ST.PHILOMENA'S COLLEGE (AUTONOMOUS), MYSURU

POST GRADUATE COURSE – SEMESTER SCHEME

Learning Outcome Based Curriculum from the

Academic year 2018-20 onwards

PG DEPARTMENT OF MATHEMATICS

ST. PHILOMENA'S COLLEGE (AUTONOMOUS) MYSORE
POST GRADUATE PROGRAMMES
Learning Outcome Based Curriculum – 2018
Guidelines/Regulations

(For Candidates admitted during the Academic year 2018 -2020 onwards)

POST GRADUATE PROGRAMMES

The Master's Degree Programme will be conducted under the existing regulations governing two year- four semesters Choice Based Credit System (CBCS) and Continuous Assessment Grading Pattern (CAGP) with Learning Outcome - Based Curriculum under Autonomous Structure.

Guidelines/Regulations

1. Eligibility for Admission

Candidates shall have studied Mathematics as Major/Core subject in any Bachelor degree course of any recognized University with not less than 45 % (40% for SC/ST and Category - I Candidates) of the aggregate marks of all the years of course of study. The qualification and the percentage marks for admission shall be as per the guidelines issued by University of Mysore from time to time

Note: - In case of candidates who have taken more than three years to complete their Bachelors Degree, the percentage of mark is arrived as per the guidelines issued by University of Mysore from time to time

2. Duration of the Programs

The duration of Programme shall extend over 4 semesters (two academic years) of 20 weeks each including instructions and examinations.

3. Maximum Period for Completion of the Programs

The candidates shall complete the Programme within 4 years from the date of admission. The term completing the Programme means passing all the prescribed examinations of the programme to become eligible for the degree. No candidate shall be permitted to appear for the examinations after the prescribed period for completing the Programme. Whenever a candidate opts for blank semesters/ dropped papers, he/she have to study the prevailing papers offered by the department when he /she continues his /her studies.

4. Medium of Instruction

The medium of instruction shall be English.

5. Hours of Instruction per Week

There shall be 24-30 hours of instructions per week in subjects without practicals / field-work and 28-34 hours of instructions per week in subjects with practicals /field-work. These hours may be distributed for lectures, seminars, tutorials, practicals, project-work and other modes of instruction which individual courses may demand.

6. Attendance

Each paper (theory/practical) shall be treated as an independent unit for the purpose of attendance. A student shall attend a minimum of 75% of the total instruction hours in a paper (theory/practical) including tutorials and seminars in each semester. There shall no provision for condonation of shortage of attendance and a student who fails to secure 75% attendance in a paper shall be required to repeat that semester with the payment of semester fees.

7. Guidelines to Implement CBCS & CAGP Master Degree Programme

Course: Every paper offered will have three components associated with the teaching-learning process, namely

(a) **L -** Lecture (b) **T -** Tutorial (c) **P -** Practical

Where

L - Stands for Lecture session.

T - Stands for Tutorial session consisting participatory discussion/self-study/desk work/ brief seminar presentations by students and such other novel methods that make a student to absorb and assimilate more effectively the contents delivered in the Lecture classes.

P -Stands for Practical session and it consists of Hands on experience / Laboratory Experiments/Field Studies/Case studies that equip students to acquire the much required skill component.

In terms of credits, every one hour session of L per week amounts to one credit per semester and a minimum of two hour session of T or P per week amounts to one credit per semester, over a period of one semester of 16 weeks for teaching – learning process. The total duration of a semester is 20 weeks inclusive of semester end examination.

A paper shall have either one or two or all the three components. That means a may have only lecture component, or only practical component or combination of any two or all the three components.

The total credit earned by a student at the end of the semester upon successfully completing the course is equal to L + T + P of each paper.

Different papers of study are labeled and defined as follows:

Hard Core Paper

A paper which should compulsorily be studied by a candidate as a core requirement is termed as a **Hard Core Paper**.

Soft Core Paper

If there is a choice or an option for the candidate to choose a paper from a pool of papers from the main discipline subject of study or from a sister/related discipline / subject which supports the main discipline/ subject is termed as a **Soft Core Paper**.

Elective Paper

Generally a paper which can be chosen from a pool of papers and which may be very specific or specialized or advanced or supportive to the discipline / subject of study or which provides an extended scope or which enables an exposure to some other discipline / subject / domain

or nurtures the candidate's proficiency / skill is called an Elective Paper. Elective papers may be offered by the main discipline / subject of study or by sister / related discipline / subject of study. ***A Soft Core paper may also be considered as an elective.***

Open Elective

An elective paper chosen generally from an unrelated discipline / subject, with an intention to seek exposure is called an **open elective. A core paper offered in a discipline / subject may be treated as an elective by other discipline / subject and vice versa**.

Project work / Dissertation work

It is a special paper involving application of knowledge in solving / analyzing / exploring a real life situation / difficult problem.

Minor Project Work

A project work up to 4 credits is called Minor Project work.

Major Project Work

A project work of 6 to 8 credits is called Major Project Work.

Dissertation Work

A project work can be of 10 – 12 credits. A Project /Dissertation work may be a hard core or a soft core as decided by the BOS concerned.

8. Scheme of Instruction

8.1 A candidate has to earn a minimum of ***76 credits***, for successful completion of a Master's Degree with a distribution of credits for different papers as given in the following table.

Paper Type	Credits
Hard Core	A minimum of 42, but not exceeding 52
Soft Core	A minimum of 16
Open Elective	A minimum of 08

8.2 A candidate can enroll for a maximum of 24 credits per semester.

8.3 Only such candidates who register for a minimum of 18 credits per semester and complete successfully 76 credits in 4 successive semesters shall be considered for declaration of ranks, medals and are eligible to apply for student fellowship, scholarship, free ships and hostel facilities.

9. Continuous Assessment, Earning of Credits and Award of Grades

The evaluation of the candidate shall be based on continuous assessment. The structure for evaluation is as follows:

9.1 Assessment and evaluation processes happen in a continuous mode. However, for reporting purposes, a semester is divided into 3 distinct components identified as C_1, C_2, and C_3

9.2 The performance of a candidate in a paper will be assessed for a maximum of 100 marks as explained below.

a) The first component (C_1) of assessment is for 15 marks. This will be based on test, assignment, seminar and attendance (Class Participation).During the first half of the semester, the first 50% of the syllabus will be completed. This shall be consolidated during the 8^{th} week of the semester. Beyond 8^{th} week, making changes in C_1 is not

permitted. The marks for the class participation - 91-100 % -05 marks, 81-90% - 04 marks and 75-80% -03 marks.

b) The second component (C_2) of assessment is for 15 marks. This will be based on test, assignment, seminar and attendance (Class Participation). The continuous assessment and scores of second half of the semester will be consolidated during the 16^{th} week of the semester. During the second half of the semester, the remaining units in the paper will be completed. The marks for the class participation- 91-100 % -05 marks, 81-90% 04 marks and 75-80% -03 marks

c) The outline for continuous assessment activities for Component – I (C_1) and Component – II (C_2) will be proposed by the teacher(s) concerned before the commencement of the semester and will be discussed and decided in the respective Departmental Council. The students should be informed about the modalities well in advance. The evaluated papers / assignments during component - I (C_1) and component - II (C_2) of assessment are immediately returned to the candidates after obtaining acknowledgement in the register maintained by the concerned teacher for this purpose.

d) During the 18^{th} – 20^{th} week of the semester, a semester end examination of 2 hours duration shall be conducted for each paper. This forms the third/final component of assessment (C_3) and the maximum marks for the final component will be 70.

10. Setting Question Papers and Evaluation of Answer Scripts.

a) Question papers in three sets shall be set one by the internal and two by the external examiners. While selecting the examiners the University Guidelines to be followed. Whenever there are no sufficient internal examiners, the Chairman of Board of Examination [BOE] shall get the question papers set by external examiners.

b) The Board of Examiners shall scrutinize and approve the question papers and scheme of valuation.

c) There shall be single valuation for all theory papers by **external examiners**. A detailed scheme of valuation to be prepared by the department and to be provided to the external examiner along with the answer scripts

d) The examination for Practical Work / Field Work / Project Work will be conducted jointly by internal and external examiners. However, the BOE on its discretion can also permit two internal examiners from the College.

e) If a paper is full of (L = 0): T: (P=0) type, then the examination for C_3 component will be as decided by the BOS concerned.

i) The details of continuous assessment are summarized in the following Table

Component	Syllabus in a paper	Weightage	Period of continuous assessment
C_1	First 50% of the Syllabus	15%	First half of the semester To be consolidated by 8th week
C_2	Remaining 50% of the Syllabus	15%	Second half of the semester To be consolidated by 16th week
C_3	Semester-end examination (all units of the paper)	70%	To be completed during 18th – 20th Week
Final grades to be announced latest by 24th week			

k) A candidate's performance from all 3 components will be in terms of scores, and the sum of all three scores will be for a maximum of 100 marks (15 + 15 + 70).

m) **Finally, awarding the grades should be completed latest by 24th week of the Semester.**

11. Minor / Major Project Evaluation

Right from the initial stage of defining the problem, the candidate has to submit the progress reports periodically and also present his / her progress in the form of seminars in addition to the regular discussion with the guide. Components of evaluation are as follows:

Component – I (C_1): Periodic Progress and Progress Reports (15)

Component – II (C_2): Results of Work and Draft Report (15)

Component – III (C_3): Final Viva Voce and evaluation (70). The report evaluation is for 40 and the Viva –voce examination is for 30.

12. In case a candidate secures less than 30% in C_1 and C_2 put together in a paper, the candidate is said to have **DROPPED** that paper, and such a candidate is not allowed to appear for C_3 in that paper.

In case a candidate's class attendance in a paper is less that 75% or as stipulated by the College, the candidate is said to have **DROPPED** that paper, and such a candidate is not allowed to appear for C_3 in that paper.

Teachers offering the papers will place the above details in the P G Department Council meeting during the last week of the semester, before the commencement of C_3 and subsequently a notification pertaining to the above will be brought out by the Principal before the commencement of C_3 examination. A copy of this notification shall also be sent to the office of the Controller of Examinations.

12.1 In case a candidate secures less than 30% in C_3 he/she may choose **DROP/MAKEUP** option.

In case a candidate secures more than or equal to 30% in C_3 but his/her grade (G) = 4, as per section 12.5 below, then he/she may be declared to have been conditionally successful in that paper, provided that such a benefit of conditional clearance based on G = 4 shall not be availed for a maximum of **8 credits** for the entire programme of Master's Degree of two years.

A candidate exercising his/her option to MAKEUP examination shall be declared passes if he/she secures more than or equal to 30% in C_3 provided he/she fulfils the conditions mentioned in the Para 12.1 & 12.5.To a candidate who does not pass in MAKE UP examination , no separate MAKEUP examination shall be conducted. Such a candidate has to appear for the examination as and when the C_3 component examination is conducted for Odd & Even semester of that academic year along with the regular candidates.

12.2 A candidate has to re-register for the DROPPED paper when the paper is offered again by the department if it is a hard core paper. The candidate may choose the same or an alternate core/elective in case the dropped paper is soft core/ elective paper. A candidate who is said to have DROPPED project work has to re-register for the same subsequently within the stipulated period. **The details of any dropped paper will not appear in the grade card.**

12.3 The tentative / provisional grade card will be issued by the Registrar (Evaluation) at the end of every semester indicating the papers completed successfully. This statement will not contain the list of DROPPED papers.

12.4 Upon successful completion Master's degree a final grade card consisting of grades of all papers successfully completed by the candidate will be issued by the Registrar (Evaluation).

12.5 The Grade (G) and the Grade Point (GP) earned by the candidate in the subject will be as given below.

P	G	GP = V x G
90 – 100	10	V x 10
80 – 89	9	V x 9
70 – 79	8	V x 8
60 – 69	7	V x 7
50 – 59	6	V x 6
40 – 49	5	V x 5
30 – 39	4	V x 4
0 – 30	0	V x 0

Here, P is the percentage of marks P= $[(C_1+C_2) + C_3]$ secured by a candidate in a paper which is rounded to nearest integer. V is the credit value of paper. G is the Grade and GP is the Grade Point.

12.6 A candidate can withdraw any paper within ten days from the date of notification of final results of that semester. Whenever a candidate withdraws a paper, he/she has to register for the same paper in case it is hard core paper, the same paper or an alternate paper if it is soft core/open elective.

A DROPPED paper is automatically considered as a paper withdrawn.

12.7 The Semester Grade Point Average (SGPA) of a candidate after successful completion the required number of credits (76) is given by

$$\textbf{SGPA} = \frac{\sum GP}{Total\ number of\ credits}$$

12.8 The Final Semester Grade Point Average (SGPA) of a candidate after successful completion the required number of credits (76) is given by

$$\textbf{CGPA} = \frac{\sum GP\ of\ all\ the\ four\ Semesters}{\sum\ Credits\ of\ all\ the\ Semesters}$$

13. Classification of results

The Final Cumulative Grade Point (FGP) to be awarded to the student is based on CGPA secured by the candidate and is given as follows:

CGPA	FGP	
	Numerical Index	Qualitative Index
4< = CGPA < 5	5	SECOND CLASS
5< = CGPA < 6	6	
6< = CGPA < 7	7	FIRST CLASS
7< = CGPA < 8	8	
8< = CGPA < 9	9	DISTINCTION
9< = CGPA < 10	10	

Overall percentage = 10 x CGPA or is said to be 50% in case CGPA < 5

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Preamble:

The aim of the post graduate education is to provide high quality education as well as a supportive learning environment for the students to reach their full academic potential. The higher education has to inculcate in students the spirit of hard work and research aptitude to know the essence of Mathematics. This is the third revision of the curriculum Board of Studies in Mathematics has designed the curriculum for M.Sc. Mathematics so as to monitor, review and enhance educational provision which ensures the Post Graduate Education remains intellectually demanding and relevant to current needs of Mathematics graduates. The thrust is given in fostering a friendly and stimulating learning environment which will motivate the students to reach high standards, enable them to acquire real insight into Mathematics and become self-confident, committed and adaptable graduates. With this in mind, we aim to provide a firm foundation in every aspect of Mathematics and to develop analytical, experimental, computational logical and reasoning skills of students.

The syllabi gives the foundation of Mathematics and evolution of Mathematics Education. The goal of the syllabus is to make the study of Mathematics, interesting and encouraging to the students to study in-depth which helps them for research. The syllabus is based on a basic and applied approach with vigor and depth. At the same time precaution is taken to make the syllabus comparable to the syllabi of other universities and the needs of research and its applications.

The syllabi is prepared after discussion at length with number of faculty members of the subject from different universities and research fields. The units of the syllabus are well defined, taking into consideration the level and the requirement to the students.

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The following modifications are incorporated in the revised syllabus from the academic year 2018-20.

Sl. No.	Semester	Existing Paper replaced	New Paper	Credits	Justification	Percentage of Changes
1.	**First**	Linear Algebra	Linear Algebra-I	**4**	To explore more problems in vector spaces	**25**
2.	**First**	**-**	**Numerical Analysis**	**4**	To study the essence of various approximations of solutions	**100**
3.	**Second**	**_**	Linear Algebra-II	**4**	As the subject is a powerful mathematical tool, finding applications in subjects diverse fields of Mathematics, we extended the idea of Linear Algebra	**25**
4.	**Third**	**_**	Mathematical Computation	**4**	To encourage and to nurture the interdisciplinary ideas of the students	**100**

TOTAL CHANGES ≈ 10%

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VISION AND MISSION OF THE COLLEGE

VISION:
The college is guided by the visionary zeal of providing value- based education to everyone irrespective of religion, caste, creed or sex by which the character is formed, intellect is explained and one can stand on his/her feet**.**

MISSION:
To transform young men and women who come to learn not from books, but also from life and to share the experience of working and playing together, which inculcates life skills to become good citizens with integrity and discipline**.**

VISION AND MISSION OF THE DEPARTMENT

VISION:
To strive for excellence in mathematical sciences that ignites students for interdisciplinary domains.

MISSION:
1. To provide quality education and research in Mathematics through updated curriculum, effective teaching learning process.
2. To inculcate innovative skills, team-work, ethical practices among students in turn to meet societal expectations

PO No.	Programme Educational Objectives (PEOs)
PEO-1	**PROFESSIONAL GROWTH** Keep on discovering new avenues in the chosen field and exploring areas that remain conducive for research and development.
PEO-2	**CORE PROFICIENCY** To expertise the students to organize, understand, evaluate, and solve problems by providing hands on experience through modern tools necessary for practice.
PEO-3	**TECHNICAL PROFICIENCY** To have the interdisciplinary knowledge and relating them the technical aspect as the impact of the subject concerned is very wide.
PEO-4	**MANAGEMENT SKILLS** Encourage personality development skills like time management, crisis management, Stress interviews and working as a team.
PEO-5	**LEARNING ENVIRONMENT** To provide students with knowledge and capability in formulating and analysis of mathematical models of real life applications.

Mapping of Mission of the department with Programme Educational Objectives

Mission	Programme Educational Objectives (PEOs)				
	PEOs-1	**PEOs-2**	**PEOs-3**	**PEOs-4**	**PEOs-5**
M1	√	√		√	
M2			√		√

Programme Outcomes (POs)

	At the end of the programme, the students will be able to:
PO-1	Apply knowledge of Mathematics, in all the fields of learning including higher research and its extensions
PO-2	Explain the knowledge of contemporary issues in the field of Mathematics and applied Sciences.
PO-3	Work effectively as an individual, and also as a member or leader in multi-disciplinary teams
PO-4	Adjust themselves completely to the demands of the growing field of Mathematics by lifelong learning
PO-5	Crack lectureship and fellowship exams approved by UGC like CSIR – NET ,SET and GATE**.**

Programme Specific Outcomes (PSOs)

PSO No.	Upon completion of the Programme the student will -
PSO-1	Develop problem-solving skills and apply them independently to problems in pure and applied mathematics.
PSO-2	Analyse complex mathematical ideas and arguments.
PSO-3	Improve their own learning and performance.
PSO-4	Develop abstract mathematical thinking.
PSO-5	Apply the knowledge of mathematical concepts in interdisciplinary fields.
PSO-6	Employ confidently the knowledge of mathematical software and tools for treating the complex mathematical problems and scientific investigations.
PSO-7	Pursue research in challenging areas of pure/applied mathematics.

Mapping of Programme Educational Objectives with Program Outcomes and Programme Specific outcomes

	Programme Outcomes					**Program Specific Outcomes**						
Programme Educational Objectives	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**	**PSO-6**	**PSO-7**
PEOs-1	√	√				√	√					√
PEOs-2	√	√				√	√		√		√	
PEOs-3			√	√			√	√		√	√	
PEOs-4				√	√	√		√		√		
PEOs-5			√		√			√	√			√

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M Sc - Mathematics - Course Structure [credits distribution]

I Semester						Total Credits
Sl. No	**Code**	**Title**	**Type**	**L:T P**	**Credit**	
1		Algebra-I	**HC**	**4:0:0**	**4**	**20**
2		Real Analysis-I	**HC**	**4:0:0**	**4**	
3		Real Analysis-II	**HC**	**4:0:0**	**4**	
4		Complex Analysis-I	**HC**	**4:0:0**	**4**	
		Any One of the following				
5		Linear Algebra-I	**SC**	**4:0:0**	**4**	
6		Combinatorics and Graph Theory	**SC**	**4:0:0**	**4**	
7		Numerical Analysis	**SC**	**4:0:0**	**4**	
II Semester						
1		Algebra-II	**HC**	**4:0:0**	**4**	**20**
2		Real Analysis-III	**HC**	**4:0:0**	**4**	
3		Complex Analysis-II	**HC**	**4:0:0**	**4**	
		Any One of the following				
4		Linear Algebra-II	**SC**	**4:0:0**	**4**	
5		Representation Theory of Finite Groups	**SC**	**4:0:0**	**4**	
6		Theory of Partitions	**SC**	**4:0:0**	**4**	
		Open Elective(offered from other departments)	**OE**	**4:0:0**	**4**	
III Semester						
1		Elements of Functional Analysis	**HC**	**4:0:0**	**4**	**20**
2		Topology-I	**HC**	**4:0:0**	**4**	
		Any two of the following				
3		Graph Theory	**SC**	**4:0:0**	**4**	
4		Commutative Algebra	**SC**	**4:0:0**	**4**	
5		Algebraic Number Theory	**SC**	**4:0:0**	**4**	
6		Galois Theory	**SC**	**4:0:0**	**4**	
7		Mathematical Computation (ID)	**SC**	**3:0:2**	**4**	
		Open Elective(offered from other departments)	**OE**	**4:0:0**	**4**	
IV Semester						
1		Measure and Integration	**HC**	**4:0:0**	**4**	**20**
2		Topology-II	**HC**	**4:0:0**	**4**	
		Any Three of the following			**4**	
3		**Project Work**	**C**	**4:0:0**	**4**	
4		Ordinary and Partial Differential Equation	**SC**	**4:0:0**	**4**	
5		Theory of Numbers	**SC**	**4:0:0**	**4**	
6		Advanced Graph Theory	**SC**	**4:0:0**	**4**	
7		Deferential Geometry	**SC**	**4:0:0**	**4**	
		O.E(offered from our dept in II and III sem)				
		Fundamentals of Mathematics	**OE**	**4:0:0**	**4**	
HC-44 + SC-28 + OE-8 = 80						**80**

ST. PHILOMENA'S COLLEGE (AUTONOMOUS)
Programme : M.Sc in Mathematics
(For Candidates admitted during the Academic year 2018-2020 onwards)

FIRST YEAR - SEMESTER – I

Course Title	Algebra-I								
Course Type	Hard Core- Theory		Total Hours	64	Hours/Week	04	Credits	04	
Course Code		Evaluation	Internal	C1+C2 = 15+15			30 Marks	100	
			External	Duration	C3	03Hrs	70 Marks		

General Objective
To introduce the concepts and to develop working knowledge on Groups, Normal Subgroups, Automorphism groups, Finite groups.

CO No.	**Course Objectives**
CO-1	To understand Residues, U(n) and Properties of prime numbers.
CO-2	To identify the concept of Normal groups and Quotients groups
CO-3	To analyse Permutation groups and Counting principle.
C0-4	To understand Sylow's theorem and its applications

CLOs No.	**Course Learning Outcomes (CLOs)** After completing this course, the student will be able to	**PSOs Addressed**	**CLDs**
CLO-1	Understand the properties of the algebraic structure with one binary operation	PSO-1	Understand
CLO-2	Describe Normal groups and Quotients groups.	PSO-2	Analyse
CLO-3	Analyse Permutation groups and Counting principle.	PSO-2	Analyse
CLO-4	Explain Sylow theorem and its applications	PSO-1	Apply

Unit	**Course Content**	**Duration**
1	**Number Theory** Congruences, residue classes, Fermat theorem, Euler and Wilson theorem, Linear congruences, Elementary arithmetical functions, Primitive roots Quadratic residues and the law of quadratic reciprocity	16 hours

Extra Reading /Key Words: Primitive roots

2	**Groups** Binary operation, definition of algebraic structure and groups Subgroups and cosets, Lagrange's Theorem, Cyclic subgroups, Normal subgroups and factor groups.	16 hours
Extra Reading /Key Words: Subgroups of finite non-abelian groups.		
3	**Isomorphism** Homomorphism- kernel and image , The fundamental theorem of homomorphism, Two laws of isomorphism	16 hours
Extra Reading /Key Words: Homomorphism and Isomorphism		
4	**Permutation Groups** Group of permutations, Alternative group, Signature of Permutation Cayley's theorem Sylow's theorems	16 hours
Extra Reading /Key Words : Permutation Groups, Sylow's theorems and Direct products		

REFERENCES

Sl. No	Title of the book	Author(s)	Publisher	Edition	Year of Publication
1	Algebra	Thomas W. Hungerford	Springer International Edition, New York	5th	2010
2	Contemporary Abstract Algebra,	J. A. Gallian	Narosa Publishing House	4th	2009
3	Algebra	Michael Artin	Prentice-Hall ofIndia	9th	2008
4	Abstract Algebra	D.S. Dummit and R. M.Foote	John Wiley andSons	10th	1999
5	Topics in Algebra	I.N. Herstein	Vikas Publishing House	4th	2013
6	A First course in Abstract Algebra	J.B. Fraleigh	Addison-Wesley	3rd	2009
7	University Algebra	N. S. Gopalakrishnan	New Age International	2nd	2009

FIRST YEAR - SEMESTER – I

Course Title	Real Analysis-I							
Course Type	Hard Core- Theory		Total Hours	64	Hours/Week	04	Credits	04
Course Code		Evaluation	Internal	C1+C2 = 15+15			30 Marks	100
			External	C3	Duration	03hrs	70 Marks	

General Objective

To learn the properties of Real numbers, Sequences and Series and the concept of convergence of sequences and series.

CO No.	Course Objectives
CO-1	To understand the Archimedean property and basic properties of Real number.
CO-2	To locate Sequence and Series comprising convergence sequences, upper and lower limits.
CO-3	To find the nature of a series through series tests.

Mapping of CLOs with PSOs &CDLs

CLOs No.	Course Learning Outcomes (CLOs) After completing this course, the student will be able to	PSOs Addressed	CLDs
CLO-1	Understand the basic properties of real numbers	PSO-1	Understand
CLO-2	Apply the properties of the sequences	PSO-2	Apply
CLO-3	Test the convergence of a given series	PSO-4	Analyse, Apply

Unit	Course Content	Duration
1	**Properties of Real Numbers** The extended real number system n-dimensional Euclidean space Binomial inequality, the Power Mean inequality, Cauchy's Schwarz inequality, Holder's and Minkowski's inequality	16 hours

Extra Reading /Key Words: Extended real number system and Euclidean space .

2	**Sequences of Real Numbers** Numerical sequences Convergent sequences Cauchy sequences	16 hours
Extra Reading /Key Words: Sequences		
3	**Series of Real Numbers-I** Series of real numbers, Series of non-negative terms, The number `e'and test of convergence	16 hours
Extra Reading /Key Words: Series		
4	**Series of Real Numbers-II** Multiplications of series, Re-arrangements. Double Series, infinite products.	16 hours
Extra Reading /Key Words: Double Series and Infinite products.		

REFERENCES

Sl. No	Title of the book	Author(s)	Publisher	Edition	Year of publication
1	Principles of Mathematical Analysis	W. Rudin	Int. Student edition, McGrawHill	3rd	1997
2	Mathematical Analysis	T. M. Apostal	Addison Wesley, Narosa, New Delhi,	2nd	1998
3	Methods of Real Analysis	R. R. Goldberg	Oxford and IBH, New Delhi	5th	2008
4	Analysis I and Analysis II	Torence Tao	Hindustan Book Agency, India,	6th	2006
5	Introduction to real analysis	Robert G Bartle	John Wiley and Sons. Inc	4th	2014
6	Elementary Analysis: The Theory of Calculus	Kenneth A. Ross	Springer Inter, Edition,2004.	4th	2008

FIRST YEAR - SEMESTER – I

Course Title	Real Analysis-II								
Course Type	Hard Core- Theory		Total Hours	64	Hours/Week	04	Credits	04	
Course Code		Evaluation	Internal	C1+C2 = 15+15			30 Marks	100	
			External	Duration	C3	03Hrs	70 Marks		

General Objective

To enable the students to appreciate various aspects of Countability, Metric spaces and understand continuous functions, Riemann-Stieltje's integral

CO No.	Course Objectives
CO-1	To understand countability and to describe topological properties of Metric space.
CO-2	To distinguish continuity and uniform continuity with examples and to infer the compactness in continuity and connectedness.
CO-3	To derive the differentiability from limiting of functions and clarify the properties and mean value theorems of differentiable functions.
CO-4	To understand the concept of Riemann- Stielije's Integrability and its properties and discuss Rectifiable curves.

Mapping of CLOs with PSOs &CDLs

CLOs No.	Course Learning Outcomes (CLOs) After completing this course, the student will be able to	PSOs Addressed	CLDs
CLO-1	Understand countable and uncountable sets and describe the topological properties on metric space.	PSO-1	Understand
CLO-2	Differentiate continuity and uniform continuity with examples and infer the compactness in continuity and connectedness.	PSO-2	Analyse
CLO-3	Derive the differentiability from limiting of functions and clarify the properties and mean value theorems of differentiable functions.	PSO-4	Evaluate
CLO-4	Explain the concept of Riemann- Stielije's Integrability and its properties and discuss Rectifiable curves.	PSO-3	Create

Unit	Course Content	Duration
1	**Basic Topology** Finite sets, Countable and uncountable sets, The topology of the real line.	16 hours

Extra Reading /Key Words: Countablity and the topology of the real line.

2	**Limits and Continuity** Limit of a function Continuous functions, Properties of continuous functions, discontinuities, Monotonic functions	16 hours
Extra Reading /Key Words: Limits and Continuity		
3	**Differentiation** Differentiability, Mean value theorems, L'Hospital rule, Taylor's theorem, Maxima and minima, Functions of bounded variation	16 hours
Extra Reading /Key Words: Differentiability, Convex and Concave functions		
4	**Riemann-Stieltje's Integral** Definition and existence of integral. Properties of the integral Integration and differentiation. First and second mean value theorems.	16 hours
Extra Reading /Key Words: Riemann-Stieltje's Integral and Motivation for Measure Integrals.		

REFERENCES

Sl. No	Title of the book	Author(s)	Publisher	Edition	Year of publication
1	Principles of Mathematical Analysis	W. Rudin	Int. Student edition, McGrawHill,	3rd	1997
2	Mathematical Analysis,	T. M. Apostal	Addison Wesley, Narosa, New Delhi,	2nd	1998
3	Methods Of Real Analysis	R. R. Goldberg	Oxford and IBH, New Delhi	5th	2008
4	Analysis I and Analysis II,	Torence Tao	Hindustan Book Agency, India,	6th	2006
5	Elementary Analysis: The Theory of Calculus	Kenneth A. Ross	Springer Inter, Edition,2004.	4th	2008

FIRST YEAR - SEMESTER – I

Course Title	Complex Analysis -I								
Course Type	Hard Core- Theory		Total Hours	64	Hours/Week	04	Credits	04	
Course Code		Evaluation	Internal	C1+C2 = 15+15			30 Marks	100	
			External	Duration	C3	03Hrs	70 Marks		

COURSE OBJECTIVES (COs)

To enable the students to appreciate and critically evaluate the analytic, harmonic functions and complex integration.

CO No.	Course Objectives
CO-1	To understand the essence of complex field
CO-2	To analyse Analytic functions and exponential functions.
CO-3	To apply Cauchy's theorem for disk and the Integral formula.
CO-4	To understand Local properties of Analytic functions.

Mapping of CLOs with PSOs &CDLs

Course Learning Outcomes (CLOs): The CLOs indicate what a student has learnt after the successful completion of a course. The CLO statements are prepared by considering the course content covered in each unit of a course.For every course there may be 5 or more CLOs. **The keywords are used at the end of each unit to define CLOs.**

CLOs No.	Course Learning Outcomes (CLOs) After completing this course, the student will be able to	PSOs Addressed	CLDs
CLO-1	Explain the essence of Complex Field	PSO-1	Understand
CLO-2	Analyse Analytic functions and exponential functions.	PSO-2	Analyze
CLO-3	Apply Cauchy's theorem for disk and the Integral formula.	PSO-4	Evaluate
CLO-4	Understand Local properties of Analytic functions.	PSO-3	Apply

Unit	Proposed Course Content	Duration
1	**Fundamentals of Complex Numbers** Algebra of complex numbers geometric representation of complex numbers Riemann sphere and Stereographic projection Lines, Circles. Limits and Continuity.	16 hours

Extra Reading /Key Words: Stereographic projection and Limits and Continuity.

2	**Sequence and Series** Analytic functions Cauchy-Riemann equations Harmonic functions, Polynomials and Rational functions. Elementary theory of power series - sequences, series, uniform convergence of power series, Abel's limit theorem, The elementary functions.	16 hours
Extra Reading /Key Words: Analytic functions and sequence of functions		
3	**Topology and Complex Integration** Topology of the complex plane. Linear fractional transformations, Cross-ratio, Symmetry, Elementary conformal mappings. Complex integration – Line integrals, Rectifiable arcs.	16 hours
Extra Reading /Key Words: Cross-ratio, conformal and isogonal mappings and Complex integration		
4	**Cauchy's Theorems** Cauchy's theorem for a rectangle. Cauchy's theorem in a Circular disk, Cauchy's integral formula. Local properties of analytic functions.	16 hours
Extra Reading /Key Words: Cauchy's theorem, Local properties of analytic functions		

REFERENCES

Sl. No	Title of the book	Author(s)	Publisher	Edition	Year of publication
1	Complex Analysis	L. V. Ahlfors	McGraw-Hill, Kogakusha	3rd	1979
2	Functions of one complex variable,	J. B. Conway	Narosa, New Delhi.	2nd	1998
3	Invitation to Complex Analysis	R. P. Boas	The Random House	1st	1987
4	An Introduction to Complex Function Theory	B. C. Palka	Springer	1st	1991
5	Foundations of Complex Analysis,	S. Ponnusamy	Narosa	4th	1995

FIRST YEAR - SEMESTER – I

Course Title	Linear Algebra -I							
Course Type	Soft Core- Theory		Total Hours	64	Hours/Week	04	Credits	04
Course Code		Evaluation	Internal	C1+C2 = 15+15			30 Marks	100
			External	Duration	C3	03Hrs	70 Marks	

COURSE OBJECTIVES (COs)

To introduce the concepts and to develop working knowledge on Vector Spaces, Inner Product Spaces, Linear Transformation on these spaces and their canonical forms and types of linear transformations.

CO No.	Course Objectives
CO-1	To identify the Algebra of Linear Transformations and Characteristics roots.
CO-2	To analyse Linear Transformation.
CO-3	To understand Hermitian, Unitary and Normal Transformation

Mapping of CLOs with PSOs &CDLs

Course Learning Outcomes (CLOs): The CLOs indicate what a student has learnt after the successful completion of a course. The CLO statements are prepared by considering the course content covered in each unit of a course.For every course there may be 5 or more CLOs. **The keywords are used at the end of each unit to define CLOs.**

CLOs No.	Course Learning Outcomes (CLOs) After completing this course, the student will be able to	PSOs Addressed	CLDs
CLO-1	Understand the concepts of Liner independence, bases and Dual spaces.	PSO-1	Understand
CLO-2	Discuss Algebra of Linear Transformations and Characteristics roots.	PSO-4	Analyse
CLO-3	Analyze rational canonical forms and Determinants.	PSO-2	Analyse
CLO-4	Apply Hermitian, Unitary and Normal Transformations.	PSO-3	Apply

Unit	Proposed Course Content	Duration
1	**Vector Spaces** Definitions and examples of Vector Spaces, Subspaces Linear Combinations and Systems of Linear Equations Linear Dependence and Linear Independence, Bases and Dimension Maximal Linearly Independent and Minimal Generating sets	16 hours

Extra Reading /Key Words: Vector Spaces and system of linear equations		
2	**Linear Transformations** Definitions, examples of Linear Transformations Null Spaces, and Ranges The Matrix Representation of a Linear Transformation Composition of Linear Transformations and Matrix Multiplication Invertibility and Isomorphisms, The Change of Coordinate Matrix and The Dual Space	16 hours
Extra Reading /Key Words: Linear Transformations		
3	**Matrix Operations** Elementary Matrix Operations and Elementary Matrices, The Rank of a Matrix and Matrix Inverses, Systems of Linear Equations, Properties of Determinants and Cofactor Expansions	16 hours
Extra Reading /Key Words: Matrix Operations		
4	**Eigenvalues and Eigenvectors of Matrices** Elementary Operations and Cramer's Rule Eigenvalues and Eigenvectors, Diagonalizability Invariant Subspaces and the Cayley-Hamilton Theorem	16 hours
Extra Reading /Key Words: Eigenvalues and Eigenvectors		

REFERENCES

Sl. No	Title of the book	Author(s)	Publisher	Edition	Year of publication
1	Linear Algebra	S. Friedberg, A. Insel, and L. Spence	PHI	4th	2009
2	Linear Algebra	K. Hoffman and R. Kunze	Prentice-Hall of India	2nd	1978
3	Finite Dimensional Vector Space	P. R. Halmos	Princeton, N.J.D.Van Nostr and Company	3rd	1958
4	Linear Algebra	Lang. S.	Addison Wesley Pub. Co. Reading, Mass	1st	1972

FIRST YEAR - SEMESTER – I

Course Title	Combinatorics and Graph Theory							
Course Type	Soft Core- Theory		Total Hours	64	Hours/Week	04	Credits	04
Course Code		Evaluation	Internal	C1+C2 = 15+15			30 Marks	100
			External	Duration	C3	03Hrs	70 Marks	

COURSE OBJECTIVES (COs)

To introduce the concepts and to develop working knowledge on partially ordered sets, Lattices, Boolean Algebra, Permutations, Combinations and basic concepts of Graph Theory

CO No.	Course Objectives
CO-1	To identify the concept of Blocks – Cut points of graphs
CO-2	To analyse Königsberg bridge problem.
CO-3	To understand Pigeon-hole principle and its applications

Mapping of CLOs with PSOs &CDLs

Course Learning Outcomes (CLOs): The CLOs indicate what a student has learnt after the successful completion of a course. The CLO statements are prepared by considering the course content covered in each unit of a course.For every course there may be 5 or more CLOs. **The keywords are used at the end of each unit to define CLOs.**

CLOs No.	Course Learning Outcomes (CLOs) After completing this course, the student will be able to	PSOs Addressed	CLDs
CLO-1	Understand the definitions namely, cut points, bridges, blocks of graphs	PSO-1	Understand
CLO-2	Apply the knowledge of graph theory knowledge in solving some real world problems	PSO-5	Apply
CLO-3	Explain Permutations and Combinations and its application	PSO-2	Analyse
CLO-4	Explain Pigeon-hole principle and its applications	PSO-3	Apply

Unit	Proposed Course Content	Duration
1	**Basics of Lattices** Partially ordered sets, Lattices, Complete lattices, Distributive Lattices Complements, Boolean Algebra, Boolean expressions Application to switching circuits	16 hours

Extra Reading /Key Words: Boolean Algebra		
2	**Permutations and Combinations** Permutations and Combinations Pigeon-hole principle Principle of inclusion and exclusion	16 hours
Extra Reading /Key Words: Aplications of permutations and Combinations		
3	**Basics of Graphs** The Königsberg bridge problem Definition, Vertices of graphs, Walks and connectedness, Degrees	16 hours
Extra Reading /Key Words: Traversability and line graphs		
4	**Blocks and acyclic graphs** Blocks - Cut points, bridges Block graphs and Cut point graphs Tree-Elementary properties of trees	16 hours
Extra Reading /Key Words: Connectivity and line connectivity		

REFERENCES

Sl. No	Title of the book	Author(s)	Publisher	Edition	Year of publication
1	Elements of Discrete Mathematics	C. L. Liu	McGraw-Hill	1st	1986
2	Discrete Mathematics and its Applications	Kenneth H. Rosen	McGraw-Hill	4th	2002
3	Graph Theory	F. Harary	Addition Wesley Reading Mass	1st	1969
4	Basic Graph Theory	K. R. Parthasarathy	Tata McGraw-Hill, New Delhi	2nd	1994
5	Introduction to Graph Theory	D. B. West	Pearson Education Inc.,	2nd	2001

FIRST YEAR - SEMESTER – I

Course Title	Numerical Analysis								
Course Type	Soft Core- Theory		Total Hours	64	Hours/Week	04	Credits	04	
Course Code		Evaluation	Internal	C1+C2 = 15+15			30 Marks	100	
			External	Duration	C3	03Hrs	70 Marks		

COURSE OBJECTIVES (COs)

To describe different approaches to solve a polynomial equation and to solve systems of linear equations

CO No.	Course Objectives
CO-1	To study Transcendental and Polynomial Equations.
CO-2	To study Gauss elimination method and Gauss-Jordan method.
CO–3	To study Jacobi iteration method and Gauss-Seidel iteration method

Mapping of CLOs with PSOs &CDLs

Course Learning Outcomes (CLOs): The CLOs indicate what a student has learnt after the successful completion of a course. The CLO statements are prepared by considering the course content covered in each unit of a course.For every course there may be 5 or more CLOs. **The keywords are used at the end of each unit to define CLOs.**

CLOs No.	Course Learning Outcomes (CLOs) After completing this course, the student will be able to	PSOs Addressed	CLDs
CLO-1	Understand some special mathematical expectations and Chebyshev's inequality.	PSO-1	Understand
CLO-2	Study Marginal and conditional distributions, the correlation co-efficient and Stochastic Independence.	PSO-2	Analyse
CLO-3	Apply the Trinomial and Multinomial Distributions, The Poisson Distribution and The Gamma and Chi-square distributions to solve problems.	PSO-5	Apply
CLO-4	Study the t & F distributions and their applications.	PSO-5	Apply

Unit	Proposed Course Content	Duration

1	**Transcendental and Polynomial Equations** Introduction, The bisection method, Iteration methods based on first degree equation Iteration methods based on second degree equation, Rate of convergence, Rate of convergence of Secant and Newton-Raphson method, Iteration methods, first order method, second order method, higher order methods. Polynomial equations, Descartes' Rule of Signs, The Birge-Vieta method	16 hours
Extra Reading /Key Words: Iteration methods of Higher degree		
2	**Solutions of System of Linear Equations by Direct Methods** Gauss elimination method Gauss-Jordan method Triangularization method Cholesky method	16 hours
Extra Reading /Key Words: Gauss elimination method and Gauss-Jordan method		
3	**Solutions of System of Linear Equations by Iteration methods** Jacobi iteration method, Gauss-Seidel iteration method, Convergence analysis, Eigenvalues and eigenvectors	16 hours
Extra Reading /Key Words: Iteration methods		
4	**Interpolation and Approximation** Introduction, Lagrange and Newton interpolations Linear and Higher order interpolation Finite difference operators Interpolating polynomials using finite differences Hermite interpolation, Approximations	16 hours
Extra Reading /Key Words : Interpolation and Approximation		

REFERENCES

Sl. No	Title of the book	Author(s)	Publisher	Edition	Year of publication
1	An introduction to numerical analysis	Atkinson K.E.	John Wiley and Sons, USA	1st	1988
2	Numerical recipesinC	Press W.H., Flannery B.P., Teukolsky S.A. and Vetterling W.T	CambridgeUniversityPress,UK,1989	2nd	2007
3	Numerical Methods for Scientific and Engineering	Computation M.K. Jain, S.R.K. Iyengar and R.K.Jain	New Age International Publishers	4th	2003

FIRST YEAR - SEMESTER – II

Course Title	Algebra-II							
Course Type	Hard Core- Theory		Total Hours	64	Hours/Week	04	Credits	04
Course Code		Evaluation	Internal	C1+C2 = 15+15			30 Marks	100
			External	Duration	C3	03Hrs	70 Marks	

COURSE OBJECTIVES (COs)

To introduce the concepts and to develop working knowledge on Rings, Field theory and Field Extension

CO No.	Course Objectives
CO-1	To understand the properties of rings and fields.
CO-2	To know the application of homomorphism and field extension
CO-3	To locate the different field extensions

Mapping of CLOs with PSOs &CDLs

Course Learning Outcomes (CLOs): The CLOs indicate what a student has learnt after the successful completion of a course. The CLO statements are prepared by considering the course content covered in each unit of a course.For every course there may be 5 or more CLOs. **The keywords are used at the end of each unit to define CLOs.**

CLOs No.	Course Learning Outcomes (CLOs) After completing this course, the student will be able to	PSOs Addressed	CLDs
CLO-1	Understand the concept of rings	PSO-1	Understand
CLO-2	Apply the properties of different ideals	PSO-5	Apply
CLO-3	Discuss Extension fields and Roots of polynomials.	PSO-3	Analyze

Unit	Proposed Course Content	Duration
1	**Rings** Rings, Integral domains and Fields, Homomorphisms, Ideals and Quotient Rings, Prime and Maximal ideals	16 hours

Extra Reading /Key Words: Rings and its Homomorphisms

2	**Ideal** Euclidean and principal ideal rings, Polynomials, Zeros of a polynomial, Factorization, Irreducibility criterion.	16 hours
Extra Reading /Key Words: Ideals and Polynomial rings		
3	**Fields** Adjunction of roots, Kronecker's lemma, Algebraic and transcendental extensions Finite fields.	16 hours
Extra Reading /Key Words: Kronecker's lemma, Algebraic and transcendental extensions		
4	**Extensions of fields** Separable and inseparable extensions Perfect and imperfect fields Theorem on the primitive element.	16 hours
Extra Reading /Key Words: Separable and inseparable extensions, Perfect and imperfect fields		

REFERENCES

Sl. No	Title of the book	Author(s)	Publisher	Edition	Year of publication
1	Algebra	Thomas W. Hungerford	Springer International Edition, New York.	2nd	2002
2	Algebra	Michael Artin	Prentice-Hall of India, New Delhi	2nd	2015
3	Contemporary Abstract Algebra	Joseph A. Gallian	Narosa	4th	1999
4	Abstract Algebra	D. S. Dummit and R. M. Foote	John Wiley and Sons,	2nd	1999
5	Topics in Algebra	I. N. Herstein	John Wiley & Sons	2nd	1975
6.	A First course in Abstract Algebra,	J. B. Fraleigh	Addison-Wesley	7th	2003
7	University Algebra	N. S. Gopalakrishnan	New Age International	2nd	1986

FIRST YEAR - SEMESTER – II

Course Title	Real Analysis-III							
Course Type	Hard Core- Theory		Total Hours	64	Hours/Week	04	Credits	04
Course Code		Evaluation	Internal	C1+C2 = 15+15			30 Marks	100
			External	Duration	C3	03Hrs	70 Marks	

COURSE OBJECTIVES (COs)

To learn the sequences and series functions and their convergence, uniform convergence, differentiation and helps to understand the concept of functions of several along with proofs of Taylor`s theorem.

CO No.	Course Objectives
CO-1	To Understand Uniform convergence and continuity.
CO-2	To Study the Stone-Weierstrass theorem and its applications.
CO-3	To Study the Taylor's theorem and its applications.

Mapping of CLOs with PSOs &CDLs

Course Learning Outcomes (CLOs): The CLOs indicate what a student has learnt after the successful completion of a course. The CLO statements are prepared by considering the course content covered in each unit of a course.For every course there may be 5 or more CLOs. **The keywords are used at the end of each unit to define CLOs.**

CLOs No.	Course Learning Outcomes (CLOs) After completing this course, the student will be able to	PSOs Addressed	CLDs
CLO-1	Understand Uniform convergence and continuity.	PSO-3	Understand
CLO-2	Apply the properties exponential and logarithmic functions.	PSO-2	Apply
CLO-3	Analyze the functions of two variables.	PSO-1	Analyse

Unit	Proposed Course Content	Duration
1	**Sequences and series of functions** Sequences and series of functions Discussions of main problem Uniform convergence, Uniform convergence and continuity Uniform convergence and integration Uniform convergence and differentiation	16 hours

Extra Reading /Key Words: Sequences of functions

2	**Special functions** Power series The exponential and logarithmic functions The trigonometric functions Improper integrals and their convergence	16 hours
Extra Reading /Key Words: Special functions		
3	**Functions of two Variables** Functions of two variables. Partial derivatives Continuity and differentiability The chain rule, Jacobians	16 hours
Extra Reading /Key Words: Functions of several variables		
4	**Implicit Function and Taylor's Theorem** The Implicit function theorem Taylor's theorem, Maxima and Minima Lagrange's multipliers	16 hours
Extra Reading /Key Words: Implicit Function and Lagrange's multipliers		

REFERENCES

Sl. No	Title of the book	Author(s)	Publisher	Edition	Year of publication
1	Principles of Mathematical Analysis	W. Rudin	Int. Student edition, McGrawHill,	3rd	1997
2	Mathematical Analysis	T. M. Apostal	AddisonWesley, Narosa, NewDelhi,	2nd	1998
3	Methods of Real Analysis	R. R. Goldberg	Oxford and IBH, New Delhi	5th	2008
4	Analysis I and Analysis II	Torence Tao	Hindustan Book Agency, India,	6th	2006
5	Elementary Analysis: The Theory of Calculus	Kenneth A. Ross	Springer Inter, Edition,2004.	4th	2008

FIRST YEAR - SEMESTER – II

Course Title	Complex Analysis-II								
Course Type	Hard Core- Theory		Total Hours	64	Hours/Week		04	Credits	04
Course Code		Evaluation	Internal	C1+C2 = 15+15				30 Marks	100
			External	Duration	C3	03Hrs		70 Marks	

COURSE OBJECTIVES (COs)

To enable the students to appreciate and critically evaluate the residues, harmonic functions and infinite products

CO No.	Course Objectives
CO-1	To understand Residues and argument principles.
CO-2	To know the nature of harmonic functions.
CO-3	To express entire function in Taylor series.
CO-4	To understand infinite products of complex numbers through Jensen's formula and Hadamard's theorem.

Mapping of CLOs with PSOs &CDLs

Course Learning Outcomes (CLOs): The CLOs indicate what a student has learnt after the successful completion of a course. The CLO statements are prepared by considering the course content covered in each unit of a course.For every course there may be 5 or more CLOs. **The keywords are used at the end of each unit to define CLOs.**

CLOs No.	Course Learning Outcomes (CLOs) After completing this course, the student will be able to	PSOs Addressed	CLDs
CLO-1	Understand Residues and argument principles	**PSO-1**	Understand
CLO-2	Explain the nature of Harmonic functions	**PSO-2**	Analyse
CLO-3	Apply Taylor's series to study the annulus of convergence.	**PSO-5**	Apply
CLO-4	Evaluate infinite products of complex numbers through Jensen's formula and Hadamard's theorem.	**PSO-2**	Evaluate
Unit	**Proposed Course Content**		**Duration**

1	**Residues** The Calculus of Residues The residue theorem, argument principle Evaluation of definite integrals.	16 hours
Extra Reading /Key Words: Residues and Complex Integration		
2	**Harmonic functions** Harmonic functions – Definition and basic properties Mean value property Poisson's formula, Schwarz's theorem and reflection principle	16 hours
Extra Reading /Key Words: Harmonic functions		
3	**Power series** Power series expansions The Weierstrass theorem The Taylor series The Laurent series.	16 hours
Extra Reading /Key Words: Taylor series and Laurent series.		
4	**Partial fractions and Entire Functions** Partial fractions and factorization Partial fractions, Mittag - Leffer's theorem Infinite products, Canonical products, The Gamma and Beta functions, Sterling's formula. Entire functions – Jensen's formula, Hadamard's theorem	16 hours
Extra Reading /Key Words: Entire functions and Infinite products		

REFERENCES

Sl. No	Title of the book	Author(s)	Publisher	Edition	Year of publication
1	Complex Analysis	L. V. Ahlfors	McGraw-Hill	3rd	1979
2	Functions of one complex variable,	J. B. Conway	Narosa, New Delhi.	2nd	1998
3	Invitation to Complex Analysis	R. P. Boas	The Random House	1st	1987
4	An Introduction to Complex Function Theory	B. C. Palka	Springer	1st	1991
5	Foundations of Complex Analysis,	S. Ponnusamy	Narosa	4th	1995

FIRST YEAR - SEMESTER – II

Course Title	Linear Algebra-II								
Course Type	Soft Core- Theory		Total Hours	64	Hours/Week	04	Credits	04	
Course Code		Evaluation	Internal	C1+C2 = 15+15			30 Marks	100	
			External	Duration	C3	03Hrs	70 Marks		

COURSE OBJECTIVES (COs)

To introduce advanced concepts in linear algebra.

CO No.	Course Objectives
CO-1	To understand ODE and its standard properties of the solution.
CO-2	To apply power series method and some standard methods to solve them.
CO-3	To interpret the PDEs and to find the integral surfaces.
CO-4	To understand Heat, Laplace and Wave Equation

Mapping of CLOs with PSOs &CDLs

Course Learning Outcomes (CLOs): The CLOs indicate what a student has learnt after the successful completion of a course. The CLO statements are prepared by considering the course content covered in each unit of a course.For every course there may be 5 or more CLOs. **The keywords are used at the end of each unit to define CLOs.**

CLOs No.	Course Learning Outcomes (CLOs) After completing this course, the student will be able to	PSOs Addressed	CLDs
CLO-1		**PSO-1**	Understand
CLO-2	Apply power series method and some standard methods to solve the ODE's.	**PSO-3**	Apply
CLO-3	Interpret the PDEs and to find the integral surfaces.	**PSO-2**	Analyse, Evaluate
CLO-4	Describe Heat, Laplace and Wave Equation.	**PSO-5**	Analyse
CLO-5	Express real world problems mathematically using differential equations.	**PSO-5**	Creating
Unit	Proposed Course Content		**Duration**

1	**Inner Products Space** Inner Products and Norms The Gram-Schmidt ,Orthogonalization Process Orthogonal Complements	16 hours
Extra Reading /Key Words: Inner Products Space		
2	**Linear Operator** The Adjoint of a Linear Operator Normal and Self-Adjoint Operators Unitary and Orthogonal Operators and Their Matrices	16 hours
Extra Reading /Key Words: Linear Operator		
3	**Orthogonal Projections** Orthogonal Projections The Spectral Theorem Bilinear and Quadratic Forms	16 hours
Extra Reading /Key Words : Orthogonal Projections		
4	**Canonical Forms** The Diagonal form, The Triangular form The Jordan Canonical Form The Minimal Polynomial; The Rational Canonical Form	16 hours
Extra Reading /Key Words : Canonical Forms		

REFERENCES

Sl. No	Title of the book	Author(s)	Publisher	Edition	Year of publication
1	Linear Algebra	S. Friedberg, A. Insel, and L. Spence	PHI	4th	2009
2	Linear Algebra	K. Hoffman and R. Kunze	Prentice-Hall of India	2nd	1978
3	Finite Dimensional Vector Space	P. R. Halmos	Princeton, N.J.D.Van Nostr and Company	3rd	1958
4	Linear Algebra	Lang. S.	Addison Wesley Pub. Co. Reading, Mass	1st	1972

FIRST YEAR - SEMESTER – II

Course Title	Representation Theory Of Finite Groups							
Course Type	Soft Core- Theory		Total Hours	64	Hours/Week	04	Credits	04
Course Code		Evaluation	Internal	C1+C2 = 15+15			30 Marks	100
			External	Duration	C3	03Hrs	70 Marks	

To give the idea of classical groups, general linear group, orthogonal group, simplistic group, unitary group conjugate representation, number of irreducible representations.

CO No.	Course Objectives
CO-1	To remember the simplex and graphical method of LPP to solve the IPP.
CO-2	To understand and apply dynamic programming problems in any multistage situation to make series of decisions.
CO-3	Understand and apply the procedure to make decisions in real life problems.
CO-4	Understand the class of inventory models and applies the technique to find solution.

Mapping of CLOs with PSOs &CDLs

Course Learning Outcomes (CLOs): The CLOs indicate what a student has learnt after the successful completion of a course. The CLO statements are prepared by considering the course content covered in each unit of a course.For every course there may be 5 or more CLOs. **The keywords are used at the end of each unit to define CLOs.**

CLOs No.	Course Learning Outcomes (CLOs) After completing this course, the student will be able to	PSOs Addressed	CLDs
CLO-1	Understand the methods of solving integer programming problems.	PSO-1	Understand
CLO-2	Determine the solution for LPP in multistage.	PSO-2	Analyze
CLO-3	Understand game theory to find solutions to problems.	PSO-5	Evaluate
CLO-4	Understand the concept of EOQ models and its types.	PSO-3	Understand
CLO-5	Discusses The Methods Of Solving Integer Programming Problems, NLPP Programming Algorithms And Inventory Models - Skill Development.	PSO-1	Apply

Unit	Proposed Course Content	Duration

1	**Classical Groups** General linear group, Orthogonal group, Symplectic group, Unitary group.	16 hours
Extra Reading /Key Words: Orthogonal and Symplectic group		
2	**Group Representation** Group representation, Conjugate representation, G-invariant spaces – irreducible representations – Schur's lemma.	16 hours
Extra Reading /Key Words: Group and Conjugate representation		
3	**Applications** Maschke's theorem – characters. Orthogonality relations for characters Number of irreducible representations	16 hours
Extra Reading /Key Words: Maschke's theorem and Orthogonality relations		
4	**Permutation representations** Regular representation. Representations of Symmetric groups. Representation of Finite abelian groups – Dihedral groups.	16 hours
Extra Reading /Key Words: Permutation representations		

REFERENCES

Sl. No	Title of the book	Author(s)	Publisher	Edition	Year of publication
1	Operation Research	Gupta P.K and Hira S.	S Chand &Co.Ltd.New Delhi.	2nd	2005
2	Operation Research Methods & Applications.	Mariappan .P.	New Century Book House Private Limited	3rd	2001
3	Operation Research .	Panneer Sevvam	Prentice Hall of India Pvt , New Delhi	5th	2003
4	Operation Research Theory & Applications	Sharma J.K.	Macmillan India Limited, Chennai	3rd	2007
5	Operations Research An Introduction	Taha Hamady A	Pearson Education Publishing Limited, New Delhi.	4th	2002

FIRST YEAR - SEMESTER – II

Course Title	Theory of Partitions							
Course Type	Soft Core- Theory		Total Hours	64	Hours/Week	04	Credits	04
Course Code		Evaluation	Internal	C1+C2 = 15+15			30 Marks	100
			External	Duration	C3	03Hrs	70 Marks	

COURSE OBJECTIVES (COs)

To learn idea of partition of numbers, generating function, Jacobi's triple product, summations formula and their applications. Also it paves the way to study identities like Rogers-Ramanujan, Euler's, Gauss, Heine's, Jacobi's identities.

CO No.	Course Objectives
CO-1	To understand the concepts of Partitions of numbers.
CO-2	To discuss Jacobi's triple product identity and its applications
CO-3	To study the Rogers - Ramanujan Identities.

Mapping of CLOs with PSOs &CDLs

Course Learning Outcomes (CLOs): The CLOs indicate what a student has learnt after the successful completion of a course. The CLO statements are prepared by considering the course content covered in each unit of a course.For every course there may be 5 or more CLOs. **The keywords are used at the end of each unit to define CLOs.**

CLOs No.	Course Learning Outcomes (CLOs) After completing this course, the student will be able to	PSOs Addressed	CLDs
CLO-1	Understand the concepts of Partitions of numbers.	PSO-3	Understand
CLO-2	Discuss Jacobi's triple product identity and its applications	PSO-2	Apply
CLO-3	Study the Rogers - Ramanujan Identities.	PSO-1	Apply

Unit	Proposed Course Content	Duration
1	**Partitions** Partitions of numbers The generating function of p(n) Other generating functions	16 hours

Extra Reading /Key Words: Partitions of numbers

2	**Euler theorems and its applications** Two theorems of Euler Jacobi's triple product identity and its applications	16 hours
Extra Reading /Key Words: Jacobi's triple product identity		
3	**Summation Formula and its Applications** $1\psi1$ - summation formula and its applications Combinatorial proofs of Euler's identity Euler's pentagonal number theorem Franklin's combinatorial proof	16 hours
Extra Reading /Key Words: $1\psi1$ - summation formula		
4	**Congruence Properties** Congruence properties of partition function The Rogers - Ramanujan Identities	16 hours
Extra Reading /Key Words: Rogers - Ramanujan Identities		

REFERENCES

Sl. No	Title of the book	Author(s)	Publisher	Edition	Year of publication
1	An Introduction to Theory of Numbers	G. H. Hardy and E. M. Wright	Oxford University Press	5th	1979
2	An Introduction to the Theory of Numbers	I. Niven, H. S. Zuckerman and H. L. Montgomery	John Wiley and Sons, Inc., New York	5th	2004
3	Ramanujan's Note Books Volume-1 to 5	Bruce C. Berndt	Springer		
4	The Theory of Partitions	G. E. Andrews	Addison Wesley	1st	1976
5	Partition Theory	A. K. Agarwal, Padmavathamma, M. V. Subbarao	Atma Ram & Sons, Chandigarh	1st	2005

SECOND YEAR - SEMESTER – III

Course Title	Elements of Functional Analysis							
Course Type	Hard Core- Theory		Total Hours	64	Hours/Week	04	Credits	04
Course Code		Evaluation	Internal	C1+C2 = 15+15			30 Marks	100
			External	Duration	C3	03Hrs	70 Marks	

COURSE OBJECTIVES (COs)

To study the Normed linear spaces, Banach spaces, Hilbert Spaces, and operators on these spaces.

CO No.	Course Objectives
CO-1	To understand the properties of contraction mapping.
CO-2	To know the application of Open mapping theorem.
CO-3	To study the orthogonal complements and conjugate space.

Mapping of CLOs with PSOs &CDLs

Course Learning Outcomes (CLOs): The CLOs indicate what a student has learnt after the successful completion of a course. The CLO statements are prepared by considering the course content covered in each unit of a course.For every course there may be 5 or more CLOs. **The keywords are used at the end of each unit to define CLOs.**

CLOs No.	Course Learning Outcomes (CLOs) After completing this course, the student will be able to	PSOs Addressed	CLDs
CLO-1	Study Continuous linear transformations and the Hahn-Banach theorem.	PSO-1	Understand
CLO-2	Understand the Open Mapping Theorem and its applications.	PSO-1	Understand
CLO-3	Obtain Orthogonal complements, Orthonormal sets and conjugate space.	PSO-3	Apply

Unit	Proposed Course Content	Duration
1	**Metric Completion.** Metric completion. Banach's contraction mapping theorem and applications, Baire' category theorem, Ascoli - Arzela theorem	16 hours

Extra Reading /Key Words: Completion ,isometry

2	**Normed Linear Space** Linear spaces and linear operators, Norm of a bounded operator The Hahn – Banach extension theorem Stone - Weirstrass theorem	16 hours
Extra Reading /Key Words: Defining Norm and Hilbert Space		
3	**Banach Space** Open mapping theorem, Closed Graph theorems The Banach –Steinhaus Principle Of Uniform Boundedness	16 hours
Extra Reading /Key Words: Projections on Banach spaces		
4	**Hilbert Spaces** The orthogonal projection Nearly orthogonal elements, Riesz's lemma, Riesz's representation theorem.	16 hours
Extra Reading /Key Words: Orthonormal spaces		

REFERENCES

Sl. No	Title of the book	Author(s)	Publisher	Edition	Year of publication
1	Introduction to Topology and Modern Analysis	G. F. Simmons	Tata McGraw-Hill	2nd	2002
2	Introduction to Functional Analysis	A. E. Taylor	Wiley, New York,	1st	1958
3	Elements of Functional Analysis	A. Page and A. L. Brown	Van Nostrand Reinhold Company	1st	1970
4	Functional Analysis	George Bachman and Lawrence Narici	Dover Publications	2nd	2000
5	A Course in Functional Analysis	J. B. Conway	Springer	2nd	1985
6.	Introductory functional analysis with applications	Erwin Kreyszig	Wiley, New York	1st	1978

SECOND YEAR - SEMESTER – III

Course Title	Topology-I							
Course Type	Hard Core- Theory		Total Hours	64	Hours/Week	04	Credits	04
Course Code		Evaluation	Internal	C1+C2 = 15+15			30 Marks	100
			External	Duration	C3	03Hrs	70 Marks	

COURSE OBJECTIVES (COs)

To learn the essentials of topological spaces and their properties in terms of continuity, connectedness and compactness.

CO No.	Course Objectives
CO-1	To understand the topological spaces.
CO-2	To discuss the continuous functions
CO-3	Toanalyze the connected spaces.

Mapping of CLOs with PSOs &CDLs

Course Learning Outcomes (CLOs): The CLOs indicate what a student has learnt after the successful completion of a course. The CLO statements are prepared by considering the course content covered in each unit of a course.For every course there may be 5 or more CLOs. **The keywords are used at the end of each unit to define CLOs.**

CLOs No.	Course Learning Outcomes (CLOs) After completing this course, the student will be able to	PSOs Addressed	CLDs
CLO-1	Understand the topological spaces	PSO-3	Understand
CLO-2	Discuss Continuous functions	PSO-2	Apply
CLO-3	Analyze Connected spaces	PSO-1	Analyze

Unit	Proposed Course Content	Duration
1	**Topological Space.** Definitions and examples Basis for a topology The order topology The product topology on X xX, The subspace topology Closed sets and limit points	16 hours

Extra Reading /Key Words: Seperable space, countable base

2	**Continuous Functions** Continuous functions The product topology The metric topology The quotient topology	16 hours
Extra Reading /Key Words: Normality of continuous functions, Convexity and continuity		
3	**Connectedness** Connected spaces Connected sets on the real line Path connectedness	16 hours
Extra Reading /Key Words: continuity and connectedness		
4	**Compactness** Compact spaces Compact sets on the real line Limit point compactness Local compactness	16 hours
Extra Reading /Key Words: continuity and compactness		

REFERENCES

Sl. No	Title of the book	Author(s)	Publisher	Edition	Year of publication
1	A First Course in Topology	J. R. Munkres	Prentice Hall India	2nd	2000
2	Introduction to Topology and Modern Analysis	G. F. Simmons	McGraw-Hill, Kogakusha	1st	1968
3	General Topology	S. Willard	Addison Wesley, New York	1st	1970
4	Topology	J. Dugundji	Allyn and Bacon, Boston	1st	1966
5	Introduction to topology	Bert Mendelson	Dover Publication	3rd	1990

SECOND YEAR - SEMESTER – III

Course Title	Graph Theory							
Course Type	Soft Core- Theory		Total Hours	64	Hours/Week	04	Credits	04
Course Code		Evaluation	Internal	C1+C2 = 15+15			30 Marks	100
			External	Duration	C3	03Hrs	70 Marks	

COURSE OBJECTIVES (COs)

To understand the fundamentals of concepts of graph theory. Also able to describe the idea of line graphs, distance concept, colorablity, relations between graphs and matrices.

CO No.	Course Objectives
CO-1	To understand the definitions namely, cut vertex, bridge and blocks of a graph.
CO-2	To study the properties of trees and connectivity.
CO-3	To identify Eulerian graphs and apply results to identify Hamiltonian graphs.
CO-4	To understand the concepts Planarity including Euler identity.

Mapping of CLOs with PSOs &CDLs

Course Learning Outcomes (CLOs): The CLOs indicate what a student has learnt after the successful completion of a course. The CLO statements are prepared by considering the course content covered in each unit of a course.For every course there may be 5 or more CLOs. **The keywords are used at the end of each unit to define CLOs.**

CLOs No.	Course Learning Outcomes (CLOs) After completing this course, the student will be able to	PSOs Addressed	CLDs
CLO-1	Understand the definitions namely, cut vertex, bridge and blocks of a graph.	PSO-1	Understand
CLO-2	Identify Eulerian graphs and apply results to identify Hamiltonian graphs.	PSO-2	Apply
CLO-3	Discuss and understand the importance of the concepts Matchings and Colorings.	PSO-5	Apply

Unit	Proposed Course Content	Duration
1	**Graphs** The Königsberg bridge problem Varieties of graphs Walks and connectedness Graph Operations and Graph isomorphism Degree sequence of a graph	16 hours

Extra Reading /Key Words: Distance Topological indices, Eccentricity		
2	**Trees** Characterization of trees, Spanning Tree, Centers and centroids. Cutpoints, bridges, and blocks Block graphs and cutpoint graphs	16 hours
Extra Reading /Key Words: Spanning tree		
3	**Connectivity and Traversability** Connectivity and line-connectivity Graphical variations of Menger's theorem Euler graphs and Hamiltonian graphs	16 hours
Extra Reading /Key Words: Hypo hamiltonian , Hypo traceable		
4	**Planar graphs and colourability** Planar graphs and Euler's formula Vertex colouring Chromatic number and Five colour theorem	16 hours
Extra Reading /Key Words: Plane triangulation, tri colouring		

REFERENCES

Sl. No	Title of the book	Author(s)	Publisher	Edition	Year of publication
1	Graph Theory	Frank Harary	Addition Wesley Reading Mass	3rd	1969
2	Graph Theory with applications	J. A. Bondy and U. S. R. Murthy	Elsevier	2nd	1976
3	Graph Theory With Applications to Engineering and Computer Science	N. Deo	Prentice Hall of India	1st	1987
4	Basic Graph Theory	K. R. Parthasarathy	Tata McGraw-Hill, New Delhi	2nd	1994
5	Introduction to Graph Theory	D. B. West	Pearson Education Inc.	2nd	2001
6	Collage Graph Theory	V. R. Kulli	Vishwa International Publications	1st	2012
7	Graphs and Diagraphs	G. Chartand and L. Lesniak	Qwadsworth and Brooks	2nd	1986
8	A First Look at Graph Theory	Clark and D. A. Holton	Allied publishers	1st	1991

SECOND YEAR - SEMESTER – III

Course Title	Commutative Algebra							
Course Type	Saft Core- Theory		Total Hours	64	Hours/Week	04	Credits	04
Course Code		Evaluation	Internal	C1+C2 = 15+15			30 Marks	100
			External	Duration	C3	03Hrs	70 Marks	

COURSE OBJECTIVES (COs)

To give the extended idea of rings, ideals, nilpotent, units, nilradicals, modules, Artinian and Noetherian rings and Artinian and Noetherian modules.

CO No.	Course Objectives
CO-1	To give the extended idea of rings, ideals, nilpotent, units, nil radicals
CO-2	To introduce module theory.
CO-3	To study Artinian and Noetherian modules.

Mapping of CLOs with PSOs &CDLs

Course Learning Outcomes (CLOs): The CLOs indicate what a student has learnt after the successful completion of a course. The CLO statements are prepared by considering the course content covered in each unit of a course.For every course there may be 5 or more CLOs. **The keywords are used at the end of each unit to define CLOs.**

CLOs No.	Course Learning Outcomes (CLOs) After completing this course, the student will be able to	PSOs Addressed	CLDs
CLO-1	Understand the properties of Nilradicals, Jacobson radicals	PSO-1	Understand
CLO-2	Explain Modules properties	PSO-2	Analyze
CLO-3	Identify Noetherian and Artinian Modules	PSO-3	Apply

Unit	Proposed Course Content	Duration
1	**Rings and ideal** Rings and ring homomorphisms, Ideals and Quotient rings Zero-divisors, nilpotent elements and units, Prime ideals and maximal ideals.	16 hours

Extra Reading /Key Words: Local Ring

2	**Radicals** The prime spectrum of a ring The nil radical and Jacobson radical Operation on ideals Extension and contraction	16 hours
Extra Reading /Key Words: Operation on ideals		
3	**Modules** Modules and modules Homomorphisms Submodules and quotient modules	16 hours
Extra Reading /Key Words: Modules		
4	**Direct sums and Free module** Direct sums, Free modules Finitely generated modules Nakayama Lemma, Simple modules Exact sequences of modules	16 hours
Extra Reading /Key Words: Schur's Lemma		

REFERENCES

Sl. No	Title of the book	Author(s)	Publisher	Edition	Year of publication
1	Introduction to Commutative Algebra,	M. F. Atiyah and I. G. Macdonald	Avalon Publishing	1st	1994
2	Introduction to Rings and Modules	C. Musili	Narosa Publishing House	1st	1997
3	Under-graduate Commutative Algebra	Miles Reid	Cambridge University Press	1st	1995
4	Commutative Algebra	N. S. Gopalakrishnan,	Oxonian Press	1st	1984
5	Commutative algebra- With a view toward algebraic geometry.	David Eisenbud,	Springer-Verlag,	1st	1995

SECOND YEAR - SEMESTER – III

Course Title	Algebraic Number Theory							
Course Type	Soft Core- Theory		Total Hours	64	Hours/Week	04	Credits	04
Course Code		Evaluation	Internal	C1+C2 = 15+15			30 Marks	100
			External	Duration	C3	03Hrs	70 Marks	

COURSE OBJECTIVES (COs)

To learn basic knowledge of quadratic fields, Diophantine equation, factorization of ideals - Dedekind domains, finiteness of the class group, class number computations.

CO No.	Course Objectives
CO-1	To understand Ramanujan - Nagell theorem.
CO-2	To Discuss Factorization of Ideals.
CO-3	To discuss Prime factorization of ideals

Mapping of CLOs with PSOs &CDLs

Course Learning Outcomes (CLOs): The CLOs indicate what a student has learnt after the successful completion of a course. The CLO statements are prepared by considering the course content covered in each unit of a course.For every course there may be 5 or more CLOs. **The keywords are used at the end of each unit to define CLOs.**

CLOs No.	Course Learning Outcomes (CLOs) After completing this course, the student will be able to	PSOs Addressed	CLDs
CLO-1	Understand the Ramanujan - Nagell theorem	PSO-3	Understand
CLO-2	Discuss the Factorization of Ideals	PSO-2	Apply
CLO-3	Apply the Prime factorization of ideals	PSO-1	Apply

Unit	Proposed Course Content	Duration
1	**Number Theoretical Applications** Number theoretical applications of unique factorization Algebraic integers	16 hours
Extra Reading /Key Words: Algebraic integers		
2	**Quadratic Fields** Quadratic fields Certain Euclidean rings of algebraic integers Diophantine equations Ramanujan - Nagell theorem	16 hours

Extra Reading /Key Words: Diophantine equations		
3	**Factorization** Factorization of Ideals - Dedekind domains Fractional ideals Invertible ideals Prime factorization of ideals	16 hours
Extra Reading /Key Words: Prime factorization of ideals		
4	**Class group and Class number** Class group and Class number Finiteness of the Class group Class number computations	16 hours
Extra Reading /Key Words: Prime factorization of ideals		

REFERENCES

Sl. No	Title of the book	Author(s)	Publisher	Edition	Year of publication
1	Abstract Algebra with Applications, Vol. II, Rings and Fields	Karlheinz Spindler	Marcel Dekker, Inc.	1st	1994
2	Algebraic Number Theory	I. N. Stewart and David Tall	Chapman and Hall	1st	2016
3	Problems in Algebraic Number Theory	Jody Esmonde and M. Ram Murthy	Springer Verlag	1st	2005
4	Algebra Vol. II: Rings	I. S. Luthar and I. B. S. Passi	Narosa Publishing House	1st	1999

SECOND YEAR - SEMESTER – III

Course Title	Galois Theory							
Course Type	Soft Core- Theory		Total Hours	64	Hours/Week	04	Credits	04
Course Code		Evaluation	Internal	C1+C2 = 15+15			30 Marks	100
			External	Duration	C3	03Hrs	70 Marks	

COURSE OBJECTIVES (COs)

To learn the idea of Galois Theory in abstract algebra it also extends the concept of Galois Theory in a field.

CO No.	Course Objectives
CO-1	To Discuss The basic isomorphisms of algebraic field theory.
CO-2	To Study the field extension.
CO-3	To understand the elements of Galois Theory.

Mapping of CLOs with PSOs &CDLs

Course Learning Outcomes (CLOs): The CLOs indicate what a student has learnt after the successful completion of a course. The CLO statements are prepared by considering the course content covered in each unit of a course.For every course there may be 5 or more CLOs. **The keywords are used at the end of each unit to define CLOs.**

CLOs No.	Course Learning Outcomes (CLOs) After completing this course, the student will be able to	PSOs Addressed	CLDs
CLO-1	Discuss The basic isomorphisms of algebraic field theory.	PSO-3	Understand
CLO-2	Study the field extension	PSO-2	Apply
CLO-3	Understand the elements of Galois Theory	PSO-1	Apply

Unit	Proposed Course Content	Duration
1	**Algebraic study of fields** Algebraically closed fields and algebraic closures The existence of an algebraic closure The basic isomorphisms of algebraic field theory	16 hours

Extra Reading /Key Words: Existence of an algebraic closure

2	**Algebraic study of fields** Automorphisms and fixed fields The Frobenius automorphism The isomorphism extension theorem	16 hours
Extra Reading /Key Words: Isomorphism extension theorem		
3	**Field extension** The index of a field extension Splitting fields Separable extensions Perfect fields Normal extensions	16 hours
Extra Reading /Key Words: Galois groups over the rationals		
4	**Galois theory** The main theorem of Galois theory Galois groups over finite fields Symmetric functions Cyclotomic extensions Constructible numbers	16 hours
Extra Reading /Key Words: solvability by radicals		

REFERENCES

Sl. No	Title of the book	Author(s)	Publisher	Edition	Year of publication
1	A First Course in Abstract Algebra	J. B. Fraleigh	Narosa Publishing House	3rd	2013
2	Galois Theory	Ian Steward	Chapman and Hall	3rd	1945
3	Galois Theory	Joseph Rotman	Universitext Springer	2nd	1998
4	Algebra	Michael Artin	Prentice-Hall of India, New Delhi	5th	1991
5	Contemporary Abstract Algebra	Joseph A. Gallian	Narosa Publishing House	4th	1999
6	Abstract Algebra	D. S. Dummit and R. M. Foote	John Wiley and Sons	5th	1999
7	Topics in Algebra	I. N. Herstein	Vikas Publishing House, New Delhi	4th	1997

SECOND YEAR - SEMESTER – III

Course Title	Mathematical Computation							
Course Type	Interdisciplinary Paper		Total Hours	64	Hours/Week	04	Credits	04
Course Code		Evaluation	Internal	C1+C2			30 Marks	100
			External	Duration	C3	02Hrs	70Marks	

Course Objectives

To understand fundamental concepts in graph theory, lattices, matrices and Boolean algebra and to introduce MATLAB programming with few examples

CO No.	Course Objectives
CO-1	To illustrate the applications of graph theory
CO-2	To Solve problems using matlab

CLOs No.	Course Learning Outcomes (CLOs) After completing this course, the student will be able to	PSOs Addressed	CLDs
CLO-1	Understand the essence of graph theory in interdisciplinary fields	PSO-1	Understand
CLO-2	Analyse the problems of matrices	PSO-2	Analyze
CLO-3	Apply the computer knowledge for solving mathematical problems.	PSO-3	Apply

Unit	Proposed Course Content	Duration
1	**Graph Theory And Lattices Theory** Partially ordered sets, lattices, complete lattices, distributed lattices Complements, Boolean algebra, Boolean expressions, application to switching circuits Graphs, vertices of graphs, walks and connectedness, degrees, operations on graphs Trees: elementary properties of trees	16 hours
Extra Reading /Key Words: Connectivity of graph		
2	**Matrix Algebra** Matrix definition, types of matrix, transpose of matrix Determinants, properties of determinants, co -factors matrix Cramer's rule, adjoint matrix, inverse of a matrix Problems on singular and non-singular matrix	16 hours

Extra Reading /Key Words: Eigen values, eigen vector		
3	**Introduction to Matlab** Basics of MATLAB programming: Reading data from files, Plotting data Calculating statistics, Exporting graphics, Array operations: Performing calculations with vectors, Creating multiple plots Loops and execution control : Programming constructs, User interaction, Flow control, Loops Functions: Creating functions, Calling functions, Setting the MATLAB path, Debugging	32 hours
Extra Reading /Key Words: MATLAB path		

REFERENCES

Sl. No	Title of the book	Author(s)	Publisher	Edition	Year of publication
1	General Lattice theory	Gratzer, George A	Birkhauser publisher,	2nd	1998
2	Basic graph theory	K.R.Parthasarathy	Tata McGraw Hill, New Delhi	1st	1994
3	Elements of discrete mathematics	L.Liu	McGraw Hill	1st	1986
4	The theory of matrices with applications	Lancaster and Tismenetsky	Academic Press	2nd	1985
5	Programming in MATLAB	Marc E Herniter			
6	Getting started with Matlab	Rudra Pratap	oxford publisher	7th	2016
7	Basics of mathematics	Kate S.K Bhapkar H.R	Pune: Technical publications	1st	2009
8	Theory and problems of discrete mathematics – Schaum series, tat	S.Lipschutz and M.Lipson	McGraw hill	2nd	2000

SECOND YEAR - SEMESTER – III

Course Title	Fundamentals Of Mathematics (OE)							
Course Type	Open Elective-Theory		Total Hours	64	Hours/Week	04	Credits	02
Course Code		Evaluation	Internal	C1+C2			30 Marks	100
			External	Duration	C3	02Hrs	70Marks	

Course Objectives

To will attain the knowledge of Permutations and Combinations, theory of matrices and gives an idea about probability

CO No.	Course Objectives
CO-1	To illustrate the applications of Logarithms and Progression
CO-2	To Solve few real world simple problems using permutation and combination

CLOs No.	Course Learning Outcomes (CLOs) After completing this course, the student will be able to	PSOs Addressed	CLDs
CLO-1	Understand the Cramer's Rule	PSO-1	Understand
CLO-2	Analyse the Pigeon-hole principle	PSO-2	Analyze
CLO-3	Express the concepts of factorial and the basic principal of counting	PSO-3	Apply

Unit	Proposed Course Content	Duration
1	**Logarithms and Progression** Definitions and properties of Logarithms and problems thereon Arithmetic, Geometric and Harmonic progression: Properties and problems thereon	14 hours
Extra Reading /Key Words: Applications of AP, GP, HP		
2	**Matrix Algebra** Types of matrices : Definitions, Examples Transpose of a matrix and problems Definition and Properties of determinants (without proof). Singular & non-singular matrix and problems Co-factors matrix, Cramer's Rule Adjoint matrix, inverse of a matrix	18 hours
Extra Reading /Key Words: Properties of determinants		

3	**Permutations and Combinations** Permutations and Combinations Pigeon-hole principle Principle of inclusion and exclusion	16 hours
Extra Reading /Key Words: Principle of inclusion and exclusion		
4	**Probability** Probability of events Condition probability Baye`s theorem Distribution function: Binomial	16 hours
Extra Reading /Key Words: Baye`s theorem		

REFERENCES

Sl. No	Title of the book	Author(s)	Publisher	Edition	Year of publication
1	A Primer on Logarithms	Shirali, Shailesh	Universities Press, Hyder abad	1st	2002
2	Basics Of Mathematics	Kate, S.K. Bhapkar, H.R.	Technical Publications, Pune	1st	2009
3	Handbook of Combinatorics	Gerard Meurant, Ronald Lewis Graham, Martin Grotschel , Laszlo Lovasz	North Holland	1st	1995
4	Theory and Problems of Discrete Mathematics. Schaum Series	S. Lipschutz and M. Lipson	Tata McGraw Hill	2nd	2000
5	An Introduction to Probability and Statistics	A.K. Md. Ehsanes Saleh Vijay K. Rohatgi	Wiley	3rd	2015
6	Fundamentals of Mathematical Statistics	S.C. Gupta, , Sultan Chand & Sons	Sultan Chand & Sons	1st	2014

SECOND YEAR - SEMESTER – IV

Course Title	Measure and Integration							
Course Type	Hard Core- Theory		Total Hours	64	Hours/Week	04	Credits	04
Course Code		Evaluation	Internal	C1+C2 = 15+15			30 Marks	100
			External	Duration	C3	03Hrs	70 Marks	

COURSE OBJECTIVES (COs)

The objective of this course is to generalize the concept of integration using measures and to develop the concept of analysis in abstract situations.

CO No.	Course Objectives
CO – 1	Understand the Lebesgue measure and Lebesgue measurable sets.
CO – 2	Discuss the properties of measurable function.
CO – 3	Apply the concepts of integration to Lebesgue integral.
CO – 4	Understand the absolute continuous function and differentiation of definite integral.
CO – 5	Describe the properties of general measure space and Radon -Nikodym theorem.

Mapping of CLOs with PSOs &CDLs

Course Learning Outcomes (CLOs): The CLOs indicate what a student has learnt after the successful completion of a course. The CLO statements are prepared by considering the course content covered in each unit of a course.For every course there may be 5 or more CLOs. **The keywords are used at the end of each unit to define CLOs.**

CLOs No.	Course Learning Outcomes (CLOs) After completing this course, the student will be able to	PSOs Addressed	CLDs
CLO-1	Explain the lebesgue measure and lebesgue measurable sets.	PSO-1	Understand
CLO-2	Derive the properties of lebesgue measurable function.	PSO-1	Apply
CLO-3	Illustrate the relation between Riemann integral and the lebesgue integral of bounded and non-negative functions.	PSO-4	Analyze
CLO-4	Express the properties of general measure space and prove Radon -Nikodym theorem.	PSO-5	Evaluate

Unit	Proposed Course Content	Duration

1	**Lebesgue Measure** Lebesgue outer measure, Measurable sets, Lebesgue measure, A non-measurable set, Measurable functions	12 hours
Extra Reading /Key Words: Hausdorff measure, complex measure		
2	**The Lebesgue Integral** Lebesgue Integral of a bounded function over as set of finite measure, The integral of a non-negative function The general Lebesgue integral Differentiating indefinite integrals	12 hours
Extra Reading /Key Words: Ergodic measure, fractals.		
3	**Differentiation and Integration** Continuity of monotone functions Differentability of monotone function Lebesgue's theorem Functions of bounded variation Jordan's theorem Absolutely continuous functions Differentiating indefinite integrals	12 hours
Extra Reading /Key Words: Convex functions, Bounded linear functions on Lp Space.		
4	**Measure and Integration** Measure spaces, Measurable functions, integration Signed measures, the Radon - Nikodym theorem, Outer measure and measurability.	12 hours
Extra Reading /Key Words: Ergodic measure, fractals.		

REFERENCES

Sl. No	Title of the book	Author(s)	Publisher	Edition	Year of publication
1	Real Analysis	Royden H.L. and Fitzpatrick P.M	PHI learning Pvt Ltd, Delhi,	4th	2013
2	Measure And Integration	Barra G.De	New age International Ltd., New Delhi.	2nd	2006
3	Real Analysis	Carthers N. L	Cambridge University Press	3rd	2006
4	Real Mathematical Analysis	Charles Chapman Pugh	Springer-New York	1st	2004

SECOND YEAR - SEMESTER – IV

Course Title	Topology-II							
Course Type	Hard Core- Theory		Total Hours	48	Hours/Week	04	Credits	04
Course Code		Evaluation	Internal	C1+C2 = 15+15			30 Marks	100
			External	Duration	C3	03Hrs	70 Marks	

COURSE OBJECTIVES (COs)

To generalize the concept of integration using measures and it helps to develop the concept of analysis in abstract situations.

CO No.	Course Objectives
CO-1	To Distinguish Urysohn's lemma and the Tietze extension theorem.
CO-2	To Discuss Tychonoff's theorem, locally compact spaces, Compactness of metric spaces.
CO-3	To Understand Fundamental group of a circle and punctured plane.

Mapping of CLOs with PSOs &CDLs

Course Learning Outcomes (CLOs): The CLOs indicate what a student has learnt after the successful completion of a course. The CLO statements are prepared by considering the course content covered in each unit of a course.For every course there may be 5 or more CLOs. **The keywords are used at the end of each unit to define CLOs.**

CLOs No.	Course Learning Outcomes (CLOs) After completing this course, the student will be able to	PSOs Addressed	CLDs
CLO-1	Distinguish Urysohn's lemma and the Tietze extension theorem	PSO-4	Understand
CLO-2	Discuss Tychonoff's theorem, locally compact spaces, Compactness of metric spaces and Ascoli's theorem	PSO-2	Apply
CLO-3	Describe Fundamental group of a circle and punctured plane	PSO-1	Analyze

Unit	Proposed Course Content	Duration
1	**Countability and Separation Axioms** The countability axioms The separation axioms Normality of a compact Hausdorff space	12 hours

Extra Reading /Key Words: countability axioms

2	**Applications of Countability and Separation Axioms** Urysohn's lemma Tietze's extension theorem Urysohn's metrization theorem Partitions of unity	12 hours
Extra Reading /Key Words: Partitions of unity		
3	**Tychonoff's Theorem** Tychonoff's theorem on the product of compact spaces Local finiteness Paracompactness Normality of a paracompact space	12 hours
Extra Reading /Key Words: Tychonoff's Theorem		
4	**The Fundamental Group** Definition of fundamental group The Fundamental group of a circle The Fundamental group of the punctured plane Essential and Inessential Maps The Fundamental Theorem of Algebra	12 hours
Extra Reading /Key Words: Fundamental group of a circle		

REFERENCES

Sl. No	Title of the book	Author(s)	Publisher	Edition	Year of publication
1	A First Course in Topology	J. R. Munkres	Prentice Hall India	2nd	2000
2	Introduction to Topology and Modern Analysis	G. F. Simmons	McGraw-Hill, Kogakusha	1st	1968
3	General Topology	S. Willard	Addison Wesley, New York	1st	1968
4	Topology	J. Dugundji	Allyn and Bacon, Boston	1st	1966
5	General Topology	J. L. Kelley	Van Nostrand and Reinhold Co., New York	1st	1955

SECOND YEAR - SEMESTER –IV

Project Work

Type: Minor Project

A project workinvolves self-study to be carried out by the student (on a research problem of current interest or on an advanced topic not covered in the syllabus) under theguidance of a faculty member. Project work shall be initiated in the third semester itself through literature survey and theproject report (dissertation) shall be submitted at the end of the fourth semester.

Project Evaluation

Right from the initial stage of defining the problem, the candidate has to submit the progress reports periodically and also present his / her progress in the form of seminars in addition to the regular discussion with the guide. Components of evaluation are as follows:

Component – I (C_1): Periodic Progress and Progress Reports (15)

Component – II (C_2): Results of Work and Draft Report (15)

Component – III (C_3): Final Viva Voce and evaluation (70). The report evaluation is for 40 and the Viva –voce examination is for 30.

SECOND YEAR - SEMESTER – IV

Course Title	Ordinary and Partial Differential Equations							
Course Type	Soft Core- Theory		Total Hours	64	Hours/Week	04	Credits	04
Course Code		Evaluation	Internal	C1+C2			30 Marks	100
			External	Duration	C3	02Hrs	70Marks	

Course Objectives

To stress the significance of Differential equations and to introduce fundamental concepts of differential equations

CO No.	Course Objectives
CO-1	To illustrate the applications of Ordinary and Partial Differential Equations
CO-2	To understand the Picard's Theorem

CLOs No.	Course Learning Outcomes (CLOs) After completing this course, the student will be able to	PSOs Addressed	CLDs
CLO-1	Understand the Picard's Theorem	PSO-1	Understand
CLO-2	Analyze the Legendre differential equations	PSO-2	Analyze
CLO-3	Apply the fundamental concepts of Ordinary and Partial Differential Equations	PSO-3	Apply

Unit	Proposed Course Content	Duration
1	**Linear Second Order Equations** Initial value problem Existence and Uniqueness by Picard's Theorem Wronskian, separation and comparison theorems Poincare phase plane Variation of parameters	16 hours
Extra Reading /Key Words: Poincare phase plane		
2	**Power series solutions and Applications** Solution near ordinary and regular singular point Convergence of the formal power series Legendre differential equations with their properties	16 hours
Extra Reading /Key Words: Legendre differential equations		

3	**Types differential equations their properties** Bessel differential equations with their properties Hermite differential equations with their properties Laguerre and hypergeometric differential equations with their properties	16 hours
Extra Reading /Key Words: Hermite differential equations		
4	**Partial differential equation** Classification of Second order PDE's Reduction to canonical forms Derivation of the equations of mathematical physics and their solutions by separation of variables.	16 hours
Extra Reading /Key Words: Reduction to canonical forms		

REFERENCES

Sl. No	Title of the book	Author(s)	Publisher	Edition	Year of publication
1	Theory of Ordinary Differential equations	E. A. Coddington and N. Levinson	Tata McGraw-Hill, New Delhi	1st	1955
2	Methods of Mathermatical Physics, Vol. I. & II	R. Courant and D. Hilbert	Tata McGraw-Hill, New Delhi	1st	1975
3	Differential Equations with applications and Historical Notes	G. F. Simmons	Tata McGraw-Hill, New Delhi	1st	1991
4	Theory of Partial differential equations	I. N. Sneddon	McGraw-Hill, International Student Edition	1st	1950
5	Ordinary Differential Equations and Stability Theory	S. G. Deo and V. Raghavendra	Tata McGraw-Hill, New Delhi	1st	1980

SECOND YEAR - SEMESTER – IV

Course Title	Theory of Numbers							
Course Type	Soft Core- Theory		Total Hours	64	Hours/Week	04	Credits	04
Course Code		Evaluation	Internal	C1+C2 = 15+15			30 Marks	100
			External	Duration	C3	03Hrs	70 Marks	

COURSE OBJECTIVES (COs)

To learn basic knowledge of numbers, functions like arithmetical, Mobius function, Euler function. It will give the glimpse of Fibonacci and Lucas series and describes the concept of continued fraction.

CO No.	Course Objectives
CO-1	To understand the Fundamental theorem of Arithmetic.
CO-2	To Discuss Arithmetical Functions.
CO-3	To introduce the application of continued fraction

Mapping of CLOs with PSOs &CDLs

Course Learning Outcomes (CLOs): The CLOs indicate what a student has learnt after the successful completion of a course. The CLO statements are prepared by considering the course content covered in each unit of a course.For every course there may be 5 or more CLOs. **The keywords are used at the end of each unit to define CLOs.**

CLOs No.	Course Learning Outcomes (CLOs) After completing this course, the student will be able to	PSOs Addressed	CLDs
CLO-1	Understand the Fundamental theorem of Arithmetic	PSO-3	Understand
CLO-2	Discuss the Arithmetical Functions	PSO-2	Apply
CLO-3	Apply the knowledge of continued fraction in approximation	PSO-1	Apply

Unit	Proposed Course Content	Duration
1	**Prime Numbers and Farey series** Prime numbers The Fundamental theorem of Arithmetic The series of Reciprocals of primes The Euclidean Algorithm. Fermat and Mersenne numbers Farey series, Farey dissection of the continuum Irrational numbers-Irrationality of m^{th} root of N, e and π	16 hours

Extra Reading /Key Words : Prime Numbers and Farey series

2	**Arithmetical Functions** Arithmetical Functions – The Mobius function, The Euler' function and Sigma function The Dirichlet product of Arithmetical functions Multiplicative functions Averages of Arithmetical functions – Euler summation formula, Some elementary asymptotic formulas The average orders of d(n), σ(n), φ(n), μ(n) An application to the distribution of lattice points visible from the origin	16 hours
Extra Reading /Key Words : Arithmetical Functions and Multiplicative functions		
3	**Continued fractions-I** Finite continued fractions Convergent of a continued fraction Continued fractions with positive quotients Simple continued fractions(SCF) The representation of an irreducible rational fraction by a SCF	16 hours
Extra Reading /Key Words : Finite Continued fractions		
4	**Continued fractions-II** The continued fraction algorithm and Euclid's algorithm The difference between the fraction and its convergent Infinite simple continued fractions The representation of an irrational number by an infinite continued fraction Equivalent numbers and periodic continued fractions, some special quadratic surds	16 hours
Extra Reading /Key Words : Infinite Continued fractions		

REFERENCES

Sl. No	Title of the book	Author(s)	Publisher	Edition	Year of publication
1	An Introduction to Theory of Numbers	G. H. Hardy and E. M. Wright	Oxford University Press	5th	1979
2	An Introduction to the Theory of Numbers	I. Niven, H. S. Zuckerman and H. L. Montgomery	John Wiley and Sons, Inc., New York	5th	2004
3	Ramanujan's Note Books Volume-1 to 5	Bruce C. Berndt	Springer	1st	1985
4	Number Theory	G. E. Andrews	Dover Books	1st	1994
5	Introduction to Analytic Number Theory	T. M. Apostol	Narosa Publishing House, New Delhi	1st	1998

SECOND YEAR - SEMESTER – IV

Course Title	Advanced Graph Theory							
Course Type	Soft Core- Theory		Total Hours	64	Hours/Week	04	Credits	04
Course Code		Evaluation	Internal	C1+C2 = 15+15			30 Marks	100
			External	Duration	C3	03Hrs	70 Marks	

COURSE OBJECTIVES (COs)

To understand the fundamentals of concepts of graph theory. Also able to describe the idea of line graphs, distance concept, colorablity, relations between graphs and matrices.

CO No.	Course Objectives
CO-1	To understand and apply the fundamental concepts of graph theory
CO-2	To apply graph theory based tools in solving practical problems.
CO-3	To identify distances in graphs and its applications.
CO-4	To understand the concepts domination theory.

Mapping of CLOs with PSOs &CDLs

Course Learning Outcomes (CLOs): The CLOs indicate what a student has learnt after the successful completion of a course. The CLO statements are prepared by considering the course content covered in each unit of a course.For every course there may be 5 or more CLOs. **The keywords are used at the end of each unit to define CLOs.**

CLOs No.	Course Learning Outcomes (CLOs) After completing this course, the student will be able to	PSOs Addressed	CLDs
CLO-1	Understand the definition of line graph	PSO-1	Understand
CLO-2	Identify distances in graphs.	PSO-2	Apply
CLO-3	Discuss and understand algebraic graph theory	PSO-5	Apply

Unit	Proposed Course Content	Duration
1	**Line Graphs** Definition and Some properties of line graphs Characterization of line graphs Line graphs and traversability	16 hours

Extra Reading /Key Words: Total graph

2	**Algebraic Graph Theory** Matrices – The adjacency matrix The incidence matrix The cycle matrix Adjacency Eigen Values	16 hours
Extra Reading /Key Words: Eigen Values		
3	**Distances in graphs** Distances in graphs and its applications Distance matrix Characteristic polynomial and Distance Eigen Values	16 hours
Extra Reading /Key Words: Distance matrix		
4	**Domination Theory** Definition, types of Domination Domination numbers -Some elementary properties	16 hours
Extra Reading /Key Words: Domination Theory		

REFERENCES

Sl. No	Title of the book	Author(s)	Publisher	Edition	Year of publication
1	Graph Theory	Frank Harary	Addition Wesley Reading Mass	3rd	1969
2	Graph Theory with applications	J. A. Bondy and U. S. R. Murthy	Elsevier	2nd	1976
3	Graph Theory With Applications to Engineering and Computer Science	N. Deo	Prentice Hall of India	1st	1987
4	Basic Graph Theory	K. R. Parthasarathy	Tata McGraw-Hill, New Delhi	2nd	1994
5	Introduction to Graph Theory	D. B. West	Pearson Education Inc.	2nd	2001
6	Domination Theory	V. R. Kulli	Vishwa International Publications	4th	2012
7	Graphs and Diagraphs	G. Chartand and L. Lesniak	Qwadsworth and Brooks	2nd	1986
8	A First Look at Graph Theory	Clark and D. A. Holton	Allied publishers	1st	1991

SECOND YEAR - SEMESTER – IV

Course Title	Differential Geometry							
Course Type	Soft Core- Theory		Total Hours	64	Hours/Week	04	Credits	04
Course Code		Evaluation	Internal	C1+C2 = 15+15			30 Marks	100
			External	Duration	C3	03Hrs	70 Marks	

COURSE OBJECTIVES (COs)

To find the properties of a surface and geodesics.

CO No.	Course Objectives
CO-1	To understand the plane curves and Space curves.
CO-2	To study the properties the four vertex theorem**.**
CO-3	To identify Isometries of surfaces.
CO-4	To understand the first fundamental form of curves**.**

Mapping of CLOs with PSOs &CDLs

Course Learning Outcomes (CLOs): The CLOs indicate what a student has learnt after the successful completion of a course. The CLO statements are prepared by considering the course content covered in each unit of a course.For every course there may be 5 or more CLOs. **The keywords are used at the end of each unit to define CLOs.**

CLOs No.	Course Learning Outcomes (CLOs) After completing this course, the student will be able to	PSOs Addressed	CLDs
CLO-1	Understand the plane curves and Space curves.	PSO-1	Understand
CLO-2	Identify Isometries of surfaces.	PSO-2	Apply
CLO-3	Discuss and understand the first fundamental form of curves.	PSO-5	Apply

Unit	Proposed Course Content	Duration
1	**Introduction to Differential Geometry** Plane curves and Space curves – Frenet-Serret Formulae Global properties of curves – Simple closed curves The isoperimetric inequality	16 hours

Extra Reading /Key Words: Frenet-Serret Formulae

2	**Four Vertex theorem and its applications** The Four Vertex theorem Surfaces in three dimensions – Smooth surfaces Tangents, Normals and Orientability, Quadric surfaces	16 hours
Extra Reading /Key Words: Quadric surfaces		
3	**First fundamental Form of Curves** The First Fundamental form – The lengths of curves on surfaces Isometries of surfaces Conformal mappings of surfaces Surface area Equiareal Maps and a theorem of Archimedes	16 hours
Extra Reading /Key Words: Conformal mappings of surfaces		
4	**Second Fundamental Form of Curves** Curvature of surfaces The Second Fundamental form The Curvature of curves on a surface Normal and Principal Curvatures	16 hours
Extra Reading /Key Words: Normal and Principal Curvatures		

REFERENCES

Sl. No	Title of the book	Author(s)	Publisher	Edition	Year of publication
1	Elementary Differential Geometry, Under-graduate Mathematics Series	A. Pressley	Springer.	1st	2010
2	An Introduction to Differential Geometry	T. J. Willmore	Oxford University Press	1st	1997
3	Differential Geometry: A First Course	D. Somasundaram	Narosa	1st	2005

St. Philomena's College (Autonomous), Mysore
M. Sc-Mathematics (CBCS)
I/II/III/IV- Semester Examination: 2018-19
Subject:

Time: 3 Hours **Max Marks: 70**

Blue Print

Sl. No		Answer all the questions, All question carries equal marks	Marks
1	a		2
	b		2
	c		2
	d		2
	e		2
	f		2
	g		2
	2		14
		OR	
	3		14
	4		14
		OR	
	5		14
	6		14
		OR	
	7		14
	8		14
		OR	
	9		14

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