40:60.

Continuous Internal Assessment (CIA)

The CIA marks shall be awarded based on the following:	Marks
Scores of Best two tests out of three tests	20
Assignment	10
Seminar/Quiz	10
Total	**40**

End Semester Examination (ESE):

Except in the case of Project-work Summer Placement Training and exclusively practical/ field placement courses, the ESE will consist of a written examination of three hours duration reckoned for a maximum 60 marks.

Part-A (5*12=60)

5 Questions out of 10

Time extension for submission of Dissertation:

Extension for submission of dissertation shall be granted as per the University norms and conditions.

Passing Minimum Marks:

There will be no minimum for internal assessment in papers I, II, and III. A candidate will be declared to have passed in a course if she gets a minimum of 50% marks in the University examination and 50% marks in total, putting together the continuous internal assessment marks and University examination marks in that course. A candidate should have secured 50% in Dissertation and Viva-Voce to get a pass.

Classification of Candidates

If a candidate secured 60% and above in both the parts put together, she is deemed to have passed in First Class.

If a candidate secured 50% and above but less that 60% in both the parts put together, she is deemed to have passed in Second Class.

If a candidate secures less than 50% in both the parts put together, she is deemed to have failed in the course.

Failed Candidates:

A candidate who fails in any course/courses may appear again in those course/courses as per University rules.

Completion of the program:

The students have to complete their program within 3 years from the completion of the duration of program, failing which their registration will stand automatically cancelled and they have to register afresh, if they want to pursue the program.

Award of degree:

A student will be declared to be eligible for the award of a degree if she has:

- Registered for and undergone all the courses under the different parts of the curriculum of her program.
- No dues to the University, hostel, NSS, Library, Clubs, Associations etc., and
- No disciplinary action pending against her.

Other regulations:

Besides the above, the common regulations of the University shall also be applicable to this program.

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Preamble:

Mathematical Modelling plays a very important role in the entire process as it helps to analyse various variables and parameters of the system/subsystem under consideration, both in quantitative and qualitative terms. Recent developments in mathematical science and computers have led to improved modelling and understanding of situations in all areas of human activity including not only engineering, medicine, biology, ecology, geology, oceanography but in economics and a variety of other social sciences. The Department of Mathematics has been launched in Sakthi College of Arts and Science in the academic year 2009, with the introduction of B.Sc., (Mathematics) Degree Programme. It has met with the vertical growth by the introduction of M.Sc., (Mathematics) in 2010 and M.Phil., (Mathematics) in 2014.

The Department has highly qualified faculty members and support staff and is committed towards the development of innovative and handy ways of teaching at graduate, post graduate and research level and carrying out cutting edge research in various research fields. The department strives to nurture the young minds towards embracing various scientific challenges. Project work and problem sessions are encouraged to develop innovative and analytical approach to physics learning.

Fixing the Learning Objectives:

Since the Academic year 2018 – 2019, the learning objectives and outcomes of the programmes B.Sc., (Mathematics), M.Sc., (Mathematics) and M.Phil., (Mathematics) have been set, following the Bloom's Taxonomy Cognitive Domain. Accordingly, it is broken into six levels of learning objectives of each course. They are -

K1 / Knowledge = Remember

K2 / Comprehension = Understand

K3 / Application = Apply

K4 / Analysis = Analyze

K5 / Evaluation = Evaluate

K6 / Synthesis = Create

Mapping COs with POs:

For each programme, the Educational objectives and the Specific objectives are specified. The programme outcomes are designed according to the curriculum, teaching, learning and evaluation process. For each course, the definite outcomes are set, giving challenge to the cognitive domain. The course outcomes are mapped with the programme outcomes. The performance of the stakeholders is assessed and the attainment rate is fixed, by using the measurements 'high', 'medium' and 'low'. The restructuring of the curriculum is done based on the rate of attainment.

Institutional Objectives:

The institution has certain definite Institutional Objectives to be attained.

- Skill Development & Capacity Building
- Women Empowerment
- Self-reliance
- Gender Equity & Integrity

Programme Educational Objectives:

The Programmes B.Sc., M.Sc., and M.Phil., (Mathematics) are offered with certain Specific Objectives.

- To identify the fundamental statements for the study of various areas of mathematics and define and describe them with clarity.
- To equip graduates with life – long learning skills, will allow them to successfully adapt to the evolving technologies throughout their professional careers.
- To graduates develop teaching skills, subject knowledge in the course of their study which will help them to shine in various fields.
- To discuss, formulate and analyze problems in Mathematics and identify the concepts and principles to solve them.
- To develop need based mathematics teaching learning resources.

Mapping PEOs with IOs:

Programme Educational Objectives	**Institutional Objectives**			
B.Sc. / M.Sc. / M.Phil., (Mathematics)	**1**	**2**	**3**	**4**
PEO1: To identify the fundamental statements for the study of various areas of mathematics and define and describe them with clarity.	*****			
PEO2: To equip graduates with life – long learning skills, will allow them to successfully adapt to the evolving technologies throughout their professional careers.		*****		
PEO3: Graduates develop teaching skills, subject knowledge in the course of their study which will help them to shine in various fields.			*****	
PEO4: To discuss, formulate and analyze problems in Mathematics and identify the concepts and principles to solve them.				*****
PEO5: To develop need based mathematics teaching learning resources.			*****	

- **Measuring: H – High; M – Medium; L – Low**

M.Phil., (MATHEMATICS)

Programme Outcomes: (POs)

- **PO1:** To acquire advanced conceptual knowledge and comprehensive understanding of the fundamental principles in the discipline of Mathematics.
- **PO2:** To demonstrate mastery of subject material, as evidenced by quality of performance in coursework, and on written and oral examinations in Mathematics.
- **PO3:** To communicate mathematical ideas, results, context, and background effectively and professionally in written and oral form.
- **PO4:** To visualize and work on laboratory multidisciplinary tasks related to current research in the fields of Mathematical, Physical and Life sciences.
- **PO5:** To produce and defend an original contribution to knowledge, as evidenced by the writing and defence of a thesis involving significant original research.
- **PO6:** To apply knowledge and critically evaluate the concepts and scientific developments to take up any challenge.
- **PO7:** To employ innovative and environment friendly methods, novel ideas to solve complex and challenging societal and environmental issues.

COMMON STRUCTURE / M.Phil., (Maths) / 2018 - 2021

Sem	Sub. Code	Title of the Course	HRS	CREDITS	CIA	CE	Total
I	MMTT11	Research Methodology	10	04	40	60	100
	MMTT12	Mathematical Methods	10	04	40	60	100
	MMTT13	Professionals Skills	10	04	40	60	100
II	MMTT21	Area Paper	10	04	40	60	100
	MMTD22	Dissertation and Viva-voce	20	12+ 2	40	60	100+100
Total Score				**30**			**600**

For each Course other than the Dissertation

Continuous Internal Assessment : 40

Marks End Semester Examination : 60

Total Marks : 100

Question Pattern for Course I - IV

Answer any 5 Questions 05 x 12 = 60

Marks Q. No 1 or 2 from Unit I Q. No 3 or 4 from Unit II

Q. No 5 or 6 from Unit III Q. No 7 or 8 from Unit IV

Q. No 9 or 10 from Unit V

CIA components

Tests (2x10) : 20 Marks

Term Paper : 10 Marks

Seminar : 10 Marks

Semester I

MMTT11 RESEARCH METHODOLOGY 6 Hours /4 Credits

Course Outcomes:

After completion of the course, certain outcomes are expected from the learners.

Description of COs	Bloom's Taxonomy Level
Gaining knowledge on Fundamental Group and Separation Theorem in the Plane	Knowledge (Level 1)
Comprehending the II order PDE by linear system with applications.	Comprehension (Level 2)
Applying the gained knowledge in research methodology, advanced topology and problem solving by PDE	Application (Level 3)
Practising thesis writing as per the procedure learnt	Synthesis (Level 6)
Carrying out innovative researches in future	Synthesis (Level 6)

COURSE CONTENT

Unit: I Research Report: Structure of report- Contents steps in drafting – Layout of research reporting – Styles of reporting – Types of report- Guidelines to review report- Typing instructions- Oral presentation- Types of research process- Data collection - Secondary data – Thesis writing : Thesis at tertiary level writing.

Unit: II The Fundamental Group: Homotopy of Paths – The Fundamental Group – Covering Spaces – The Fundamental Group of the Circle – Retraction and Fixed Points

Unit III: The Fundamental Group: The Fundamental Theorem of Algebra – The Borsuk – Ulam Theorem – Deformation Retracts and Homotopy. Type – The Fundamental Group of Sn – Fundamental Groups of Some Surfaces

Unit IV: Separation Theorem in the Plane: The Jordan Separation Theorem – Invariance of Domain – The Jordan Curve Theorem – Imbedding Graphs in the Plane.

Unit V: First order systems in two variables and linearization: The general phase plane-some population models – Linear approximation at equilibrium points – Linear systems in matrix form -Averaging Methods: An energy balance method for limit cycles – Amplitude and frequency estimates – slowly varying amplitudes – nearly periodic solutions - periodic solutions: harmony balance – Equivalent linear equation by harmonic balance – Accuracy of a period estimate.

Text Books:

1. Research Methodology, R. Panneer Selvam, Prentice Hall of India, New Delhi, 2005. Unit I
2. Topology: A First Course, James R. Munkers, Second Edition Prentice Hall of

India Pvt Ltd, NW, 2000 Unit II, Unit III, and Unit IV

3. Nonlinear Ordinary Differential Equations ,D.W.Jordan, &P.Smith, Clarendon Press, Oxford, 1977. Unit V

Reference Books:

1. W. S. Massey, Algebraic Topology- An Introduction, Springer-Verlag , New York, 1976
2. Differential Equations by G.F.Simmons, Tata McGraw Hill, NewDelhi (1979).
3. Notes on Nonlinear Systems by J.K.Aggarwal, Van Nostrand, 1972.

Semester I

MMTT12 MATHEMATICAL METHODS 6 Hours/4Credits

Course Outcomes:

After completion of the course, certain outcomes are expected from the learners.

Description of COs	Bloom's Taxonomy Level
Gaining knowledge of advanced level representation theorem, fourier transforms and conformal mapping theory, problems with boundary conditions.	Knowledge (Level 1)
Getting acquainted with Real and Complex Analysis	Comprehension (Level 2)
Creating perfect documentation in social and science discipline by LaTeX	Application (Level 3)
Attaining more accurate results for mathematical equations through MATLAB	Synthesis (Level 6)
Gaining multiple knowledge by problem solving method and presentation style.	Synthesis (Level 6)

COURSE CONTENT

Unit I: Reisz Representation Theorem**:** Topological preliminaries – Riesz representation theorem – Regularity properties of Borel measures –Lebegue measure – continuity properties of measurable functions.

Unit II: Fourier Transforms**:** Formal properties–Inversion theorem–The Plancherel theorem 1 – Banach Algebra L .

Unit III: Conformal Mapping**:** Preservation of angles–Linear fractionaltransformations – Normal families - Riemann Mapping Theorem- The class-Continuity at the boundary – mapping of an annulus.

Unit IV: LaTeX: Text Formatting, TEX and its offering, What"s different in LATEX 2ε, Distinguishing LATEX 2ε, Basics of LATEX file commands and Environments – commands names and arguments, Environments , Declarations, Lengths, Special characters , Fragile commands, Exercises, Document layout and Organization- Document class, Page style, Paths of the document , Table of contents, Fine- turning text ,Word division.

Unit V: MATLAB: Programming in MatLab–Polynomials, Curve Fitting and Interpolation-Applications in Numerical Analysis.

Text Books:

1.W. Rudin, Real and Complex Analysis, 3rd edition, McGraw Hill International, 1986. Unit I (Chapter 2), Unit II (Chapter 9), Unit III (Chapter 14)

2. Guide to LATEX ,H.Kopaka and P.W. Daly, third edition, Addison – Wesley , London, 1999. Unit IV (Chap 1,2,3)

3. Amos Gilat, MATLAB An Introduction with Applications, John wiley& sons, 2004.Unit V (Chapters 7, 8 and 10)

Reference Books:

1. V. Karunakaran, Complex Analysis 2 edn, Narosa, New Delhi, 2005.
2. C.D. Aliprantis and O.Burkinshaw, Priniciples of Real Analysis 2edn, Academic Press, Inc. New York, 1990.
3. Serge Lang, Complex Analysis, Addison Wesley, 1977.
4. Introduction to MATLAB 7 for Engineers, William John Palm McGraw- Hill Professional, 2005.

MPST13 - PROFESSIONAL SKILLS (Common Paper)

Hours 6/ Credits 4

Course Outcomes:

After completing the course, certain outcomes are expected from the learners.

Description of COs	Bloom's Taxonomy Level
Acquiring knowledge of communication skills with special reference to its elements, types, development and styles.	Knowledge (Level 1)
Understanding the terms like Communication technology, Computer Mediated Teaching	Comprehension (Level 2)
Developing skills in ICT and applying them in teaching, learning contexts and research.	Synthesis (Level 6)
Developing Multimedia/E-contents in their respective subjects.	Synthesis (Level 6)
Integrating Technology into Teaching and Learning	Synthesis (Level 6)

COURSE CONTENT

Unit I - Computer Application Skills

Fundamentals of Computers and windows, Operating System – MS – Office Components; Word: Equation editor, Table Manipulation – Formatting Features – organizational Chart. MS – EXCEL: Statistical Functions – Number Manipulation – Chart Preparation with various types of graphs. MS Powerpoint: Powerpoint presentation with multimedia features. Internet and its applications: E-mail and attachments – working with search engines.

Unit II - Communication Skills (English/Tamil/Both)

English: Skills of Communication: Listening, Speaking, reading and Writing – Writing Synopsis, Abstract and proposals. Developing good language asbilities – Public speaking – Writing Skills.

Tamil: பயிற்றுவிக்கும் திறன் - பேச்சுத்திறன் - வெளிப்பாட்டுத் திறன் - ஆய்வுத்திட்டம் - ஆய்வுச்சுருக்கம் தயாரித்தல்.

Unit III - Communication technology

Computer Mediated Teaching: Multimedia, E – Content, Satellite Based Communication – EDUSAT and ETV channels. Web: Internet I Education.

Unit IV - Pedagogical Skills

Micro teaching Skills: Skill of Induction, Skill of Stimulus Variation. Skill of Explaining, Skill of Probing Questions, Skill of Blackboard, Writing and Skill of Closure – Integration of Teaching Skills – Evaluation of Teaching Skills – Research Extension and Consultancy.

Unit V - Industrial Technology

Lecture Techniques: Steps, Planning of a lecture, Lecture Notes, Updating, Delivery of Lecture. Teaching – Learning Techniques: Team teaching, Group Discussion. Seminar, Workshops, Symposium and Panel Discussion – Games and Simulations – Web Based Instructions.

References

- Micael D. and William (2000). Integrating Technology into Teaching and Learning: Concepts and Applications, Prentice Hasll, New York.
- Information and Communication Technology in Education: A Curriuculum for Schools and Programme of Teacher development. Jonathan Anderson
- Pandey S.K.(2005). Teaching communication. Commonwealth publisher, Delhi
- Sharma. R.A.(2006), Fundamentals of education technology, Surya publication, Meerut
- Kum Babu A. and Dandapani S. (2006), Microteaching, Neelkamal Publications, Hyderabad
- Vanaja M and Rajasekhar S. (2006), Computer Education, Neelkamal Publications, Hyderabad

SEMESTER II

MMTT2/ AREA PAPERS

1. Domination in Graphs
2. Fuzzy Hyper Graphs
3. Fuzzy Sets, Logic and Theory of Neural Networks
4. Topology and image processing
5. Graph and Hypergraphs
6. Non Linear Differential Equations

Any other paper as per the choice of any faculty member of the Department of Mathematics shall be added in this list. The syllabus will be framed by the Department and shall be implemented after getting orders from the Vice-Chancellor.

One from the list of special paper may be selected by the students depending on the area of their research.

DOMINATION IN GRAPHS **6 Hours/4Credits**

Course Outcomes:

After completing the course, certain outcomes are expected from the learners.

Description of COs	Bloom's Taxonomy Level
Gaining knowledge of the concept of Domination	Knowledge (Level 1)
Knowing about diameter, independence and irredundance of graph	Knowledge (Level 1)
Getting acquainted with varieties of Domination	Comprehension (Level 2)

COURSE CONTENT

Unit I: Bounds on the Domination Number: Introduction- Bounds in terms of order- Bounds in terms of order, degree, packing- Bounds in terms of order and size- Bounds in terms of degree, diameter and grith-bounds in terms of independents and covering – Product graphs and Vizing's Conjecture- Grid graphs.(Chap 2:2.1- 2.6)

Unit II: Dominations, Independents, Irredundance: Hereditary and super hereditary properties – Independent sets – Dominating sets- Irredundant sets- The domination chain- Extension chain- Extensions using maximality and minimality. (Chap 3:3.1-3.6)

Unit III: Efficiency, Condition on the Domination set: Introduction-Codes and cups-closed neighborhoods-Computational results-Realizability.(chap4:4.1-4.5)

Unit IV: Varieties of Domination: multiple Domination-Parity Restrictions-Locating-Domination-Distace domination-Strong and weak domination-Global and factor Domination –Domination in directed Graphs.(chap7:7.1-7.7)

Unit V: Sum and Product of Parameters: Nordhaus- Gaddum type results-Gallai type theorems – Other Sums and Products.(chap 9:9.1-9.3)

References:

1. Teresa W.Haynes, Stephen T.H., Hedetniemi and Peter J Slater, "Fundamentals of Domination In Graphs", Marcel Deckker, Newyork,(1998)
2. Michael A.Henning, Anders Yeo, Total Dominations in Graphs, Springer Monographs in Mathematics (2013)
3. T.Hedetniemi, R.C.Lasker, "Topics on Dominations", Northoland, (1991).

FUZZY GRAPHS AND FUZZY HYPER GRAPHS

6 Hours/4Credits

Course Outcomes:

After completing the course, certain outcomes are expected from the learners.

Description of COs	Bloom's Taxonomy Level
Gaining knowledge of the conditions, properties and types of fuzzy graph and fuzzy hyper graphs	Knowledge (Level 1)
Comprehending the concept of Fuzzy as a factor yielding more reasonable and reachable results in all fields	Knowledge (Level 1)
Gaining research idea in fuzzy graph and fuzzy hyper graphs	Synthesis (Level 6)

COURSE CONTENT

Unit I: Fuzzy Subsets: Fuzzy relations-Fuzzy equivalence Relations-Pattern Classification- Similarity relations. (Chapter 1: 1.1 to 1.4)

Unit II: Fuzzy Graphs: Paths and connectedness – Bridges and cut vertices-Forests and trees-Trees and cycles-Characterization of fuzzy trees-Fuzzy cut sets-Fuzzy chords, Fuzzy cotrees and fuzzy twigs- Fuzzy one chain with boundary 0, cobound and cocycles- Fuzzy cycle sets and Fuzzy cocycle set –Fuzzy Line graphs.(Chapter 2: 2.1 to 2.2)

Unit III: Fuzzy Interval and Operation on Fuzzy Graphs: Fuzzy intersection graphs-Fuzzy interval graphs-The Fulkerson and gross characterization-The Gilmore and Hoffman characterization-Operations on fuzzy graphs-Cartesian products and composition-Union and join-On fuzzy tree definitions. (Chapter 2: 2.3 to 2.5)

Unit IV: Fuzzy Hyper Graph: Fuzzy hyper graph-Fuzzy Transversals of fuzzy graphs-s Properties of Tr(H) –Construction H . (Chapter 4: 4.1 to 4.2)

Unit V : Coloring and Intersection of Fuzzy Hyper Graph: Coloring of fuzzy hyper graphs-Beta degree coloring procedures-Chromatic values of fuzzy coloring-Intersecting fuzzy hyper graphs-Characterization of strongly intersection hyper graph-Simply ordered intersecting hyper graph-H dominant Transversals. (Chapter 4 : 4.3 to 4.4)

Text Book:

1. "Fuzzy graphs and fuzzy hyper graphs", John N. Mordeson, PremchandS. Nair, Physica-Verlag, A Springer-Verlag Company, 2000

Reference Books:

1. Klir, G.J.U.St.Chair, U.H., and Yuvan, B „Fuzzy set theory, Foundations and applications", prentice Hall, Upper saddle river, N.J, 1997.
2. Rosenfeld, L.Zadeh, K.S.Fu, M.Shimura, „Fuzzy sets and their applications",Academic press,1975

3. Berg, C.“Hyper graphs“, North Holland , Amsterdam,1989.

Semester II

FUZZY SETS, LOGIC AND THEORY OF NEURAL NETWORKS 6 Hours/4Credits

Course Outcomes:

After completing the course, certain outcomes are expected from the learners.

Description of COs	Bloom's Taxonomy Level
Gaining basic knowledge of the fuzzy sets, relations, types, functionalities	Knowledge (Level 1)
Comprehending the concept of fuzzy numbers, properties, framing equations for real time applications.	Comprehension (Level 2)
Acquiring knowledge of partition problems, solutions with applications.	Knowledge (Level 1)

COURSE CONTENT

Unit I: Fuzzy sets and Fuzzy Relations: Fuzzy sets – Basic Types and concepts – Properties of α – Cuts-Representations of fuzzy sets – Decomposition theorems – Extension principle for fuzzy sets. Crisp and fuzzy relations – Projections and cylindric extensions – Binary fuzzy relations – Binary relations on a single set – Fuzzy equivalence relations – Fuzzy compatibility relations – Fuzzy ordering relations – Fuzzy morphisms – Sup-I compositions of fuzzy relations. Inf-wicompositions of fuzzy relations.

Unit II: Fuzzy Relation Equations: Introduction – Problem partitioning – Solution method – Fuzzy relations equations based on Sup-I Composition – Fuzzy relation equations based on Inf-wicompositions – Approximate solutions – The use of neural Networks.

Unit III: Fuzzy logic: Introduction – fuzzy propositions – Fuzzy Quantifiers – Linguistic hedges – Inference from conditional fuzzy propositions – Inference from conditional and qualified propositions-Inference qualified propositions.

Unit IV: Fuzzy control: Origin and objective – Automatic control – The fuzzy controllers, Types of fuzzy controllers – The mamdani controller – Defuzzification – The Sugeno controller, design parameters – scaling factors – fuzzy sets – Rules – adaptive fuzzy control – applications.

Unit V: Neural Network Theory: Neuronal Dynamics: Activations and signals – neurons as functions – signal monotonocity – biological activations and signals – Competitive neuronal signals – Neuron fields – Neuronal dynamical systems – Common signal functions – Pulse-Coded signal functions. Achieve models – Neuronal dynamical systems – Additive neuronal dynamics – Additive neuronal feedback – Additive Activation models – Bivalent additive BAM – Bidirectional stability – Lypunov functions – Bivalent BAM theorem.

Text Books:

1. "Fuzzy sets and fuzzy logic: Theory and applications", G.J. Klir and Yuvan

boprentice hall of India, New Delhi, (2002). (Relevant Sections Only) Units I,II,III

2. "Fuzzy Set Theory and its Applications", H.J. Zimmermann, fourth edition, Kluwer publishers, London, (2001). (Relevant Sections Only) Unit V.

Reference Books:

1. "Introduction to the theory of fuzzy sets",Kanufmann, Volume 1, Academic press, Inc., Orlando, Florida(1973)
2. "Fuzzy Mathematics: an introduction for engineers and scientists", John.N. Moderson and premchandS.Nair-Playsicaverlag, Heidelberg, Germany,(1998).
3. "Neural Networks, Fuzzy logic and Genetic Algorithms synthesis and Applications" S.Rajasekaran and G.A. Vijayalakshmipai., prentice-Hall of India. New Delhi, (2004).

Semester II

TOPOLOGY AND IMAGE PROCESSING 6 Hours/4Credits

Course Outcomes:

After completing the course, certain outcomes are expected from the learners.

Description of COs	Bloom's Taxonomy Level
Gaining basic knowledge of the advanced level topological and function	Knowledge (Level 1)
Comprehending the concept of image process and compression	Comprehension (Level 2)
Acquiring knowledge of connected compactness and axioms in R.	Knowledge (Level 1)
Carrying out research in topology and image processing together	Synthesis (Level 6)

COURSE CONTENT

Unit I: Topological Space and Continuous Functions: Topological spaces – Basis for topology – The order of topology – The product topology on X*Y – The Subspace topology – Closed sets and limit points – continuous functions – the product topology – the metric topology – the quotient topology.

Unit II: Connectedness and compactness: Connected spaces – Connected sub spaces of the real line – Compactness and local connectedness – Compact spaces – Compact subspaces of the real line - Limit point compactness – Local compactness.

Unit III: Count ability and separation axioms: The countability axioms – The separation axioms – Normal spaces – The Urysohn lemma – The Urysohn metrization theorem – The Tycon off theorem – The complete metric space.

Unit IV: Digital Image Fundamentals: Introduction – An imagr model-Sampling and quantization – Basic relationships between pixels – Image geometry – Properties of 2D fourier transform.

Unit V: Image Compression: Fundamentals – Image compression – models – Error free compression – Lossy compression – Image compression standards, image segmentation: Detection of discontinuouities – Edge linking and boundary detection – Thresholding – Region oriented segment – Use of motion segmentation.

Text Books:

1. "Topology" James R.Munkres, second edition, PHI Learning private limited, new Delhi, 2011.

Unit I :Chapter 2: section 12 – 21

Unit II :Chapter 3: section 23 – 29

Unit III :Chapter 4: section 30 – 34, Chapter 5: section 37, chapter 7: section 43 and 45

2. “Fundamentals of digital image processing”, A.K.Jainprentil Hall of India 1989.

Unit IV and Unit V.

Reference Books:

1. “Algebraic Topology-An Introduction” W.S. Massey, Springer Verlay Network 1976.
2. “Digital Image Processing” C.Gonzalez and R.E.Woods, Addison Wesley.

Semester II

GRAPH AND HYPERGRAPHS **6 Hours/4Credits**

Objectives:

1. Directed graphs is using more application in science and engineering.
2. Good understanding about in labeling
3. To provide knowledge in hypergraphs
4. The learner will be gain knowledge in graph, directed graph and hypergraph in advance level.

Unit I: Directed graphs: Binary relation – relation matrix – cyclic digraph – arborescence – fundamental circuits in digraph – incidence matrix in digraph – adjacency matrix in digraph – perfect graphs: perfect graphs – product of graphs – chordal graphs – interval graphs – comparability graphs – circulation and nowhere-zero k-flows – group-valued flows.

Unit II: Labelings: Prodecessor and successor – Graceful labelling – Sequential functions – applications – magic graphs – conservative graphs.

Unit III: Dual Hypergraphs – Degrees-interecting families – the coloured edge property and Chavtal‟s conjecture.

Unit IV: The Helly property-section of a hypergraph – and the Kruskal-katona theorem – conformal hypergraphs.

Unit V: Transerval hypergraphs – athe coefficients τ and $\tau^{\prime\prime}$ – τ-critical hypergraphs – the köoproperty.

Text Books:

1. Graph Theory and its Applications by B.Sooryanarayana and G.K. Ranganath, Chand & Company Ltd ND 2001.
2. Topics in Graph Theory and Algorithms by Dr.M.Murugan, Muthali Publishing house, Chennai
3. Hypergraphs: Combinatorics of Finite sets by Claude BERGE, North-Holland, 1989.

Semester II

NON LINEAR DIFFERENTIAL EQUATIONS **6 Hours/ 4 Credits**

Course Outcomes:

After completing the course, certain outcomes are expected from the learners.

Description of COs	Bloom's Taxonomy Level
Gaining basic knowledge of linear ODE and Non linear ODE with application	Knowledge (Level 1)
Comprehending the concept of Perturbation Methods	Comprehension (Level 2)
Finding solutions for undetermined conditions of balance and time estimate	Synthesis (Level 6)
Trying out oscillation solutions in varies applications	Synthesis (Level 6)

COURSE CONTENT

Unit I : First order systems in two variables and linearization: The general phase plane-some population models – Linear approximation at equilibrium points – Linear systems in matrix form.

Unit II: Averaging Methods: An energy balance method for limit cycles – Amplitude and frequency estimates – slowly varying amplitudes – nearly periodic solutions - periodic solutions: harmony balance – Equivalent linear equation by harmonic balance – Accuracy of a period estimate.

Unit III: Perturbation Methods: Outline of the direct method – Forced Oscillations far from resonance - Forced Oscillations near resonance with Weak excitation – Amplitude equation for undamped pendulum – Amplitude Perturbation for the pendulum equation – Lindstedt‟s Method – Forced oscillation of a self – excited equation – The Perturbation Method and Fourier series.

Unit IV: Linear Systems: Time Varying Systems – Constant coefficient System – Periodic Coefficients – Floquet Theory – Wronskian.

Unit V: Stability: Poincare stability – solutions, paths and norms – Liapunov stability Stability of linear systems – Comparison theorem for the zero solutions of nearly – linear systems.

Text Book

Nonlinear Ordinary Differential Equations ,D.W.Jordan, & P.Smith, Clarendon Press, Oxford, 1977.

References

1. Differential Equations by G.F.Simmons, Tata McGraw Hill, NewDelhi (1979).
2. Ordinary Differential Equations and Stability Theory ByD.A.Sanchez, Freeman (1968).

3. Notes on Nonlinear Systems by J.K.Aggarwal, Van Nostrand, 1972.