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0 PREAMBLE

Over the past decades the higher education system of our country has undergone substantial structural and functional changes resulting in both quantitative and qualitative development of the beneficiaries. Such changes have gained momentum with the introduction of Choice Based Credit System (CBCS) which further expects learning outcome-based curriculum in order to maximize the benefits of the newly designed curriculum. The learning outcome-based curriculum will definitely help the teachers of the discipline to visualize the curriculum more specifically in terms of the learning outcomes expected from the students at the end of the instructional process. It is pertinent to mention here that the purpose of education is to develop an integrated personality of the individual and the educational system provides all knowledge and skills to the learner for this.

Tamil Nadu State Council for Higher Education (TANSCHE) has formed the State Integrated Boards of Studies, which, with great diligence and expertise has devised the mandatory areas that have to be covered for three-year under graduation and two-year postgraduation courses to realize the facilitation of the mobility of faculty and students from one university to another and to easily solve the problem of equivalence among courses. Great care has been taken so that these areas would take 75% of the course content and the remaining 25% can be decided by the individual institutions. The areas that must be covered by the student that are mandatory for earning the degree to have due value has been worked out so that the student will gain enough depth of knowledge in the subject concerned. 25% percent of the syllabus should be designed by the institutions, and the areas covered under this also must have a weightage of 25%. This gives the autonomous institution seamless liberty on every Board of Studies (BOS) to innovate and experiment, and more importantly, it is here that the institution devises appropriate strategies by which (i) to make creative and critical applications of what has been learnt in the mandatory components, and (ii) to meaningfully connect the learners to the career demands and expectations. It is essential that the theoretical subject knowledge of the students must be translated into practical hands-on experience.

The LOCF (Learning Outcomes based Curriculum Framework) committee constituted by University Grants Commission (UGC) is pleased to submit its report concerning the syllabi for B.Sc. Mathematics as a subject. The committee discussed the framework of syllabi in its meetings and suggests the implementation of these syllabi in the Departments of Mathematics in Government Arts College (Autonomous), Coimbatore based on following facts:

- The learning outcomes of each paper are designed so that these may help learners to understand the main objectives of studying the course.

- This will enable learners to select elective papers depending on the individual inclinations and contemporary requirements.

- The objectives of LOCF are to mentally prepare the students to learn Mathematics leading to graduate degree in Mathematics.

- These syllabi in Mathematics under CBCS are recommended keeping in view of the wide applications of Mathematics in science, engineering, social science, business and a host of other areas.

- The study of the syllabi will enable the students to be equipped with the state of the art of the subject and will empower them to get jobs in technological and engineering fields as well as in business, education and health care sectors.

- The LOCF committee in Mathematics has prepared this draft paying suitable attention to objectives and learning outcomes of the papers. These syllabi may be implemented with minor modifications with appropriate justifications keeping in view regional, national and international context and needs.

- The outcomes of each paper may be modified as per the local requirements.
- The text books mentioned in references are denotative/demonstrative. The divisions of each paper in units are specified to the context mentioned in courses. These units will help the learners to complete the study of concerned paper in certain periods and prepare them for examinations.

- The papers are organized considering the credit load in a particular semester. The core papers of general interest are suggested for semesters I to VI. The elective courses are proposed for the B.Sc. students having Mathematics as a subject.

- The mathematics is a vast subject with immense diversity. Hence it is very difficult for every student to learn each branch of mathematics, even though each paper has its unique importance. Under these circumstances, LOCF in Mathematics suggests a number of elective papers along with compulsory papers. A student can select elective papers as per his/her needs and interests.

- The committee expects that the papers may be taught using various Computer Algebra Systems (CAS) softwares such as Mathematica, MATLAB to strengthen the conceptual understanding and to widen up the horizon of students self-experience.

- The committee of the LOCF in Mathematics expects that the concerned department will encourage their faculty members to include necessary topics in addition to courses suggested by LOCF committee. It is hoped that the needs of all round development in the careers of learners/students will be fulfilled by the recommendations of LOCF in Mathematics.

LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK IN B.SC. MATHEMATICS AS A SUBJECT

1. INTRODUCTION

One of the significant reforms in the undergraduate education is to introduce the Learning Outcomes-based Curriculum Framework (LOCF) which makes its student-centric, interactive and outcome-oriented with well-defined aims, objectives and goals to achieve. Outcome based learning is the principal end of pedagogical transactions in higher education in today's world in the light of exponential change brought about in science and technology, especially in mathematics, and the prevalent utilitarian world view of the society. The learning outcomes are attained by students through skills acquired during a programme of study. Programme learning outcomes will include subject-specific skills and generic skills, including transferable global skills and competencies. It would also focus on knowledge and skills that prepare students for further study, employment, and citizenship. They help ensure comparability of learning levels and academic standards across colleges/universities and provide a broad picture of the level of competence of graduates.

The quality education in a subject like mathematics is a very challenging task for Higher Education System in India. UGC has already taken an appropriate measure to define the minimum levels of learning for mathematics courses for undergraduate and post-graduate levels. The quality of higher education in mathematics should be improved in such a manner that young minds are able to compete in this field globally in terms of their knowledge and skills in the globalised era of the date. Also, there is an urgenteed of sustained initiatives to be taken by colleges/institutes/universities for outcome-oriented higher education in mathematics so that graduates are enabled to enhance the chances of employability. Presently, the goal of higher education in mathematics may be achieved using the following measures:

i. Curriculum reform based on a learning outcomes-based curriculum framework (LOCF).
ii. Improving learning environment and academic resources.
iii. Elevating the quality of teaching and research.
i. Involving students in discussions, problem-solving and out of box thinking about various ideas of mathematics and their applicability, which may lead to empowerment and

enhancement of the social welfare at large.

ii. Encouraging the learners to make use of LOCF to learn mathematics through distance education.

iii. Motivating the learners to understand various concepts of mathematics keeping in view the regional context.

iv. Enabling learners to create research atmosphere in mathematical sciences in their colleges/institutes/universities.

v. Teach courses of mathematics based on Choice Based Credit System (CBCS).

One of the benchmarks to measure the progress of a country is the advancement of the knowledge of mathematics. Hence, innovative measures should be taken to improve the quality of mathematical knowledge in our society. This is also because mathematics has wide ranging applications in engineering, technology and a host of other areas.

1.1 Course Structure – Types of Courses.

The following types of courses are offered under CBCS-LOCF:

1. **Core Courses (CC):** A core course is a compulsory course. A student of Mathematics has to take 14 such Mathematics courses over six semesters.

2. **Elective Courses (EC):** An elective course is a course that is to be chosen from a specified set of courses. These courses are of two types.

Discipline Specific Electives (DSE): These are elective courses that provide advanced undergraduate training in specialized areas of Mathematics A set of **4**, semester-specific, courses of this kind are offered in the fifth and sixth semesters of the Undergraduate programme.

Generic Electives (GE): These courses, in disciplines other than Mathematics, are intended to broaden the training of a student in the Mathematics Undergraduate programme. A student of Mathematics will take one such course, offered by another department, in each of Semesters V to VI.

3. **Ability Enhancement Compulsory Course (AECC):** Two such courses are to be taken, one in Semester I (Environmental Studies) and one in Semester II (Value Education–Gandhian Thoughts).

4. **Skill Enhancement Course (SEC):** A student is to take one such course each in Semester III through Semester VI. Be sides an individual/group project in Semester VI.

2. LEARNING OUTCOMES-BASED APPROACH TO CURRICULUM PLANNING

The Bachelor's Degree in B.Sc. Mathematics as a subject is awarded to the students on the basis of knowledge, understanding, skills, attitudes, values and academic achievements sought to be acquired by learners at the end of these programmes. Hence, the learning outcomes of mathematics for these courses are aimed at facilitating the learners to acquire these attributes, keeping in view of their preferences and aspirations for knowledge of mathematics.

The LOCF in mathematics has designed courses in the light of graduate attributes, description of qualifications, courses and programme learning outcomes. The committee has tried to frame the syllabi of mathematics in such a way that it may lead to all round development and delivery of complete curriculum planning. Hence, it provides specific guidelines to the learners to acquire sufficient knowledge during this programme.

The objectives of LOCF (Mathematics) are to prepare the syllabi having standard level of study. It is also aimed at prescribing standard norms for teaching-learning process and examination pattern. Hence, the programme has been chalked out in such manner that there is scope of flexibility and innovation in

i. Modifications of prescribed syllabi.

ii. Teaching-learning methodology.

iii. Assessment technique of students and knowledge levels.

iv. Learning outcomes of courses.

v. Inclusion of new elective courses subject to availability of experts in colleges/institutes/universities across the country.

2.1 Nature and extent of Bachelor's Degree Programme

Mathematics is the study of quantity, structure, space and change. It has very broad scope in science, engineering and social sciences. The key are as of study in mathematics are:

1. Algebra
2. Calculus
3. Analytical Geometry
4. Differential Equations

5. Analysis
6. Mechanics

Degree programs in mathematics cover topics which are already mentioned in details under various headings are given. The depth and breadth of study of individual topics depend on the nature and devotion of learners in specific mathematics programmes.

As a part of effort to enhance employability of mathematics graduates, the courses have been designed to include learning experiences, which of further opportunities in various sectors of human activities. In this context, the experience of the project works in the areas of applications of mathematics.

2.2 Aims of Bachelor's degree programme in Mathematics

The overall aims of B.Sc. Mathematics as a subject are to

- create deep interest in learning mathematics.
- develop broad and balanced knowledge and understanding of definitions, concepts, principles and theorems.
- familiarize the students with suitable tools of mathematical analysis to handle issues and problems in mathematics and related sciences.
- enhance the ability of learners to apply the knowledge and skills acquired by them during the programme to solve specific theoretical and applied problems in mathematics.
- provide students/learners sufficient knowledge and skills enabling them to undertake further studies in mathematics and its allied areas on multiple disciplines concerned with mathematics.
- encourage the students to develop a range of generic skills helpful in employment, internships and social activities.

3. GRADUATE ATTRIBUTES IN MATHEMATICS

The graduate attributes in mathematics are the summation of the expected course learning outcomes mentioned in the beginning of each course. Some of them are stated below.

- **Disciplinary knowledge:**

Capability of demonstrating comprehensive knowledge of mathematics and understanding of one or more disciplines which form a part of an under graduate programme of study.

- **Communications skills:**

  i.Ability to communicate various concepts of mathematics effectively using examples and their geometrical visualizations.

  ii. Ability to use mathematics as a precise language of communication in other branches of human knowledge.

  iii. Ability to communicate long standing unsolved problems in mathematics.

  iv. Ability to show the importance of mathematics as precursor to various scientific developments since the beginning of the civilization.

  v. Abilitytoexplainthedevelopmentofmathematicsinthecivilizationalcontextandits role as queen of all sciences.

- **Critical thinking and analytical reasoning:**

  i. Ability to employ critical thinking in understanding the concepts in every area of mathematics.

  ii. Ability to analyze the results and apply them in various problems appearing in different branches of mathematics.

- **Research-related skills:**

  i. Capabilityforinquiringaboutappropriatequestionsrelatingtotheconceptsinvarious fields of mathematics.

  ii. To know about the advances in various branches of mathematics.

- **Information/digital literacy:**

  i. Capability to use appropriate softwares to solve system of equations and differential equations.

  ii. Capability to understand and apply the programming concepts of C++ to mathematical investigations and problem solving.

- **Self-directed learning:**

  Ability to work independently and do in-depth study of various notions of mathematics.

- **Moral and ethical awareness/reasoning:**

  Ability to identify unethical behavior such as fabrication, falsification or misrepresentation of data and adopting objective, unbiased and truthful actions in all aspects.

- **Lifelong learning:**

  Ability to think, acquire knowledge and skills through logical reasoning and to inculcate the habit of self-learning.

4. QUALIFICATION DESCRIPTORS FOR B.SC. MATHEMATICS AS A SUBJECT

The qualification descriptor suggests the generic outcomes and attributes to be obtained while obtaining the degree of B.Sc. with Mathematics as a subject. The qualification descriptors indicate the academic standards on the basis of following factors:

i. Level of knowledge

ii. Understanding

iii. Skills

iv. Competencies and attitudes

v. Values.

These parameters are expected to be attained and demonstrated by the learners after becoming graduates in these programmes. The colleges consider the above mentioned parameters at the time of designing, approving, assessing and reviewing academic programmes containing common courses for B.Sc. Mathematics as a subject. The learning experiences and assessment procedures should be so designed that every graduate with mathematics may achieve the programme learning outcomes with equal opportunity irrespective of the class, gender, community and regions. Each graduate in mathematics should be able to:

i. demonstrate fundamental systematic knowledge of mathematics and its applications in engineering, science, technology and mathematical sciences. It should also enhance the subject specific knowledge and help in creating jobs in various sectors.

ii. demonstrate educational skills in areas of analysis, geometry, algebra, mechanics, differential equations etc.

iii. apply knowledge, understanding and skills to identify the difficult/unsolved problems in mathematics and to collect the required information in possible range of sources and try to analyse and evaluate these problems using appropriate

methodologies.

iv. fulfill one's learning requirements in mathematics, drawing from a range of contemporary research works and their applications in diverse areas of mathematical sciences.

v. apply one's disciplinary knowledge and skills in mathematics in newer domains and uncharted areas.

vi. Identify challenging problems in mathematics and obtain well-defined solutions.

vii. Exhibit subject-specific transferable knowledge in mathematics relevant to job trends and employment opportunities.

5. PROGRAMME LEARNING OUTCOMES OF B.Sc. MATHEMATICS AS A SUBJECT

1. Bachelor's degree in mathematics is the culmination of in-depth knowledge of algebra, calculus, geometry, differential equations and several other branches of mathematics. This also leads to study of related are as like computer science and statistics. Thus, this programme helps learners in building a solid foundation for higher studies in mathematics.

2. The skills and knowledge gained has intrinsic beauty, which also leads to proficiency in analytical reasoning. This cans be utilised in modeling and solving real life problems.

3. Students undergoing this programme learn to logically question assertions, to recognise patterns and to distinguish between essential and irrelevant aspects of problems. They also share ideas and in sight while seeking and benefitting from knowledge and insight of others. This helps them to learn behave responsibly in a rapidly changing interdependent society.

4. Students completing this programme will be able to present mathematics clearly and precisely, make vague ideas precise by formulating them in the language of mathematics, describe mathematical ideas from multiple perspectives and explain fundamental concepts of mathematics to non-mathematicians.

5. Completion of this programme will also enable the learners to join teaching profession in primary and secondary schools.

6. This programme will also help students to enhance their employability for government jobs, jobs in banking, insurance and investment sectors, data analyst jobs and jobs in various other public and private enterprises.

6. TEACHING-LEARNING METHODOLOGIES

The teaching-learning process should be aimed at systematic exposition of basic concepts so as to acquire knowledge of mathematics in a canonical manner. In this context, applications of mathematics and linkage with the theory constitute a vital aspect of the teaching-learning process. The course offers many modes of learning and assessment. Students have great freedom of choice of subjects which they can study. The various components of teaching learning process are summarized in the following heads.

1. **Lectures:** The most common method of imparting knowledge is through lectures. There are diverse modes of delivering lectures such as through blackboard, power point presentation and other technology aided means. A judicious mix of these means is a key aspect of teaching-learning process.

2. Tutorials: Assimilating mathematical ideas, deepening understanding, and gaining mastery of new concepts all take time, commitment, and intelligent effort. To reinforce learning, to monitor progress, and to provide a regular pattern of study, tutorials are essential requirements. During these tutorials, difficulties faced by the students in understanding the lectures, are dealt with. Tutorials are also aimed at solving problems associated with the concepts discussed during the lectures.

3. **Practicals:** To give a geometrical visualisation and obtaining numerical solutions of mathematical problems, various Computer Algebra Systems (CAS) are used in practical sessions. These sessions provide vital insights into mathematical concepts and draw learner's attention towards limitations of numerical computations. During practicals, mathematical models arising in real life problems can also be simulated.

4. Options System: LOCF in mathematics provides great flexibility both in terms of variety of courses and range of references in each course. In fifth and sixth semesters students can opt for elective courses from a wide range of pure and applied courses, depending on their interests and requirements.

5. **Field based learning:** Students may enhance their knowledge through field based learning while understanding the practical importance of mathematics especially in industries.

6. **Prescribed textbooks:** A large number of books are included in the list of references of each course for enrichment and enhancement of knowledge.

7. **E-learning resources:** Learner may also access electronic resources and educational websites for better understanding and updating the concepts.

8. **Self-study materials:** Self-study material provided by the teachers/instructors is an integral part of learning mathematics. It helps in bridging the gaps in the classroom teaching. It also provides scope for teachers to give additional information beyond classroom learning.

9. **Open-ended projects:** Home assignments at regular intervals and project work involving applications of theory are necessary to assimilate basic concepts of mathematics. Hence, it is incumbent on the part of a learner to complete open-ended projects assigned by the teacher.

10. **Internships:** The teaching-learning process needs to be further supported by other activities devoted to subject-specific and interdisciplinary skills, summer and winter internships in mathematics. During these internships it is expected that a learner will interact with experts and write a report on a topic provided to the learner.

11. **Institute visits:** Institute visit by a learner is also a part of learning process. During such visits a learner has access to knowledge by attending academic activities such as seminars, colloquia, library consultation and discussion with faculty members. These activities provide guidance and direction for further study.

12. **Industrial visits:** Industrial visits offer an opportunity to observe real time applications of mathematical concepts. These visits also give an opportunity to realise the power of mathematical ideas and their translation in problem solving.

13. **Training programmes:** Training programmes such as Mathematics Training and Talent Search (MTTS) program, organised by various agencies/institutes like National Board for Higher Mathematics, also provide an opportunity to learn various dimensions of mathematics.

7. ASSESSMENT METHODS

A range of assessment methods which are appropriate to test the understanding of various concepts of mathematics will be used. Priority will be given to formative assessment. Various learning outcomes will be assessed using time-bound examinations, series of open and closed book tests with uniform distribution over time, problem solving, home assignments, individual and group project reports, seminar presentations, viva-voce examination, participation in mathematical quizzes/competitions at local, regional, national and international levels and participations in internship programs. For various courses in mathematics, the following assessment methods shall be adopted:

i. Announced/unannounced quizzes

ii. Scheduled/unscheduled tests

iii. Problem solving sessions aligned with classroom lectures

iv. Practical assignments

v. Regular chamber consultation with faculty members

vi. Periodic tests, mid semester examination and semester end comprehensive examination

vii. Seminar presentations

viii. Computer skill test and computer simulation of concepts learnt

ix. Awareness tests of historical development of mathematical ideas

x. Awareness tests of recent advances in mathematics

xi. Awareness tests of various national/international prizes in mathematics including Fields Medal, Abel prize, Rolf Nevanlinna Prize, Srinivasa Ramanujan Medal etc. and the work of recipients of these prizes

xii. Awareness test of applications of mathematics in other branches of science, technology and other disciplines.

8.STRUCTURE OF B.SC.MATHEMATICS

B.Sc., DEGREE COURSE

SCHEME OF EXAMINATIONS: CBCS PATTERN

(For the students admitted during the academic year 2021-2022 and onwards)

PART	SUB CODE	TITLE OF THE PAPER	Hours/Week	Internal (CA) Marks	External Marks	Total Marks	Ext– Min.	Total Pass Mark	Credits
SEMESTER - I									
I	21TAM11L	**Part–I:** Language- I: Tamil –Paper-I	6	50	50	100	20	40	3
II	21ENG12L	**Part–II:** Language-II:English-Paper-I	6	50	50	100	20	40	3
III	21BMA13C	**Core-I:** Algebra	5	50	50	100	20	40	4
III	21BMA14C	**Core-II:** Calculus	5	50	50	100	20	40	4
III	21BMA15A	**Allied – I:** Numerical Analysis	6	50	50	100	20	40	4
IV	21ENV1GE	Environmental Studies	2	50	50	100	20	40	2
SEMESTER - II									
I	21TAM21L	**Part–I:** Language- I: Tamil –Paper-II	6	50	50	100	20	40	3
II	21ENG22L	**Part–II:**Language-II:English-Paper-II	6	50	50	100	20	40	3
III	21BMA23C	**Core-III:** Differential Equations And Laplace Transforms	5	50	50	100	20	40	4
III	21BMA24C	**Core-IV:** Analytical Geometry of 2D & 3D	5	50	50	100	20	40	4
III	21BMA25A	**Allied – II:** Discrete Mathematical Structure	6	50	50	100	20	40	4
IV	21VAL2GE	**Value Education**– Gandhian Thoughts	2	50	50	100	20	40	2

PART	SUB CODE	TITLE OF THE PAPER	Hours/Week	Internal (CA) Marks	External Marks	Total Marks	Ext– Min.	Total Pass Mark	Credits
SEMESTER - III									
I	21TAM31L	**Part–I:** Language- I: Tamil –Paper-III	6	50	50	100	20	40	3
II	21ENG32L	**Part–II:** Language-II: English-Paper-III	6	50	50	100	20	40	3
III	21BMA33C	**Core -V :** Trigonometry, Vector Analysis and Fourier Series	6	50	50	100	20	40	4
III	21BMA34A	**Allied – III:** Physics –I(Theory**)**	6	30	45	75	18	30	4
III	21BMA35P	**Allied – III:** Physics –I(Practical)	2	25	25	50	10	20	2
IV	21BMA35S	**Skill Based Elective Subject –I:** Optimization Techniques - I	4	50	50	100	20	40	3
SEMESTER - IV									
I	21TAM41L	**Part–I:** Language- I: Tamil –Paper-IV	6	50	50	100	20	40	3
II	21ENG42L	**Part–II:**Language-II: English-Paper-IV	6	50	50	100	20	40	3
III	21BMA43C	**Core - VI:** Abstract Algebra	6	50	50	100	20	40	4
III	21BMA44A	**Allied – IV:** Physics –II (Theory)	6	30	45	75	18	30	4
III	21BMA45P	**Allied – IV:** Physics –I&II (Practical)	2	25	25	50	10	20	2
IV	21BMA46S	**Skill Based Elective Subject – II:** Optimization Techniques – II	4	50	50	100	20	40	3
V	21EXA4GE	**@ Extension Activities:** NCC/NSS/SPORTS//YRC	-	-	-	-	-	-	1

@ No External examinations. Only Continuous Internal Assessment (CIA)
Includes 25/40 continous internal assessment marks for theory and practical papers respectively
Project evaluation done by both Internal and External examiners for 80 Marks.

PART	SUB CODE	TITLE OF THE PAPER	Hours/Week	Internal (CA) Marks	External Marks	Total Marks	Ext– Min.	Total Pass Mark	Credits
SEMESTER - V									
III	21BMA51C	**Core -VII** : Linear Algebra	6	50	50	100	20	40	5
III	21BMA52C	**Core –VIII :** Real Analysis - I	5	50	50	100	20	40	5
III	21BMA53C	**Core – IX :** Statics	5	50	50	100	20	40	5
III	21BMA54C	**Core – X :** Mathematical Statistics-I	5	50	50	100	20	40	4
III		**Project**	2	50	50	100	20	40	15
IV	21BMA55S	**Skill Based Elective Subject – III:** C Programming	4	50	50	100	20	40	3
IV	21BMA5EL	**Non-Major Elective Subject – I:** Arithmetic For All - I	3	50	50	100	20	40	2
SEMESTER - VI									
III	21BMA61C	**Core -XI:**Real Analysis - II	6	50	50	100	20	40	5
III	21BMA62C	**Core -XII:** Dynamics	5	50	50	100	20	40	5
III	21BMA63C	**Core -XIII:** Complex Analysis	5	50	50	100	20	40	5
III	21BMA64C	**Core –XIV:** Mathematical Statistics – II	5	50	50	100	20	40	4
III	21BMA65P	**Project & Viva – Voce**	2	50	50	100	20	40	15
IV	21BMA66S	**Skill Based Elective Subject – IV:** Latex	4	50	50	100	20	40	3
IV	21BMA6EL	**Non-Major Elective Subject – II:** Arithmetic For All - II	3	50	50	100	20	40	2
		TOTAL/CREDITS				**3600**			**140**

B.Sc., DEGREE COURSE

SCHEME OF EXAMINATIONS: CBCS PATTERN

(For the students admitted during the academic year 2021-2022 and onwards)

PART	SEMESTER	SUBJECT CODE	TITLE OF THE PAPER	Hours/Week	Internal (CA) Marks	External Marks	Total Marks	Ext– Min.	Total Pass Mark	Credits
IV	**I**	21BPH14A	**Allied I:** Mathematics –I (For Physics and Chemistry)	8	50	50	100	20	40	5
IV	**I**	21BST14A	**Allied I:**Mathematics For Statistics-I	8	50	50	100	20	40	
IV	**II**	21BPH24A	**Allied II:** Mathematics -II (For Physics and Chemistry)	8	50	50	100	20	40	5
IV	**II**	21BST25A	**Allied I:**Mathematics For Statistics –II	8	50	50	100	20	40	
IV	**II**	21BCS24A	**Allied II:** Discrete Mathematics For Computer Science	8	50	50	100	20	40	
IV	**III**	21BCS34A	**Allied III:** Operations Research For Computer Science	8	50	50	100	20	40	
IV	**I**	21BIT14A	**Allied I:** Mathematical Foundations for Information Technology	8	50	50	100	20	40	
IV	**III**	21BCO34A	**Allied III:** Business Mathematics	8	50	50	100	20	40	
IV	**II**	21BIB25A	**Allied I:** Mathematics For Business (For B.Com IB)	8	50	50	100	20	40	
IV	**I**	21GEO14A	**Allied I:** Mathematics for Geology -I	8	50	50	100	20	40	5
IV	**II**	21GEO24A	**Allied II:** Mathematics for Geology -II	8	50	50	100	20	40	5

YEAR	SEM.	SUBJECT CODE	TITLE OF THE PAPER	Hours/ Week
2021-22 onwards	**I**	**21BMA13C**	**ALGEBRA**	**5**

COURSE LEVEL OUTCOMES:

On the successful completion of the course, student will be able to:

1. Identify the appropriate tests to find the convergence of an infinite series
2. Discuss the concept of Binomial, Exponential, Logarithmic series and their applications to summation of series
3 .Develop the relation between the roots and the coefficients of polynomial equation.
4. Explain the Descartes rule of signs to find the number of real and complex roots of polynomial equation.
5. Illustrate the methods of finding approximate roots of an equation.
6. Describe various methods to solve both algebraic and transcendental equations.

UNIT: I

CONVERGENCE AND DIVERGENCE OF SERIES: Infinite series – Geometric series – Some general theorems concerning infinite series – Convergence of the series $\sum_{n=1}^{\infty}\frac{1}{n^k}$ – Cauchy's condensation test – D'Alembert's Ratio test – Cauchy's Root test – Raabe'stest.

(Chapter 2 - Sections: 8 to 19)

UNIT: II

BINOMIAL THEOREM: Binomial theorem for rational index – Application of the Binomial theorem to the summation of series – Approximate values.

(Chapter 3 - Sections: 5 to 10 and 14)

UNIT: III

EXPONENTIAL AND LOGARITHMIC SERIES: The Exponential theorem – Summation - The Logarithmic series – Euler's constant – summation – The application of the exponential and logarithmic series to limits and approximations.

(Chapter 4 - Sections: 1 to 11)

UNIT: IV

THEORY OF EQUATIONS: Roots of an equation – Relations between the roots and co-efficient of equations – Symmetric functions of the roots – Transformation of equations – Reciprocal equations
(Chapter 6 - Sections: 1 to 12, 15 & 16)

UNIT: V

THEORY OF EQUATIONS (Cont.): To increase or decrease the roots of a given equation by a given quantity – Removal of terms – Descartes' Rule of signs - Rolle's theorem – Multiple roots – Horner's method of approximation.

(Chapter 6 – Sections: 17, 19, 24 to 26 and 30. (Omit section 30.1))

PEDAGOGY STRATEGIES

- Board and Chalk lecture
- Powerpoint slide presentations
- Assignments
- Quizes

REFERENCE:

ALGEBRA VOL I - T.K.MANICAVACHAGOM PILLAY, T.NATARAJAN, andK.S.GANAPATHY,S. ViswanathanPvt. Ltd, 2007.

FUTHER READING:

1. Algebra- N.P. Bali, Laxmi Publications, New Delhi, Edition 2010.
2. Mathematics for B.Sc Vol.-I- P. Kandasamy and K .Thilgavathy(For B.Sc – Semester I), S Chand and Company Ltd., New Delhi 2004.

INTERNET RESOURCES:

- https://www.brainkart.com/article/Introduction-to-Binomial-Exponential-and -Logarithmic- series 35107/
- http://www.jjernigan.com/172/ConvergenceDivergenceNotes.pdf

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES.

			Course Level Outcomes (CLO)					
			1	2	3	4	5	6
Program Level Outcomes (PLO)	1	Disciplinary knowledge		✓			✓	
	2	Communication skills	✓		✓			✓
	3	Critical thinking		✓	✓		✓	✓
	4	Research related skills	✓				✓	
	5	Analytical reasoning	✓			✓	✓	✓
	6	Problem solving	✓	✓		✓	✓	✓
	7	Team work		✓		✓	✓	
	8	Moral and ethical awareness			✓		✓	

YEAR	SEM.	SUBJECT CODE	TITLE OF THE PAPER	Hours/ Week
2021-22 onwards	**I**	**21BMA14C**	**CALCULUS**	**5**

COURSE LEVEL OUTCOMES:

On the successful completion of the course, student will be able to:

1.Recall the basic concepts in differentiation and get the knowledge of curvature, radius of curvature, evolutes and involutes.
2.Discussthe concepts of integrals of irrational functions and able to evaluate integrals by the repeated use of integration by parts.
3. Use the knowledge of double and triple integrals for finding area and volumes.
4. Know the method of solving multiple integrals by using the concept of change of variables.
5.Acquire the information about Beta and Gamma functions and apply it in various problems.

UNIT: I

CURVATURE OF PLANE CURVES: Curvature – Circle, radius and centre of curvature – Cartesian formula for the radius of curvature – The coordinates of the centre of curvature - Evolute and Involute –Radius of curvature when the curve is given in polar co-ordinates - Pedal equation of a curve.

(Chapter X – Sections: 2.1 to 2.7)

UNIT: II

INTEGRATION: Integration of irrational functions – Properties of definite integrals - Integration by parts – Reduction Formulae – Bernoulli's Formula.

(Chapter 1 – Sections: 8 to 15.1)

UNIT: III

MULTIPLE INTEGRALS: Evaluation of the double integral – Change of order of integration – Double integral in polar co-ordinates – Triple integrals – Applications of Multiple integrals – Volumes of solids of revolution – Volumes of solids as double integrals – Volume as a triple integral.

(Chapter 5 - Sections: 1 to 6.3)

UNIT: IV

CHANGE OF VARIABLES: Jacobian – Two important results regarding Jacobians- Change of variables in the case of two variables – Change of variables in the case of three variables. Transformation from cartesian to polar co-ordinates – Transformation from cartesian to spherical polar co-ordinates.

(Chapter 6 – Sections: 1.1 to 2.4)-

UNIT: V

IMPROPER INTEGRALS: Beta and Gamma functions – Recurrence formula for Gamma functions – Properties of Beta functions - Relation between Beta and Gamma functions – Applications of Gamma functions to multiple integrals.

(Chapter 7 - Sections: 2.1 to 6)

PEDAGOGY STRATEGIES:

- Board and chalk lecture
- Power point slide presentation
- Tutorials
- Assignment
- Quizes
- Class test

REFERENCES :

CALCULUS VOL - I - S. NARAYANANand T.K. MANICAVACHAGOM PILLAY,SViswanathan Publishers, 2013. **(For Unit I)**

CALCULUS, VOL – II -S. NARAYANANand T.K. MANICAVACHAGOM PILLAY, S Viswanathan Publishers, 2013. (**For Units II to V)**

FURTHER READING:

1. Mathematics for B.Sc. Vol I and VOL. II, P. Kandasamy. &K.Thilagavathy, S. Chand and Co, 2004
2. A Text books of Calculus – Shanthi Narayanan &J. N. Kapoor, S. Chand & Co 2014

INTERNET RESOURCES:

1. https://www.khanaacademy.org/math/calculus-home.
2. https://ocus.mit.edu/resources/res-18-006-calculus-revisited-single-variable-calculus-fall-2010/study mareials/

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES.

			Course Level Outcomes (CLO)					
			1	2	3	4	5	6
Program Level Outcomes (PLO)	1	Disciplinary knowledge	✓	✓			✓	
	2	Communication skills		✓		✓		✓
	3	Critical thinking	✓			✓		✓
	4	Research related skills		✓		✓	✓	
	5	Analytical reasoning	✓			✓	✓	✓
	6	Problem solving	✓	✓	✓	✓	✓	✓
	7	Team work		✓		✓	✓	
	8	Moral and ethical awareness	✓		✓		✓	

YEAR	SEM.	SUBJECT CODE	TITLE OF THE PAPER	Hours/ Week
2021-22 onwards	I	21BMA15A	NUMERICAL ANALYSIS	6

COURSE LEVEL OUTCOMES:

On the successful completion of the course, student will be able to:

1. Compute numerical solution of algebraic and transcendental equations.
2. Illustrate the methods of finding numerical solutions to the polynomial equation.
3. Apply the finite difference and interpolation concepts.
4. Develop skills in framing mathematical models for constructing polynomial to the given data.
5. Describe various methods for finding solution using numerical differentiation and Numerical integration.
7. Explain the numerical techniques to apply in the field of Science and Engineering.

UNIT: I

SOLUTION OF TRANSCENDENTAL EQUATIONS AND ALGEBRAIC EQUATIONS: Bisection method – Iteration method – Newton Raphson method.

SOLUTION OF SIMULTANEOUS LINEAR ALGEBRAIC EQUATIONS: Gauss elimination and Gauss Jordan methods – Gauss Jacobi and Gauss Seidal methods.

(Chapter 3 - Sections: 2, 3, 5; Chapter 4 - Sections: 2, 6)

UNIT: II

FINITE DIFFERENCE OPERATORS: Operators $\Delta, \nabla, \delta, \mu$ and E - Properties of these operators and relation between them.

INTERPOLATION (FOR EQUAL INTERVALS): Newton's forward and Newton's backward interpolation formulae.

(Chapter 5 - Sections: 2 to 8, 10, 14, 15, 16, 18; Chapter 6 - Sections: 1, 3, 4)

UNIT: III

CENTRAL DIFFERENCE INTERPOLATION FORMULAE: Gauss's forward interpolation formula - Gauss's backward interpolation formula - Stirling's interpolation formula and Bessel's interpolation formula.

(Chapter 7 - Sections: 1 to 6)

UNIT: IV

INTERPOLATION (FOR UNEQUAL INTERVALS): Divided differences – Properties of Divided differences – Newton's divided difference formula – Lagrange's formula and inverse interpolation.

(Chapter 8 - Sections: 1 to 4, 9)

UNIT: V

NUMERICAL DIFFERENTIATION: Newton's forward difference formula and backward difference formula to compute the derivative – Derivative using Stirling's formula.

NUMERICAL INTEGRATION: Trapezoidal rule – Simpson's one third and three eighth rule.

(Chapter 9 - Sections: 1 to 4, 7, 8, 10)

PEDAGOGY STRATEGIES:

- Board and Chalk lecture
- Powerpoint slide presentations
- Assignments
- Quizes

REFERENCE :

NUMERICAL METHODS IN SCIENCE AND ENGINEERING - M. K.

VENKATRAMAN, Second Edition (revised), The National Publishing Company, 1987.

FURTHER READING:

1.NUMERICAL METHODS - P. KANDASAMY, K. THILAGAVATHY and

K. GUNAVATHY, S. Chand and Company Limited, New Delhi, Revised Edition 2005.

2.INTRODUCTORY METHODS OF NUMERICAL ANALYSIS - S. S. SASTRY,

Third Edition, Prentice Hall India Private Limited, New Delhi, 2003.

INTERNET RESOURCES:

1.https://nptel.ac.in/courses/111/107/111107105/

2.https://www.math.ust.hk>nu...pdf

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES.

			Course Level Outcomes (CLO)					
			1	2	3	4	5	6
Program Level Outcomes (PLO)	1	Disciplinary knowledge				✓	✓	✓
	2	Communication skills		✓	✓	✓		
	3	Critical thinking	✓		✓		✓	✓
	4	Research related skills	✓	✓		✓		✓
	5	Analytical reasoning	✓		✓		✓	
	6	Problem solving		✓	✓			✓
	7	Team work	✓	✓			✓	
	8	Moral and ethical awareness			✓	✓		✓

YEAR	SEM.	SUBJECT CODE	TITLE OF THE PAPER	Hours/ Week
2021-22 onwards	II	21BMA23C	DIFFERENTIAL EQUATIONS AND LAPLACE TRANSFORMS	5

COURSE LEVEL OUTCOMES:

On the successful completion of the course, student will be able to:

1. Develop knowledge to solve ordinary differential equations and partial differential equations.
2. Describe methods for solving higher order linear differential equations.
3. Expose differential equations as a powerful tool in solving problems in physical and social sciences.
4. Demonstrate competency to solve linear partial differential equation by Lagrange's method.
5. Discuss the concepts of Laplace transforms and inverse Laplace transforms to solve ordinary differential equation with constant coefficients.
6. Explain the application of first order and second order equations and simultaneous linear differential equations.

UNIT: I

ORDINARY DIFFERENTIAL EQUATIONS: Exact differential equations - Equations of the first order, but of higher degree.

(Chapter 1 - Sections: 3 to 7)

UNIT: II

ORDINARY DIFFERENTIAL EQUATIONS (CONT.) : Linear differential equations with constant coefficients – Special methods of finding particular integral – Linear equations with variable coefficients – Equations reducible to the linear homogeneous equations – Variation of parameters.

(Chapter 2 - Sections: 2 to 4, 8 to 10)

UNIT: III

ORDINARY DIFFERENTIAL EQUATIONS (CONT.) : Simultaneous equations of the first order and first degree – Methods for solving dx/P=dy/Q=dz/R - Simultaneous linear differential equations with constant coefficients – Total Differential Equations.

(Chapter 3 – Sections: 1 to 7)

UNIT: IV

PARTIAL DIFFERENTIAL EQUATIONS: Derivation of partial differential equations by elimination of arbitrary constants and arbitrary functions – Different integrals of partial differential equations - standard types of first order equations - Lagrange's equations.

(Chapter 4 – Sections: 1 to 6)

UNIT: V

LAPLACE TRANSFORMS: Definition - Laplace transforms of standard functions - some general theorems - Inverse Laplace transforms - Applications to first order and second order equations with constant coefficients and simultaneous linear differential equation.

(Chapter 5 - except Sections: 10 and 11)

PEDAGOGY STRATEGIES:

- Board and Chalk lecture
- Powerpoint slide presentations
- Assignments
- Quizes

REFERENCE:

CALCULUS VOLUME – III - S.NARAYANAN and T.K.MANICAVACHAGOM

PILLAY, S.Viswanathan Printers, 2013.

FURTHER READING:

1.MATHEMATICS FOR B.SC- BRANCH –I , VOLUME III - P.KANDASAMY &

K. THILAGAVATHY, S. Chand and Company Limited, New Delhi, 2004.

2. LAPLACE AND FOURIER TRANSFORMS – Dr.J.K. GOYAL AND K.P.GUPTA,

PragatiprakashanPublishers,Meerut 2000.

INTERNET RESOURCES:

1.https://nptel.ac.in/courses/111105035/

2.https://www.math.ust.hk/''machas/differential equations.pdf

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES :

			Course Level Outcomes (CLO)					
			1	2	3	4	5	6
Program Level Outcomes (PLO)	1	Disciplinary knowledge				✓	✓	✓
	2	Communication skills		✓	✓	✓		
	3	Critical thinking	✓		✓		✓	✓
	4	Research related skills	✓	✓		✓		✓
	5	Analytical reasoning	✓		✓		✓	
	6	Problem solving		✓	✓			✓
	7	Team work	✓	✓			✓	
	8	Moral and ethical awareness			✓	✓		✓

YEAR	SEM.	SUBJECT CODE	TITLE OF THE PAPER	Hours/ Week
2021-22 onwards	II	21BMA24C	ANALYTICAL GEOMETRY OF 2D &3D	5

COURSE LEVEL OUTCOMES:

On the successful completion of the course, student will be able to:

1. Represent conics in polar coordinates and study about the characteristics of conics.
2. Demonstrate the basic concepts of direction cosines and three-dimensional geometry.
3. Discuss about straight lines connected with plane and infer about skew lines.
4. Identify the equation of a sphere and explain about the tangent plane to a sphere.
5. Determine the equations of a cone, right circular cone and cylinder.
6. Categorize the different kinds of problems in cone and cylinder and solve it.

UNIT: I

ANALYTICAL GEOMETRY OF 2D: Polar equation of a conic – Chord of the conic – Asymptotes of the conic – Equation of the normal – Some properties of the general conic.

(Chapter IX – Sections: 9 to 13)

UNIT: II

ANALYTICAL GEOMETRY OF 3D: Direction Cosines – Direction Ratios – Planes – Equation of the plane passing through the points – Angle between the planes – Equation of the plane through the line of intersection of two given planes.

(Chapter I - Sections: 7 to 11 and Chapter II)

UNIT: III

STRAIGHT LINE: Equation of the straight lines passing through two given points – The Plane and the straight line – Angle between the plane and the straight line – Co planarity of straight line - Shortest Distance (SD) and equation of SD between two lines.

(Chapter III – Sections: 1 to 8)

UNIT: IV

SPHERE: Standard equation of sphere - Results based on the properties of a sphere - Equation of circle on a sphere - Equation of tangent plane to a sphere.

(Chapter IV- Sections: 1 to 8)

UNIT: V

CONE AND CYLINDER: Cone whose vertex is at the origin - Right circular cone - Equation of a cylinder - Right circular cylinder – Enveloping cylinder.

(Chapter V – Sections: 1, 2, 8)

PEDAGOGY STRATEGIES

- Board and Chalk lecture
- Power point slide presentations
- Assignments
- Quiz

REFERENCES:

1. ANALYTICAL GEOMETRY–2D**,** T.K. Manickavachagom Pillay & T. Natarajan, S. Viswanathan (Printers & Publishers) Pvt Ltd, 2007. (For Unit I)

2. ANALYTICAL GEOMETRY–3D**,** T.K. Manickavachagom Pillay& T. Natarajan , S. Viswanathan (Printers & Publishers) Pvt Ltd, 2007. (For Units II, III, IV & V)

FURTHER READING:

1. Analytical Geometry - 2D - P. Duraipandian& Laxmi Duraipandian, Asia Publishing Company.

2. Analytical Geometry - 3D - P. Duraipandian& Laxmi Duraipandian, Emerald Publishers.

INTERNET RESOURCES

- https://mathworld.wolfram.com/DirectionCosine.html
- https://www.superprof.co.uk/resources/academic/maths/analytical-geometry/distance/angle-between-line-and-plane.html
- https://www.embibe.com/exams/right-circular-cone/

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES:

			Core Course Level Outcomes (CLO)					
			1	**2**	**3**	**4**	**5**	**6**
Programme Level outcomes (PLO)	**1**	**Disciplinary Knowledge**	✓		✓	✓		✓
	2	**Communication Skills**		✓	✓		✓	
	3	**Critical Thinking**	✓		✓		✓	
	4	**Research Related Skills**	✓	✓			✓	✓
	5	**Analytical Reasoning**		✓		✓	✓	
	6	**Problem Solving**				✓		✓
	7	**Team Work**	✓		✓		✓	✓
	8	**Moral and ethical awareness**		✓	✓			✓

YEAR	SEM.	SUBJECT CODE	TITLE OF THE PAPER	Hours/ Week
2021-22 onwards	**II**	**21BMA25A**	**DISCRETE MATHEMATICAL STRUCTURE**	**6**

COURSE LEVEL OUTCOMES:

On the successful completion of the course, student will be able to:

1.Write different normal forms of well-formed formulae.
2.Demonstrate the skill to construct simple mathematical proofs and to validate them.
3.Know some basic terminology of graphs theory.
4.Discuss the essential properties of an abstract algebraic system.
5.Assimilate the idea of grammar used to generate strings in meta language.

UNIT: I

MATHEMATICAL LOGIC: Connectives – Negation – Conjunction – Disjunction – Conditional and Biconditional – Well-formed Formulas – Tautologies – Equivalence of Formulas – Duality law – Tautological implication – Functionally Complete set of Connectives – Other Connectives – Normal forms – Disjunctive and Conjunctive normal forms – Principal Disjunctive and Principal Conjunctive normal forms.

(Chapter 1- Sections: 1.1 to 1.3)

UNIT: II

THEORY OF INFERENCE AND PREDICATE CALCULUS: Rules of Inference – Consistency of Premises and Indirect Method of Proof – The Predicate Calculus – Predicates, The Statement functions, Variables and Quantifiers – Free and Bound Variables, Inference Theory of the Predicate Calculus.

(Chapter 1 - Sections: 1.4 to 1.6)

UNIT: III

GRAPH THEORY: Basic definitions – degree of vertex-some special simple graphs - Matrix representation of graphs – Trees - Spanning trees - Minimum spanning trees - Rooted and Binary trees - Binary tree - Tree Traversal – Expression Trees – Problems

(Chapter 7)

UNIT: IV

LATTICES: Lattices as partially ordered sets – Definition and Examples – Some Properties of Lattices – Lattices as Algebraic Systems – Sub Lattices, Direct Product and Homomorphism – Some Special Lattices.

(Chapter 4 - Section: 4.1)

UNIT: V

FORMAL LANGUAGES AND AUTOMATA: Phrase-Structure Grammar- Types of Phrase Structure Grammar – Backus – Naur Form - Finite state machine - input and output strings for FSM – Finite state Automata - Problems

(Chapter 8 – Page No: 448 to 490)

PEDAGOGYSTRATEGIES:

- Board and Chalklecture
- Powerpoint slide presentations
- Assignments
- Quizes

REFERENCE:

1. DISCRETE MATHEMATICAL STRUCTURES WITH APPLICATIONS TO COMPUTER SCIENCE - J. P. TREMBLAY, R. MANOHAR, Tata McGraw Hill Publishing Company Limited, New Delhi, 1997. (For Units I,II,IV)
2. DISCRETE MATHEMATICS WITH GRAPH THEORY AND COMBINATORICS - T.VEERARAJAN, Tata McGraw Hill Publishing Company Limited, New Delhi, 2007. (For Units III, V)

FURTHER READING:

1. DISCRETE AND COMBINATORIAL MATHEMATICS- Ralph. P.Grimaldi, and B.V.Ramana, Pearson Education, 5th Edition, New Delhi -2009.
2. INTRODUCTION TO AUTOMATA THEORY, LANGUAGES AND COMPUTATION - J.E.Hopcroft, R.Motwani, J.D.Ullman, Pearson 3rd Edition, New Delhi -2013.

INTERNET RESOURCES:

1. http://www.mhhe.com/rosen/dm7
2. www.tatamcgrawhill.com
3. https://youtu.be/7FSBi8Iz6XQ
4. https://youtu.be/WzcsPcKIoOo
5. https://youtu.be/hJIST1cEf6A

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES:

			Core Course Level Outcomes (CLO)					
			1	2	3	4	5	6
Programme Level outcomes (PLO)	1	Disciplinary Knowledge	✓		✓	✓		✓
	2	Communication Skills		✓	✓		✓	✓
	3	Critical Thinking			✓		✓	
	4	Research Related Skills	✓	✓			✓	✓
	5	Analytical Reasoning		✓			✓	
	6	Problem Solving				✓		✓
	7	Team Work	✓		✓		✓	✓
	8	Moral and ethical awareness		✓	✓	✓		✓

YEAR	SEM.	SUBJECT CODE	TITLE OF THE PAPER	Hours/ Week
2021-22 onwards	III	21BMA33C	TRIGONOMETRY, VECTOR ANALYSIS AND FOURIER SERIES	6

COURSE LEVEL OUTCOMES:

On the successful completion of the course, student will be able to:

1. Identify the relations between trigonometric and hyperbolic functions and separate the real and imaginary parts of hyperbolic functions.
2. Compute Logarithm of Complex quantities and the sum of the series of trigonometric and hyperbolic functions.
3. Discuss the geometrical and physical significance of Vector Differentiation and to apply them.
4. Apply Vector Integration to find the work done by a force, surface area and volume of solids.
5. Determine Fourier Cosine and Fourier Sine series representations of a given function and the Fourier representations of odd and even functions.

UNIT: I

TRIGONOMETRY: Expansions of Cosnθ, Sinnθ, $Sin^n\theta$, $Cos^n\theta$, Cosθ, Sinθ, - Hyperbolic functions – Separation of real and imaginary parts of Hyperbolic functions.

(Chapter III &Chapter IV)

UNIT: II

TRIGNOMETRY: Logarithm of Complex quantities – Summation of Trigonometric series**:** Method of differences-Sum of sines of n angles in A.P – Sum of cosines of n-angles in A.P – $C+iS$ Method – Gregory Series – Euler Series

(Chapter V – Section: 5; Chapter VI)

UNIT: III

VECTOR DIFFERENTIATION:

Scalar point function- Vector point function – Gradient of scalar point function – Directional derivative of a scalar point function – Divergence and curl of a vector point function – Solenoidal vector – Irrotational vector – Problems.

(Chapter I)

UNIT: IV

VECTOR INTEGRATION: Introduction – Line integral – Surface and Volume integrals – Gauss Divergence theorem – Stoke's theorem – Green's theorem – Problems based on these theorems.

(Chapter II)

UNIT: V

FOURIER SERIES: Definition – Finding Fourier coefficient for a given periodic function with period 2π – Odd and Even functions –Half range Fourier series –Development in Cosine series and Sine series.

(Chapter VI - Section: 1 to 5)

PEDAGOGY STRATEGIES:

- Board and Chalk Lecture
- PowerPoint slide presentations
- Assignments
- Quizes

REFERENCE:

1. TRIGONOMETRY - S. NARAYANAN and T.K MANICAVACHAGOM PILLAY,S. Viswanathan(Printers and Publishers) PVT Ltd. (For Units I and II)
2. VECTOR ANALYSIS, ANALYTICAL SOLID GEOMETRY & SEQUENCES AND SERIES - P R VITTAL, 2NDEdition, 1999, Margham Publications, Chennai. (For Units III and IV)
3. CALCULUS VOL III -T.K. MANICAVACHAGOM PILLAY, S.NARAYANAN, S.Viswanathan Printers, 2007.(For Unit V)

FUTHER READING:

VECTOR ANALYSIS AND AN INTRODUCTION TO TENSOR ANALYSIS - Murray R.Spiegal, Schaum's Outline Series, McGraw-Hill.

INTERNETRESOURCES

1. https://www.efunda.com/math/taylor_series/trig.cfm
2. https://www.youtube.com/watch?v=0d-xE2SvsSo
3. https://www.youtube.com/watch?v=WgTyb9er7Go
4. https://mathworld.wolfram.com/FourierSeries.html

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES.

			Course Level Outcomes (CLO)				
			1	2	3	4	5
Program Level Outcomes (PLO)	1	Disciplinary knowledge	✓		✓	✓	✓
	2	Communication skills					
	3	Critical thinking		✓		✓	
	4	Research related skills			✓	✓	
	5	Analytical reasoning		✓		✓	✓
	6	Problem solving	✓	✓	✓	✓	✓
	7	Team work	✓	✓			
	8	Moral and ethical awareness					

YEAR	SEM.	SUBJECT CODE	TITLE OF THE PAPER	Hours/ Week
2021-22 onwards	**III**	**21BMA35S**	**OPTIMIZATION TECHNIQUE - I**	**4**

COURSE LEVEL OUTCOMES:

On the successful completion of the course, student will be able to:

1.Apply the basic concepts of mathematics to formulate the LPP also to learn Graphical method and Simplex method to solve the LPP.
2.Apply Big M, Two Phase and duality methods to solve the LPP.
3.Use MODI method, Hungarian Assignment Method to find an optimum solution.
4. Discuss about Inventory Models and its application.
5. Explain various Queueing Models that we come across in real life.

UNIT: I

LINEAR PROGRAMMING PROBLEM: LPP – Mathematical formulation of the problem – Graphical solution – Some exceptional cases – Canonical and Standard forms of LPP – Simplex method.

(Chapter 2 - Sections: 2.1 to 2.4, Chapter 3 - Sections: 3.1 to 3.5, Chapter 4 - Section: 4.3)

UNIT: II

LINEAR PROGRAMMING PROBLEM: Use of artificial variables – Big M method – Two phase method.

DUALITY: General primal – dual pair – Formulating dual problem – Solving dual and finding the solution of the primal – Dual Simplex method.

(Chapter 4 - Section: 4.4, Chapter 5 - Sections: 5.1 to 5.4, 5.7, 5.9)

UNIT: III

TRANSPORTATION PROBLEM: General structure of the problem – Basic solutions – Loops in transportation tables – Transportation algorithm [MODI method].

ASSIGNMENT PROBLEM: Mathematical formulation of the problem – Hungarian assignment method.

(Chapter 10 - Sections: 10.8 to 10.10, 10.12, 10.13; Chapter 11 - Sections: 11.1 to 11.3)

UNIT: IV

INVENTORY CONTROL: Types of inventories – Reasons for carrying inventories – The inventory decisions – Costs associated with inventory – Factors affecting inventory control – Economic Order Quantity (EOQ) – Deterministic inventory problems with shortages and without shortages – EOQ problems with price breaks (No derivations of the formulas required).

(Chapter 19 - Sections: 19.1 to 19.12)

UNIT: V

QUEUEING THEORY: Queueing system – Elements of Queueing system — Operating Characteristics of a Queueing System - Classification of Queuing models – Transient and steady states – (M/M/I):(∞/FIFO), (M/M/I):(N/FIFO); models – Birth-Death process – (M/M/C):(∞/FIFO) models (No derivation of the formula's required).

(Chapter 21 - Sections: 21.1 to 21.4, 21.7 to 21.9)

PEDAGOGY STRATEGIES

• Board and Chalk lecture
• PowerPoint slide presentations
• Seminar
• Assignments

REFERENCES:

OPERATIONS RESEARCH - KANTI SWARUP, P. K. GUPTA and MAN MOHAN, Fourteenth Edition, Sultan Chand and Sons, New Delhi, Reprint 2009.

FURTHER READING:

OPERATIONS RESEARCH - HAMDY A. TAHA, Eighth Edition, Macmillan Publishing Company, 2007.

INTERNET RESOURCES:

- https://thalis.math.upatras.gr/~tsantas/DownLoadFiles/Taha%20-%20Operation%20Research%208Ed.pdf
- https://youtu.be/DJp-b2-W8YY
- https://youtu.be/jwhVa3DvpC0
- https://youtu.be/W9oDsHe69pY

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES

			Course Level Outcomes (CLO)				
			1	2	3	4	5
Programme Level Outcomes (PLO)	1	Disciplinary Knowledge	✓	✓	✓	✓	✓
	2	Analytical reasoning	✓	✓	✓	✓	✓
	3	Research- related skills	✓	✓	✓	✓	✓
	4	Scientific reasoning	✓	✓	✓	✓	✓
	5	Problem Solving	✓	✓	✓	✓	✓
	6	Digital Literacy	✓	✓	✓		
	7	Self-directed learning	✓	✓	✓	✓	✓

YEAR	SEM.	SUBJECT CODE	TITLE OF THE PAPER	Hours/ Week
2021-22 onwards	IV	21BMA43C	ABSTRACT ALGEBRA	6

COURSE LEVEL OUTCOMES:

On the successful completion of the course, student will be able to:

1. Assess properties implied by the definitions of groups and rings
2. Demonstrate various canonical types of subgroups such as normal subgroups, cyclic subgroups and analyze the characteristics of these subgroups.
3. Discuss the connection and transition between previously studied mathematics and more advanced mathematics. The students will actively participate in the transition of important concepts such homomorphism & isomorphism from discrete mathematics to advanced abstract mathematics.
4. Describe the concepts of ideals and quotient rings.
5. Produce rigorous proofs of propositions arising in the context of abstract algebra.

UNIT: I

SET THEORY: Definition - Mappings – The Integers.

(Chapter 1 – Sections: 1.1 to 1.3)

UNIT: II

Group Theory: Definition of a Group – Some examples of Groups – Some preliminary lemmas – Subgroups – A counting Principle

(Chapter 2 – Sections: 2.1 to 2.5)

UNIT: III

Group Theory: Normal Subgroups and Quotient Groups – Homomorphism – Automorphism – Cayley's theorem – Permutation group.

(Chapter 2 – Sections: 2.6 to 2.10)

UNIT: IV

Ring Theory: Definition and examples of Rings – Some special classes of Rings – Homomorphism – Ideals and Quotient Rings.

(Chapter 3 – Sections: 3.1 to 3.4)

UNIT: V

Ring Theory: More Ideals and Quotient Rings – The field of Quotients of an integral domain – Euclidean Rings – A particular Euclidean Ring.

(Chapter 3 – Sections: 3.5 to 3.8)

PEDAGOGY STRATEGIES:

- Board and Chalk Lecture
- Seminar
- Assignments
- Online and offline Quizzes
- Group Presentation
- Discussion

REFERENCE:

TOPICS IN ALGEBRA–I N. Herstein, Vikas Publishers House Private Limited, Reprint 2016.

FUTHER READING:

1. MODERN ALGEBRA - ARUMUGAM S and Isaac, A. T, Scitech Publication (India) Pvt. Ltd, Chennai – 600 017.
2. MODERN ALGEBRA, Surjeet Singh and Qazi Zameeruddin, Eighth Edition, Vikas Publishing House, Reprint 2018.
3. Abstract Algebra: Theory and Applications, Thomas W Judson, Stephan F Austin State University, 2016, https://open.umn.edu
4. Introduction to Abstract Algebra, Alexander Paulin, https://math.berkeley.edu/~apaulin/AbstractAlgebra.pdf

INTERNET RESOURCES:

1. Introduction to Abstract Algebra, https://www.math.utk.edu
2. A Gentle Introduction to Abstract Algebra – CSUN, https://www.csun.edu

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES:

			Course Level Outcomes (CLO)				
			1	2	3	4	5
Programme Level Outcomes (PLO)	1	Disciplinary Knowledge	✓	✓		✓	
	2	Communication Skills					
	3	Critical Thinking	✓	✓		✓	
	4	Research Related Skills			✓		✓
	5	Analytical Reasoning	✓				✓
	6	Problem Solving		✓			
	7	Team Work			✓	✓	
	8	Moral and Ethical Awareness			✓		

YEAR	SEM.	SUBJECT CODE	TITLE OF THE PAPER	Hours/ Week
2021-22 onwards	IV	21BMA46S	OPTIMIZATION TECHNIQUE - II	4

COURSE LEVEL OUTCOMES:

On the successful completion of the course, student will be able to:

1. Identify the number of jobs and machines to find the order of preferences of jobs to be executed.
2. Discuss the maximum and minimax principle for finding the saddle points
3. Utilize the Fractional cut method for solving IPP problems.
4. Determine the nth year of Replacement of one or more Machines in a company.
5. Combine to construct Network, Finding the critical path and PERT calculations for scheduling of events.

UNIT: I

SEQUENCING: Problem of sequencing – Basic terms used in sequencing – Processing n jobs and two machines – Processing n jobs and three machines – Processing n jobs and m machines – Processing two jobs and m machines.
(Chapter 12 - Sections: 12.1 to 12.6)

UNIT: II

GAME THEORY: Introduction – Two person zero sum games – Basic terms – The Maximin – Minimax principle – Games without saddle points – Mixed strategies – Dominance property – Graphical solution of $2 \times n$ games and $m \times 2$ games.
(Chapter 17 - Sections: 17.1 to 17.7)

UNIT: III

INTEGER PROGRAMMING: Gomory's all I.P.P method – Construction of Gomory's constraints – Fractional cut method - All Integer LPP – Mixed Integer LPP.
(Chapter 7 – Sections: 7.1 to 7.6)

UNIT: IV

REPLACEMENT PROBLEM: Introduction – Replacement of equipment/asset that deteriorates gradually – Replacement of equipment that fails suddenly – Recruitment and promotion problem.
(Chapter 18 - Sections: 18.1 to 18.4)

UNIT: V

NETWORK SCHEDULING BY PERT/CPM : Introduction – Network basic components – Logical sequencing – Rules of Network – Construction – Concurrent activities – Critical path analysis – Probability considerations in PERT – Distinction between PERT and CPM. (Chapter 25 - Sections: 25.1 to 25.8)

PEDAGOGY STRATEGIES

- Board and Chalk lecture
- Power point slide presentation
- Seminar
- Assignments
- Group Discussions

REFERENCES:

OPERATIONS RESEARCH - KANTI SWARUP, P. K. GUPTA and MAN MOHAN, Fourteenth Edition, Sultan Chand and Sons, New Delhi, Reprint 2009.

FURTHER READING:

OPERATIONS RESEARCH -HAMDY A. TAHA, Eighth Edition, Macmillan Publishing Company, 2007.

INTERNET RESOURCES:

https://nptel.ac.in/courses/111/105/111105039/

https://nptel.ac.in/courses/105/108/105108127/

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES:

			Course Level Outcomes (CLO)				
			1	2	3	4	5
Programme Level Outcomes (PLO)	1	Disciplinary Knowledge	✓	✓		✓	
	2	Communication Skills					
	3	Critical Thinking	✓	✓		✓	
	4	Research Related Skills			✓		✓
	5	Analytical Reasoning	✓		✓		✓
	6	Problem Solving		✓			
	7	Team Work	✓		✓	✓	
	8	Moral and Ethical Awareness			✓		✓

Year	Sem.	Subject Code	Title of the Paper	Hours/ Week
2021-22 onwards	**V**	**21BMA51C**	**LINEAR ALGEBRA**	**6**

COURSE LEVEL OUTCOMES:

On the successful completion of the course, student will be able to:
1. Acquire skills in operations with vectors and matrices.
2. Recognize the concepts of the terms span, linear independence, basis and dimension and apply these concepts to various vector spaces and subspaces.
3. Determine and apply orthogonality.
4. Practice problem-solving using the apparatus of linear algebra.
5. Describe the tools for visualization and calculation of linear algebra concepts.

UNIT: I

Matrices: Algebra of Matrices -Types of Matrices – The inverse of a Matrix - Characteristic equation and Cayley Hamilton theorem Statement and proof– Eigen values and Eigen vectors – Problems

(Chapter 7 - Sections: 7.1, 7.2, 7.3, 7.7, 7.8)

UNIT: II

Vector spaces: Elementary basic concepts – Linear independence and bases.

(Chapter 4 - Sections: 4.1, 4.2)

UNIT: III

Vector Spaces: Dual spaces – Inner product spaces.

(Chapter 4 - Sections: 4.3, 4.4)

UNIT: IV

Linear Transformation: Algebra of linear transformations – Characteristic roots.

(Chapter 6 - Sections: 6.1, 6.2)

UNIT: V

Linear Transformation: Matrices - Canonical forms - Triangular forms.

(Chapter 6 - Sections: 6.3, 6.4)

PEDAGOGY STRATEGIES:

- Board and Chalk Lecture
- Seminar
- Assignments
- Online and offline Quizzes
- Group Presentation
- Discussion

REFERENCE:

1. MODERN ALGEBRA – S.Arumugam and A.T Issac, Eighth Edition, Sci Tech Publications (India) Private Limited, Reprint June 2016. (For Unit I)
2. TOPICS IN ALGEBRA - I. N. Herstein, Second Edition, Vikas Publishers House Private Limited, Reprint 2016. (For Units II, III, IV, V)

FUTHER READING:

MODERN ALGEBRA- Surjeet Singh and Qazi Zameeruddin, Eigth Edition, Vikas Publishing House, Reprint 2018.

FURTHER READING:

1. Linear Algebra - Saint Michael's College, http://joshua.smcvt.edu/linearalgebra/book.pdf
2. Linear Algebra, Kenneth Hoffman and Ray Kunze, http://www.math.pku.edu.cn›anjp›textbook

INTERNET RESOURCES:

1. Linear Algebra – UC Mathematics: https://www.math.ucdavisedu
2. Introduction to Linear Algebra, 5th Edition – MIT Mathematics: http://www.math.pku.edu.cn/teachers/anjp/textbook.pdf

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES:

Programme Level Outcomes (PLO)			Course Level Outcomes (CLO)				
			1	2	3	4	5
	1	Disciplinary Knowledge	✓	✓			✓
	2	Communication Skills	✓		✓		
	3	Critical Thinking					✓
	4	Research Related Skills				✓	
	5	Analytical Reasoning		✓		✓	
	6	Problem Solving	✓		✓		
	7	Team Work				✓	✓
	8	Moral and Ethical Awareness		✓		✓	

YEAR	SEM.	SUBJECT CODE	TITLE OF THE PAPER	Hours/ Week
2021-22 onwards	**V**	**21BMA52C**	**REAL ANALYSIS - I**	**5**

On the successful completion of the course, student will be able to:

1. Explain the real numbers, least upper bounds, lower bounds, and the triangle inequality.
2. Appreciate the functions between sets, equivalent sets, finite, countable and uncountable sets.
3. Describe the difference between open sets and closed sets in Mathematical Analysis.
4. Identify if a function on a metric space is discontinuous or continuous.
5. Calculate the limit of a sequence and recognize convergent, divergent, bounded, Cauchy Sequences.
6. Discuss the concept of limits and continuity.

UNIT: I

THE REAL NUMBER SYSTEM: Introduction-The field axioms – The order axioms – Geometric representation of real numbers – Intervals – Integers – The unique factorization theorem for integers – Rational numbers – Irrational numbers – Upper bounds, maximum element, least upper bound (supremum) – The completeness axiom – Some properties of the supremum; Properties of the integers deduced from the completeness axiom – The Archimedean property of the real number system – Rational numbers with finite decimal representation –Finite decimal approximation to real numbers – Infinite decimal representation of real numbers –Absolute values and the triangle inequality – The Cauchy-Schwarz inequality – Plus and minus infinity and the extended real number system R^*

(Chapter 1: Sections: 1.1 – 1.20)

UNIT II

SOME BASIC NOTIONS OF SET THEORY: Introduction - Notations – Ordered pairs – Cartesian product of two sets – Relations and functions – Further terminology concerning functions – One-to-one functions and inverses – Composite functions – Sequences – Similar (equinumerous) sets – Finite and Infinite sets – Countable and Uncountable sets – Uncountability of the real number system – Set algebra – Countable collection of countable sets.

(Chapter 2: Sections: 2.1 – 2.15)

UNIT III

ELEMENTS OF POINT SET TOPOLOGY: Introduction - Euclidean space in R^n - Open balls and open sets in R^n - The structure of open sets in R^1 - Closed sets – Adherent points – Accumulation points –Closed sets and Adherent points – The Bolzano – Weierstrass theorem – The Cantors intersection theorem.

(Chapter 3: Sections: 3.1 – 3.9)

UNIT IV

ELEMENTS OF POINT SET TOPOLOGY(CONTINUED): The LindelÖf covering theorem – The Heine-Borel covering theorem – Compactness in R^n - Metric spaces – Point set topology in metric spaces – Compact subsets of a metric space – Boundary of a set.

(Chapter 3: Sections: 3.10 – 3.16)

UNIT V

LIMITS AND CONTINUITY: Introduction - Convergent sequences in a metric space – Cauchy sequences – Complete metric spaces – Limit of a function – Limit of vector – valued functions –Continuous functions – Continuity of composite functions – Examples of continuous

functions. (Chapter 4: Sections: 4.1 – 4.5, 4.7 – 4.9, 4.11)

PEDAGOGY STRATEGIES:

- Board and Chalk lecture
- Powerpoint slide presentations
- Assignments
- Quizes

REFERENCE :

MATHEMATICAL ANALYSIS, T. M. Apostol, Narosa Publishing Company, II Editon, 2002.

FURTHER READING:

1.PRINCIPLES OF MATHEMATICAL ANALYSIS, Walter Rudin, McGraw Hill,1976.

2. METHODS OF REAL ANALYSIS, Richard R. Goldberg, Oxford and IBH Publishing

Company Private Limited, New Delhi, 1970.

INTERNET RESOURCES:

1. https://nptel.ac.in/courses/111/105/111105069/#

2. https://nptel.ac.in/courses/111/101/111101134/

3. https://www.digimat.in/nptel/courses/video/11110/

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES:

			Course Level Outcomes (CLO)					
			1	2	3	4	5	6
ProgrammeLevel Outcomes (PLO)	1	Disciplinary knowledge	✓		✓		✓	
	2	Communication skills		✓		✓		✓
	3	Critical thinking	✓	✓			✓	
	4	Research related skills	✓		✓	✓		✓
	5	Analytical reasoning		✓		✓		✓
	6	Problem solving	✓		✓		✓	
	7	Team work		✓	✓	✓	✓	
	8	Moral and ethical awareness	✓		✓	✓		✓

YEAR	SEM.	SUBJECT CODE	TITLE OF THE PAPER	Hours/ Week
2021-22 onwards	V	21BMA53C	STATIC	5

COURSE LEVEL OUTCOMES:

On the successful completion of the course, student will be able to:
1. Understand and apply the concepts of forces and moments.
2. Analyse the basics of coplanar forces and equilibrium of forces acting on a rigid body.
3. Analyze systems that include frictional forces and solve problems
4. Identify Centre of gravity and apply it for different objects
5. Find equilibrium of strings and derive tension at any point.

UNIT: I

PARALLEL FORCES AND MOMENT: Resultant of parallel forces – Conditions of equilibrium of parallel forces - Moment of a force – Varignon's theorem

COUPLES: Definition - Equilibrium of two couples – Equivalence of two couples – Resultant of coplanar couples.

(Chapter III - Sections: 1 to 12, ; Chapter IV - Sections: 1 to 3, 6 to 10)

UNIT: II

EQUILIBRIUM OF THREE FORCES ACTING ON A RIGID BODY: Rigid body subjected to any 3 forces - Three coplanar forces theorem – Conditions of equilibrium.

COPLANAR FORCES: Reduction of coplanar forces – Conditions for a system of forces to reduce to a single force or to a couple – Equation to the line of action of the resultant – Conditions of equilibrium of a system of coplanar forces.

(Chapter V- Sections: 1 to 3; Chapter VI - Sections: 1 to 5, 8 to 10)

UNIT: III

FRICTION: Introduction – Statical, Dynamical and Limiting friction – Laws of Friction – Co-efficient of Friction – Angle of Friction – Cone of Friction - Equilibrium of a body on a rough inclined plane under a force parallel to the plane and under any force.

(Chapter VII - Sections: 1 to 12)

UNIT: IV

CENTER OF GRAVITY: Centre of like parallel forces- Centre of mass and CG -CG of a rod, Rectangular lamina, Uniform triangular lamina, Quadrilateral lamina – General formula for determination of CG.

CG BY INTEGRATION: CG of uniform circular arc – Sector of a circle – Solid semi sphere – Hollow sphere.

(Chapter VIII - Sections: 1 - 12, 18)

UNIT: V

EQUILIBRIUM OF STRING: Equation of a common catenary – Tension at any point – Approximation to the shape of the catenary – Parabolic catenary - Suspension bridges – Simple problems.

(Chapter XI - Sections: 1 to 5, 7 to 9)

PEDAGOGY STRATEGIES:

- Board and Chalk lecture
- Assignments
- Quizes
- Seminars
- Group discussions

REFERENCE:

STATICS - Dr. M. K. VENKATARAMAN, 12th Edition, Agasthiar Publications, 2007.

FUTHER READING:

MECHANICS- P.DURAIPANDIAN, LAXMI DURAIPANDIAN, MUTHAMIZH JAYAPRAGASAM, Sixth Edition, S Chand and Company Limited, 2006.

INTERNET RESOURCES

- https://nptel.ac.in/courses/112/105/112105164/
- https://nptel.ac.in/courses/122/102/122102004/
- https://www.khanacademy.org/science/ap-physics-1

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES:

			Course Level Outcomes (CLO)					
			1	2	3	4	5	6
Programme Level Outcomes (PLO)	1	Disciplinary knowledge	✓		✓		✓	
	2	Communication skills		✓		✓		✓
	3	Critical thinking	✓	✓			✓	
	4	Research related skills	✓		✓	✓		✓
	5	Analytical reasoning		✓		✓		✓
	6	Problem solving	✓		✓		✓	
	7	Team work		✓	✓	✓	✓	
	8	Moral and ethical awareness	✓		✓	✓		✓

YEAR	SEM.	SUBJECT CODE	TITLE OF THE PAPER	Hours/ Week
2021-22 onwards	**V**	**21BMA54C**	**MATHEMATICAL STATISTICS - I**	**5**

COURSE LEVEL OUTCOMES:

On the successful completion of this course, student will be able to:

1. Recognize the importance of axioms of Probability, Multiplication Theorem and Baye's Theorem.
2. Discuss the concepts of Random Variables and Mathematical Expectation.
3. Apply the knowledge of Chebyshev's inequality in problems.
4. Distinguish the Binomial , Poisson ,Normal, Uniform, Beta and Gamma distributions.
5. Summarize the significance of Generating Functions and Law of Large Numbers.
6. Analyze some probability distribution of special importance in either theory or practice.
7. Apply the knowledge of Correlation and Regression of Multiple Variables in problems.
8. Determine Partial and multiple correlation and regression of three variables.

UNIT: I

THEORY OF PROBABILITY: Axioms of Probability – Generalized Addition theorem – Conditional Probability –Independent events – Multiplication theorem – Baye's theorem.

(Chapter III - Sections: 3.8 to 3.14; Chapter IV - Section: 4.2)

UNIT: II

RANDOM VARIABLES: The concept of random variable – The Distribution function – Discrete type and Continuous type – Two dimensional random variables – Marginal distribution – Conditional distributions – Independence of random variables.

MATHEMATICAL EXPECTATION: Mathematical Expectation – Moments of random variable – Skewness, Kurtosis, covariance, Properties of Expectation and Properties of Variance.

(Chapter V - Sections: 5.1 to 5.5, Chapter VI - Sections: 6.1 to 6.6)

UNIT: III

Moment generating function – Cumulants – Characteristic function- Chebyshev's inequality- Weak law of large numbers - BorelCantelli lemma - Probability generating function

(Chapter VII - Sections: 7.1 to 7.3, 7.5, 7.7.1, 7.8 and 7.9)

UNIT: IV

SOME PROBABILITY DISTRIBUTIONS: Bernoulli's scheme – Binomial, Poisson, Normal, Uniform, Beta and Gamma distribution.

(Chapter VIII - Sections: 8.1 to 8.5; Chapter IX - Sections: 9.1 to 9.3, 9.5 to 9.7)

UNIT: V

CORRELATION AND REGRESSION: Pearson's coefficient of correlation and regression – Partial and multiple correlation and regression of three variables only.

(Chapter X - Sections: 10.2, 10.4; Chapter XI - Sections: 11.1, 11.2.1 to 11.2.3, 11.4; Chapter XII - Sections: 12.4, 12.5, 12.7, 12.8)

PEDAGOGY STRATEGIES

- Board and Chalk lecture
- PowerPoint slide presentations
- Seminar
- Assignments
- Quizzes
- Group discussion

REFERENCES:

FUNDAMENTALS OF MATHEMATICAL STATISTICS - V. K. KAPOOR and S. C. GUPTA, Eleventh Edition, Sultan Chand & Sons, New Delhi, 2002.

FURTHER READING:

INTRODUCTION TO MATHEMATICAL STATISTICS - R. V. HOGG and T. V. CRAIG, Third Edition, Amerind Publishing Company Private Limited, New Delhi, 1970.

INTERNET RESOURCES:

1. https://youtu.be/6VLxmc0vlts
2. https://youtu.be/Z_GyV_SuFTI
3. https://youtu.be/JyVWQZNfE1I
4. https://youtu.be/4jTeyIc9bVA

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES:

			Course Level Outcomes (CLO)					
			1	2	3	4	5	6
Programme Level Outcomes (PLO)	1	Disciplinary knowledge	✓		✓		✓	
	2	Communication skills		✓		✓		✓
	3	Critical thinking	✓	✓			✓	
	4	Research related skills	✓		✓	✓		✓
	5	Analytical reasoning		✓		✓		✓
	6	Problem solving	✓		✓		✓	
	7	Team work		✓	✓	✓	✓	
	8	Moral and ethical awareness	✓		✓	✓		✓

YEAR	SEM.	SUBJECT CODE	TITLE OF THE PAPER	Hours/ Week
2021-22 onwards	V	21BMA55S	C PROGRAMMING	5

COURSE LEVEL OUTCOMES:

On the successful completion of the course, student will be able to:

1. Outline the importance of programming languages in solving the real world problems.
2. Identify the suitable data type among arrays, functions, structures and unions to store and manipulate data in C.
3. Associate operators and expressions in C language
4. Analyse the problem, divide it into modules and represent them using functions in C.
5. Develop information on initialization, reading and writing a character to manage input and output operations.
6. Create C program for a given problem by using the necessary program structure, data types and to generate the correct output.

Unit :I

CONSTANTS, VARIABLES AND DATA TYPES: Introduction – Character set – C tokens – Keywords and Identifiers – Constants – Variables – Data Types – Declaration of variables – Declaration of storage class – Assigning values to variables – Defining symbolic constants.

OPERATORS AND EXPRESSIONS: Arithmetic, Relational, Logical, Assignment, Increment and Decrement, Conditional, Bitwise, Special operators – Arithmetic expressions – Evaluation of expressions – Precedence of arithmetic operators – Type conversion in expressions – Operator precedence and associativity.

(Chapter 2 – Sections: 2.1 to 2.11; Chapter 3 – Sections: 3.1 to 3.12, 3.14 to 3.15)

Unit : II

MANAGING INPUT AND OUTPUT OPERATIONS: Reading a character – Writing a character – Formatted input – Formatted output.

DECISION MAKING AND BRANCHING: Decision making with IF statement – Simple IF statement – The IF…ELSE statement – Nesting of IF…ELSE statements – The ELSE – IF Ladder – The SWITCH statement – The ?: operator – The GOTO statement.

(Chapter 4 – Section 4.1 to 4.5; Chapter 5 – Sections: 5.1 to 5.9)

Unit : III

DECISION MAKING AND LOOPING: The WHILE statement – The DO statement – The FOR statement – Jumps in LOOPS.

ARRAYS: One dimensional array – Declaration of One dimensional array – Initialization of One dimensional arrays – Two dimensional arrays – Initializing Two-dimensional arrays – Multi-dimensional arrays.

(Chapter 6 – Sections: 6.1 to 6.5; Chapter 7 – Sections: 7.1 to 7.7)

Unit : IV

USER-DEFINED FUNCTIONS: Need for user-defined functions – A multifunction program - Elements of user-defined functions – Definition of functions – Return values and their types – Function calls – Function declaration – Category of functions – No arguments and no return values – Arguments but no return values – Arguments with return values – No arguments but returns a value – Functions that return multiple values – Nesting of functions – Recursion – Passing arrays to functions.

(Chapter 9 – Sections: 9.1 to 9.17)

Unit : V

STRUCTURES: Defining a structure – Declaring structure variables – Accessing structure members – Structure Initialization – Copying and comparing structure variables – Operations on individual members – Arrays of structures – Arrays within structures – Structures within structures.

(Chapter 10 – Sections: 10.1 to 10.10)

PEDAGOGY STRATEGIES

- Board and Chalk lecture
- Powerpoint slide presentations
- Assignments
- Quizes

REFERENCE:

PROGRAMMING IN ANSI C – E. BALAGURUSAMY, Fourth Edition, Tata McGraw Hill Publishing Company Ltd., NewDelhi 2008.

FURTHER READING:

1. THE SPIRIT OF C, An Introduction to Modern Programming, Henry Mullish and Herbert L. Cooper, Jaico Publishing House, 1999.

INTERNET RESOURCES:

- https://www.programiz.com/c-programming
- https://www.cprogramming.com

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES.

			Course Level Outcomes (CLO)					
			1	2	3	4	5	6
Program Level Outcomes (PLO)	1	Disciplinary knowledge	✓		✓			✓
	2	Communication skills	✓		✓		✓	
	3	Critical thinking	✓	✓	✓		✓	✓
	4	Research related skills	✓			✓	✓	
	5	Analytical reasoning		✓	✓		✓	✓
	6	Problem solving		✓		✓	✓	
	7	Team work			✓	✓	✓	✓
	8	Moral and ethical awareness		✓	✓		✓	✓

YEAR	SEM.	SUBJECT CODE	TITLE OF THE PAPER	Hours/ Week
2021-22 onwards	V	21BMA5EL	ARITHMETIC FOR ALL - I	3

COURSE LEVEL OUTCOMES:

On the successful completion of the course, student will be able to:

1. Identify the method of finding HCF and LCM of given set of numbers.
2. Discuss" BODMAS" rule to find out the value of a given Expression.
3. Calculate the Average of the given data.
4. Prepare Equations for the statement problems based on the conditions to find unknown.
5. Interpret the concept of percentage in solving the problems in profit and loss.
6. Explain the chain rule to solve the problems in Time and Work.

UNIT: I

Numbers – H.C.F and L.C.M of Numbers – Decimal Fractions.

(Sections: 1 to 3)

UNIT: II

Simplification, Square Roots and Cube Roots – Average

(Sections: 4 to 6)

UNIT: III

Problems on Numbers – Problems on Ages, Surds and Indices

(Sections: 7 to 9)

UNIT: IV

Percentage – Profit and Loss – Ratio and Proportion

(Sections: 10 to 12)

UNIT: V

Partnership – Chain Rule – Time and work.

(Sections: 13 to 15)

PEDAGOGY STRATEGIES:

- Board and Chalk lecture
- Power point slide presentation

- Seminar
- Assignments
- Group Discussions

REFERENCES:

QUANTITATIVE APTITUDE (FOR COMPETITIVE EXAMINATIONS) - Dr. R. S. AGGARWAL, Reprint 2014, S. Chand and Company Pvt Limited, Ram Nagar, New Delhi - 110055.

INTERNET RESOURCES:

https://www.indiabix.com/aptitude/questions-and-answers/

https://www.sawaal.com/aptitude-reasoning-questions-and-answers.html

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES:

			Course Level Outcomes (CLO)					
			1	2	3	4	5	6
Programme Level Outcomes (PLO)	1	Disciplinary knowledge	✓		✓		✓	
	2	Communication skills		✓		✓		✓
	3	Critical thinking	✓	✓			✓	
	4	Research related skills	✓		✓	✓		✓
	5	Analytical reasoning		✓		✓		✓
	6	Problem solving	✓		✓		✓	
	7	Team work		✓	✓	✓	✓	
	8	Moral and ethical awareness	✓		✓	✓		✓

YEAR	SEM.	SUBJECT CODE	TITLE OF THE PAPER	Hours/ Week
2021-22 onwards	VI	21BMA61C	REAL ANALYSIS - II	6

COURSE LEVEL OUTCOMES:
On the successful completion of the course, student will be able to:

1.Identify continuous functions on connected spaces and compact spaces.
2.Apply the concept of uniform continuity and derivatives of functions.
3.Verify Mean- value theorem for derivatives and intermediate value theorem for derivatives for functions.
4.Differentiate functions of bounded variations and total variation.
5.Compare Riemann-Stieltjes integral with Riemann Integral

UNIT: I

THE CONCEPT OF CONTINUITY: Continuity and inverse images of open or closed sets – Functions continuous on compact sets – Topological mappings (homeomorphisms) – Bolzano's theorem – Connectedness – Components of a metric space.

(Chapter 4 - Sections: 4.12 to 4.17)

UNIT: II

UNIFORM CONTINUITY: Uniform continuity - Uniform continuity and compact sets – Fixed-point theorem for contractions – Discontinuities of real-valued functions – Monotonic functions.

DERIVATIVES: Introduction - Definition of derivative – Derivatives and continuity – Algebra of derivatives – The chain rule – One-sided derivatives and infinite derivatives – Functions with non zero derivative – Zero derivatives and local extrema.

(Chapter 4 - Sections: 4. 19 to 4.23; Chapter 5 - Sections: 5.1 to 5.8)

UNIT: III

DERIVATIVES (CONTINUED): Rolle's Theorem – The Mean-value theorem for derivatives – Intermediate-value theorem for derivatives – Taylor's formula with remainder – Derivatives of vector-valued functions – Partial derivatives.

(Chapter 5 - Sections: 5.9 to 5.14)

UNIT: IV

FUNCTIONS OF BOUNDED VARIATION: Introduction - Properties of monotonic functions – Functions of bounded variation – Total variation – Additive property of total variation – Total variation on $[a, x]$ as a function of x - Functions of bounded variation expressed as the difference of increasing functions – Continuous functions of bounded variation.

(Chapter 6 - Sections: 6.1 to 6.8)

UNIT: V

THE RIEMANN–STIELTJES INTEGRAL: Introduction - Notation – The definition of Riemann-Stieltjes integral – Linear properties – Integration by parts – Change of variables in a Riemann-Stieltjes Integral – Reduction to a Riemann Integral.

(Chapter 7 - Sections: 7.1 to 7.7)

PEDAGOGY STRATEGIES:

- Board and Chalk Lecture
- PowerPoint slide presentations
- Assignments
- Quizes

REFERENCE:

MATHEMATICAL ANALYSIS - TOM M. APOSTOL, Second Edition, Narosa Publishing House, 2002.

FUTHER READING:

PRINCIPLES OF MATHEMATICAL ANALYSIS - WALTER RULDIN, McGraw Hill, 1976.

INTERNET RESOURCES:

1. https://www.mathcity.org/msc/real_analysis_notes_by_syed_gul_shah
2. http://ocw.mit.edu/courses/mathematics/18-100c-real-analysis-fall-2012
3. https://www.mathcity.org/atiq/fa14-mth321
4. https://www.mathcity.org/msc/mcqs_short_questions/real_analysis

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES.

			Course Level Outcomes (CLO)				
			1	2	3	4	5
Program Level Outcomes (PLO)	1	Disciplinary knowledge	✓		✓	✓	✓
	2	Communication skills					
	3	Critical thinking	✓	✓	✓	✓	✓
	4	Research related skills	✓	✓	✓	✓	✓
	5	Analytical reasoning	✓	✓	✓	✓	✓
	6	Problem solving	✓	✓	✓		✓
	7	Team work	✓	✓		✓	✓
	8	Moral and ethical awareness		✓		✓	✓

YEAR	SEM.	SUBJECT CODE	TITLE OF THE PAPER	Hours/ Week
2021-22 onwards	**VI**	**21BMA62C**	**DYNAMICS**	**5**

COURSE LEVEL OUTCOMES:

On the successful completion of the course, student will be able

1. Discuss about Projectiles
2. Describe the concept of Collision of Elastic Bodies.
3. Extrapolate the concept of Simple Harmonic Motion.
4. Explain the Central Forces.
5. Illustrate the methods of finding Moment of Inertia.
6. Describe various methods to solve Dynamics Problems.

UNIT: I

PROJECTILES: Definitions – Two fundamental principles - Path of a projectile – Characteristic of the motion of the Projectile - Horizontal projection of a particle from a point at a certain height – Maximum horizontal range.

(Chapter VI - Sections: 6.1 to 6.7)

UNIT: II

COLLISION OF ELASTIC BODIES: Introduction – Definitions - Fundamental laws of impact – Impact of a smooth sphere on a fixed smooth plane – Direct impact of two smooth spheres – Loss of kinetic energy – Oblique impact of two smooth spheres – Loss of kinetic energy.

(Chapter VIII - Sections: 8.1 to 8.8)

UNIT: III

SIMPLE HARMONIC MOTION: Introduction - SHM in a straight line – Simple problems – Composition of two SHM of the same period and in the same straight line – Composition of two simple harmonic motions of the same period in two perpendicular directions – Simple

pendulum - Equivalent simple pendulum – The Seconds pendulum – Loss or gain in the number of oscillations made by a pendulum.

(Chapter X - Sections: 10.1, 10.2, 10.6, 10.7, 10.12, 10.14, 10.15, 10.16)

UNIT: IV

CENTRAL FORCES: Introduction – Velocity and Acceleration in Polar Coordinates – Equations of Motion in Polar Coordinates – Note on the Equiangular Spiral – Motion under a central force - Differential equation of central orbit – Pedal equation to the central orbit – Two fold problems in the central orbit.

(Chapter XI - Sections: 11.1 to 11.6, 11.8, 11.11)

UNIT: V

MOMENT OF INERTIA: Definition – The Theorem on parallel axes – The Theorem of Perpendicular axes – M.I. of uniform rod – Rectangular lamina – Uniform Circular ring – Uniform Circular disc – Uniform Elliptic lamina – Solid sphere – Hollow sphere – Right circular cone - Hollow cone – Triangular lamina.

(Chapter XII - Sections: 12.1 to12.4)

PEDAGOGY STRATEGIES:

- Board and Chalk lecture
- Powerpoint slide presentations
- Assignments
- Quizes

REFERENCE:

DYNAMICS - Dr. M.K.VENKATARAMAN, Sixteenth Edition, Agasthiar Publications, 2014.

FURTHER READING:

MECHANICS- P. DURAIPANDIAN, LAXMI DURAIPANDIAN, MUTHAMIZH JAYAPRAGASAM, Sixth Edition, S Chand and Company Limited, 2006.

INTERNET RESOURCES:

htpp://www.introduction to Dynamics.com

htpp://www.Moment of Inertia.com

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES.

			Course Level Outcomes (CLO)				
			1	2	3	4	5
Program Level Outcomes (PLO)	1	Disciplinary knowledge	✓		✓	✓	✓
	2	Communication skills					
	3	Critical thinking	✓	✓	✓	✓	✓
	4	Research related skills	✓	✓	✓	✓	✓
	5	Analytical reasoning	✓	✓	✓	✓	✓
	6	Problem solving	✓	✓	✓		✓
	7	Team work	✓	✓		✓	✓
	8	Moral and ethical awareness		✓		✓	✓

YEAR	SEM.	SUBJECT CODE	TITLE OF THE PAPER	Hours/ Week
2021-22 onwards	VI	21BMA63C	COMPLEX ANALYSIS	5

COURSE LEVEL OUTCOMES:

On the successful completion of the course, student will be able to:

1. Construct analytic function and explain the concepts of CR equations.
2. Describe bilinear transformations and paraphrase about conformal mappings.
3. Determine the definite integrals by using Cauchy's Theorem.
4. Discuss about Cauchy's Integral formula and apply to solve problems.
5. Infer the occurrence of singular points and relate Cauchy's Residue Theorem to solve problems.
6. Relate Taylor's and Laurent's series and solve problems.

UNIT: I

ANALYTIC FUNCTIONS: Complex function – Limit of a function – Continuity of a function – Uniform continuity – Differentiability and analyticity of a function – Necessary condition for differentiability – Sufficient condition for differentiability – C. R. Equation in polar co-ordinates - Harmonic Function.

(Chapter 4 – Sections: 4.1 to 4.8; Chapter 6 - 6.12)

UNIT: II

CONFORMAL MAPPINGS: Bilinear Transformation - Circles and inverse points- Transformation $W = z^2, W = e^z, W = \sin z, W = \cos z$ - Conformal mapping.

(Chapter 7 – 7.1 to 7.4, 7.6 to 7.8)

UNIT: III

COMPLEX INTEGRATION: Simple rectifiable positively oriented curves – Simple integrals using definition – Definite integrals – Interior and exterior of a closed curve – Simply connected region – Cauchy-Goursat's theorem. Integrals along an arc joining two points –Problems.

(Chapter 8 - Sections 8.1 to 8.8)

UNIT: IV

COMPLEX INTEGRATION (CONTINUED)

Cauchy's integral formula – Cauchy's formula for derivative – Cauchy's formula for higher derivatives – Morera's theorem – Problems.

TAYLOR'S AND LAURENT'S SERIES: Taylor's series – Zeros of an analytic function – Laurent's series.

(Chapter 8 - Section 8.9; Chapter 9 – Sections: 9.1 to 9.3)

UNIT: V

RESIDUES

Singular points and types of singularities - Residues – Calculus of residues – Problems.

(Chapter 9 – Sections: 9.5 to 9.13; Chapter 10 – Sections: 10.1, 10.2)

PEDAGOGY STRATEGIES

- Board and Chalk lecture
- Power point slide presentations
- Assignments
- Quiz

REFERENCES:

Duraipandian P, Laxmi Duraipandian, and Muhilan D **(**1984), **Complex Analysis** - Second Edition, Emerald Publisher.

FURTHER READING:

1. Choudhary B, (2007), The Elements of Complex Analysis, Wiley Eastern Limited.
2. Arumugam S, Thangapandi Isaac A and Somasundaram A (2004), Complex Analysis, Scitech Publications Pvt. Ltd.

INTERNET RESOURCES

- https://mathworld.wolfram.com/ConformalMapping.html
- https://brilliant.org/wiki/cauchy-integral-formula/
- https://complex-analysis.com/content/classification_of_singularities.html

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES.

			Core Course Level Outcomes (CLO)					
			1	2	3	4	5	6
Programme Level outcomes (PLO)	1	Disciplinary Knowledge	✔		✔	✔		✔
	2	Communication Skills		✔	✔			
	3	Critical Thinking	✔				✔	
	4	Research Related Skills	✔	✔			✔	✔
	5	Analytical Reasoning		✔		✔		
	6	Problem Solving				✔		✔
	7	Team Work	✔				✔	
	8	Moral and ethical awareness		✔	✔		✔	

YEAR	SEM.	SUBJECT CODE	TITLE OF THE PAPER	Hours/ Week
2021-22 onwards	**VI**	**21BMA64C**	**MATHEMATICAL STATISTICS - II**	**5**

COURSE LEVEL OUTCOMES:

On the successful completion of the course, student will be able to:

1. Understand the concepts of sampling distribution of a statistic and its, properties, difference between parameter and statistic. Formulate null and alternate hypothesis and apply it in small and large samples.

2. Demonstrate the knowledge of t, F, and chi square distributions and its applications in real life problems.

3. Describe the properties of unbiasedness, consistency, sufficiency, and efficient estimators.

4. Calculate confidence interval for a population parameter for single and more than one sample cases. Demonstrate understanding of the theory of maximum likelihood estimators and method of moments.

5. Understand the concepts of quality control, chance and assignable case of variation, control charts for variables and attributes, setting of mean chartlimits, range chart limits using mean and range charts.

UNIT: I

TESTING OF HYPOTHESIS AND SAMPLING DISTRIBUTION I: Parameter and Statistic - Test of significance – Null Hypothesis – Type I and Type II errors – Critical region – Exact test based on normal, Derivation of χ^2 Distribution – M.G.F of χ^2 Distribution – Applications of χ^2 Distribution.

(Chapter 14 - Sections: 14.3, 14.4, 14.5, 14.7, 14.8.1 to 14.8.4; Chapter 15 - Sections: 15.1 to 15.3; 15.6 - 15.6.1 to 15.6.4)

UNIT: II

EXACT SAMPLING DISTRIBUTIONS II: Student's 't' Distribution – Fishers 't' Distribution – Applications of 't' Distribution - χ^2 and F -Distribution with regard to mean, proportions – Variance and standard deviation – F-Distribution – Applications of F-Distribution – F- test for equality of two population variances

(Chapter 16 - Sections: 16.1; 16.2 - 16.2.1 to 16.2.5, 16.3.1 to 16.3.4, 16.5, 16.6.1)

UNIT: III

THEORY OF ESTIMATION: Characteristics of estimators – Cramer-Rao inequality Unbiasedness – Consistency – Efficient Estimators – Sufficiency.

(Chapter 17 - Sections: 17.1 to 17.3)

UNIT: IV

METHODS OF ESTIMATION: Methods of estimation – Method of moments and method of Maximum Likelihood Estimation – Properties of Maximum Likelihood Estimators – Method of Minimum Variance - Confidence Interval and Confidence Limits.

(Chapter 17- Sections: 17.6.1 to 17.6.3, 17.7)

UNIT: V

STATISTICAL QUALITY CONTROL: Meaning, Causes of variation – Assignable causes – Non Assignable causes – Process control and product control – Control chart for variables – Construction of $\overline{X}$ & R chart – Control chart of attributes – p- chart – np-chart – c-chart.

(Chapter 1 - Sections: 1.1 to 1.9)

PEDAGOGY STRATEGIES

- Board and Chalk lecture
- Power point slide presentations
- Assignments
- Quiz

REFERENCE:

1. FUNDAMENTALS OF MATHEMATICAL STATISTICS - S. C. GUPTA and V. K. KAPOOR, Eleventh Edition, Sultan Chand and Sons, New Delhi, 2002. (For Units I, II, III and IV)
2. FUNDAMENTALS OF APPLIED STATISTICS - V.K.KAPOOR and S.C.GUPTA, Third Edition, Sultan Chand and Sons, New Delhi, 2012.(For Unit V)

FUTHER READING:

INTRODUCTION TO MATHEMATICAL STATISTICS - R V.HOGG and T.V. CRAIG, Third Edition, Amerind Publishing Company Private Limited, New Delhi, 1970.

INTERNET RESOURSE

1. https://nptel.ac.in/courses/111/104/11110403/
2. https://nptel.ac.in/courses/111/105/111105090/

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES.

			Core Course Level Outcomes (CLO)					
			1	2	3	4	5	6
Programme Level outcomes (PLO)	1	Disciplinary Knowledge	✔		✔			✔
	2	Communication Skills		✔	✔			✔
	3	Critical Thinking	✔				✔	
	4	Research Related Skills	✔	✔			✔	✔
	5	Analytical Reasoning		✔		✔		✔
	6	Problem Solving				✔		✔
	7	Team Work	✔				✔	
	8	Moral and ethical awareness		✔	✔		✔	✔

YEAR	SEM.	SUBJECT CODE	TITLE OF THE PAPER	Hours/ Week
2021-22 onwards	VI	21BMA66S	LATEX	4

COURSELEVEL OUTCOMES:

On the successful completion of the course, student will be able to:
1. Show to download and install open source software Latex.
2.Discussthat the Latex is not WYSIWYG (what you see is what you get) and formatting Latex.
3. Designing projects, reports, articles, books etc., by using Latex
4. Apply and analyze the Latex commands in different environments.
5. Create complex mathematical structures and formulas by using Latex in easy way to produce professional looking PDF.

UNIT: I

TEXT, SYMBOLS AND COMMANDS: Command names and arguments – Environments – Declarations – Lengths – Special characters – Exercises.

(Chapter 2 - Sections: 2.1 to 2.6)

UNIT: II

Fine-tuning text – Word division.

DOCUMENT LAYOUT AND ORGANIZATION: Document class – Page style – Parts of the document – Table of contents.

(Chapter 2 - Sections: 2.7 to 2.8; Chapter 3 - Sections: 3.1 to 3.4)

UNIT: III

DISPLAYED TEXT: Changing font – Centering and indenting – Lists – Theorem–like declarations – Tables – Printing literal text – Foot notes and marginal notes – Comments within text.

(Chapter 4 - Sections: 4.1 to 4.3, 4.5, 4.8.1 - 4.8.3 4.9 to 4.11)

UNIT: IV

MATHEMATICAL FORMULAS: Mathematical environments – Main elements of math mode – Mathematical symbols.

(Chapter 5 - Sections: 5.1 to 5.3)

UNIT: V

Additional elements – Fine-tuning mathematics.

(Chapter 5 - Sections: 5.4, 5.5)

PEDAGOGY STRATEGIES

- Board and Chalk lecture
- PowerPoint slide presentations
- Seminar
- Assignments

REFERENCES:

A GUIDE TO LATEX - HELMUT KOPKA and PATRICK W. DALY, Fourth Edition, Addison-Wesley.

FURTHER READING:

GETTING STARTED WITH LATEX - DAVID R. WILKINS, Second Edition.

INTERNET RESOURCES

- https://www.math.ucdavis.edu/~tracy/courses/math129/Guide_To_LaTeX.pdf
- https://youtu.be/zrPLMjInudI

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES.

			Course Level Outcomes (CLO)				
			1	2	3	4	5
Programme Level Outcomes (PLO)	1	Disciplinary Knowledge	✓		✓	✓	✓
	2	Analytical reasoning				✓	✓
	3	Research- related skills			✓	✓	✓
	4	Scientific reasoning			✓	✓	✓
	5	Digital Literacy	✓				
	6	Team work			✓		✓
	7	Self-directed learning			✓		✓

YEAR	SEM.	SUBJECT CODE	TITLE OF THE PAPER	Hours/ Week
2021-22 onwards	VI	21BMA6EL	ARITHEMETIC FOR ALL - II	3

COURSE LEVEL OUTCOMES:

On the successful completion of the course, student will be able to:

1. Recite the Time and Distance formula to solve Problems on Trains.
2. Discuss the Rule of Allegation to solve the mixture problems.
3. Calculate CI for the interest compounded quarterly, half yearly, annually etc.
4. Illustrate the problems in Surface area, Races and Games.
5. Estimate the day of particular date in a given Year.
6. Relate the concepts of Stock Market and Discounting of Bills.

UNIT: I

Pipes and cistern – Time and distance – Problems on trains

(Sections: 16 to 18)

UNIT: II

Boats and Streams – Allegation or mixture – Simple Interest.

(Sections: 19 to 21)

UNIT: III

Compound Interest – Logarithms – Area.

(Sections: 22 to 24)

UNIT: IV

Volume and Surface areas – Races and games of skill – Calendar.

(Sections: 25 to 27)

UNIT: V

Clocks – Stocks and shares – True Discount.

(Sections: 28, 29 and 32)

PEDAGOGY STRATEGIES

- Board and Chalk lecture
- Power point slide presentation
- Seminar
- Assignments
- Group Discussions

REFERENCES:

QUANTITATIVE APTITUDE (FOR COMPETITIVE EXAMINATIONS) - Dr. R. S. AGGARWAL, Reprint 2014, S Chand and Company Pvt Limited, Ram Nagar, New Delhi - 110055.

INTERNET RESOURCES:

https://www.indiabix.com/aptitude/questions-and-answers/

https://www.sawaal.com/aptitude-reasoning-questions-and-answers.html

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES.

			Core Course Level Outcomes (CLO)					
			1	2	3	4	5	6
Programme Level outcomes (PLO)	1	Disciplinary Knowledge	✓		✓	✓		✓
	2	Communication Skills		✓	✓			✓
	3	Critical Thinking	✓		✓		✓	
	4	Research Related Skills	✓	✓			✓	✓
	5	Analytical Reasoning		✓		✔		
	6	Problem Solving				✔		✔
	7	Team Work	✔		✔		✔	
	8	Moral and ethical awareness		✔	✔		✔	✔

YEAR	SEM.	SUBJECT CODE	TITLE OF THE PAPER	Hours/ Week
2021-22 onwards	I	21BPH14A/ 21BCH14A	ALLIED – I: MATHEMATICS – I (FOR PHYSICS AND CHEMISTRY)	8

COURSE LEVEL OUTCOMES:

On the successful completion of the course, student will be able to:

1. Recall the characteristics equation and Eigen values and Eigen vectors of matrix.
2. Demonstrate the concepts and methods for finding the roots of the equation.
3. Calculate the real roots of an equation.
4. Develop the nature of curvature and radius of curvature for different curves.
5. Explain the trigonometric functions.

UNIT: I

MATRICES: Characteristic Equation of a matrix – Characteristic vectors of a matrix - Cayley Hamilton's theorem

(Chapter 5)

UNIT: II

THEORY OF EQUATIONS: Relations between the roots and coefficients of equation – Imaginary and Irrational roots – Symmetric functions of the roots of an equation in terms of its coefficient – Reciprocal equation – Transformation of equation – Multiplication of roots by m.(Chapter 6 - Sections: 1 to 8)

UNIT: III

THEORY OF EQUATIONS (CONTINUED): Diminishing the roots of an equation – Descarte's Rule of signs – Horner's method – Newton's method.

(Chapter 6 - Sections: 9 to 14)

UNIT: IV

POLAR CO-ORDINATES, CURVATURE AND RADIUS OF CURVATURE: Angle of intersection of two curves – Pedal equation – Cartesian Formula for Radius of Curvature – Parametric formula – Radius of curvature in polar co-ordinates – Radius of curvature for pedal curve.

(Chapter 10 and Chapter 11)

UNIT: V

TRIGONOMETRY: Expansions – Roots of Equations – Hyperbolic functions.

(Chapter 14)

PEDAGOGY STRATEGIES

- Board and Chalk lecture
- Powerpoint slide presentations
- Assignments
- Quizes

REFERENCE:

ALLIED MATHEMATICS - Dr. P. R. VITTAL, Margham Publications, Chennai, 1998.

FUTHER READING:

1. ALGEBRA VOLUME- I - T. K. MANICAVACHAGOM PILLAY and OTHERS, S. Viswanathan Printers and Publisher Private Limited, 2008
2. ALGEBRA VOLUME- II - T. K. MANICAVACHAGOM PILLAY and OTHERS, S. Viswanathan Printers and Publisher Private Limited, 2008.
3. CALCULUS VOLUME - I - T. K. MANICAVACHAGOM PILLAY and OTHERS, S. Viswanathan Printers and Publisher Private Limited, 2008.
4. TRIGONOMETRY - T.K.MANICAVACHAGOM PILLAY and OTHERS, S. Viswanathan Printers and Publisher Private Limited, Tenth Edition, 2007.

INTERNET RESOURCES:

- https://www.brainkart.com/article/Introduction-to-Binomial-Exponential-and -Logarithmic- series 35107/
- http://www.jjernigan.com/172/ConvergenceDivergenceNotes.pdf

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES

			Course Level Outcomes (CLO)				
			1	2	3	4	5
Program Level Outcomes (PLO)	1	Disciplinary knowledge	✓	✓			✓
	2	Communication skills	✓		✓		
	3	Critical thinking		✓	✓		✓
	4	Research related skills	✓				✓
	5	Analytical reasoning	✓			✓	✓
	6	Problem solving	✓	✓		✓	✓
	7	Team work		✓		✓	✓
	8	Moral and ethical awareness			✓		✓

YEAR	SEM.	SUBJECT CODE	TITLE OF THE PAPER	Hours/ Week
2021-22 onwards	I	21BST14A	ALLIED – I: MATHEMATICS FOR STATISTICS -I	8

COURSE LEARNING OUTCOME:

On the successful completion of the course, student will be able to:

1. Solve the higher degree polynomial equations
2. Find Eigen values and Eigen vectors for non-homogeneous linear equations.
3. Find the derivatives of different functions by applying appropriate rules.
4. Compute the various methods of integration and apply them.
5. Create the knowledge of solving different types of ordinary differential equations.

UNIT: I

THEORY OF EQUATIONS: In an equation with real coefficients imaginary roots occur in pairs – In an equation with rational coefficients irrational roots occur in pairs – Relations between the roots and coefficients of equations – Reciprocal equation.

(Chapter 6- Sections: 9, 10, 11, 16)

UNIT: II

MATRICES: System of non-homogeneous linear equations – Eigen values and Eigen vectors – Cayley – Hamilton theorem (proof not needed) –Problem based on this theorem.

(Chapter 2 : Section 16)

UNIT III

DIFFERENTIAL CALCULUS: Standard forms – General theorems on differential coefficients– Product rule, Quotient rule, Differential coefficient of $\tan x, \cot x, \sec x, \cos ecx$, function of function rule, Inverse function, differential of hyperbolic and Inverse hyperbolic function – Logarithmic differentiation.

(Chapter 2 : Sections 2-4)

UNIT IV :

INTEGRAL CALCULUS: Methods of Integration- Integrals of functions containing linear functions of x, Integrals of functions involving $a^2 \pm x^2$ - integrals of the functions of the form $\int f(x)^n x^{n-1} dx$ - Integrals of the functions of the form $\int \{f(x)\}^n f'(x) dx$, integrals of

the form $\int F\{f(x)\}f'(x)dx$ - Integrals of rational algebraic functions (Type I, Type –II) – Special Cases.

(Chapter: I, Sections 5 -7.5)

UNIT: V

ORDINARY DIFFERENTIAL EQUATION: Differential Equations of First order and Higher degree – Equations solvable for p - Equations solvable for y - Equations solvable for x – Clairaut's Equation, Linear Homogeneous Equation and variation of parameter .

(Chapter 1 – Sections:1,5,6.1 and 10)

PEDAGOGY STRATEGIES

- Board and Chalk lecture
- Powerpoint slide presentations
- Assignments
- Quizes

REFERENCE:

1. **ALGEBRA VOLUME I -** T. K. MANICAVACHAGOM PILLAY and OTHERS, S. Viswanathan Printers and Publisher Private Limited, 2013 (For UNIT-I).

2. **ALGEBRA VOLUME II -** T. K. MANICAVACHAGOM PILLAY and OTHERS, S. Viswanathan Printers and Publisher Private Limited, 2011(For UNIT-II).

3. **CALCULUS VOLUME I** - T. K. MANICAVACHAGOM PILLAY and OTHERS, S. Viswanathan Printers and Publisher Private Limited, 2009 (For UNIT III)

4. **CALCULUS VOLUME II** - T. K. MANICAVACHAGOM PILLAY and OTHERS, S. Viswanathan Printers and Publisher Private Limited, 2007 (For UNIT-IV).

5. **CALCULUS VOLUME III** - T. K. MANICAVACHAGOM PILLAY and OTHERS, S. Viswanathan Printers and Publisher Private Limited, 2011 (For UNIT-V).

FUTHER READING:

ANCILLARY MATHEMATICS - P. R. VITTAL, Margam Publication, Chennai, 1998.

INTERNET RESOURCES:

- https://www.edutopia.org/article/11-teacher-recommended-math-apps-and-online-tools
- https://www.teachthought.com/technology/25-best-math-resources-2018/

- https://www.brainkart.com/article/Introduction-to-Binomial-Exponential-and -Logarithmic- series 35107/
- http://www.jjernigan.com/172/ConvergenceDivergenceNotes.pdf

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES.

			Course Level Outcomes (CLO)				
			1	2	3	4	5
Program Level Outcomes (PLO)	**1**	**Disciplinary knowledge**	✓	✓			✓
	2	**Communication skills**	✓		✓		
	3	**Critical thinking**		✓	✓		✓
	4	**Research related skills**	✓				✓
	5	**Analytical reasoning**	✓			✓	✓
	6	**Problem solving**	✓	✓	✓	✓	✓
	7	**Team work**		✓		✓	✓
	8	**Moral and ethical awareness**			✓		✓

YEAR	SEM.	SUBJECT CODE	TITLE OF THE PAPER	Hours/ Week
2021-22 onwards	II	21BPH14A/ 21BCH14A	ALLIED – I: MATHEMATICS – II (FOR PHYSICS AND CHEMISTRY)	8

COURSE LEVEL OUTCOMES:

On the successful completion of the course, students will be able to:

1. Know basic concepts relating integration, differentiation and Fourier series.
2. Understand several functions through Fourier series.
3. Develop skills in problem solving, modelling, approximation and mathematical exploration techniques of differentiation and integration of real valued functions.
4. Learn methods of formation and solving differential equations of dimensions one and higher
5. Impart the application of periodic

UNIT: I

INTEGRAL CALCULUS: Definite Integral - Double integral – Double integral in polar coordinates – Triple Integral - Beta, Gamma Functions – Properties.

(Chapter 20 – Sections: 20.1 to 20.4; Chapter 30)

UNIT: II

ORDINARY DIFFERENTIAL EQUATION: Differential Equations of First order and Higher degree – Equations solvable for p - Equations solvable for y - Equations solvable for x – Clairaut's Equation. Linear Homogeneous Equation and variation of parameter

(Chapter 22 – Sections: 22.1 to 22.2; Chapter 24)

UNIT: III

PARTIAL DIFFERENTIAL EQUATION: Formation of PDE – Non Linear Differential Equations of first order – Standard Types – Lagrange's Linear Partial Differential Equations. (Chapter 26)

UNIT: IV

LAPLACE TRANSFORMS: Laplace transform of elementary functions – Properties – Inverse Laplace Transform – Solving Differential Equations using Laplace Transform. (Chapter 27)

UNIT: V

FOURIER SERIES: Fourier coefficients – Fourier series for odd and even functions – Half Range Fourier series. (Chapter 21)

PEDAGOGY STRATEGIES:

• Board and Chalk lecture

• Assignments

• Quizes

REFERENCE:

ALLIEDMATHEMATICS - Dr. P. R. VITTAL, Margham Publications, Chennai, 1998.

FUTHER READING:

1. CALCULUS VOLUME II - T. K. MANICAVACHAGOM PILLAY and OTHERS, S. Viswanathan Printers and Publisher Private Limited, 2008.
2. CALCULUSVOLUME III - T. K. MANICAVACHAGOM PILLAY and OTHERS, S. Viswanathan Printers and Publisher Private Limited, 2008.
3. DIFFERENTIAL EQUATIONS - S. NARAYANAN AND OTHERS, Nineth Edition, S. Viswanathan Printers and Publishers, 2007.
4. ENGINEERING MATHEMATICS VOLUME III - A. SINGARAVELU, Fifth Edition, Meenakshi Agencies, Chennai, 2005.

INTERNET RESOURCES:

https://ocw.mit.edu

https://ncbi.nlm.nin.gov

https://www.maa.org

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES.

			Course Level Outcomes (CLO)				
			1	2	3	4	5
Program Level Outcomes (PLO)	1	Disciplinary knowledge	✓	✓			✓
	2	Communication skills	✓		✓		
	3	Critical thinking		✓	✓		✓
	4	Research related skills	✓				✓
	5	Analytical reasoning	✓			✓	✓
	6	Problem solving	✓	✓	✓	✓	✓
	7	Team work		✓		✓	✓
	8	Moral and ethical awareness			✓		✓

YEAR	SEM.	SUBJECT CODE	TITLE OF THE PAPER	Hours/ Week
2021-22 onwards	II	21BST25A	ALLIED – II: MATHEMATICS FOR STATISTICS - II	8

COURSE LEVEL OUTCOMES:

On the successful completion of the course, student will be able to:

1. Associate the basic concepts of functions, equivalence and countability.
2. Develop sufficient knowledge about sequences of real numbers.
3. Classify the idea of convergence and divergence.
4. Describe the methods to test for absolute convergence and summability of series.
5. Infer the idea of limits of a function and metric spaces.
6. Summarize the various types of tests for convergence and solve it.

UNIT:I

SETS AND FUNCTIONS: Sets and elements – Operation on sets – Functions – Real valued functions – Equivalence– Countability – Real numbers – Least upper bounds

(Chapter 1 : Sections 1.1 – 1.7)

UNIT : II

SEQUENCE OF REAL NUMBER: Definition of Sequence and Subsequence – Limit of a Sequence – Convergent Sequence – Divergent sequence – Bounded Sequence – Monotone Sequence – Operation on Convergent Sequence – Operation on Divergent sequence

(Chapter 2 : Sections 2.1-2.8)

UNIT: III

SERIES OF REAL NUMBERS: Convergence and Divergence – Series with non-negative terms – Alternating Series – Conditional Convergence and Absolute Convergence – Test for absolute convergence

(Chapter 3 : Sections 3.1 – 3.4, 3.6)

UNIT : IV

SERIES OF REAL NUMBERS (Continuation):

Test for Absolute Convergence – Series whose terms form a non-increasing Sequence – Summation by Parts – (C,1) Summability of Series.

(Chapter 3 : Section 3.6 – 3.9)

UNIT : V

LIMITS AND METRIC SPACES: Limits of a function on the real line – Metric spaces – Limits in Metric space

(Chapter 4 : Sections 4.1 – 4.3)

PEDAGOGY STRATEGIES

- Board and Chalk lecture
- Power point slide presentations
- Assignments
- Quiz
- Seminars

REFERENCES:

METHODS OF REAL ANALYSIS - Richard R. Goldberg, Oxford & IBH Publishing Co.

Pvt. Ltd., NewDelhi, 1963.

FURTHER READING:

1. The elements of Real Analysis –Robert G. Bartle, Second Edition, 2007, John Wiley & Sons
2. Introduction to Real Analysis –Robert G. Bartle and Donald R. Sherbert, Second Edition, 2004, John Wiley & Sons

INTERNET RESOURCES:

- https://ocw.mit.edu/courses/mathematics/18-100c-real-analysis-fall-2012/
- https://www.coursera.org/courses?query=real%20analysis
- https://www.classcentral.com/course/swayam-basic-real-analysis-17525
- https://www.maa.org/press/maa-reviews/resources-for-the-study-of-real-analysis

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES

			Course Level Outcomes (CLO)					
			1	2	3	4	5	6
Programme Level outcomes (PLO)	1	Disciplinary Knowledge	✔		✔	✔		✔
	2	Communication Skills		✔	✔		✔	
	3	Critical Thinking	✔			✔	✔	
	4	Research Related Skills	✔	✔			✔	✔
	5	Analytical Reasoning		✔		✔		✔
	6	Problem Solving	✔			✔		✔
	7	Team Work	✔		✔		✔	
	8	Moral and ethical awareness		✔	✔		✔	

YEAR	SEM.	SUBJECT CODE	TITLE OF THE PAPER	Hours/ Week
2021-22 onwards	II	21BCS 24A	ALLIED – II: DISCRETE MATHEMATICS FOR COMPUTER SCIENCE	8

COURSE LEVEL OUTCOMES:

On successful completion of the course, students will be able to;

1. Summarize the various normal forms of Well-formed formulae.
2. Demonstrate the skill to construct simple mathematical proofs and to validate them.
3. Recogonize set theoretic language and be able to use it to codify mathematical objects, ordered pairs, Cartesian products, relations and functions.
4. Evaluate recurrence relations.
5. Explain the significance of Recurrence relation, Solution of non-homogeneous relations and Generating functions.
6. Distinguish the various graph theoretic concepts and familiarize with their applications.
7. Discuss the Types of graphs and Representation of graphs in computer memory.
8. Apply the knowledge of Laws of set theory, Relations and Functions.

UNIT: I

MATHEMATICAL LOGIC: Propositions and Logical Operators – Truth table – Tautology – Contradiction – Equivalence and Implication – Normal forms (DNF, CNF, PDNF and PCNF).

(Chapter I - Sections: 1.1 to 1.3)

UNIT: II

INFERENCE THEORY: Inference theory for statement calculus – Predicates – Quantifiers – Variables – Free and bound variables – Inference theory for predicate calculus.

(Chapter I - Sections: 1.4 to 1.6)

UNIT: III

BASIC SET THEORY: Basic definitions – Venn diagrams and set operations – Laws of set theory – Principle of inclusion and exclusion – Relations – Properties of relations – Matrices of relations – Functions – Injective, surjective and bijective functions.

(Chapter II - Sections: 2.1, 2.3 and 2.4)

UNIT: IV

RECURRENCE RELATIONS AND GENERATING FUNCTIONS: Recurrence – an introduction-Polynomials and their evaluation-Recurrence relation-Solutions of finite order homogeneous (linear) relations- Solution of non-homogeneous relations- Generating functions- Some common recurrence relations.

(Chapter V - Sections: 5.1, 5.26)

UNIT: V

GRAPH THEORY: Basic terminology – Types of graphs – Paths, cycle and connectivity – Representation of graphs in computer memory – Trees – Properties of trees – Binary trees – Traversing binary trees – Computer representation of general trees.

(Chapter V - Sections: 5.1, 5.2)

PEDAGOGY STRATEGIES

- Board and Chalk lecture
- Powerpoint slide presentations
- Seminar
- Assignments
- Online and Offline Class Practicals
- Quizes
- Group discussion

REFERENCES:

1. DISCRETE MATHEMATICAL STRUCTURES WITH APPLICATIONS TO COMPUTER SCIENCE - J. P. TREMBLAY and R. MANOHAR, Mc Graw Hill International Edition, 1997. (For Units I, II, III &V)

2. DISCRETE MATHEMATICS - Dr.M.K.VENKATARAMAN, Dr.N.SRIDHARAN and N.CHANDARSEKARAN, The National Publishing Company, Chennai, 2002. (For Unit IV)

INTERNET RESOURCES:

1. https://youtu.be/QBBw8-3JPik
2. https://youtu.be/LE2Dm4O3r3w
3. https://youtu.be/QR5hpvJJqIg
4. https://youtu.be/SygOHW0oeB4
5. https://youtu.be/-J2KeQaS2eY

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES.

			Course Level Outcomes (CLO)							
			1	2	3	4	5	6	7	8
Program Level Outcomes (PLO)	1	Disciplinary knowledge	✓	✓			✓			
	2	Communication skills	✓		✓			✓		✓
	3	Critical thinking		✓	✓		✓	✓		✓
	4	Research related skills	✓				✓		✓	
	5	Analytical reasoning	✓			✓	✓	✓	✓	
	6	Problem solving	✓	✓	✓	✓	✓	✓		✓
	7	Team work		✓		✓	✓		✓	
	8	Moral and ethical awareness			✓		✓			✓

YEAR	SEM.	SUBJECT CODE	TITLE OF THE PAPER	Hours/ Week
2021-22 onwards	II	21BCS 34A	ALLIED – III: OPERATIONS RESEARCH FOR COMPUTER SCIENCE	8

COURSE LEVEL OUTCOMES:

On the successful completion of the course, student will be able to:

1. Explain fundamental ideas of models and techniques for effective decision making, model formulation and applications.
2. Discuss the concepts and application of operations research in various fields and the principles of construction of mathematical models of conflicting situations.
3. Apply game theory concepts to articulate real-world situations by identifying, analyzing and practicing strategic decisions.
4. Build and solve assignment and Transportations problems.
5. Identify the importance of stocks, the reasons for holding stocks and determine the optimal order quantity for models.
6. Describe the concepts of network scheduling by PERT / CPM

UNIT: I

LINEAR PROGRAMMING PROBLEM: Formulation of L.P.P – Graphical solutions of L.P.P – Canonical and standard forms of L.P.P – Simplex method – Big M Method

(Chapter 2 – Sections: 2.1 to 2.4: Chapter 3 – Sections 3.1 to 3.5: Chapter 4- Sections: 4.1 to 4.4)

UNIT: II

GAME THEORY: Two person zero sum game – The Maximin-Minimax principle – Problems. Solution of 2×2 rectangular games – Domination property - $(2\times n)$ and $(m\times 2)$ graphical method- Dominance property – Problems.

(Chapter 17 - Sections: 17.1 to 17.7)

UNIT: III

THE TRANSPORTATION PROBLEMS: Basic feasible solution by L.C.M – NWC – VAM – Optimum solutions (MODI Method) – Unbalanced transportation problems. The Assignment problems – Assignment algorithm – Optimum solutions (Hungarian Method) – Unbalanced assignment problems.

(Chapter 10 - Sections: 10.1 to 10.13; Chapter 11 - Sections: 11.1 to 11.4)

UNIT: IV

INVENTORY CONTROL: Types of inventories – Inventory costs – EOQ problem with no shortages – Production problem with no shortages – EOQ with shortages – Production problem with shortages – EOQ with price breaks.

(Chapter 19 - Sections: 19.1 to 19.12)

UNIT: V

NETWORK SCHEDULING BY PERT/CPM : Introduction – Network basic components – Logical sequencing – Rules of Network – Construction – Concurrent activities – Critical path analysis – Probability considerations in PERT – Distinction between PERT and CPM.

(Chapter 25 - Sections: 25.1 to 25.8)

PEDAGOGY STRATEGIES:

- Board and Chalk lecture
- Power point slide presentations
- Assignments
- Quizes

REFERENCE:

1. OPERATIONS RESEARCH - KANTISWARUP, P. K. GUPTA, MAN MOHAN, Fourteenth Revised Edition, S. Chand & Sons Educational Publications, New Delhi, Reprint 2009.
2. PROBLEMS IN OPERATIONS RESEARCH - P. K. GUPTA, MAN MOHAN, Eleventh Edition, S. Chand and Sons Educational Publications, Reprint 2007.

FUTHER READING:

1. OPERATIONS RESEARCH – An Introduction - HAMDY A. TAHA, Pearson Education, Reprint 2009.
2. PROBLEMS IN OPERATIONS RESEARCH - P. K. GUPTA AND D. S. HIRA, Third Edition, S. Chand and Company Limited, Reprint 2000.
3. OPERATIONS RESEARCH THEORY AND APPLICATIONS - J. K. SHARMA, Second Edition, Macmillan India Limited, Reprint 2002.

INTERNET RESOURCES:

1. https://nptel.ac.in/course/111/102/111102012/
2. https://nptel.ac.in/course/111/104/111104027/
3. https://nptel.ac.in/course/109/103/103109021/
4. https://nptel.ac.in/course/110/105/110106045/

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES:

			Course Level Outcomes (CLO)					
			1	2	3	4	5	6
Program Level Outcomes (PLO)	1	Disciplinary knowledge		✓		✓	✓	
	2	Communication skills	✓		✓			✓
	3	Critical thinking		✓		✓		✓
	4	Research related skills	✓				✓	
	5	Analytical reasoning	✓	✓		✓	✓	
	6	Problem solving	✓	✓	✓	✓	✓	✓
	7	Team work		✓		✓	✓	
	8	Moral and ethical awareness			✓		✓	✓

YEAR	SEM.	SUBJECT CODE	TITLE OF THE PAPER	Hours/ Week
2021-22 onwards	II	21BIT 14A	ALLIED – I: MATHEMATICAL FOUNDATIONS FOR INFORMATION TECHNOLOGY	8

COURSE LEVEL OUTCOMES:

On the successful completion of the course, student will be able to:

1. To introduce the basic mathematical concepts of Matrices, Set theory, Mathematical logic, Relations, Graphs and Trees.
2. Discuss about Matrix Operations.
3. Distinguish about sets, Venn diagram.
4. Summarize and apply the concept of Mathematical logics.
5. Estimate the concepts of relations.
6. Compute the basic concepts in Graph Theory.

UNIT: I

MATRICES: Introduction – Matrix Operations – Inverse of a square matrix – Elementary operations and Rank of a matrix – Simultaneous equations – Inverse by partitioning – eigenvalues and eigenvectors.

(Chapter VI – Sections: 6.1 to 6.7)

UNIT: II

SET THEORY: Introduction – Sets – Notation and descriptions of sets – Sub sets- Venn - Euler Diagram -Operations on sets - Properties of set operations - Verification of the basic laws of algebra by Venn diagram.

(Chapter I - Sections 1.1 to 1.8)

UNIT: III

MATHEMATICAL LOGIC: Statements and notations- Connectives - Normal forms - Theory of inference for statement calculus.

(Chapter I - Sections 1.1 to 1.4)

UNIT: IV

RELATIONS : Cartesian product of two sets – Relations - Representation of Relation - Operations on relations - Equivalence Relations - Closures and Warshall's Algorithm.

(Chapter II – Sections: 2.1 to 2.6)

UNIT: V

GRAPH THEORY: Basic Concepts - Matrix representations of graphs – Trees - Spanning trees

(Chapter XI – Sections: 11.1 to 11.4)

PEDAGOGYSTRATEGIES:

- Board and Chalk lecture
- Powerpoint slide presentations
- Assignments
- Quizes

REFERENCE:

1. DISCRETE MATHEMATICAL STRUCTURES WITH APPLICATIONS TO

COMPUTER SCIENCE - J.P.TREMBLAY and R.MANOHAR, McGraw Hill International

Edition**.** (For Unit III)

2. DISCRETE MATHEMATICS -Dr. M.K.VENKATRAMAN, Dr. N.SRIDHARAN,

N.CHANDRASEKARAN - NPC, Chennai. (For Units I, II, IV and V)

FUTHER READING:

1. ENGINEERING MATHEMATICS VOL II **–** Dr.M.K. VENKATRAMAN **-** NPC

2. DISCRETE MATHEMATICS - J. K. SHARMA, Second Edition, Macmillan India Ltd., 2005.

INTERNET RESOURCES:

1. https://youtu.be/-uaD00a1oV8
2. https://youtu.be/3nKpt7vIRjc
3. https://youtu.be/fxWbmGNJ1Z4

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES.

			Course Level Outcomes (CLO)					
			1	2	3	4	5	6
Program Level Outcomes (PLO)	1	Disciplinary knowledge	✓	✓			✓	
	2	Communication skills	✓		✓			✓
	3	Critical thinking		✓	✓		✓	✓
	4	Research related skills	✓				✓	
	5	Analytical reasoning	✓			✓	✓	✓
	6	Problem solving	✓	✓	✓	✓	✓	✓
	7	Team work		✓		✓	✓	
	8	Moral and ethical awareness			✓		✓	

YEAR	SEM.	SUBJECT CODE	TITLE OF THE PAPER	Hours/ Week
2021-22 onwards	II	21BCO34A	ALLIED – III: BUSINESS MATHEMATICS	8

COURSE LEVEL OUTCOME:

On the successful completion of the course, student will be able to:

1. Recognize Matrices and Determinants.
2. Differentiate simple algebraic functions.
3. Integrate simple functions.
4. Analyze linear programming problems.
5. Apply the knowledge of Transportation and Assignment Problems.

UNIT: I

MATRICES AND DETERMINANTS: Definition – Different types of matrices with examples – Matrix operations – Solving system of linear equations – Inverse of a matrix – Rank of matrix – Determinants and its properties – Cramer's rule – Problems.

(Chapter 4 - Sections: 1 to 12)

UNIT: II

Variables, constants and functions – Limits of Algebraic functions – Simple Differentiation of Algebraic functions – Meaning of derivatives – Evaluation of first and second order derivatives – Maxima and Minima – Application to Business problems.

(Chapter 5 and Chapter 6)

UNIT: III

Elementary integral calculus – Determining Indefinite and Definite integrals of simple functions – Integration by parts.

(Chapter 8)

UNIT: IV

OPERATIONS RESEARCH: Mathematical formulation of the linear programming problem – Graphical solution – Simplex method – Simple problems using slack variable.

(Chapter 2 - Sections: 2.1 to 2.4; Chapter 3 - Sections: 3.1 to 3.3; Chapter 4 - Section: 4.3)

UNIT: V

OPERATIONS RESEARCH: Transportation problem – Assignment problem and special cases in assignment problem – Simple problems.

(Chapter 10 - Sections: 10.8 to 10.9; Chapter 11 - Sections: 11.1 to 11.4)

PEDAGOGYSTRATEGIES:

- Board and Chalk lecture
- Powerpoint slide presentations
- Assignments
- Quizes

REFERENCE

1. BUSINESS MATHEMATICS AND STATISTICS - P. A. NAVANITHAM, Jai Publishers, Trichy, 2008. **(For Unit I, II,III)**
2. OPERATIONS RESEARCH - V. KANTI SWARUP, P. K. GUPTA and MAN MOHAN, Fourteenth Edition, Sultan Chand and Sons, New Delhi, Reprint 2009. **(For Units IV and V)**

FUTHER READING:

PROBLEMS IN OPERATIONS RESEARCH - P. K. GUPTA and MANMOHAN, Sultan Chand and Sons, New Delhi, Reprint 2007.

INTERNET RESOURCES:

1. https://youtu.be/-uaD00a1oV8
2. https://youtu.be/3nKpt7vIRjc
3. https://youtu.be/fxWbmGNJ1Z4

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES.

			Course Level Outcomes (CLO)					
			1	2	3	4	5	6
Program Level Outcomes (PLO)	1	Disciplinary knowledge	✓	✓			✓	
	2	Communication skills	✓		✓			✓
	3	Critical thinking		✓	✓		✓	✓
	4	Research related skills	✓				✓	
	5	Analytical reasoning	✓			✓	✓	✓
	6	Problem solving	✓	✓	✓	✓	✓	✓
	7	Team work		✓		✓	✓	
	8	Moral and ethical awareness			✓		✓	

YEAR	SEM.	SUBJECT CODE	TITLE OF THE PAPER	Hours/ Week
2021-22 onwards	II	21BIB 25A	ALLIED – I: MATHEMATICS FOR BUSINESS (B.Com IB)	8

COURSE LEARNING OUTCOMES:

On the successful completion of the course, student will be able to:

1. Analyze real world scenarios to recognize when simple and compound interest and annuities are appropriate, formulate problems about the scenarios in order to solve the problems using multiple approach, judge if the results are reasonable and then interpret the results.
2. Apply the knowledge in Mathematics (set theory, Matrices, Numerical Analysis) in solving business problems.
3. Analyze and demonstrate mathematical skills required in mathematically intensive areas in Business.
4. Integrate concept in international business concepts with functioning of global trade.
5. Compare the viability of different approaches in Business Mathematics that are encountered on the real world, understand and be able to communicate the underlying business concepts and Mathematics involved to help another person gain insight onto situation.

UNIT: I

SERIES: Set theory – Arithmetic and Geometric series – Simple and Compound interest – Effective rate of interest – Sinking fund – Annuities – Present value – Discounting of Bills – True Discount – Banker's Gain.

(Chapter 1 and Chapter 2)

UNIT: II

MATRICES AND DETERMINANTS: Definition – Different types of matrices with examples – Matrix operations – Solving system of linear equations – Inverse of a matrix – Rank of matrix – Determinants and its properties – Cramer's rule – Problems.

(Chapter 4 - Sections: 1 to 12)

UNIT: III

LINEAR PROGRAMMING PROBLEM: Linear Programming Problem – Formations – Solution by Graphical method solution by Simple method.

(Chapter 9)

UNIT: IV

NUMERICAL DIFFERENTIATIONS: Newton's forward difference formula and backward difference formula to compute the derivative- Derivative using Sterling's formula.

(Chapter 9 – Sections: 1 to 4)

UNIT: V

NUMERICAL INTEGRATIONS: Trepezoidal rule – Simpson's one third and three eight rule.

(Chapter 9 – Sections: 7, 8, 10)

PEDAGOGY STRATEGIES:

- Board and Chalk Lecture
- Seminar
- Assignments
- Online and offline Quizzes
- Group Presentation
- Discussion

REFERENCE:

1. BUSINESS MATHEMATICS AND STATISTICS - P.A.NAVANITHAM, Jai Publishers, Trichy, 2008. (For UNITS I, II & III)
2. NUMERICAL METHODS ON SCIENCE AND ENGINEERING - M. K. Venkataraman, Second Edition (revised), the National publishing Company, 1987. (For Units IV & V)

FUTHER READING:

1. INTRODUCTION TO BUSINESS MATHEMATICS – SUNDARESAN and JAYASELEEN, S Chand Co Ltd, Newdelhi.
2. NUMERICAL METHODS- P. Kandasamy, K. Thilagavathy and K. Gunavathi, S. Chand Limited, Wew Delhi, Revised Edition, 2005.

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES:

Program L Program Level Outcomes (PLO)			Course Level Outcomes (CLO)				
			1	2	3	4	5
	1	Disciplinary Knowledge	✓		✓		
	2	Communication Skills				✓	✓
	3	Critical Thinking	✓		✓		
	4	Research Related Skills		✓			✓
	5	Analytical Reasoning	✓		✓		
	6	Problem Solving		✓			✓
	7	Team Work				✓	
	8	Moral and Ethical Awareness		✓			✓

YEAR	SEM.	SUBJECT CODE	TITLE OF THE PAPER	Hours/ Week
2021-22 onwards	I	21GEO14 A	ALLIED – I: MATHEMATICS FOR GEOLOGY-I	8

COURSE LEARNING OUTCOMES:

On the successful completion of the course, student will be able to:

1. Find the Eigen values and Eigen vectors of a square matrix and apply Cayley Hamilton theorem
2. Compute the successive derivatives of functions and hence to find the radius of curvature in Cartesian co-ordinates
3. Understand the general properties of definite integrals and to apply reduction formulae for various combinations of integrals
4. To solve first order higher degree differential equations using the methods solvable for x, solvable for y, and Clairaut's form.
5. Developing partial differential equations and to find solutions of first order equations in standard form.

UNIT: I

MATRICES: Characteristic roots of a square matrix – Evaluation of Eigen values and Eigen Vectors – Verification of Cayley-Hamilton Theorem

(Chapter 2: Section 16)

UNIT: II

SUCCESSIVE DIFFERENTIATION AND CURVATURE: Leibnitz's theorem (statement only) for the nth derivative of a product of functions – Applications – Curvature and radius of curvature in Cartesian Co-ordinates.

(Chapter 3: Sections: 2.1, 2.2 and Chapter 10: Sections: 2.1, 2.2, 2.3, 2.4)

UNIT: III

INTEGRATION: General properties of definite integral (without proof) and problems using these properties – Reduction formula for $\int e^{ax}x^n dx$, $\int sin^n x\,dx$, $\int cos^n x\,dx$ where n is a positive integer - Evaluation of $\int_0^{\frac{\pi}{2}} e^{ax}x^n\,dx$, $\int_0^{\frac{\pi}{2}} sin^n x dx$, $\int_0^{\frac{\pi}{2}} cos^n x dx$ where n is a positive integer. (Chapter 1: Sections 4, 11, 13.1, 13.3, 13.4)

UNIT: IV

DIFFERENTIAL EQUATIONS OF THE FIRST ORDER: Equation of first order but of Higher degree – Equation solvable for $\frac{dy}{dx}$. Equation solvable for y-equation solvable for x. (Simple problems only) – Clairaut's form (Simple case only). (Chapter 1: Section: 5, 5.1 – 5.4, 6.2)

UNIT V:

PARTIAL DIFFERENTIAL EQUATIONS: Formation of partial differential equation by elimination of constants and arbitrary function – Definition of general, Particular and complete solution of partial differential equations – Singular integral (Geometrical meaning not expected) solution of first order equations in their standard forms $F(p,q) = 0, F(x,p,q) = 0, F(y,p,q) = 0, F(z,p,q) = 0, F_1(x,p) = F_2(y,q), z = p_x + q_y + f(p,q)$. (Chapter 4: Sections: 2.1-2.2, 3, 5, 5.1 – 5.4)

PEDAGOGY STRATEGIES

- Board and Chalk lecture
- Powerpoint slide presentations
- Assignments
- Quizes

REFERENCE:

1. T.K. Manickavasagampillay, T. Natarajan &K.S. Ganapathy, Algebra (vol.II), S. Viswanathanpvt. Ltd Reprint 2004 (Unit I)
2. S. Narayanan &T.K. Manickavasagampillay, Calculus (Vol I) S. Viswanathanpvt. Ltd Reprint 2003 (Unit II)
3. S. Narayanan &T.K. Manickavasagampillay, Calculus (Vol II) S. Viswanathanpvt. Ltd Reprint 2003 (Unit III)
4. S. Narayanan &T.K. Manickavasagampillay, Calculus (Vol III) S. Viswanathanpvt. Ltd Reprint 2004 (Unit IV & V)

FUTHER READING:

ANCILLARY MATHEMATICS - P. R. VITTAL, Margam Publication, Chennai, 1998.

INTERNET RESOURCES:

- https://www.brainkart.com/article/Introduction-to-Binomial-Exponential-and - Logarithmic- series 35107/
- http://www.jjernigan.com/172/ConvergenceDivergenceNotes.pdf

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES:

			Course Level Outcomes (CLO)				
			1	2	3	4	5
Program Level Outcomes (PLO)	1	Disciplinary knowledge	✓		✓		✓
	2	Communication skills		✓	✓	v	
	3	Critical thinking	✓		✓		✓
	4	Research related skills	✓			✓	✓
	5	Analytical reasoning	✓		✓		✓
	6	Problem solving		✓		✓	✓
	7	Team work			✓	✓	✓
	8	Moral and ethical awareness	✓	✓			✓

YEAR	SEM.	SUBJECT CODE	TITLE OF THE PAPER	Hours/ Week
2021-22 onwards	II	21GEO 24A	ALLIED – II: MATHEMATICS FOR GEOLOGY-II	8

COURSE LEVEL OUTCOMES:

On the successful completion of the course, student will be able to:

7. Demonstrate expansion of trigonometric and inverse trigonometric functions.
8. Distinguish hyperbolic functions& trigonometric functions and relation between hyperbolic functions and trigonometric functions.
9. Infer the problem of integration to apply Laplace transform.
10. Provide information on properties of Laplace transform and inverse Laplace Transform.
11. Solve the ordinary differential equations using Laplace transform
12. Categorize the function for the Expansion of Fourier series.

Unit: I

EXPANSION: Expansion of $cosn\theta$ and $sinn\theta$ – Expansion of $tann\theta$ in powers of $tan\theta$ (n is a positive integer) – Related problems – powers of sines and cosines of θ in terms of functions of multiple of θ - Expansion of $cos^n\theta$, $sin^n\theta$ – Expansions of $cosn\theta$ and $sinn\theta$ in series of ascending powers of θ (proof not required) and simple problems.

(Chapter 3: Sections: 1,2, 4, 4.1 and 5)

Unit: II

HYPERBOLIC FUNCTIONS: Euler's formula for $e^{i\theta}$ – Definition of hyperbolic functions – relation between hyperbolic functions – Relation between hyperbolic function corresponding to relations between circular functions – Inverse hyperbolic functions – Simple problems.

(Chapter 4: Sections: 1,2,2.1, 2.2, 2.3)

Unit: III

LAPLACE TRANSFORM: Definition – Laplace transform of functions $e^{at}, \cos at, \sin at, and\ t^n$ where n is a positive integer. First shifting theorem – Laplace transform of $e^{-at}f(t)$ is $F(s+a)$ – Laplace transform of $e^{-at}cosbt, e^{-at}sinbt\ and\ e^{-at}f(t)$ – Some general theorems on Laplace transform.

(Chapter 5: Sections: 1, 2, 4)

Unit: IV

INVERSE LAPLACE TRANSFORM: Inverse Laplace transform relating to the standard forms – Application to the solution for ordinary differential equations with constant coefficients involving the above transformations.

(Chapter 5: Sections: 6, 7, 8)

Unit: V

FOURIER SERIES: Definition of Fourier series – Finding Fourier coefficients for a given periodic function with period 2π – (odd and even functions) – Half range series.

(Chapter 6: Sections: 2, 3, 3.1, 3.2, 4)

PEDAGOGY STRATEGIES

- Board and Chalk lecture
- Powerpoint slide presentations
- Assignments
- Quizes

REFERENCES:

1. TRIGONOMETRY - S. Narayanan &T.K. Manickavasagampillay, S. Viswanathan pvt. Ltd Reprint 2004 (Unit I, II)
2. CALCULUS (VOL III) - S. Narayanan &T.K. Manickavasagampillay, S. Viswanathan pvt. Ltd Reprint 2004 (Unit III, IV & V)

FURTHER READING:

ALLIED MATHEMATICS- Dr. P. R. VITTAL, Margham Publications, Chennai, 1998.

INTERNET RESOURCES:

- https://www.mathsisfun.com/sets/function-hyperbolic.html
- http://www.mathcentre.ac.uk/resources/workbooks/mathcentre/hyperbolicfunctions.pdf
- https://brilliant.org/wiki/hyperbolic-trigonometric-functions/

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES.

			Course Level Outcomes (CLO)					
			1	2	3	4	5	6
Program Level Outcomes (PLO)	1	Disciplinary knowledge	✓		✓		✓	✓
	2	Communication skills		✓	✓	✓		
	3	Critical thinking	✓		✓	✓	✓	✓
	4	Research related skills	✓			✓	✓	✓
	5	Analytical reasoning	✓		✓		✓	✓
	6	Problem solving		✓		✓	✓	
	7	Team work			✓	✓	✓	✓
	8	Moral and ethical awareness	✓	✓			✓	✓

MODEL QUESTION PAPER

GOVERNMENT ARTS COLLEGE (AUTONOMOUS), COIMBATORE-18

21BMA13C **REG. NO…….**

B.Sc. DEGREE EXAMINATIONS Month and Year …….

MATHEMATICS **SEMESTER I**

ALGEBRA

TIME: 3 Hrs **MAX. MARKS: 50**

PART- A

I Choose the correct answer $(5\times1=5\,Marks)$

1. The series $1+\frac{1}{2}+\frac{1}{3}+...+\frac{1}{n}+...$

(a) converges (b) diverges (c) oscillates finitely (d) oscillates infinitely

$1+\frac{1}{2}+\frac{1}{3}+...+\frac{1}{n}+...$ என்ற தொடர்

(அ) ஒருங்கும் (ஆ) விரியும் (இ) வரையறுக்கப்பட்ட மதிப்புகளுக்கு ஊசலாடும் (ஈ) முடிவிலிகளுக்கு ஊசலாடும்.

2. The series $1+\frac{1}{2}+\frac{1}{2^2}+\frac{1}{2^3}+\cdots$ is converges to

(a) 2 (b) $\frac{1}{2}$ (c) 4 (d) $\frac{1}{4}$

$1+\frac{1}{2}+\frac{1}{2^2}+\frac{1}{2^3}+\cdots$ என்ற தொடர் -------- க்கு ஒருங்கும்.

(அ) 2 (ஆ) $\frac{1}{2}$ (இ) 4 (ஈ) $\frac{1}{4}$

3. The series $\frac{1}{1^k}+\frac{1}{2^k}+\frac{1}{3^k}+\cdots$ is convergent when

(a) $k<1$ (b) $k\le1$ (c) $k>1$ (d) $k\ge1$

$\frac{1}{1^k}+\frac{1}{2^k}+\frac{1}{3^k}+\cdots$ என்ற தொடர் ஒருங்குவதற்கு k என்பது

(அ) $k<1$ (ஆ) $k\le1$ (இ) $k>1$ (ஈ) $k\ge1$

4. When $|x|<1$, the series $1+2x+3x^2+4x^3+...=$

(a) $(1-x)^{-1}$ (b) $(1+x)^{-2}$ (c) $(1+x)^{-1}$ (d) $(1-x)^{-2}$

$|x|<1$ எனில் $1+2x+3x^2+4x^3+...=$

(அ) $(1-x)^{-1}$ (ஆ) $(1+x)^{-2}$ (இ) $(1+x)^{-1}$ (ஈ) $(1-x)^{-2}$

5. The series expansion for $(1-\frac{2x}{5})^{\frac{1}{3}}$ is convergent when

(a) $|x| > 2/5$ (b) $|x| < 5/2$ (c) $|x| < 2/5$ (d) $|x| > 5/2$

$(1-\frac{2x}{5})^{\frac{1}{3}}$ ன் விரிவாக்கத் தொடர் ஒருங்குவதற்க்கு

(அ) $|x| > 2/5$ (ஆ) $|x| < 5/2$ (இ) $|x| < 2/5$ (ஈ) $|x| > 5/2$

II Answer any THREE questions $(3\times 2 = 6 \, Marks)$

6. Define a convergent series.

ஒருங்கும் தொடர் வரிசை வறையறுக்கவும்.

7. If $\sum u_n$ where $u_n = \frac{n^3+1}{4n^3-2n^2+1}$, find $\lim_{n\to\infty} u_{n.}$. Is the series convergent?

$\sum u_n$ ல் $u_n = \frac{n^3+1}{4n^3-2n^2+1}$ எனில் $\lim_{n\to\infty} u_{n.}$ காண்க. இந்த தொடர் வரிசை ஒருங்குமா?

8. State Raabe's test.

ராபிஷ் சோதனையைக் கூறுக.

9. Find the coefficient of x^2 in the expansion of $(1+x)^{2/3}$.

$(1+x)^{2/3}$ ன் விரிவாக்கதில் x^2 ன் கெழுவைக் காண்க.

10. Find to three decimal places $(998)^{\frac{1}{3}}$.

$(998)^{\frac{1}{3}}$ ன் மதிப்பைக மூன்று தசம புள்ளிகளில் கணக்கீடுக.

PART- B $(5\times 3 = 15 \, Marks)$

Answer ALL the questions

11. a) If $u_1+u_2+\cdots+u_n+\cdots$ is convergent and has the sum s, then prove that $u_{m+1}+u_{m+2}+\cdots$ is convergent and has the sum $s-(u_1+u_2+\cdots+u_m)$, where m is any positive integer.

$u_1+u_2+\cdots+u_n+\cdots$ என்ற தொடர் s-க்கு ஒருங்கும் எனில் $u_{m+1}+u_{m+2}+\cdots$ என்ற தொடர் $s-(u_1+u_2+\cdots+u_m)$க்கு ஒருங்கும் என நிரூபி.

(OR)

b) Discuss the convergence of the series $1+2+3+4+...+n+...$

$1+2+3+4+...+n+...$ என்ற தொடரின் ஒருங்குதலை விவாதிக்கவும்.

12. a) If a series $u_1+u_2+u_3+...+u_n+...$ converges, prove that $\lim_{n\to\infty} u_n = 0$. Is the converse true?

$u_1+u_2+u_3+...+u_n+...$ என்ற தொடர் ஒருங்கும் எனில் $\lim_{n\to\infty} u_n = 0$ என நிரூபி. இதன் மறுதலை உண்மையா எனக் கூறுக..

(OR)

b) Test the convergence of the series $\sum \frac{1}{\sqrt{n^2+1}}$

$\sum \frac{1}{\sqrt{n^2+1}}$ என்ற தொடர் ஒருங்குமா என சோதனை செய்க..

13. a) Examine the convergence of the series $\sum \frac{n^3+1}{2^n+1}$

$\sum \frac{n^3+1}{2^n+1}$ என்ற தொடர் ஒருங்குமா என சோதனை செய்க..

(OR)

b) Prove that $\sum \frac{x^n}{n^n}$ is a convergent series.

$\sum \frac{x^n}{n^n}$ என்ற தொடர் ஒருங்கும் என நிரூபி.

14. a) Find the (r+1) th term of $(1+3x)^{5/2}$ given $|x| < \frac{1}{3}$

$|x| < \frac{1}{3}$ எனில் $(1+3x)^{5/2}$ ன் விரிவாக்கத்தொடரில் (r +1) ன்றாவது உறுப்பைக் காண்க.

(OR)

b) Find the greatest term in the expansion of $(1+x)^{13/2}$, when $x = \frac{2}{3}$.

$x = 2/3$ எனில் $(1+x)^{\frac{13}{2}}$ ன் விரிவாக்கத்தொடரில் மிகப்பெறிய உறுப்பைக் காண்க.

15. a) Find the coefficient of x^n in the expansion of $\frac{1-2x}{(1-3x)^2}$

$\frac{1-2x}{(1-3x)^2}$ ன் விரிவாக்கத்தொடரில் x^n ன் கெழுவைக் காண்க.

(OR)

b) Calculate correct to six places of decimals $(1.01)^{1/2}-(0.99)^{1/2}$

$(1.01)^{1/2}-(0.99)^{1/2}$ ன் மதிப்பை ஆறு தசம புள்ளிகளில் கணக்கீடுக..

PART- **C** $(3\times 8=24\,Marks)$

IV. Answer any THREE questions

16. Examine the convergence of the series $\sum\left(\frac{n}{n+1}\right)^{\frac{1}{2}}x^n$.

$\sum\left(\frac{n}{n+1}\right)^{\frac{1}{2}}x^n$ என்ற தொடர் ஒருங்குமா என சோதனை செய்க.

17. Discuss the convergence of the series $1+\frac{(1!)^2}{2!}x+\frac{(2!)^2}{4!}x^2+\frac{(3!)^2}{6!}x^3+\cdots$

$1+\frac{(1!)^2}{2!}x+\frac{(2!)^2}{4!}x^2+\frac{(3!)^2}{6!}x^3+\cdots$ என்ற தொடரின் ஒருங்குதலை விவாதிக்கவும்.

18. Prove that the series $1+\frac{1}{2}.\frac{a}{b}+\frac{1.3a(a+1)}{2.4b(b+1)}+\frac{1.3.5}{2.4.6}.\frac{a(a+1)(a+2)}{b(b+1)(b+2)}+\cdots$ is convergent if $a>0,b>0$ and $b>a+\frac{1}{2}$.

$1+\frac{1}{2}.\frac{a}{b}+\frac{1.3a(a+1)}{2.4b(b+1)}+\frac{1.3.5}{2.4.6}.\frac{a(a+1)(a+2)}{b(b+1)(b+2)}+\cdots$ என்ற தொடர் ஒருங்குவதற்கு $a>0,b>0$ மற்றும் $b>a+\frac{1}{2}$ என நிரூபி.

19. Show that $\sqrt{x^2+16}-\sqrt{x^2+9}=\frac{7}{2x}$ nearly for sufficiently large values of *x*.

x என்பது மிகப்பெறிய மதிப்பெனில் தோராயமாக $\sqrt{x^2+16}-\sqrt{x^2+9}=\frac{7}{2x}$ என நிரூபி.

20. Find the sum to infinity of the series $\frac{1}{24}-\frac{1.3}{24.32}+\frac{1.3.5}{24.32.40}-\cdots$

$\frac{1}{24}-\frac{1.3}{24.32}+\frac{1.3.5}{24.32.40}-\cdots$ என்ற தொடரின் கூட்டுத்தொகை மதிப்பைக் காண்க.

⊗⊗⊗⊗⊗⊗

SEMESTER I

Year	Sem.	Subject Code	Title of the paper	Hours/Week
2021 -2022 onwards	**I**	**21ENV1GE**	**ENVIRONMENTAL STUDIES (For all UG courses)**	**2**

COURSE LEARNING OUTCOMES:

On the successful completion of the course, students will be able to:

1. Recognize the role of the environment and the need to conserve it for sustaining life.
2. Enumerate the natural resources
3. Explores the adverse effects of deforestation and over exploitation of natural resources
4. Associate the components of the ecosystem and need for biodiversity conservation.
5. Evaluate the environmental pollution hazards and their effects on the living system.
6. Interpret the different disaster management procedures.
7. Analyse the climatic change and global effects
8. Infer the need for environmental laws in the constitution of India.
9. Relate the growth of the human population and its impact on the environment.

UNIT I:

Environment – Introduction – Nature - Scope – Content – Need for study. Natural resources- Forest and energy resources- Use and overexploitation - deforestation. Energy resources- renewable and non-renewable energy resources.

UNIT II:

Ecosystem – concept – types- Forest, Grassland, Desert and Aquatic (Pond)- Structure and function of an ecosystem – Producers- consumers and decomposers – Food chain – food web- ecological pyramids- energy flow. Biodiversity and its conservation- *in situ* and *ex situ* conservation- Mega biodiversity centres and hotspots.

UNIT III:

Environmental pollution- definition- causes-effects and control measures of air, water, soil, thermal and nuclear pollution. Waste management- Industrial and solid waste. Disaster management – earthquake, cyclone, flood and landslides.

UNIT IV:

Social Issues and the environment-Urbanization-Urban problems related to energy and watershed management. Environmental Ethics- Issues and possible solutions- Wasteland reclamation- Climate change - causes and effects. Global warming- Acid rain- Ozone layer depletion- Public awareness. Environmental laws- Environment Protection Act, Wildlife Protection Act, Forest Conservation Act.

UNIT V:

Human population and its impact on environment- Population growth- Resettlement and Rehabilitation of project affected persons- Case studies – Sardar Sarovar Project, Maharashtra and Bandipur National Park- Project Tiger, Karnataka, NTPC, India.

Role of Indian and Global religions and Cultures in environmental conservation- Case study: sacred groves in Western Ghats (kavu) & Chinese culture. Human and Wildlife Conflict.

PEDAGOGY STRATEGIES

- ❖ Board and Chalk lectures
- ❖ PowerPoint slide presentations
- ❖ Assignments

Textbooks:

1. Sharma, P. D. 2000. Ecology & Environment. Rastogi Publications, Meerut, India.
2. Bharucha, E. 2003. Text book of Environmental Studies. UGC, New Delhi & Bharati Vidyapeeth Institute of Environmental Education and Research, Pune.
3. Arumugam, M. and Kumaresan, V. 2016. Environmental Studies (Tamil version). Saras Publications, Nagerkoil.

Online/E-Resources:

https://www.edx.org/course/subject/environmental-studies
https://www.coursera.org/courses?_facet_changed_=true&domains=life-sciences%2Cphysical- science-and-engineering%2Csocial-sciences&query=environmental%20science%20and%20sustainability&userQuery=environmental% 20science%20and%20sustainability

https://www.open.edu/openlearn/nature-environment/free-courses

COURSE LEVEL MAPPING OF PROGRAMME LEVEL OUTCOME:

Program Level Outcomes (PLO)	**Course Level Outcome (CLO)**								
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Disciplinary Knowledge		√	√		√	√			
Communication Skills		√		√				√	√
Critical Thinking	√		√		√		√		
Research related skills	√		√			√		√	
Analytical reasoning	√			√		√		√	
Problem Solving		√	√			√			√
Team Work				√	√		√		√
Moral and ethical awareness		√		√		√		√	√

SEMESTER II

Year	Subject Title	Semester	Sub Code
2021 -22 Onwards	**VALUE EDUCATION – GANDHIAN THOUGHTS (For all UG courses)**	**II**	**21VAL2GE**

COURSE LEVEL OUTCOMES:

On the successful completion of the course, student will be able to:

1. Interpret Gandhiji's experiments to his spiritual pursuits and search for purity, political activities through fasting protests, and even his role as an educator using diet and meals as teaching exercises.

2. Lead a life marked with humility and truthfulness and subsequent realization of the Truth as the purpose of human life.

3. Infer lessons that are fundamental to living in harmony and social progress such as respect, empathy, equality, solidarity and critical thinking.

4. Promote tolerance and understanding above and beyond our political, cultural and religious differences.

5. Create special emphasis on the defense of human rights, the protection of ethnic minorities

6. Emerge as responsible citizens with clear conviction to practice values and ethics in life.
7. Transform themselves to become good leaders.

8. Realize their role and contribution to the nation building.

UNIT I: Birth and Parentage - Childhood - At the High school - Stealing and Atonement - Glimpses of Religion - Gandhi's choice - Experiments in Dietetics - Acquaintance with Religions - The Great Exhibition.

UNIT II: The first case - Preparing for South Africa - same experiences - on the way to Pretoria – Coolie - Natal Indian Congress - Education of Children - Brahmacharya.

UNIT III: Simple life - The Boer war - Sanitary Reform and Famine Relief - Lord Curzon's Darbar - A month with Gokhale - Experiments in Earth and water treatment - Indian opinion - Coolie Locations or Ghettoes - The Black plague.

UNIT IV: The Magic spell of a Book - The Zulu Rebellion - The Birth of Satyagraha - More experiments in Dietetics - Kasturbai's Courage - Domestic Satyagraha- Fasting -

Shanti Niketan - Woes of Third-Class passengers.

UNIT V: Kumbha mela - Lakshman Jhula - Founding of the Ashram - Abolition of Indentured Emigration - The Kheda Satyagraha - The Rowlatt Bills - Navajivan and young India - Congress Initiation - The Birth of Khadi.

TEXT BOOKS

1. M.K.GANDHI, "The Story of My Experiments with Truth", An Autobiography Apple publishing International(P) Ltd, Chennai.
2. . மகாத்மா காந்தியின் சுயசரிதை - சத்தியசோதனை தமிழாக்கம் - -ரா.வேங்கடராஜுலு, நவஜீவன் பரசுராலயம், அகமதாபாத

PEDAGOGY STRATEGIES

- Board and Chalk lecture
- Powerpoint slide presentations
- Seminar
- Assignments
- Quizes
- Group discussion

COURSE LEVEL MAPPING OF PROGRAM LEVEL OUTCOMES.

			Course Level Outcomes (CLO)							
			1	2	3	4	5	6	7	8
Program Level Outcomes (PLO)	1	Reflective thinking	✓	✓			✓		✓	✓
	2	Communication skills		✓		✓	✓	✓	✓	✓
	3	Critical thinking	✓			✓		✓	✓	✓
	4	Multicultural competence				✓	✓	✓	✓	✓
	5	Analytical reasoning		✓	✓	✓		✓		
	6	Problem solving		✓	✓	✓		✓	✓	✓
	7	Team work	✓		✓		✓	✓	✓	
	8	Leadership readiness/qualities			✓		✓	✓		✓
	9	Moral and ethical awareness	✓		✓		✓	✓		✓