P.K.R. ARTS COLLEGE FOR WOMEN

(Re-Accredited with 'A' Grade by NAAC)

Autonomous Institution-Affiliated to Bharathiar University

Gobichettipalayam-638 476

DEPARTMENT OF MATHEMATICS

MASTER OF SCIENCE IN MATHEMATICS

SYLLABUS

SCHOLASTIC COURSES
AND
CO-SCHOLASTIC COURSES

For all the candidates admitted from the Academic Year

2025-2026 and onwards

Under CBCS PATTERN

CONTENTS

P.K.R. ARTS COLLEGE FOR WOMEN
(Re-Accredited with 'A' Grade by NAAC)
Autonomous Institution - affiliated to Bharathiar University
No: 21, Pariyur Road, Gobichettipalayam-638 476.

MEETING OF BOARD OF STUDIES IN MATHEMATICS

Academic year 2025 – 2026

PROGRAMME: M.Sc. Mathematics

Date: 25.04.2025 **Time: 10.00 am**

Agenda

1. Confirm the minutes of the eighth meeting of the board of Studies held on 27.04.2024.
2. Approve the action taken on the resolutions passed in the previous meeting of the Board of Studies held on 27.04.2024 and the Eighth meeting of the academic council held on 08.05.2024.
3. Approve the new rules and regulations for the students admitted in PG programme from the academic year 2025-2026 & onwards.
4. Approve the Programme Structure, Programme Scheme, Scheme of Examinations, Question paper pattern and knowledge level in OBE pattern for the students admitted in PG programme from the academic year 2025-2026 & onwards.
5. Ratify the Removal/Inclusion/ Modification/Introduction in the Programme Structure, Programme Scheme and in the Scheme of Examinations (if any) (along with the Mapping of CO'S and PO'S Statements) for the students admitted in the PG Programme in 2024-2025.
6. Consider and Recommend the revision of the minor changes such as shifting of courses and Modifications in the syllabus in PG Programme.
7. Recommend Fresh panel of Examiners for QP Setting/ Practical Examinations/ Project Viva- Voce / Central Valuation for PG Programme.
8. Any other matter.

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DEPARTMENT OF MATHEMATICS

MEMBERS IN BOARD OF STUDIES

Academic Year: 2025-2026

S.No	CATEGORIES	NAME & DESIGNATION	SIGNATURE
1	Chairperson	Ms.R.Jayalakshmi, Head, Department of Mathematics, P.K.R. Arts College for Women, Gobichettipalayam – 638476. Mobile: 9486640983 Mail ID : jaipranikaa@gmail.com	
2	University Nominee	Dr.K.K.Mythili, Associate Professor and Head, Department of Mathematics CA, Vellalar College for Women(AUTONOMOUS), Thindal, Erode -12. Mobile : 9443523525 Mail ID: mathsmyth@gmail.com	
3	Subject Expert-1	Dr. A.K.Abdul Hakeem, Associate Professor, Department of Mathematics, Sri Ramakrishna Mission Vidhyalaya College of Arts and Science, Coimbatore – 641 048. Mobile: 9442401998, 9486078612 Mail ID: drabdulmaths@gmail.com	
4	Subject Expert-2	Dr.P.Karthikeyan, Assistant Professor, Department of Mathematics, Sri Vasavi College, Erode – 638 316. Mobile: 6381777633. E – mail ID: pkarthisvc@gmail.com	
5	Industry Representative	Ms.A.C.Uvashalini, PeopleSoft Associate, Kovaion Consulting Private Ltd, Bangalore. Mobile: 9790352523 Mail ID: uvamaths19@gmail.com	

6	**PG Meritorious Alumnus**	**Dr. B.Usha,** **Assistant Professor(Sr.G),** **Department of Mathematics,** **Kongu Engineering College,** **Perundurai - 638060.** **Mobile: 9965013796** **Mail ID: usha_b.sh@kongu.edu**	
7	**Ex Officio Member**	**Ms. S.A.Dhanalakshmi,** **Controller of Examinations,** **P.K.R. Arts College for Women,** **Gobichettipalayam – 638476.** **Mobile:9842420006** **Mail ID:dhanagobu@gmail.com**	
8	**Member-1**	**Dr. M.Kasthuri,** **Associate Professor and Head,** **Department of Mathematics,** **P.K.R. Arts College for Women,** **Gobichettipalayam - – 638476.** **Mobile : 9443951244** **Mail ID:joevarshini@gmail.com**	
9	**Member-2**	**Ms. L.Priya,** **Assistant Professor in Mathematics,** **P.K.R. Arts College for Women,** **Gobichettipalayam – 638476.** **Mobile: 9994048302** **Mail ID: priyal@pkrarts.org**	
10	**Member-3**	**Ms. A.Poornima,** **Assistant Professor in Mathematics,** **P.K.R. Arts College for Women,** **Gobichettipalayam – 638476.** **Mobile: 9894199372** **Mail ID:poornima.mphil@gmail.com**	
11	**Member-4**	**Ms. S.Mayuri** **Assistant Professor in Mathematics,** **P.K.R. Arts College for Women,** **Gobichettipalayam – 638476.** **Mobile: 7708897235** **Mail ID:mayuris@pkrarts.org**	
12	**Present Student Member**	**Ms.K.Elamathi** **I M.Sc Mathematics** **P.K.R. Arts College for Women,** **Gobichettipalayam – 638476.** **Mobile: 87783 65707** **Mail ID: kamalirajeshwaran19@gmail.com**	

VISION AND MISSION OF THE COLLEGE

VISION

To make a centre of excellence in higher education by imparting value based quality education to rural women, to empower and make them economically independent, and socially committed to the task of building a strong nation.

MISSION

Empowering the rural women by inculcating the core values of truth and righteousness and by ensuring quality in the teaching-learning process along with co-curricular and extra-curricular activities for their economic independence, social commitment and national development.

GOALS AND OBJECTIVES

- The college had been founded by the tillers of the soil, aimed at providing access to higher education for women students of the rural areas, who do not have the facilities of their urban counterparts.
- To provide quality education to empower the rural women.
- To impart value based education and prepare the women students to uphold the rich cultural heritage and secular ideals of the nation.
- To awaken the social consciousness among students and motivate them to serve society with the motive of establishing an egalitarian system.
- To provide opportunities to develop the overall personality of the students and thus enabling them to face challenges in the competitive global scenario.

CORE VALUES OF THE INSTITUTION

- Education
- Enlightenment
- Discipline
- Service

RULES AND REGULATION FOR THE STUDENTS ADMITTED FROM 2025- 2026 AND ONWARDS

RULES AND REGULATIONS FOR PG STUDENTS ADMITTED FROM 2025-2026 & ONWARDS

P.K.R. Arts College founded in the year 1994 with the vision to make the college a "**Centre of Excellence"** in higher education by imparting value based quality education to rural women, to empower and make them economically independent and socially committed to the task of building a strong nation. Ever since its inception the college took steps to inculcate the core values of truth and righteousness through right kind of teaching and learning methods and grown to leap and bounds.

As per the expectations of UGC on the Autonomous colleges, our college has initiated the following measures for the quality improvement of its functioning:

1. To Re-structure and design the course curricula;
2. To Inculcate research culture amongst the students and teachers;
3. Promote healthy practices such as community service, extension services, projects, etc. for the benefit of the society

The P.K.R. Arts College for Women follows the UGC, TANSCHE and Bharathiar University guidelines of CBCS pattern in framing Programme Scheme and Scheme of Examinations for the students admitted in various PG Programmes from the Academic year 2017-18 and Onwards.

DEFINITION OF TERMS:

Choice Based Credit System (CBCS):

CBCS is a flexible system of learning that permits students to,

- Learn at their own pace
- Choose electives from a wide range of elective courses offered by the departments
- Adopt an inter-disciplinary approach in learning
- Undergo additional courses and acquire more than the required number of credits
- Make best use of the expertise of available faculty

Programme:

The term ***"Programme"*** is used to refer to the Master level of study offered in P.K.R. Arts College for Women. For e.g. M.A. Programme indicates Master of Arts and M.Sc., Programme indicates, Master of Science.

Branch:

The term ***"branch"*** is used to refer to the subject specialization under the Masters Level of study offered in P.K.R. Arts College for Women. For e.g. M.A. Tamil Literature indicates Masters of Arts, specializing Tamil Literature and M.Sc., - Mathematics, indicates Master of Science, specializing in Mathematics.

Duration:

The total study periods of various programmes are:

Postgraduate (Masters) programme (M.A. or M. Sc, M.Com., M.C.A., & M.B.A): Two years (Four semesters)

Curriculum:

The term "Curriculum" indicates the various components of the programme and branch of study.

Course:

The term "Course" is used to refer to the specific subject of the particular Programme and branch of study.

Programme Scheme:

Programme scheme denotes the course outline or the components of the particular Programme and branch of study.

Scheme of examinations:

Scheme of examination indicates the contact hours allotted for each course, the duration of End Semester Examination, marks details for CIA and ESE and the credit score specified for each course.

Syllabus:

The subject content of each course is referred to as "Syllabus".

Semester:

The term "semester" denotes the start and the end of teaching period of the Academic year. The college adopts two semester pattern of an Academic Year. The duration of each semester is roughly around six months period but not less than 90 working days. The semester is subdivided as (ODD and EVEN) spanning six months (odd semester is from June to November and Even semester is from December to May).

Credit system:

It is a system of assigning weightage to each one of the courses and components of the curriculum of a programme and branch of study in terms of the weightage of the teaching learning process of that particular course. The weightage is given in terms of credit points.

Credit point:

Credit point is the numerical weightage given to the particular course of study. The student learner should obtain the mandatory minimum credit points specified for each programme and branch of study to earn her degree. The student learner may also earn extra credits by the way of completing extra courses (subjects).

Programmes offered:

1. M.A. Tamil Literature
2. M.A. English Language and Literature
3. M. Sc Mathematics
4. M. Sc Physics
5. M.C.A. Computer Applications
6. M.Com Commerce
7. M.B.A. Business Administration

Credits to be earned:

All PG Programmes : 90 credits

(Including AICTE approved M.C.A. and M.B.A. Programmes)

Duration:

Duration for all the PG programmes is TWO (02) years.

COMPONENTS FOR PG PROGRAMMES:

Scholastic Courses:

Part III: This part consists of

a) Core courses : Theory and Practical
b) Elective courses
(CBCS - Discipline Specific Elective courses / Open Elective Course)

Part IV: Following are the components under Part: IV

A: Skill Enhancement:

Courses offered by the department - offered during semesters I and III (ONLY MBA)

B: Ability Enhancement:

i) Cyber Security - offered during semester II (for students of all PG programmes)

Part V: Following are the components under Part V

i) Proficiency Enhancement:

Self Study Course - offered during semester III

ii) Competency Enhancement :

a) Online course / Learning Object Repository (LOR) - to be completed during Semester I – IV by the candidate and,
Certificate Course - to be completed during Semester I – IV by the candidate
(OR)
b) Student Start-up Venture / Internship / Capstone Project & Viva-voce – to be completed during Semester III – IV (ONLY MBA)

Co-Scholastic Courses:

Following THREE categories of CO-SCHOLASTIC COURSES are offered to nurture - choice based skill / ability / proficiency / competency enhancement of an individual in addition to the courses specified under the scheme of examinations.

The categories available are

a) VALUE ADDED COURSES
b) EXTRA CREDIT COURSES

ADMISSION NORMS:

The eligibility conditions and the guidelines issued by the Bharathiar University in admitting students are followed for all the PG Programmes offered in P.K.R. Arts College for Women.

EXAMINATION AND EVALUATIONS:

Requirement for appearing End Semester Examinations:

Attendance: (as per the norms and guidelines of Bharathiar University)

i) A candidate is eligible to appear for the End Semester examinations in any semester, if:
   - She secures not less than 75% of attendance in the number of working days during the semester.
   - Her progress has been satisfactory
   - Her conduct has been satisfactory

ii) Candidates who earn attendance between 65% and 75% are ineligible to appear for the current semester examinations. However, the Principal may condone the lack of attendance of those students on the following grounds and permit them to write End Semester Examinations, after the payment of condonation fee:
   - Prolonged illness
   - Major Surgery
   - Accident which demands a long rest

The cause of the long period of absence should be informed with supportive documents to the Principal within a week's time and get the leave sanctioned.

iii) Candidates who earn attendance between 55% and 64% are ineligible to appear for the current semester examinations. However, they can write arrear subjects, if any. They are permitted to continue their studies in the next semester; while continuing in the next semester, they have to compensate and earn combined attendance of 75% or more by taking the average of the attendance earned in the current and the previous semester.

iv) Candidates who earn attendance below 55% are not eligible to appear for the current semester examinations and also have to discontinue the course and rejoin in the same semester in the next academic year, if vacancy is available, with proper

approval from the Bharathiar University and the Principal through the Head of the Department concerned. These candidates are eligible to write arrear subjects, if any.

v) Students having a minimum of 75% of attendance in the Practical classes alone will be eligible to submit their record note books and appear for CIA and ESE practical examinations.

vi) Students shall be permitted to appear for the practical examinations only with the submissions of bonafide records.

Scheme of examinations:

A. All End Semester Examinations (theory and practical) shall be conducted twice a year, in November / December and in April / May. All failed candidates shall be governed by the regulations and syllabus in force at the time of their subsequent appearances.

b. Additional supplementary End Semester Examinations in final semester subjects and Special Supplementary End Semester Examinations for students who have failed in only one subject up to III semester (PG Programmes) are conducted in June / July every year to facilitate the final year students who have failed to score passing minimum to go for higher studies or seek job early.

RULES TO BE FOLLOWED BY STUDENTS DURING EXAMINATION:

1. A candidate entering the examination hall must possess hall-ticket and identity card issued by the Principal; else she will be denied admission to write the examination.
2. Candidates have to occupy their allotted seats 10 minutes before the commencement of examination and maintain discipline and silence inside the examination hall. They have to give due attention to the instructions given by the Hall Superintendent before the commencement and also during the examination.
3. No candidate will be permitted to enter examination hall after 30 minutes from the commencement of examination. Similarly, no candidate will be permitted to leave the exam hall before 30 minutes from the commencement of examination.
4. A candidate who leaves the examination hall will not be permitted to re-enter the hall under any account.
5. Candidates are expected to bring their own pens, pencils, eraser, geometrical instruments, non-programmable calculators etc., and will not be allowed to borrow from others.
6. Candidates should use only blue or black ink or ball-point pen while answering their papers. Only for drawing diagrams or chart, colour pens/sketch pens are allowed.
7. Clark's mathematical table, Statistical table and Compound present value table will be supplied to candidates on request and the same should be returned immediately after use, without any scribbling. However, the candidates will be allowed to use their own mathematical and statistical tables / data sheets/graph sheets which are uncommon and specifically required to answer a particular paper after obtaining permission from Chief/Hall Superintendent. Such sheets or tables with any scribbling will not be permitted.
8. Candidates are prohibited from possessing study material in any form or mobile phone or and any such Electronics/ Communication instruments inside the examination hall. Mere possession of such materials inside the examination hall itself will be considered as the material meant for malpractice and will lead to disciplinary actions.
9. Candidates must verify and satisfy themselves that they have received correct question paper before they start answering for questions. Question paper not relevant should be returned to the hall superintendent at once.
10. Candidates are not allowed to write beyond the time prescribed for the examinations.
11. Rough work, if any, must be done by the candidates on the bottom of the page itself. Candidates can reserve, if necessary, one fourth of the page at the bottom exclusively for the purpose. No separate answer book for rough work will be supplied to candidates.

Rough work carried out of by a candidate will become part and parcel of the answer paper.

12. Candidates are forbidden from asking questions or clarifications of any kind from the fellow student or Hall Superintendent during the examination.
13. Candidates should not detach any sheet from the main answer book or smuggle out additional sheet or main book.
14. Candidates should handover the answer books personally to the Hall superintendent, before leaving the examination hall.
15. Candidates should not write their Register number anywhere else (except in the specified space) on the first page of Answer Book. Writing the name or making any appeal in the answer book or any other identifiable marking will be treated as an attempt to influence the examiner. Hence, any such act will attract disciplinary measures.
16. The students who indulge in any malpractice while writing examination will be immediately referred to the Chief Superintendent for the initiation of appropriate disciplinary action.
17. In case of impersonation, the accused will be handed over to police authorities for investigation and necessary action.
18. In the event of public holiday being declared after the publication of timetable, the examinations will not be postponed or cancelled. The examinations will be conducted as scheduled unless otherwise notified.
19. Any letter or telegram or phone call to a candidate shall not in any case be delivered / informed to the candidate until he/she completes examination.
20. Candidates with disabilities and who could not write examination by themselves shall submit a request to the Principal in the beginning of the Academic Year with the support of documentary evidences for alternate arrangements.

Transitory positions:

The candidate who have completed the course of study (TWO YEARS IN CASE OF PG PROGRAMMES) but have arrears will be permitted to take up the examinations only under the regulations in force at the time.

Facility to appear in an examination already passed:

The Candidates who have passed examinations may be permitted to appear again (Only once) for the end semester examinations of that course or courses under the regulations and syllabi in force then, with a view to improve their performance(s). If they do not show

improvement, their previous marks shall be the final marks in all records (such candidates should not have applied for their Degree certificate in Convocations held in between). Also such reappearances shall be permitted only once at the examination(s) conducted in the college in the next two semesters only.

Provision to re-total the answer book:

Candidates who desire to have their answer books re-totaled shall apply to the controller of Examinations, remitting the prescribed fees within 10 calendar days from the date of publication of results. Where the marks obtained in the re-totaling are higher than the marks awarded earlier, the Controller of Examinations shall issue the revised mark sheets after withdrawing the previous one.

Provision to appeal for re-evaluation of End Semester Examination Marks:

Candidates who desire to have their answer books revalued shall apply to the Controller of Examinations, remitting the prescribed fees within 10 calendar days from the date of publication of results (The date mentioned in the Mark sheet). If the revalued marks are higher to the extent of getting a passing minimum and more than the marks awarded earlier, then the COE shall issue the revised mark sheet after withdrawing the mark sheet issued previously. If the revalued marks are higher than the marks awarded earlier but not to the extent of getting a passing minimum, then the first valuation marks shall be the final marks. The principles of moderation formulated in the Results Passing Board for the respective examination shall be applied for the revaluation cases also.

Transparency system:

Under this system, the photo copy of the answer script written by the student is issued on request. The procedure is that the candidate who desires to get the Photo copy of her answer script shall apply to the COE, remitting the prescribed fee within 10 calendar days from the date (noted in the mark sheet) of publication of results. On a specific day, the candidates who have applied for this facility will be given with the photo copy of the answer script and would be directed to discuss the issues with the subject expert who is specially appointed for the purpose. The students may scrutinize the answers script, discuss with the subject expert, get clarifications and if they are not convinced with the marks awarded then they may go for applying for revaluation. Such a request shall be made within 3 calendar days. The procedure followed for the revaluation is applied to this category also.

Passing Minimum:

A candidate who secures not less than 50% marks in ESE of various components shall be declared to have passed the examination in that course (subject).

Classification of successful candidates and grading system:

No candidate shall be eligible for classification or grading unless, the candidate

- Has undergone the prescribed course of study for the prescribed period
- Has passed / completed all the courses (subjects) / components prescribed for the programme
- Has earned the credit points prescribed for the programme.

Part: III

Candidates who have passed all the Part: III examinations in FIRST ATTEMPT within the study period of the respective semester and securing 75% and above in aggregate of Part: III shall be declared to have passed the Part: III examination in first class with distinction. All other candidates who have passed Part: III subjects and securing 60% & above and 50% to 59.9% shall be declared to have passed the Part: III examinations in First and Second class respectively.

GRADING SYSTEM

Based on the guidelines of Bharathiar University on grading system the following grading System for the students admitted from 2017-18 & onwards.

Conversion of Marks to Grade Points and Letter Grade:

RANGE OF MARKS	GRADE POINT	LETTER GRADE	DESCRIPTION
90 - 100	9.0 -10.0	O	Outstanding
80 - 89	8.0 – 8.9	D+	Excellent
75 - 79	7.5 – 7.9	D	Distinction
70 - 74	7.0 – 7.4	A+	Very Good
60 - 69	6.0 – 6.9	A	Good
50 - 59	5.0 – 5.9	B	Average
40 - 49	4.0 – 4.9	U	Reappear
0-39	0.0	U	Reappear
Absent	0.0	AAA	Absent

Classification:

CGPA	GRADE	CLASSIFICATION OF FINAL RESULT
9.5 – 10.0	O+	First class – Exemplary*
9.0 and above but below 9.5	O	
8.5 and above but below 9.0	D++	First class with Distinction
8.0 and above but below 8.5	D+	
7.5 and above but below 8.0	D	
7.0 and above but below 7.5	A+	First Class
6.5 and above but below 7.0	A+	
6.0 and above but below 6.5	A	
5.5 and above but below 6.0	B+	Second Class
5.0 and above but below 5.5	B	
4.0 and above but below 4.9	U	Re-appear
0 and above but below 4.0	U	

***Applicable for the students who have passed the Part: III examinations in FIRST APPEARANCE within the study period of the respective semesters.**

- Cumulative Grade Point Average (CGPA) and final classifications are to be made for the students who have passed all courses (subjects) / completed all components prescribed for the programme
- Part-III components alone are considered for CGPA.
- Part-IV & Part-V are not to be considered for finding the CGPA or for the classification of Part—III
- The maximum marks per course (subject) are to be fixed at 100. (if it is less or more than 100 it should be converted to 100)
- Grade point average – For a semester: (GPA): = $\sum$**CGP / C**

  Where C = Credits earned for the course in any semester

  G = Grade Point obtained for the course in any semester

$$GPA = \frac{\text{Sum of the multiplication of grade points by the credits of the courses}}{\text{Sum of the credits of the courses in a semester}}$$

- Cumulative Grade Point Average – For the entire programme: (CGPA) is calculated by using the formula:

$$CGPA = \frac{\sum CGP}{\sum C}$$ Where C = Credit Point GP = Grade Point

$$\textbf{CGPA} = \frac{\text{Sum of the multiplication of grade points by the credits of the entire programme}}{\text{Sum of the credits of the courses of the entire programme}}$$

- **CGPA is given only in Consolidated mark statement / Grade sheet**

Ranking:

- Candidates who have passed all the courses (subjects) or completed all the components prescribed for the programme within the period of study are only eligible for Ranking
- Ranking is based on the marks scored in Part-III subjects only.
- Candidates passing the Part-III subjects in First Attempt within the study period of respective semesters are only eligible for ranking.
- In case of Reappearance, the first appearance mark is only considered for ranking
- Candidates absenting for the courses (subjects) prescribed in Part-III and getting higher marks in the subsequent appearances will not be considered for Ranking.

MALPRACTICE AND PUNISHMENT

Punishment for malpractice committed during End Semester Examinations.

The students, who indulge in any malpractice, while writing examination, will be directed to report to Chief Superintendent. The chief superintendent will review and forward the case to Controller of Examinations and the COE in turn will submit the details to Examination Committee for the initiation of appropriate disciplinary proceedings.

NATURE OF MALPRACTICE	NATURE OF PUNISHMENT	LEVEL OF PUNISHMENT
Making an appeal in any form inside the answer script	**Warning** may be given and if repeated the examination taken by the candidate will be cancelled	LEVEL: I
Possession of mobile phone / study materials / incriminating materials in any form	The **particular examination** taken by the candidate will be **cancelled**	LEVEL: II
Aiding / Passing / Referring / Copying from mobile phone / study material	The **particular examination** and a**ll t**he **examinations** written already in this semester including Arrear will be **cancelled and** may be permitted to write subsequent semester examinations	LEVEL: III
Insubordinate behavior or threatening the Invigilator	The **particular examination** and a**ll t**he **examinations** written already in this semester will be **cancelled** and also will be **debarred** from appearing for the **ONE subsequent semester examinations**	LEVEL:IV
Inserting previously written answers	The **particular examination** and a**ll t**he **examinations** written already in this semester will be **cancelled** and also will be **debarred** from appearing for the **TWO subsequent semester examinations**	LEVEL: V

Case of **Impersonation**	The **particular examination** and a**ll t**he **examinations** written already in this semester will be **cancelled** and will be **expelled** **From the college and the matter will be referred to the Police if necessary for further action.**	LEVEL: VI

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VISION AND MISSION OF THE DEPARTMENT

VISION

Creating a congenial environment to learn mathematical designs and to use mathematical knowledge for problem solving.

MISSION

To motivate the students to upgrade their interests in contemporary mathematical techniques and to enable them to acquire the required knowledge to strengthen their analytical skills.

PROGRAMME EDUCATIONAL OBJECTIVES

1. To provide value-based quality education with theoretical and applied skills for rural women.
2. To facilitate personality development opportunities for students to face life's challenges in today's competitive scenario.
3. To empower rural women and make them economically independent through employability and entrepreneurship.
4. To awaken social consciousness of the students through community engagement for active contribution to the society.
5. To equip the students to become morally, ethically and socially responsible for building a strong nation.

GRADUATE ATTRIBUTES

1. Disciplinary knowledge.
2. Communication skills.
3. Critical thinking, problem solving and analytical reasoning.
4. Research skills and reflective thinking.
5. Teamwork and Leadership skills for interpersonal competence.
6. Continuous autonomous learning and digital literacy.
7. Social consciousness with concern for environment.

PROGRAMME OUTCOMES

1. **Disciplinary knowledge**: Demonstrate critical and systematic proficiency about the breadth and depth of the basic and emerging trends in the arts and science streams appropriate to the programme.
2. **Communication skills**: Communicate ideas clearly and effectively through verbal and non-verbal forms to specialist and non-specialist audiences with professionalism and multi-disciplinary approach.
3. **Critical thinking, problem solving and analytical reasoning:** Apply appropriate knowledge and skills to identify, formulate, critically analyse and substantially conclude with simple solutions to problems.
4. **Research skills and reflective thinking:** Explore real-time scenarios, analyse and interpret data and information, articulate and support findings with evidences incorporating economic and business practices to reach valid conclusion.
5. **Teamwork and Leadership skills for interpersonal competence:** Ability to interact, communicate and collaborate in a trans-disciplinary context.
6. **Continuous autonomous learning and digital literacy:** Ability to find, evaluate and compose clear information for self-directed learning through conventional and digital media.
7. **Social consciousness with concern for environment**: Capability to synthesise the economic, legal, social, environment, health, safety and cultural dimensions of the society with moral and ethical reasoning and promote equity through sustainable development practices.

PROGRAMME SPECIFIC OUTCOMES

On successful Completion of **M.Sc Mathematics Programme,** the students would have

1. exhibit extensive knowledge of Classical and Advanced concepts of Algebra, Analysis, Differential Equations and Statistics.
2. convey the mathematical ideas on their activities with peers and professionals through Mathematical techniques and soft skills.
3. apply conceptual understanding of advanced mathematics in other disciplines to identify, formulate, analyze and conclude with simple solution to problems.
4. demonstrate the necessary skills and knowledge of deeper understanding in the field of research and developments through seminars and projects.
5. develop teamwork and leadership quality to handle all kinds of circumstances to accomplish their tasks through various group activities.
6. inculcate continuous learning attitude to adopt new skills and techniques to overcome the problems related with new technologies.
7. identify the social issues and use the problem solving skills for the upliftment of the multi cultural society.

M.SC MATHEMATICS – PROGRAMME STRUCTURE

CBCS – 2025 – 2026 & Onwards

CATEGORY	COMPONENTS	NO. OF COURSES	CREDIT(S) / COURSE	TOTAL CREDITS	PROPOSED SEMESTER
Part - III	Core Courses	15	1/2/3/4/5/6	62	I - IV
	Core Practical	01	01	01	I
	Core (Open Elective)	01	02	02	III
	Core Elective Courses	04	03	12	I - IV
	Core Elective Practical	01	01	01	II
	Project and Viva-Voce	01	04	04	IV
Part – IV	A. Ability Enhancement : Cyber Security	01	02	02	II
Part - V	Competency Enhancement :				
	i. Online Course / Learning Object Repository	01	02	06	I to IV
	ii. Certificate Course	01	02		
	iii. Self study	01	02		III
Total Marks:2500 & Total Credits:90					

P.K.R. ARTS COLLEGE FOR WOMEN (Autonomous),
Gobichettipalayam – 638 476.

MASTER OF SCIENCE - MATHEMATICS
Programme Scheme and Scheme of Examinations
(For students admitted from 2025-2026 & onwards)

Scholastic Courses:

Category / Part	Component	Course Code	Title of the Course	Contact Hrs/ week	Exam Duration hrs.	Max. Marks			Credits
						CIA	ESE	Total	
SEMESTER - I									
Part III	Core: I	25MAP01	Advanced Algebra	6	3	25	75	100	5
Part III	Core :II	25MAP02	Real Analysis	6	3	25	75	100	5
Part III	Core : III	25MAP03	Ordinary Differential Equations	6	3	25	75	100	4
Part III	Core : IV	25MAP04	Python Programming	5	3	25	75	100	3
Part III	Core : V Elective : I	25MAP05A/ 25MAP05B	Numerical Analysis/ Optimization Techniques	5	3	25	75	100	3
Part III	Core : VI Practical	25MAP06	Programming in Python Practical	2	3	40	60	100	1
			TOTAL	**30**				**600**	**21**
SEMESTER - II									
Part III	Core :VII	25MAP07	Complex Analysis	6	3	25	75	100	5
Part III	Core : VIII	25MAP08	Partial Differential Equations	5	3	25	75	100	4
Part III	Core : IX	25MAP09	Measure Theory and Integration	5	3	25	75	100	4
Part III	Core :X	25MAP10	Differential Geometry	5	3	25	75	100	4
Part III	Core : XI Elective : II	25MAP11A/ 25MAP11B	Probability Theory/ Programming in C++	5	3	25	75	100	3
Part III	Core : XII Elective : II Practical	25MAP12A/ 25MAP12B	Mathematical Software, R - Practical/ Programming in C++ - Practical	2	3	40	60	100	1
Part IV	Ability Enhancement	25AEP01	Cyber Security	2	3	100	-	100	2
			TOTAL	**30**				**700**	**23**

SEMESTER – III									
Part III	Core : XIII	25MAP13	Topology	6	3	25	75	100	5
Part III	Core :XIV	25MAP14	Theory of Numbers	6	3	25	75	100	4
Part III	Core : XV	25MAP15	Classical Mechanics	6	3	25	75	100	4
Part III	Core : XVI	25MAP16	Research Tools & Techniques	3	3	25	75	100	2
Part III	Core :XVII Open Elective	*****	Offered for students of other programmes / departments	3	3	25	75	100	2
Part III	Core :XVIII Elective : III	25MAP17A/ 25MAP17B	Graph Theory / Integral Transforms	6	3	25	75	100	3
Part V	Proficiency Enhancement	25PEMA01	Mathematics for Competitive Examinations (Self Study)	-	3	-	100	100	2
			TOTAL	**30**				**700**	**22**
SEMESTER – IV									
Part III	Core :XIX	25MAP18	Functional Analysis	6	3	25	75	100	5
Part III	Core: XX	25MAP19	Mathematical Methods	6	3	25	75	100	4
Part III	Core :XXI	25MAP20	Fluid Dynamics	6	3	25	75	100	4
Part III	Core : XXII	25MAP21	Project Work & Viva Voce	6	3	20	80	100	4
Part III	Core : XXIII Elective : IV	25MAP22A/ 25MAP22B	Fuzzy Logic and Fuzzy Sets / Control Theory	6	3	25	75	100	3
			TOTAL	**30**				**500**	**20**
Part V	Competency Enhancement	Online Course / Learning Object Repository (LOR)		SEMSTER I – IV					**2**
		Certificate Course		SEMESTER I - IV					**2**
Total Credits									**90**

Total Marks -2500 & Total Credits - 90

Chair Person
Name, Designation : Mrs. R.Jayalakshmi,
Assistant Professor & Head,
Department of Mathematics,
P.K.R. Arts College for Women,
127, Pariyur Road,
Gobichettipalayam.

a) LIST OF ELECTIVE COURSES

COURSE CODE	SEMESTER	COURSE TITLE	Contact Hrs/ week	Exam Duration hrs.	Max.Marks			Credits
					CIA	ESE	Total	
25MAP05A	I	Numerical Analysis	5	3	25	75	100	3
25MAP05B	I	Optimization Techniques	5	3	25	75	100	3
25MAP11A	II	Probability Theory	5	3	25	75	100	3
25MAP11B	II	Programming in C++	5	3	25	75	100	3
25MAP12A	II	Mathematical Software, R – Practical	2	3	40	60	100	1
25MAP12B	II	Programming in C++ - Practical	2	3	40	60	100	1
25MAP17A	III	Graph Theory	6	3	25	75	100	3
25MAP17B	III	Integral Transforms	6	3	25	75	100	3
25MAP22A	IV	Fuzzy Logic and Fuzzy Sets	6	3	25	75	100	3
25MAP22B	IV	Control Theory	6	3	25	75	100	3

b) LIST OF ABILITY ENHANCEMENT COURSES

COURSE CODE	SEMESTER	COURSE TITLE	Contact Hours per Week	Exam Duration hrs.	Max.Marks			Credits
					CIA	ESE	Total	
25AEP01	II	CYBER SECURITY	2	3	100	-	100	2

c) LIST OF PROFICIENCY ENHANCEMENT COURSES

COURSE CODE	SEMESTER	COURSE TITLE	Contact Hours per Week	Exam Duration hrs.	Max.Marks			Credits
					CIA	ESE	Total	
25PEMAP01	**III**	Mathematics for Competitive Examinations (Self Study)	**-**	**3**	**-**	**100**	**100**	**2**

d) COURSES FOR COMPETENCY ENHANCEMENT:

Semester	Course	Hours per Week	Credit
I - IV	Online Course / Learning Object Repository (LOR)	Self-Paced with Faculty mentoring and Support SEMESTER I – IV	**2**
	Certificate Course		**2**
	Student start-up venture / Internship / Capstone project & Viva-voce (Only for MBA with alternate credits for the above components)		**4***

Total Marks: 2500 and above **Total Credits: 90 credits**

Chair Person
Mrs. R.Jayalakshmi,
Assistant Professor & Head,
Department of Mathematics,
P.K.R. Arts College for Women,
127, Pariyur Road,
Gobichettipalayam.

SYLLABUS WAS PREPARED AND FINALISED AS MENTIONED BELOW:

Category	Component	Course Code	Course Title	Faculty name
SEMESTER - I				
Part III	Core: I	25MAP01	Advanced Algebra	Ms.L.Priya
Part III	Core :II	25MAP02	Real Analysis	Mrs.R.Jayalakshmi
Part III	Core : III	25MAP03	Ordinary Differential Equations	Mrs.A.Poornima
Part III	Core : IV	25MAP04	Python Programming	Ms.L.Priya
Part III	Core:V Elective : I	25MAP05A/ 25MAP05B	Numerical Analysis/ Optimization Techniques	Mrs. S.Deepika Mrs.S.Mayuri
Part III	Core : VI Practical-I	25MAP06	Programming in Python Practical	Ms.L.Priya
SEMESTER - II				
III	Core :VII	25MAP07	Complex Analysis	Mrs. A.Poornima
III	Core : VIII	25MAP08	Partial Differential Equations	Dr.M.Kasthuri
III	Core : IX	25MAP09	Measure Theory and Integration	Mrs. P.Yamuna Rani
III	Core :X	25MAP10	Differential Geometry	Ms. S.Amshalekha
III	Core : XI Elective : II	25MAP11A /	Probability Theory/	Mrs.T.Nanthini & Mrs.S.Mayuri
III	Core : XI Elective : II	25MAP11B	Programming in C++	Mrs.T.Nanthini
III	Core : XII Elective : II Practical	25MAP12A /	Mathematical Software, R – Practical/	Mrs.S.Mayuri
III	Core : XII Elective : II Practical	25MAP12B	Programming in C++ - Practical	Mrs.T.Nanthini
SEMESTER - III				
III	Core : XIII	25MAP13	Topology	Mrs.P.Yamuna Rani
III	Core :XIV	25MAP14	Theory of Numbers	Mrs.S.Deepika

III	Core : XV	25MAP15	Classical Mechanics	Mrs.S.Poornima
III	Core : XVI	25MAP16	Research Tools & Techniques	Ms.L.Priya
III	Core :XVII Open Elective	*****	Offered for students of other programmes / departments (Mathematical Aptitude for Competitive Examinations)	Ms.S.Amshalekha
III	Core :XVIII Elective : III	25MAP17A /	Graph Theory /	Mrs.S.A.Dhanalakshmi
III	Core :XVIII Elective : III	25MAP17B	Integral Transforms	Ms.S.Amshalekha
V	Proficiency Enhancement	25PEMAP01	Mathematics for Competitive Examinations (Self Study)	Mrs.E.Deepika
SEMESTER - IV				
III	Core :XIX	25MAP18	Functional Analysis	Ms.L.Priya
III	Core: XX	25MAP19	Mathematical Methods	Mrs.R.Jayalakshmi
III	Core :XXI	25MAP20	Fluid Dynamics	Mrs.S.Deepika
III	Core : XXIII Elective : IV	25MAP22A /	Fuzzy Logic and Fuzzy Sets /	Mrs.S.Mayuri
III	Core : XXIII Elective : IV	25MAP22B	Control Theory	Ms.L.Priya

Curriculum Structure and Syllabus for the **M.SC MATHEMATICS** programme are prepared and verified in line with the guidelines of CDC.

Prepared by

Ms. L.Priya,
Assistant Professor,
Department of Mathematics,
P.K.R. Arts College for Women,
127, Pariyur Road,
Gobichettipalayam.

Approved by

Chair Person
Mrs. R.Jayalakshmi,
Assistant Professor & Head,
Department of Mathematics,
P.K.R. Arts College for Women,
127, Pariyur Road,
Gobichettipalayam.

LIST OF OPEN ELECTIVE COURSES

Course Code	Department	Course	Evaluation	Credits
25TAPOE1	Department of Tamil	Nju;T Nehf;fpy; jkpo; ,yf;fpa tuyhW	Both CIA and ESE	2
25ENPOE1	Department of English	English for Career Development		
25MAPOE1	Department of Mathematics	Mathematical Aptitude for Competitive Examinations		
25PHPOE1	Department of Physics	Environmental Physics		
25CAPOE1	Department of Computer Science	Green Computing		
25CGPOE1	Department of Commerce	Applied E-Commerce		
25BAPOE1	Department of Management	AGRI- PRENEURSHIP		

II . CO-SCHOLASTIC COURSES:

a) VALUE ADDED COURSES:

Semester	Course Code	Course Title	Contact Hours / week	Exam Duration Hours	Max. Marks @ annual Exam				
					Aptitude	Resume writing	Self Intro	Verbal	Total
Course to be taught after regular hours									
Value Added Course I									
Semester I	25VAP1	ABSTRACT REASONING AND INTERPERSONAL COMMUNICATION	2	-	-	-		-	
Semester II			2	3	25	25	25	25	100
Value Added Course II									
Semester III	25VAP2	QUANTITATIVE LITERACY	2	-	-	-		-	
Semester IV			2	3	25	25	25	25	100
						TOTAL	**200**		

b) COURSES WITH CREDIT TRANSFERABILITY

c) EXTRA CREDIT COURSES (Self-study courses)

1. Courses offered by parent department for ALL STUDENTS OF THE PROGRAMME
2. Courses offered by parent department for ADVANCED LEARNERS OF THE PROGRAMME
3. Courses offered in a department under PART-III for STUDENTS OF OTHER PROGRAMMES – Inter-disciplinary courses
4. Credit transferability for Disciplinary / Inter-disciplinary / Trans-disciplinary / General courses offered in UGC SWAYAM MOOCS
5. Comprehension Courses

List of courses offered for ADVANCED LEARNERS ONLY (Self-study)

Course Code	Department	Courses offered for ADVANCED LEARNERS ONLY
25MAALP1	Department of Mathematics	1) **ANALYTIC NUMBER THEORY**
25MAALP2		2) **QUANTITATIVE TECHNIQUES**
25MAALP3		3) **COMMUTATIVE ALGEBRA**
25MAALP4		4) **PROBABILITY AND STATISTICS**

CO-SCHOLASTIC COURSES:

The co-scholastic courses are non-credit and are only counted for the final grading and ranking. However for the award of the degree, completion of co-scholastic courses (Value-added Courses) is also MANDATED.

Course Code	Category and Course Title		Marks	Credits
25VAP1	VALUE ADDED COURSE - I	ABSTRACT REASONING AND INTERPERSONAL COMMUNICATION	100	
25VAP2	VALUE ADDED COURSE - II	QUANTITATIVE LITERACY	100	

NOTE:

a). **Credit Transferability:** Course(s) from UGC SWAYAM MOOCS can be completed by students and the credits earned can be transferred under PART-III/PART-IV/PART-V: ANY SEMESTER. (Refer guidelines under other components).

b). Extra Credit Course(s):

A student who is interested shall take up any course(s) (one or many, PART-III only) and earn extra credits. There are FOUR categories in this:

(a). Courses offered by parent department for ALL STUDENTS

(b). Courses offered by parent department for ADVANCED LEARNERS

Course Code	Department	Courses offered for ADVANCED LEARNERS ONLY
25MAALP1	Department of Mathematics	➢ **ANALYTIC NUMBER THEORY**
25MAALP2		➢ **QUANTITATIVE TECHNIQUES**
25MAALP3		➢ **COMMUTATIVE ALGEBRA**
25MAALP4		➢ **PROBABILITY AND STATISTICS**

(c) Courses offered under PART-III in other programmes

(d) General Courses in SWAYAM MOOCS

SYLLABUS

(For students admitted from 2025-2026 & onwards)

SEMESTER - I

Category	Component	Course Code	Course Title	Contact Hours/ Semester	Credits
PART III	**CORE : I**	**25MAP01**	**ADVANCED ALGEBRA**	**72**	**5**

Contact Hours per Week: 6

Year	Semester	Internal Marks	External Marks	Total Marks
I	**I**	**25**	**75**	**100**

PREAMBLE :

To enable the students to learn and gain knowledge about algebraic structures, theory of groups, rings, fields and linear transformations.

COURSE OUTCOME:

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

COs	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Recall the basic definitions in theory of Groups, Rings, Fields and linear transformations.	**K_1**
CO2	Identify the difference between algebraic and transcendental extensions and to find the minimal polynomial for algebraic elements over a field.	**K_2**
CO3	Apply the concept of Groups, Rings, Fields and linear transformations to find the dimensions.	**K_3**
CO4	Analyze the results in Groups, Rings, Fields and linear transformations.	**K_4**
CO5	Evaluate the problems using permutations, polynomials and linear transformations	**K_5**
CO6	Create some examples in Groups, Rings, Fields and linear transformations.	**K_6**

K_1 - Remember; K_2 – Understand; K_3 - Apply; K_4 - Analyze; K_5 – Evaluate; K_6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	9	9	9	9	9	9	3
CO2	9	9	9	9	9	9	3
CO3	9	9	9	9	3	3	3
CO4	9	9	9	9	1	1	1
CO5	9	9	3	3	0	0	0
CO6	9	9	3	0	0	0	0
Total Contribution of COs to POs	54	54	42	39	22	22	10
Weighted Percentage of COs contribution to POs	4.12	4.14	3.31	3.19	3.18	3.17	2.02

Level of Correlation: 0-No Correlation; 1-Low Correlation; 3-Medium Correlation; 9-High Correlation between CO's and PO's.

COURSE CONTENT:

UNIT- I GROUP THEORY (15 Hours)

Another counting principle – Sylow's theorem .

UNIT- II RING THEORY (15 Hours)

Euclidean rings – A particular Euclidean ring – Polynomial rings – Polynomials over the rational field.

UNIT- III FIELDS (15 Hours)

Extension Fields – Roots of polynomials.

UNIT -IV FIELDS (Continuation) (15 Hours)

Elements of Galois theory – Finite Fields.

UNIT- V LINEAR TRANSFORMATIONS (12 Hours)

Canonical forms: Triangular form – Trace and Transpose – Hermitian, unitary and normal Transformations.

TEXT BOOK:

Herstein.I.N (Reprint 2017)– "Topics in Algebra", 2nd Edition, Wiley Indian Pvt.Ltd, New Delhi-110002.

UNIT	CHAPTER	SECTION
I	II	2.11 ,2.12
II	III	3.7 to 3.10
III	V	5.1,5.3
IV	V VII	5.6 7.1.
V	VI	6.4, 6.8 and 6.10

REFERENCE BOOKS:

1. Fraleigh.J.B.(2003) – "A I Course in Abstract Algebra",3rd Edition Narosa Publishing House, New Delhi.
2. Artin.M (1991)– "Algebra", Prentice-Hall, Englewood Cliff.
3. Hungerford.T.W.(1974) – "Algebra", Springer, New York.

WEB REFERENCES:

1.https://youtu.be/_PFLMe3TASQ
2.https://youtu.be/wKdYjOYqYGM
3.https://en.m.wikipedia.org/wiki/Sylow_theorems#:~:text=In%20mathematics%2C%20specifically%20in%20the,a%20given%20finite%20group%20contains.
4.https://youtu.be/GrxybUy3UrU

Category	Component	Course Code	Course Title	Contact Hours/ Semester	Credits
PART III	**CORE : II**	**25MAP02**	**REAL ANALYSIS**	**72**	**5**

Contact Hours per Week: 6

Year	Semester	Internal Marks	External Marks	Total Marks
I	**I**	**25**	**75**	**100**

PREAMBLE :

To enable the students to learn and gain knowledge about Riemann Stieltjes Integral, Sequence and Series of functions and Functions of Several Variables.

COURSE OUTCOME:

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

COs	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Recall the definitions of lower and upper bound, Riemann Stieltjes Integral, point wise , uniform convergence, equi-continuous families of functions, dimension, vector space, invertible operators and determinants.	**K_1**
CO2	Demonstrate the basic concepts of the series of real numbers, necessary conditions of R.S. integral, uniform convergence, uniformly closed algebra, uniform closure, linear transformation and differentiation of integrals.	**K_2**
CO3	Apply the necessary conditions of R.S. Integral, the concepts of Uniform convergence, solution of integrals, linear transformations for finding the solution of integrals convergence criteria of a certain function and dimensions respectively.	**K_3**
CO4	Analyze the concept of Riemann Stieltjes Integral sequence and series of functions, functions of several variables.	**K_4**
CO5	Evaluate the problems based on Riemann Stieltjes integral, sequence and series of functions and Derivatives of Higher Order.	**K_5**
CO6	Construct the necessary conditions of R.S. Integral, Generalisation of Stone-Weierstrass theorem and functions of several variables.	**K_6**

K_1 - Remember; K_2 – Understand; K_3 - Apply; K_4 - Analyze;
K_5 – Evaluate ; K_6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	9	9	9	9	3	1	1
CO2	9	9	9	9	1	2	1
CO3	9	9	9	9	3	2	1
CO4	9	9	9	9	3	1	1
CO5	9	9	9	9	3	2	1
CO6	9	9	9	9	3	2	1
Total Contribution of COs to POs	54	54	54	54	16	10	6
Weighted Percentage of COs contribution to POs	4.12	4.14	4.26	4.42	2.32	1.44	1.21

Level of Correlation: 0-No Correlation; 1-Low Correlation; 3-Medium Correlation; 9-High Correlation between CO's and PO's.

COURSE CONTENT:

UNIT- I THE RIEMANN STIELTJES INTEGRAL (15 Hours)

Definition and Existence of the Integral –Properties of the integral –Integration and Differentiation.

UNIT- II SEQUENCE AND SERIES OF FUNCTIONS (15 Hours)

Uniform convergence - Uniform convergence and continuity –Uniform convergence and integration .

UNIT- III SEQUENCE AND SERIES OF FUNCTIONS (Continued…) (15 Hours)

Uniform convergence and differentiation –Equicontinuous families of functions – The Stone Weirstrass theorem.

UNIT- IV FUNCTIONS OF SEVERAL VARIABLES (15 Hours)

Linear transformation –Contraction principle.

UNIT- V FUNCTIONS OF SEVERAL VARIABLES (Continued…) (12 Hours)

Inverse function theorem –Implicit function theorem – Determinants – Differentiation of Integrals.

TEXT BOOKS:

Walter Rudin–(2017) "Principles of Mathematical Analysis", Third edition, McGraw Hill Education Pvt.ltd, New York.

UNIT	CHAPTER	PAGE NUMBER
I	6	121-134
II	7	143-152
III	9	152-165
IV	9	204-211, 220-221
V	9	221-228, 231-238

REFERENCE BOOKS:

1. Robert G.Bartle and Donald R.Sherbert (2010), Third Edition,"Introduction to Real Analysis", John Wiley and sons.
2.S.C.Malik, Savitha Arora (2012),"Mathematical Analysis", Fourth Edition, New Age International Private Ltd, Publishers, New Delhi.

WEB REFERENCES:

1.https://ocw.mit.edu/courses/mathematics/18-100c-real-analysis-fall-2012/
2.http://ramanujan.math.trinity.edu/wtrench/texts/TRENCH_REAL_ANALYSIS.PDF
3.http://www.math.louisville.edu/~lee/RealAnalysis/

Category	Component	Course Code	Course Title	Contact Hours/ Semester	Credits
PART III	**CORE : III**	**25MAP03**	**ORDINARY DIFFERENTIAL EQUATIONS**	**72**	**4**

Contact Hours per Week: 6

Year	Semester	Internal Marks	External Marks	Total Marks
I	**I**	**25**	**75**	**100**

PREAMBLE :

To enable the students to learn various methods to solve systems of linear differential equations and non-linear initial value problems.

COURSE OUTCOME:

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

COs	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Recall the fundamental concepts of power series solution, existence and uniqueness of solutions of systems of linear differential equations and non linear IVPs.	**K_1**
CO2	Explain series solutions, existence and uniqueness results, oscillations of equations.	**K_2**
CO3	Apply the various methods to solve linear differential equations.	**K_3**
CO4	Analyze the applicability of the results in systems of linear differential equations and the oscillations of second order differential equations.	**K_4**
CO5	Determine the power series solutions, the solutions of systems of linear differential equations and oscillations of second order differential equations.	**K_5**
CO6	Formulate the research problem into a model by using differential equations.	**K_6**

K_1 - Remember; K_2 – Understand; K_3 - Apply; K_4 - Analyze; K_5 – Evaluate; K_6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	9	9	9	9	9	9	3
CO2	9	9	9	9	9	9	3
CO3	9	9	9	9	9	9	3
CO4	9	9	9	9	3	3	3
CO5	9	9	9	9	3	3	1
CO6	9	9	9	9	3	3	1
Total Contribution of COs to POs	54	54	54	54	36	36	14
Weighted Percentage of COs contribution to POs	4.12	4.14	4.26	4.42	5.21	5.18	2.82

Level of Correlation: 0-No Correlation; 1-Low Correlation; 3-Medium Correlation; 9-High Correlation between CO's and PO's.

COURSE CONTENT:

UNIT- I: SOLUTIONS IN POWER SERIES (15 Hours)

Second order linear equations with ordinary points – Legendre equation and Legendre polynomials – Second order equations with regular singular points – Bessel function

UNIT- II: SYSTEMS OF LINEAR DIFFERENTIAL EQUATIONS (15 Hours)

Systems of I order equations – Existence and uniqueness theorem – Fundamental matrix.

UNIT- III: SYSTEMS OF LINEAR DIFFERENTIAL EQUATIONS(contd..)(15 Hours)

Non-homogeneous linear systems – Linear systems with constant coefficients – Linear systems with periodic co-efficients.

UNIT- IV: EXISTENCE AND UNIQUENESS OF SOLUTIONS (15 Hours)

Successive approximations – Picard's theorem - Non-uniqueness of solution – Continuation and dependence on initial conditions, Existence of solutions in the large.

UNIT- V: OSCILLATIONS OF SECOND ORDER EQUATIONS (12 Hours)

Fundamental results – Sturm's comparison theorem – Elementary linear oscillations. Comparison theorem of Hille-Wintner – Oscillations of $x''+a(t)x=0$.

TEXT BOOK:

S.G.Deo,V.Lakshmikanthan and V.Raghavendra "Ordinary Differential Equations", Second Edition- Seventh reprint 2014,Tata McGraw-Hill Publishing company Limited, New Delhi.

UNIT	CHAPTER	SECTION
I	III	3.1 – 3.5
II	IV	4.1 – 4.5
III	IV	4.6 – 4.8
IV	V	5.1 – 5.7
V	VIII	8.1 – 8.5

REFERENCE BOOKS:

1. Coddington.E.A. andLevinson.N., (1955), "Theory of Ordinary Differential Equations", McGraw Hill, New York.
2. George F.Simmons(1974)," Differential Equations with applications And Historical Notes", Tata McGraw Hill, New York.
3. V.Dharmaiah" Introduction to theory of Ordinary Differential Equations", PHI Learning Private Limited.

WEB REFERENCES:

1. https://nptel.ac.in/courses/111/104/111104031/#

2 https://nptel.ac.in/courses/122/107/122107037/

Category	Component	Course Code	Course Title	Contact Hours/ Semester	Credits
PART III	**CORE : IV**	**25MAP04**	**PYTHON PROGRAMMING**	**60**	**3**

Contact Hours per Week: 5

Year	Semester	Internal Marks	External Marks	Total Marks
I	**I**	**25**	**75**	**100**

PREAMBLE :

To enable the students to learn the Python programming concepts like object oriented programming and structured programming. It provides assess to the course outcome describing Python's core data types, lists, dictionaries, execution and applying OOP concepts.

COURSE OUTCOME:

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

COs	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Recall the fundamental concepts of basic features of Python.	**K_1**
CO2	Understand the basics of Python Programming, Operators, Control Statements, functions and data structures.	**K_2**
CO3	Interpret the various concepts of python Programming.	**K_3**
CO4	Analyze the functioning of Python in Operators, Control Statements, functions and data structures.	**K_4**
CO5	Determine the behavior of Python Programming.	**K_5**
CO6	Construct a research platform by Python Programming.	**K_6**

K_1 - Remember; K_2 – Understand; K_3 - Apply; K_4 - Analyze; K_5 – Evaluate; K_6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	9	9	9	9	9	9	9
CO2	9	9	9	9	9	9	9
CO3	9	9	9	9	9	9	9
CO4	9	9	9	9	9	9	3
CO5	9	9	9	9	9	9	3
CO6	9	9	9	9	9	9	3
Total Contribution of COs to POs	54	54	54	54	54	54	36
Weighted Percentage of COs contribution to POs	4.12	4.14	4.26	4.42	7.81	7.77	7.26

Level of Correlation: 0-No Correlation; 1-Low Correlation; 3-Medium Correlation; 9-High Correlation between CO's and PO's.

COURSE CONTENT:

UNIT- I BASICS OF PYTHON PROGRAMMING (12 Hours)

Features of Python – History of Python – Writing and Executing I Python Program – Literal Constants – Variables and Identifiers – Data Types – Input Operation – Comments – Reserved Words – Identation.

UNIT- II OPERATORS AND EXPRESSIONS : (12 Hours)

Operators and Expressions – Expressions in Python – Operations on Strings – Other Data Types – Type Conversion.

UNIT- III DECISION CONTROL STATEMENTS: (12 Hours)

Introduction to Decision Control Statements – Selection/Conditional Branching Statements – Basic Loop Structures/ Iterative Statements – Nested Loops – The Break Statement – The Continue Statement – The Continuous Statement – The Pass Statement – The else Statement used with Loops.

UNIT- IV FUNCTIONS AND MODULES : (12 Hours)

Introduction – Function Definition – Function Call – Variable Scope and Lifetime – The return Statement – Python Strings Revisited : Introduction – Concatenating, Appending and Multiplying Strings – String are Immutable – String Formatting Operator.

UNIT -V DATA STRUCTURES : (12 Hours)

Data Structures : Sequence – Lists – Tuple – Dictionaries.

TEXT BOOK:

Reema Thareja "Python Programming Using Problem Solving Approach", 11th Impression-2021, Oxford Higher Education, New Delhi.

UNIT	CHAPTER	SECTION
I	III	3.1, 3.2, 3.4 - 3.11
II	III	3.12 –3.16
III	IV	4.1– 4.8
IV	V, VI	5.1 – 5.5, 6.1 -6.3
V	VIII	8.1, 8.2.1 – 8.2.6, 8.4.1 - 8.4.9, 8.6.1 - 8.6.5

REFERENCE BOOKS:

1. E.Balaguruswamy, " Introduction to Computing and Problem Solving using Python", McGraw Hill Publications, New Delhi.
2. Mark J.Guzdial and Barbara Ericson, "Introduction to computing and Programming in Python", Pearson India Education Services Pvt Ltd, 4th Edition, 2018.
3. Kenneth A. Lambert, "Fundamentals of Python: I Programme", Cengage publishers, 2nd edition, 2021.

WEB REFERENCES:

1. **https://fliphtml5.com/manzw/rsdl/basic**
2. **https://fliphtml5.com/manzw/rsdl/basic/51-100**
3. **https://nibmehub.com/opac-service/pdf/read/Python%20Programming%20for%20the%20Absolute%20Beginner-%203rd%20Edition.pdf**

Category	Component	Course Code	Course Title	Contact Hours/ Semester	Credits
PART III	**CORE : V ELECTIVE : I**	**25MAP05A**	**NUMERICAL ANALYSIS**	**60**	**3**

Contact Hours per Week: 5

Year	Semester	Internal Marks	External Marks	Total Marks
I	**I**	**25**	**75**	**100**

PREAMBLE :

To enable the students to learn and gain knowledge about numerical integration and Solution of ordinary differential equations.

COURSE OUTCOME:

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

COs	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Recall the basic definitions of numerical differentiation and integration, Numerical Solution of Ordinary differential equations and Partial differential equations.	**K_1**
CO2	Explain the concepts of numerical integration and differentiation, Euler and Modified Euler methods, Runge kutta methods ,Multistep methods, Milne's method, Adams Moulton method .	**K_2**
CO3	Apply the different method to solve the problems on numerical differentiation and integration, Numerical Solution of Ordinary differential equations and Partial differential equations.	**K_3**
CO4	Analyze the numerical solution of Euler and modified Euler method, boundary value problems and characteristic value problems	**K_4**
CO5	Evaluate the problems based on system of equations and partial differential equations	**K_5**
CO6	Construct the problem and find the solution by using Gauss interpolation formulae.	**K_6**

K_1 - Remember; K_2 – Understand; K_3 - Apply; K_4 - Analyze; K_5 – Evaluate; K_6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	9	9	9	9	9	3	3
CO2	9	9	9	9	9	3	3
CO3	9	9	9	9	3	3	3
CO4	9	9	9	3	3	3	0
CO5	3	3	3	3	1	1	1
CO6	3	3	3	1	1	1	1
Total Contribution of COs to POs	42	42	42	34	26	14	11
Weighted Percentage of COs contribution to POs	3.20	3.22	3.31	2.78	3.76	2.01	2.22

Level of Correlation: 0-No Correlation; 1-Low Correlation; 3-Medium Correlation; 9-High Correlation between CO's and PO's.

COURSE CONTENT:

UNIT- I: NUMERICAL DIFFERENTIATION AND INTEGRATION: (10 Hours)

Derivatives from differences tables –Higher order derivatives –Divided difference, Central-Difference formulae –Composite formula of Trapezoidal rule –Romberg integration –Simpson's rules.

UNIT- II: SOLVING SET OF EQUATIONS (10 Hours)

The Elimination method –Gaussian Elimination and Gauss Jordan methods –LU Decomposition method –Matrix inversion by Gauss-Jordan method –Methods of Iteration – Jacobi and Gauss Seidal Iteration –Relaxation method –Systems of Nonlinear equations.

UNIT- III: NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS

(15 Hours)

Taylor series method –Euler and Modified Euler methods –Rungekutta methods – Multistep methods –Milne's method –Adams Moulton method.

UNIT- IV: BOUNDARY VALUE PROBLEMS AND CHARACTERISTIC VALUE PROBLEMS (15 Hours)

The shooting method –solution through a set of equations –Derivative boundary conditions –Characteristic value problems –Eigen values of a matrix by Iteration –The power method.

UNIT- V: NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS (10 Hours)

(Solutions of Elliptic, Parabolic and Hyperbolic partial differential equations)

Types of Partial differential Equations- The Heat equation and the Wave equation-Solving the vibrating string problem-Parabolic equation in Two or Three Dimension – The Wave equation in Two Dimensions.

TEXT BOOK:

Gerald.C.F. and Wheatley.P.O.- (1998 Fifth Edition). "Applied Numerical Analysis", Addison Wesley.

UNIT	Section	Page number
I	5.1-5.8	354-387
II	2.3-2.5 2.10-2.12	123-146 164-177
III	6.1-6.7	448-474
IV	7.1-7.5	525-549
V	8.1-8.6	600-626

REFERENCE BOOKS:

1.Chapra.S.C. and Raymond.P.C. (2000) – " Numerical Methods for Engineers", tata McGraw Hill, New Delhi.
2.Burden.R.L. and Douglas Faires.J. (1989 Fourth Edition) – " Numerical Analysis", P.W.S.Kent Publishing Company, Boston .
3.Sastry.S.S.(1998) – " Introductory methods of Numerical Analysis", Prentice Hall of India, New Delhi.
4.Kandasamy.P.(2003) – "Numerical Methods", S.Chand & Co.Ltd., New Delhi.

WEB REFERENCES:

1. https://youtu.be/5ZArZy3h7T4
2. https://www.slideshare.net/niravbvyas/numerical-methods-oridnary-differential-equations
3. https://youtu.be/UWqVvR8SmDA

Category	Component	Course Code	Course Title	Contact Hours/ Semester	Credits
PART III	**CORE : V ELECTIVE : I**	**25MAP05B**	**OPTIMIZATION TECHNIQUES**	**60**	**3**

Contact Hours per Week: 5

Year	Semester	Internal Marks	External Marks	Total Marks
I	**I**	**25**	**75**	**100**

PREAMBLE :

To enable the students to learn and gain knowledge about Network Scheduling, Games and Strategies, various kinds of Simulations, Queuing theory and decision analysis.

COURSE OUTCOME:

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

COs	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Recall the definitions of Activities, Players, Payoff Matrix, Value of the Game, Poisson process, Simulation Models, Network Scheduling and decision tree.	**K_1**
CO2	Explain the concepts of Activities, Players, Payoff Matrix and Value of the Game, queuing system, Simulation Models, Network Scheduling and decision making environment.	**K_2**
CO3	Apply the concepts of the Maximin or Minimax Principles, queuing models, simulation models, Network scheduling, decision under uncertainty.	**K_3**
CO4	Compare the concepts of Pure Strategies, Mixed Strategies, Looping, Dangling, decision making environments, queuing systems.	**K_4**
CO5	Evaluate the problems based on Games and strategies, Critical Path, Event – Type Simulation, decision under risk, Poisson queuing systems.	**K_5**
CO6	Construct the Network and Critical Path ,Formulate Games and strategies	**K_6**

K_1 - Remember; K_2 – Understand; K_3 - Apply; K_4 - Analyze; K_5 – Evaluate; K_6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	9	9	9	9	9	3	3
CO2	9	9	9	9	9	3	3
CO3	9	9	9	9	3	3	3
CO4	9	9	9	3	3	3	0
CO5	3	3	3	3	1	1	1
CO6	3	3	3	1	1	1	1
Total Contribution of COs to POs	42	42	42	34	26	14	11
Weighted Percentage of COs contribution to POs	3.20	3.22	3.31	2.78	3.76	2.01	2.22

Level of Correlation: 0-No Correlation; 1-Low Correlation; 3-Medium Correlation; 9-High Correlation between CO's and PO's.

COURSE CONTENT:

UNIT- I: GAMES AND STRATEGIES (10 Hours)

Games and Strategies – Introduction – Two – Person Zero – Sum Games – Some Basic Terms – The Maximin – Minimax Principle – Games Without Saddle Points – Mixed Strategies – Graphical solution of 2xn and mx2 games.

UNIT- II: QUEUING THEORY (14 Hours)

Queuing Theory : General Concepts and Definitions – Classification of queues – Poisson Process, Properties of Poisson Process – Queuing Models: 1.(M/M/1):(∞/FCFS), 2. (M/M/1):(N/FCFS), 3. (M/M/c):(∞/FCFS).

UNIT- III: SIMULATION (10 Hours)

Simualtion – Introduction – Why Simualtion? – Process of Simualtion – Simualtion Models - Event – Type Simualtion - Generation of Random Numbers – Monte-Carlo simulation.

UNIT – IV: NETWORK SCHEDULING (14 Hours)

Network Scheduling by PERT/CPM – Introduction – Network: Basic Components – Logical Sequencing – Rules of Network Construction - Concurrent Activities - Critical Path Analysis – Probability considerations in PERT - Distinction between PERT and CPM.

UNIT-V: DECISION ANALYSIS (12 Hours)

Decision making environment – Decisions under uncertainty – Decision under risk – Decision – Tree Analysis.

TEXT BOOK:

Kantiswarup, P. K. Gupta, Man Mohan (2017) –" Operations Research", 18th Revised edition, S. Chand & Sons Education Publications, New Delhi.

UNIT	Section	Page number
I	**17.1 – 17.6**	**443-456**
II	21.1-21.10	**589-621**
III	**22.1 – 22.7**	**639-646**
IV	**25.1 – 25.8**	**763-791**
V	**16.1-16.7**	**415-435**

REFERENCE BOOKS:

1. Dharani Venkata Krishnan .S – " Operations Research Principles and Problems" Keerthi publishing house PVT Ltd.
2. Prem Kumar Gupta D. S. Hira – "Operations Research " , S. Chand & Company Ltd, Ram Nagar, New Delhi.

Category	Component	Course Code	Course Title	Contact Hours/ Semester	Credits
PART III	**CORE : VI PRACTICAL**	**25MAP06**	**PROGRAMMING IN PYTHON - PRACTICAL**	**24**	**1**

Contact Hours per Week: 2

Year	Semester	Internal Marks	External Marks	Total Marks
I	**I**	**40**	**60**	**100**

PREAMBLE :

To enable the students to learn and gain knowledge about Python programming language.

COURSE OUTCOME:

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

COs	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Recall the basic concepts of Python language to solve the mathematical problems	**K_1**
CO2	Illustrate Python language to get the solution of mathematical concepts	**K_2**
CO3	Applying Python programming to get the execation of mathematical problems	**K_3**
CO4	Examine the coding of Python software in cheating the classes and objects, Correlation coefficient Probability Measres of Central tendency, temperature conversion, finding roots ,R-K method, Ordinary differential equations and distance calculation	**K_4**
CO5	Assess the Python software to find the solution of mathematical problems	**K_5**
CO6	Develop the Python software to solve the mathematical problems	**K_6**

K_1 - Remember; K_2 – Understand; K_3 - Apply; K_4 - Analyze; K_5 – Evaluate; K_6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	9	9	9	9	9	9	9
CO2	9	9	9	9	9	9	9
CO3	9	9	9	9	9	9	9
CO4	9	9	9	9	9	9	3
CO5	9	9	9	9	9	9	3
CO6	9	9	9	9	9	9	3
Total Contribution of COs to POs	54	54	54	54	54	54	36
Weighted Percentage of COs contribution to POs	4.12	4.14	4.26	4.42	7.81	7.77	7.26

Level of Correlation: 0-No Correlation; 1-Low Correlation; 3-Medium Correlation; 9-High Correlation between CO's and PO's.

LIST OF PROGRAMS

All the following listed programs have to be executed and recorded

1. Write a program to create a class and object in Python.
2. Write a program to find correlation coefficient between the variables.
3. Write a program to find the probability of a prime number appearing when a 21 sided die is rolled.
4. Write a program to find standard deviation for the given set of values.
5. Write a program to calculate the mean, median and mode using Python.
6. Write a program to convert temperature from Celcius to Fahrenheit and vice versa.
7. Write a program for finding the roots of quadratic function.
8. Write a program to solve the initial value problem using Runge - Kutta method.
9. Write a program to solve ordinary differential equation using Python.
10. Write a Python program to calculate distance between two points using latitude and longitude.

WEB REFERENCES:

1. https://www.tutorialgateway.org/python-program

2. https://realpython.com/python-math-module/

3. https://www.geeksforgeeks.org/mathematical-functions-python-set-1-numeric-functions/

4. https://www.udemy.com/course/math-with-python/

SEMESTER – II

Category	Component	Course Code	Course Title	Contact Hours/ Semester	Credits
PART III	CORE VII	25MAP07	COMPLEX ANALYSIS	72	5

Contact Hours per Week: 6

Year	Semester	Internal Marks	External Marks	Total Marks
I	II	25	75	100

PREAMBLE :

To enable the students to learn the concepts of analytic function.

COURSE OUTCOME:

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

COs	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Recall the results in conformal mapping, complex integration and series and product developments.	K_1
CO2	Explain the concepts of analytic functions, Cauchy's theorem, Cauchy's integral formula, power series expansion and mapping.	K_2
CO3	Apply the theorems and results to solve problems involving complex functions.	K_3
CO4	Analyze the local properties, zeros, power series expansion for analytic functions and conformal mapping.	K_4
CO5	Determine the power series expansion, convergence of infinite products of an analytic function and residues.	K_5
CO6	Construct the series and product development of complex functions.	K_6

K_1 - Remember; K_2 – Understand; K_3 - Apply; K_4 - Analyze; K_5 – Evaluate; K_6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	9	9	9	9	9	3	3
CO2	9	9	9	9	9	3	3
CO3	9	9	9	9	3	3	3
CO4	9	9	9	9	3	3	3
CO5	9	9	9	9	3	1	1
CO6	9	9	9	9	1	0	0
Total Contribution of COs to POs	54	54	54	54	28	13	13
Weighted Percentage of COs contribution to POs	4.12	4.14	4.26	4.42	4.05	1.87	2.62

Level of Correlation: 0-No Correlation; 1-Low Correlation; 3-Medium Correlation; 9-High Correlation between CO's and PO's.

COURSE CONTENT:

UNIT- I: INTRODUCTION TO THE CONCEPT OF ANALYTIC FUNCTION **(20 Hours)**

Limits and continuity – Analytic functions – Polynomials – Rational functions. Conformality: Arcs and closed curves – Analytic functions in regions – Conformal Mapping – Length and Area – Linear Transformations: The Linear group – The Cross ratio – Elementary Riemann Surfaces.

UNIT- II: COMPLEX INTEGRATION **(20 Hours)**

Line Integrals - Rectifiable Arcs – Line Integrals as Functions of Arcs – Cauchy's theorem for a rectangle - Cauchy's theorem in a disk- Cauchy's Integral formula: The Index of a point with respect to a closed curve – The Integral formula – Higher derivatives - Removable singularities, Taylor's Theorem – Zeros and Poles – The Local Mapping– The Maximum principle – Chains and cycles.

UNIT- III: THE CALCULUS OF RESIDUES **(10 Hours)**

The Residue theorem – The Argument principle – Harmonic functions: Definitions and basic Properties – The Mean value property – Poisson's Formula.

UNIT- IV: SERIES AND PRODUCT DEVELOPMENTS **(12 Hours)**

Weierstrass's Theorem – The Taylor Series – The Laurent Series – Partial fractions and Factorization: Partial Fractions – Infinite Products – Canonical Products.

UNIT- V: MAPPING THEOREM **(10 Hours)**

The Riemann Mapping Theorem: Statement and Proof – Boundary Behaviour – Use of the reflection principle – Analytic Arcs – Conformal mapping of Polygons: The Behaviour at an angle – The Schwarz – Christoffel Formula – Mapping on a rectangle.

Riemann Surfaces and Topological Data Analysis in Industry 5.0

TEXT BOOK:

Ahlfors L.V. – (2014), "Complex Analysis", 4th Reprint, McGraw Hill Education (India) Pvt.Ltd, New York.

UNIT	CHAPTER	SECTION
I	2	1.1 – 1.4
	3	2.1 – 2.4, 3.1, 3.2 and 3.4
II	4	1.1 – 1.5, 2.1 – 2.3, 3.1 - 3.4,4.1
III	4	5.1 – 5.2, 6.1 – 6.3
IV	5	1.1 – 1.3, 2.1 – 2.3
V	6	1.1 – 1.4, 2.1 – 2.3

REFERENCE BOOK:

RuelV.Churchill(1990) – "Complex Variables and Applications", Fifth Edition, McGraw – Hill International Editions**.**

WEB REFERENCES:

1.https://www.coursera.org/learn/complex-analysis
2.https://complex-analysis.com/
3.https://mathworld.wolfram.com/ComplexAnalysis.html

Category	Component	Course Code	Course Title	Contact Hours/ Semester	Credits
PART III	**CORE : VIII**	**25MAP08**	**PARTIAL DIFFERENTIAL EQUATIONS**	**60**	**4**

Contact Hours per Week: 5

Year	Semester	Internal Marks	External Marks	Total Marks
I	**II**	**25**	**75**	**100**

PREAMBLE :

To enable the students to learn and gain knowledge about initial and boundary- value problems, Methods for solving Partial Differential Equations.

COURSE OUTCOME:

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

COs	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Recall the basic concepts and various types of second order PDE.	**K_1**
CO2	Discuss the classification of second order PDE, Cauchy problem, existence and uniqueness results of initial boundary – value problems, methods to find Green's function.	**K_2**
CO3	Apply the method of separation of variables, method of characteristics, Green's function to solve initial boundary – value problems.	**K_3**
CO4	Analyze the general solutions, existence and uniqueness of solutions of initial boundary – value problems.	**K_4**
CO5	Determine the solutions of second order liner PDE.	**K_5**
CO6	Formulate physical problems as PDE and construct the solutions.	**K_6**

K_1 - Remember; K_2 – Understand; K_3 - Apply; K_4 - Analyze; K_5 – Evaluate; K_6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	9	9	9	9	9	9	3
CO2	9	9	9	9	9	9	3
CO3	9	9	9	9	9	9	3
CO4	9	9	9	9	3	3	1
CO5	9	9	9	9	3	3	1
CO6	9	9	9	9	3	3	1
Total Contribution of COs to POs	54	54	54	54	36	36	12
Weighted Percentage of COs contribution to POs	4.12	4.14	4.26	4.42	5.21	5.18	2.42

Level of Correlation: 0-No Correlation; 1-Low Correlation; 3-Medium Correlation; 9-High Correlation between CO's and PO's.

COURSE CONTENT:

UNIT- I: MATHEMATICAL MODEL (12 Hours)

The Classical equation – The vibrating string – The vibrating membrane – Conduction ofheat in solids. Classification of second order equations: Second order equations in two independent variables – Cannonical forms – Equations with constant coefficients – General solution.

UNIT –II: THE CAUCHY PROBLEM (12 Hours)

The Cauchy problem – Cauchy – Kowlalewskaya theorem –Homogeneous wave equation – Initial – Boundary value problems – Non-homogeneous boundary conditions – Non-homogeneous wave equation.

UNIT- III: METHOD OF SEPARATION OF VARIABLES (12 Hours)

Separation of variables – The vibrating string problem – Existence and Uniqueness of solution of the vibrating string problem. The heat conduction problem – Existence and uniqueness of solution of the heat conduction problem – The Laplace and beam equations.

UNIT –IV: BOUNDARY VALUE PROBLEMS (12 Hours)

Boundary value problems – Maximum and minimum principles – Uniqueness and continuity theorems – Dirichlet problems for a circle – Dirichlet problems for a circular annulus – Neumann problem for a circle Drirchlet problem for a rectangle.

UNIT- V: GREEN'S FUNCTIONS (12 Hours)

The Dirac delta function – Properties of Green's function – Method of Green's functions –Dirichlet problem for the Laplace operator – Method of images – Method of Eigen functions.

TEXT BOOK:

TynMyint. U with Lokenath Debnath (2017) – "Linear Partial Differential Equations for Scientists and Engineers", 4th Edition , Birkhusar Boston, New York.

UNIT	CHAPTER	SECTION
I	III IV	3.1 – 3.5 (omit 3.4) 4.1 – 4.4
II	V	5.1 – 5.5, 5.7
III	VII	7.1 – 7.6
IV	IX	9.1 – 9.7
V	XI	11.1 – 11.8 (omit 11.6)

REFERENCE BOOKS

1. Evans.L.C., (2013) – "Partial Differential Equations", AMS, Providence, R I.
2. Sneddon.I.N. (1957) - "Elements of Partial Differential Equations", McGraw Hill, London.

WEB REFERENCES:

1. https://www.youtube.com/watch?v=bPPWp65qpIA
2. https://www.youtube.com/watch?v=BmTFbUAOeec&list=PLGCj8f6sgswntUil8yzohR_
3. https://nptel.ac.in/courses/111/104/111104031/#

Category	Component	Course Code	Course Title	Contact Hours/ Semester	Credits
PART III	CORE : IX	25MAP09	MEASURE THEORY AND INTEGRATION	60	4

Contact Hours per Week: 5

Year	Semester	Internal Marks	External Marks	Total Marks
I	II	25	75	100

PREAMBLE :

To enable the students to learn and gain knowledge about the concepts of measurable sets and measurable spaces.

COURSE OUTCOME:

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

COS	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Recall the concepts of Lebesgue measure in integration, differentiation of measurable sets and product measures.	K_1
CO2	Explain the properties of Lebesgue measurable sets and product measures.	K_2
CO3	Apply the Lebesgue measure, integration, differentiation, product measure in measurable sets.	K_3
CO4	Analyze the integration and differentiation of measurable functions over general measure spaces, measurable sets and product measures.	K_4
CO5	Evaluate the Lebesgue measure , Lebesgue Integration, Lebesgue Differentiation and product Measures.	K_5
CO6	Construct the measurability of Lebesgue measure in integration, differentiation and in product measures.	K_6

K_1 - Remember; K_2 – Understand; K_3 - Apply; K_4 - Analyze;
K_5 – Evaluate; K_6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	9	9	9	9	3	3	3
CO2	9	9	9	9	3	3	3
CO3	9	9	9	9	3	3	3
CO4	9	9	9	9	3	3	3
CO5	9	9	9	9	3	3	1
CO6	9	9	9	9	3	1	0
Total Contribution of COs to POs	54	54	54	54	18	16	13
Weighted Percentage of COs contribution to POs	4.12	4.14	4.26	4.42	2.60	2.30	2.62

Level of Correlation: 0-No Correlation; 1-Low Correlation; 3-Medium Correlation; 9-High Correlation between CO's and PO's.

COURSE CONTENT:

UNIT- I: LEBESGUE MEASURE (12 Hours)

Introduction – Lebesgue Outer Measure – The σ - Algebra of Lebesgue Measurable Sets – Outer and Inner Approximation of Lebesgue Measurable Sets – Countable Additivity, Continuity and the Borel–Cantelli Lemma.

UNIT –II: LEBESGUE INTEGRATION (12 Hours)

The Riemann Integral – The Lebesgue Integral of a Bounded Measurable Function over a Set of Finite Measure – The Lebesgue Integral of a Measurable Nonnegative Function –The General Lebesgue Integral.

UNIT –III: DIFFERENTIATION AND INTEGRATION (12 Hours)

Continuity of Monotone Functions – Differentiability of Monotone Functions: Lebesgue's Theorem – Functions of Bounded Variations: Jordan's Theorem.

UNIT- IV: INTEGRATION OVER GENERAL MEASURE SPACES (12 Hours)
Measurable Functions – Integration of Nonnegative Measurable Functions– The Radon–Nikodym Theorem.

UNIT- V: THE CONSTRUCTION OF PARTICULAR MEASURES (12 Hours)
Product Measures: The Theorems of Fubini and Tonelli.

TEXT BOOK :

H.L. Royden, P.M. Fitzpatrick (2014) - "Real Analysis", 4th Edition, PHI Learning Private Limited, Delhi.

UNITS	CHAPTER	SECTIONS	PAGE No
I	2	2.1–2.5	29-47
II	4	4.1–4.4	68-89
III	6	6.1–6.3	107-118
IV	18	18.1–18.2, 18.4	359-371, 381-385
V	20	20.1	414-422

REFERENCE BOOKS :

1. Bartle R.G (1976) - "Elements of Real Analysis", 2nd Edition, John Wiley and Sons, New York.
2. RudinW(1986) - "Real and complex Analysis" , 3rd Edition,McGraw– Hill, New York.
3. Tom M.Apostal(2002)- "Mathematical Analysis" , 2nd Edition , Narosa Publishing House, New Delhi.

WEB REFERENCES:

1. http://users.metu.edu.tr/eduard/TEACH/GC/MeasureTheory_II/MTLI.pdf
2. https://library.oapen.org/bitstream/id/ce19d94d-b8b6-420f-9e69-d9f565703c26/1007045.pdf
3. https://www.whitman.edu/Documents/Academics/Mathematics/2017/Wang.pdf
4. https://www.uio.no/studier/emner/matnat/math/MAT2400/v11/RealAnalCh4.pdf

Category	Component	Course Code	Course Title	Contact Hours/ Semester	Credits
PART III	CORE : X	25MAP10	DIFFERENTIAL GEOMETRY	60	4

Contact Hours per Week: 5

Year	Semester	Internal Marks	External Marks	Total Marks
I	II	25	75	100

PREAMBLE:

To enable the students to learn and gain knowledge about the space curves, fundamental forms and geodesic on a surface.

COURSE OUTCOME:

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

COs	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Recollect the basic concepts of theory of space curves and surfaces	K_1
CO2	Explain the fundamental ideas in differential geometry	K_2
CO3	Use the formulae and theoretical ideas of differential geometry in distinct curvatures.	K_3
CO4	Analyze the nature of space curves on various surfaces, intrinsic and non-intrinsic properties and Geodesics	K_4
CO5	Evaluate the problems on theory of space curve, Fundamental forms , intrinsic and non-intrinsic properties and Geodesics	K_5
CO6	Construct the various cuve Equations ,Fundamental Equations of Surface Theory, Gauss quationsWeingarten equations and Mainardi-Codazzi equations	K_6

K_1 - Remember; K_2 – Understand; K_3 - Apply; K_4 - Analyze; K_5 – Evaluate; K_6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	9	9	9	9	3	9	9
CO2	9	9	9	9	3	9	9
CO3	9	9	9	9	3	9	9
CO4	9	9	9	9	3	3	3
CO5	9	9	9	9	3	3	3
CO6	9	9	9	9	0	3	0
Total Contribution of COs to POs	54	54	54	54	15	36	33
Weighted Percentage of COs contribution to POs	4.12	4.14	4.26	4.42	2.17	5.18	6.65

Level of Correlation: 0-No Correlation; 1-Low Correlation; 3-Medium Correlation; 9-High Correlation between CO's and PO's.

COURSE CONTENT:

UNIT –I: THEORY OF SPACE CURVES (15 Hours)

Introduction – Representation of space curves – Unique parametric representation of a space curve – Arc-length – Tangent and osculating plane – Principle normal and binormal – Curvature and torsion –Contact between curves and surfaces.

UNIT- II: THEORY OF SPACE CURVES (CONTINUATION) (15 Hours)

Osculating circle and osculating sphere – Locus of centre of spherical curvature – Tangent surfaces – Involutes and Evolutes –Spherical indicatrix- Intrinsic equations of space curves – Fundamental existence theorem for space curves.

UNIT- III: THE I FUNDAMENTAL FORM (10 Hours)

The I fundamental form – Local intrinsic properties of a surface: Introduction - Definition of a surface – Nature of points on a surface – Representation of a surface – Curves on surfaces –Metric on a surface –The I fundamental form– Families of curves – Orthogonal trajectories – Double family of curves.

UNIT –IV: THE SECOND FUNDAMENTAL FORM (10 Hours)

The Second Fundamental form and local non-intrinsic properties of a surface: Introduction –The Second fundamental form-Classification of points on a surface-Principal curvatures- Lines of curvature.

UNIT- V: GEODESIC ON A SURFACE (10 Hours)

Normal property of Geodesics –Gaussian curvature-The Fundamental Equations of Surface Theory: Introduction – Tensor notations –Gauss equations –Weingarten equations-Mainardi-Codazzi equations.

TEXT BOOK:

Somasundaram.D (2010)– "Differential Geometry", Fourth Reprint, Narosa Publishing House Pvt. Ltd., Chennai.

UNIT	CHAPTER	SECTION
I	I	1.1 - 1.7, 1.10
II	I	1.11 - 1.13 , 1.15 – 1.17
III	II	2.1 - 2.5, 2.9-2.13
IV	IV	4.1 - 4.5
V	III	3.5, 3.12, 5.1-5.5

WEB REFERENCES:

1. https://youtu.be/qQr1aTNwwuU

2.https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwijzNC0jZfzAhXk4jgGHZkHDsgQFnoECBkQAQ&url=https%3A%2F%2Fwww.slideserve.com%2Ffawn%2Fdifferential-geometry-for-curves-and-surfaces&usg=AOvVaw01NT_DiB3ovtmR77udV3Tv

3.https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwiMg_LyjZfzAhXBwjgGHb_oCTcQwqsBegQIKhAB&url=https%3A%2F%2Fwww.youtube.com%2Fwatch%3Fv%3D4fB0VfKZRXM&usg=AOvVaw2uIMJy-UceDwNTEsBVPKuA

Category	Component	Course Code	Course Title	Contact Hours/ Semester	Credits
PART III	CORE : XI ELECTIVE : II	25MAP11A	PROBABILITY THEORY	60	3

Contact Hours per Week: 5

Year	Semester	Internal Marks	External Marks	Total Marks
I	II	25	75	100

PREAMBLE:

To enable the students to learn and gain knowledge about random events, random variable, distribution function and characteristic function.

COURSE OUTCOME:

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

COs	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Recall and explain fundamental concepts of probability	K_1
CO2	Understand and interpret various types of random variables, their distribution functions	K_2
CO3	Apply formulas for expectation, moments, absolute moments, and use inequalities like Chebyshev's in solving problems.	K_3
CO4	Analyze relationships between random variables using regression (first and second type) and moment calculations for random vectors.	K_4
CO5	Evaluate characteristic functions, their properties, and their use in determining distributions, including for multidimensional vectors.	K_5
CO6	Construct and distinguish various discrete and continuous probability distributions to model real-life problems.	K_6

K_1 - Remember; K_2 – Understand; K_3 - Apply; K_4 - Analyze; K_5 – Evaluate; K_6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	9	9	9	9	9	9	9
CO2	9	9	9	9	9	9	9
CO3	9	9	9	9	9	3	3
CO4	9	9	9	9	3	3	3
CO5	9	9	9	9	3	1	1
CO6	9	9	9	9	3	1	1
Total Contribution of COs to POs	54	54	54	54	36	26	26
Weighted Percentage of COs contribution to POs	4.12	4.14	4.26	4.42	5.21	3.74	5.24

Level of Correlation: 0-No Correlation; 1-Low Correlation; 3-Medium Correlation; 9-High Correlation between CO's and PO's.

COURSE CONTENT:

UNIT-I : RANDOM EVENTS: (12 Hours)

Random events – Probability axioms – Combinatorial formulae – conditional probability – Bayes Theorem – Independent events.

UNIT-II : RANDOM VARIABLES: (12 Hours)

Random Variables – Distribution Function – Joint Distribution – Marginal Distribution – Conditional Distribution – Independent random variables – Functions of random variables.

UNIT-III : PARAMETERS OF THE DISTRIBUTION: (12 Hours)

Expectation- Moments – The Chebyshev Inequality – Absolute moments – Order parameters – Moments of random vectors – Regression of the first and second types.

UNIT-IV: CHARACTERISTIC FUNCTIONS: (12 Hours)

Properties of characteristic functions – Characteristic functions and moments – semi0invariants – characteristic function of the sum of the independent random variables – Determination of distribution function by the Characteristic function – Characteristic function of multidimensional random vectors – Probability generating functions.

UNIT-V : SOME PROBABILITY DISTRIBUTIONS: (12 Hours)

One point, two point, Binomial – Polya – Hypergeometric – Poisson (discrete) distributions – Uniform – normal gamma – Beta – Cauchy and Laplace (continuous) distributions.

TEXT BOOK :

M. Fisz, Probability Theory and Mathematical Statistics, John Wiley and Sons, New York, 1963.

UNIT	CHAPTER	SECTION
I	I	1.1 – 1.7
II	II	2.1 – 2.9
III	III	3.1 – 3.8
IV	IV	4.1 – 4.7
V	V	5.1 – 5.10

REFERENCE BOOKS :

1. R.B. Ash, Real Analysis and Probability, Academic Press, New York, 1972
2. K.L.Chung, A course in Probability, Academic Press, New York, 1974.
4. R.Durrett, Probability : Theory and Examples, (2nd Edition) Duxbury Press, New York, 1996.
5. V.K.RohatgiAn Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern Ltd., New Delhi, 1988(3rd Print).
6. S.I.Resnick, A Probability Path, Birhauser, Berlin,1999.
7. B.R.Bhat , Modern Probability Theory (3rd Edition), New Age International (P)Ltd, New Delhi, 1999.

WEB REFERENCES:

http://mathforum.org, http://ocw.mit.edu/ocwweb/Mathematics,
http://www.opensource.org, http://www.probability.net

Category	Component	Course Code	Course Title	Contact Hours/ Semester	Credits
PART III	CORE : XI ELECTIVE : II	25MAP11B	PROGRAMMING IN C++	60	3

Contact Hours per Week: 5

Year	Semester	Internal Marks	External Marks	Total Marks
I	II	25	75	100

PREAMBLE:

To enable the students to learn and gain knowledge about C++ Programming such as Tokens, Expressions, Control Structure, Classes and Objects.

COURSE OUTCOME:

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

COs	CO STATEMENT	KNOWLEDGE LEVEL
CO	Recall the basic concepts of programming in C++	K_1
CO2	Discuss the concepts of Object Oriented Programming, Functions, Classes, Operators, Constructors and Destructors.	K_2
CO3	Identify the syntax of declaration of variable, reference variable, control structure, inline function, function prototyping, functions, operators, classes, Constructors and Destructors.	K_3
CO4	Analyze the concepts OOPs, functions, classes and object, operators, constructor and destructors.	K_4
CO5	Evaluate the values of mathematical function by using various functions, classes, constructor and destructors.	K_5
CO6	Construct the program by using inline function, friend function, control structure, functions, operators, classes, Constructors and Destructors.	K_6

K_1- Remember; K_2 – Understand; K_3 - Apply; K_4 - Analyze; K_5 – Evaluate; K_6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	9	9	9	9	9	9	9
CO2	9	9	9	9	9	9	9
CO3	9	9	9	9	9	3	3
CO4	9	9	9	9	3	3	3
CO5	9	9	9	9	3	1	1
CO6	9	9	9	9	3	1	1
Total Contribution of COs to POs	54	54	54	54	36	26	26
Weighted Percentage of COs contribution to POs	4.12	4.14	4.26	4.42	5.21	3.74	5.24

Level of Correlation: 0-No Correlation; 1-Low Correlation; 3-Medium Correlation; 9-High Correlation between CO's and PO's.

COURSE CONTENT:

UNIT – I: TOKENS, EXPRESSIONS AND CONTROL STRUCTURE (12 Hours)

Basic Concept of Object Oriented Programming : Basic Concept of OOPS - Benefits of OOP – Application of OOP.

Tokens, Expressions and Control Structure: Introduction – Tokens – Keywords – Identifiers and Constants – Basic Data Types – User Defined Data Types – Derived Data Types – Declaration of Variables – Dynamic Initialization of Variables – Reference Variables – Operators - Control Structures.

UNIT- II: FUNCTIONS IN C++ (12 Hours)

Functions in C++: Introduction – The Main Function – Function Prototyping – Call by Reference– Return by Reference – Inline Functions – Default Arguments – const Arguments – Recursion – Function Over Loading – Friend and Virtual Functions – Math Library Functions.

UNIT – III: CLASSES AND OBJECTS (12 Hours)

Classes and Objects: Introduction – C Structures Revisited – Specifying a Class – Defining Member Functions – A C++ Program with Class – Making An Outside Function Inline –Nesting Of Member Functions – Private Member Functions – Arrays Within A Class –Arrays of Objects – Objects as Function Arguments – Friend Functions.

UNIT – IV: CONSTRUCTORS AND DESTRUCTORS (12 Hours)

Constructors and Destructors: Introduction – Constructors – Parameterized Constructors – Multiple Constructors in a Class – Constructors with Default Arguments – Dynamic Initializations of Objects – Copy Constructor – Destructors.

UNIT – V: OPERATOR OVERLOADING (12 Hours)

Operator Overloading: Introduction – Defining Operator Overloading – Overloading Unary Operators – Overloading Binary Operators – Overloading Binary Operators Using Friends – Manipulating of Strings Using Operators – Rules for Overloading Operators.

TEXT BOOK:

E. Balaguruswamy, Object–Oriented Programming with C++, Seven Edition, Tata McGrawHill Publishing Company Limited.

UNIT	CHAPTER	SECTION
I	1 & 3	1.5 – 1.8, 3.1 – 3.8, 3.11 - 3.14 and 3.25
II	4	4.1 – 4.12
III	5	5.1 – 5.15
IV	6	6.1 –6.11
V	7	7.1 – 7.8

REFERENCE BOOKS:

1. Bjarne Stroustrup-"The C++ Programming language", Third Edition, 2009, Dorling Kindersley Pvt.Ltd.
2. John R Hubbard – " Programming with C++", Third Edition, Tata McGraw Hill Education Private Limited.
3. D.Ravichandran - "Programming with C++", Second Edition, Tata McGraw Hill Education Private Limited.
4. Ramesh Bangia- "Basics of C++ Programming", Third Edition, 2009, Firewall media.

WEB REFERENCES:

1. https://www.w3schools.com/cpp/cpp_getstarted.asp
2. https://www.doc.ic.ac.uk/~wjk/c++Intro/
3. https://www.udemy.com/course/introduction-to-programming-c-cpp/
4. https://developerinsider.co/introduction-to-cpp-cpp-programming/

Category	Component	Course Code	Course Title	Contact Hours/ Semester	Credits
PART III	**CORE : XII ELECTIVE : II PRACTICAL**	**25MAP12A**	**MATHEMATICAL SOFTWARE, R - PRACTICAL**	**24**	**1**

Contact Hours per Week: 2

Year	Semester	Internal Marks	External Marks	Total Marks
I	**II**	**40**	**60**	**100**

PREAMBLE :

To enable the students to get experienced about R Software.

COURSE OUTCOME:

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

COs	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Understand and apply basic programming concepts in R such as functions, data frames	**K_1**
CO2	Demonstrate Perform statistical data analysis in R including computation of measures like mean, variance, standard deviation and interpretation of summary statistics.	**K_2**
CO3	Create and interpret various visualizations in R including pie charts, bar charts, and probability distribution plots.	**K_3**
CO4	Understand and apply concepts of conditional probability, moment generating functions (MGF), and analyze their behavior under varying conditions.	**K_4**
CO5	Simulate and analyze discrete and continuous probability distributions and compare them with approximations.	**K_5**
CO6	Develop models and perform simulations to understand probabilistic behavior using computational tools and assess distributional characteristics.	**K_6**

K_1 - Remember; K_2 – Understand; K_3 - Apply; K_4 - Analyze; K_5 – Evaluate; K_6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	9	9	9	9	9	9	9
CO2	9	9	9	9	9	9	9
CO3	9	9	9	9	9	9	9
CO4	9	9	9	9	3	3	3
CO5	9	9	9	9	3	1	1
CO6	9	9	9	9	3	1	1
Total Contribution of COs to POs	54	54	54	54	36	32	32
Weighted Percentage of COs contribution to POs	4.12	4.14	4.26	4.42	5.21	4.60	6.45

Level of Correlation: 0-No Correlation; 1-Low Correlation; 3-Medium Correlation; 9-High Correlation between CO's and PO's.

List of Programs

1. Write a program in R to define and call functions in the R environment.
2. Write a program in R to create and implement data frames.
3. Write a program in R to read a CSV file and analyze the data.
4. Write a program in R to create pie charts and bar charts.
5. Write a program in R to calculate the standard deviation and variance of the given data.
6. Write a program in R to visualize the normal distribution with a mean of 0 and a standard deviation of 1.
7. Write a program in R to simulate Chebyshev's inequality.
8. Write a program in R to compute conditional probability.
9. Write a program in R to compare the Binomial distribution (n = 100, p = 0.5) with its normal approximation.
10. Write a program in R to demonstrate discrete probability distributions (e.g., Binomial, Poisson, Geometric, and Negative Binomial distributions).
11. Write a program in R to demonstrate continuous probability distributions (e.g., Normal, Uniform, Exponential, and Gamma distributions).
12. Write a program in R to show the Moment Generating Function (MGF) for the Normal and Poisson distributions.

BOOKS FOR REFERENCE:

1. https://www.youtube.com/watch?v=eDrhZb2onWY
2. https://www.youtube.com/watch?v=KlsYCECWEWE
3. https://www.tutorialspoint.com/r/index.html

Category	Component	Course Code	Course Title	Contact Hours/ Semester	Credits
PART III	CORE : XII ELECTIVE : II PRACTICAL	25MAP12B	PROGRAMMING IN C++ - PRACTICAL	24	1

Contact Hours per Week: 2

Year	Semester	Internal Marks	External Marks	Total Marks
I	II	40	60	100

PREAMBLE:

To enable the students to learn and gain knowledge about C++ Programming such as finding the values for data, different types of functions.

COURSE OUTCOME:

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

COs	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Recognize the commands provided in the C++ environment	K_1
CO2	Demonstrate the data values	K_2
CO3	classify the various kinds of function	K_3
CO4	Analyze the data which is used to find the different function values.	K_4
CO5	Estimate the data values by using different function	K_5
CO6	Create the C++ program which is used find values of data	K_6

K_1 - Remember; K_2 – Understand; K_3 - Apply; K_4 - Analyze; K_5 – Evaluate; K_6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	9	9	9	9	9	9	9
CO2	9	9	9	9	9	9	9
CO3	9	9	9	9	9	9	9
CO4	9	9	9	9	3	3	3
CO5	9	9	9	9	3	1	1
CO6	9	9	9	9	3	1	1
Total Contribution of COs to POs	54	54	54	54	36	32	32
Weighted Percentage of COs contribution to POs	4.12	4.14	4.26	4.42	5.21	4.60	6.45

Level of Correlation: 0-No Correlation; 1-Low Correlation; 3-Medium Correlation; 9-High Correlation between CO's and PO's.

LIST OF PROGRAMS

All the following listed programs have to be executed and recorded

1. DISTANCE CONVERSION PROBLEM:
Create two classes DM and DB which store the value of distances. DM store the value of distances. DM stores distances in meters and centimeters in DB in feet and inches. Write a Program that can create the values of the class objects and add one object DM with another object DB. Use a friend function to carry out addition operation. The object that stores the result may be DM object or DB object depending on the units in which results are required. The display should be in the order of meter and centimeter and feet or inches depending on the order of display.

2. OVERLOADING OBJECTS:
Create a class FLOAT that contains one float data member overload all the four arithmetic operators so that operate on the objects of FLOAT.

3. OVERLOADING CONVERSIONS:
Design a class polar which describes a pant in a plane using polar Co-ordinates radius and angle. A point in polar Co-ordinates is as shown below. Use the overloader + operator to add two objects of polar. Note that we cannot add polar values of two points directly. This requires I the conversion. Points into rectangular Co-ordinates and finally converting the result into polar Co-ordinates. You need to use following trigonometric formulas. *X= r * cos (a); Y= r * sin (a);* a=$\tan^{-1}(\frac{}{})$; r= *sqrt (X * X +Y * Y);*

4. OVRELOADING MATRIX:
Create a class MAT of size M*N. Define all possible matrix operations for MAT type objects. Verify the identity. *(A-B)^2 = A^2+B^2 – 2*A*B*

5. AREA COMPUTATION USING DERIVED CLASS:
Area of rectangle = *X*Y*
Area of triangle = ½ * *X* * *Y*

6. VECTOR PROBLEM:
Define a class for vector containing scalar values. Apply overloading concepts for vector addition, Multiplication of a vector by a scalar quantity, replace the values in a position vector.

7. INHERITANCE:
Create three classes alpha, beta and gamma, each containing one data member. The class gamma should be inherited from both alpha and beta. Use a constructor function in the class gamma to assign values to the data members of all the classes. Write a program to print the data members of all the three classes.

8. INLINE FUNCTION:
Create two inline functions that can return the multiplication and division for two data members.

9. STATIC DATA MEMBER:
Write a program to illustrate the use of static data member.

10. **ARRAY OF OBJECT**:
Create a class employee and illustrate the use of object array.

WEB REFERENCES:
1. http://biet.ac.in/pdfs/C++%20LAB%20MANUAL.pdf
2. http://www.cppforschool.com/assignments.html
3. https://www.programiz.com/cpp-programming/library-function/cstdlib/labs

CATEGORY	COURSE TYPE	COURSE CODE	COURSE TITLE	CONTACT HOURS	CREDIT
PART – IV	ABILITY ENHANCEMENT	25AEP01	CYBER SECURITY	24	2

Contact hours per week: 2

YEAR	SEMESTER	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS
I	II	100	-	100

PREAMBLE

To understand the basics of cyber security and the security threats in day-to-day activities.

COURSE OUTCOMES

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

CO Number	CO Statement	Knowledge Level
CO1	Recall the basic concepts of information security and its types	K1
CO2	Gain knowledge on cyber space issues and cyber security measures	K2
CO3	Identify various risks and threats in cyber space	K3
CO4	Apply security measures to prevent ourselves from threats in social media	K4
CO5	Compare various social media, security issues and measures	K5
CO6	Propose a secured cyber platform for people to connect each other for their social and professional concerns	K6

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	**9**	**9**	**9**	**9**	**9**	**9**	**3**
CO2	**9**	**9**	**9**	**9**	**9**	**9**	**3**
CO3	**9**	**9**	**9**	**9**	**9**	**9**	**3**
CO4	**9**	**9**	**9**	**9**	**3**	**3**	**3**
CO5	**9**	**9**	**3**	**3**	**3**	**3**	**3**
CO6	**9**	**9**	**3**	**3**	**3**	**3**	**3**
Total contribution of COs to POs	**54**	**54**	**42**	**42**	**36**	**36**	**18**
Weighted Percentage COs Contribution to POs	4.12	4.14	3.31	3.43	5.21	5.18	3.63

Level of correlation: 0–No correlation; 1–Low correlation; 3–Medium correlation; 9-High correlation between COs and POs.

CYBER SECURITY

UNIT I: INTRODUCTION TO CYBER SECURITY (5 HOURS)

Cyber security Means Different Things to Different Folks- Cyber security is a Constantly Moving Target- Looking at the Risks That Cyber security Mitigates.

UNIT II: GETTING TO KNOW COMMON CYBER ATTACKS (5 HOURS)

Attacks That Damage- Impersonation- Interception- Data Theft- Malware- Poisoned Web Service Attacks- Malvertising.

UNIT-III: EVALUATING CYBER SECURITY POSTURE (5 HOURS)

Identifying Risks- Protecting against Risks- Evaluating Your Current Security Measures- Privacy 101- Banking Online Safely- Safely Using Smart Devices.

UNIT-IV: SECURING SMALL BUSINESS (5 HOURS)

Making Sure Someone is in charge- Watching Out for Employees. Ten Ways You can improve Your cyber security without spending a fortune- Ten Ways to safely use public Wi-Fi.

UNIT-V: CYBER SECURITY CAREER PATHS (4 HOURS)

Professional Roles in Cyber Security- Exploring Career Paths- Starting Out in Information Security-Overcoming a Criminal Record- Looking at other Professions with a Cyber security Focus.

REFERENCE BOOK:

1. "Cyber security-for dummies A Wiley Brand", Joseph Steinberg, John Wiley & Sons, Inc., 2020.

CHAPTERS AND PAGE NUMBERS:

Unit I : Chapter 1 – 7 -18,
Unit II : Chapter 2- 21-36, 38-39,
Unit III : Chapter 4 – 70-83,
Unit IV : Chapter 9 – 155-163, Chapter 18-315-320, Chapter 20 – 327-330,
Unit V : Chapter16 – 287-295, 299-300

WEB REFERENCES:

1. https://m.youtube.com/watch?v=o6pgd8gLFHg
2. https://m.youtube.com/watch?v=3rl4ZjZpcHU
3. https://blog.barkly.com/10-fundamental-cybersecurity-lessons-for-beginners
4. https://5social media security risk and how to avoid them.html
5. https://10 cyber security twitter profiles to watch.html
6. https://cyber security in banking 4 trends to watch in 2017.html
7. https://gmail hacking security tips-Indian cyber security solutions.html
8. https://why social media sites are the new cyber weapons of.html
9. EBook:A complete guide to Staying Ahead in the Cyber Security Game

SEMESTER – III

Category	Component	Course Code	Course Title	Contact Hours/ Semester	Credits
PART III	CORE : XIII	25MAP13	TOPOLOGY	72	5

Contact Hours per Week: 6

Year	Semester	Internal Marks	External Marks	Total Marks
II	III	25	75	100

PREAMBLE :

To enable the students to learn and gain knowledge about Topological spaces, connectedness, Compact Spaces, Countability and Completely regular spaces.

COURSE OUTCOME:

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

COs	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Recall the basic definitions of Topological spaces, connectedness, Compact Spaces, Countability and Completely regular spaces.	K_1
CO2	Explain the concepts of Topological spaces, connectedness, Compact Spaces, Countability and Completely regular spaces.	K_2
CO3	Apply the concepts of Continuous Functions, Compact Spaces, Urysohn Metrization Theorem and Tychonoff Theorem in topological spaces.	K_3
CO4	analyze the separation properties, convergent sequence, metric space in the general theory of topological space.	K_4
CO5	Justify the relationship between compact spaces, connected spaces and regular spaces.	K_5
CO6	Construct the examples for Topological spaces, connectedness, Compact Spaces, and Countability.	K_6

K_1 - Remember; K_2 – Understand; K_3 - Apply; K_4 - Analyze; K_5 – Evaluate; K_6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	9	9	9	9	9	9	3
CO2	9	9	9	9	9	3	3
CO3	9	9	9	9	3	1	3
CO4	9	9	9	9	1	1	1
CO5	9	9	3	3	0	1	0
CO6	9	9	3	0	0	0	0
Total Contribution of COs to POs	54	54	42	39	22	15	10
Weighted Percentage of COs contribution to POs	4.12	4.14	3.31	3.19	3.18	2.16	2.02

Level of Correlation: 0-No Correlation; 1-Low Correlation; 3-Medium Correlation; 9-High Correlation between CO's and PO's.

COURSE CONTENT:

UNIT- I: TOPOLOGICAL SPACE (15 Hours)

Topological spaces – Basis for a Topology – The Order Topology – Product Topology – Closed sets and Limit Points – Continuous Functions.

UNIT- II: CONNECTEDNESS (15 Hours)

Metric Topology-Connected Spaces – Connected sets in the real line –Components and path components -Local connectedness.

UNIT- III: COMPACT SPACE (15 Hours)

Compact Spaces –Compact subspaces of the real line-Limit Point Compactness – Local compactness.

UNIT- IV: COUNTABILITY (12 Hours)

The Countability Axioms – The Separation Axioms – Normal spaces – The Urysohn Lemma – The Urysohn Metrization Theorem.

UNIT- V: THE TYCHONOFF THEOREM (15 Hours)

The Tychonoff Theorem – Completely regular spaces – The stone-Cech Compactification.

TEXT BOOK:

James R. Munkres (2005) - "Topology", 2nd edition, Prentice Hall of India Private Limited, New Delhi.

UNIT	CHAPTER	PAGE NUMBER
I	II	75 - 111
II	II,III	119 – 133,147 - 162
III	III	163 - 185
IV	IV	189 - 218
V	V	230 - 241

REFERENCE BOOKS:

1. J. Dugundji, (1966) –"Topology", Allyn and Bacon, (Reprinted in India by Prentice Hall of India Private Limited)
2. George F. Simmons,(1963) - " Introduction to Topology and Modern Analysis", McGraw Hill Book Company.

WEB REFERENCES:

1. https://youtu.be/PytSjbqDizE
2. https://en.m.wikipedia.org/wiki/Topology
3. https://youtu.be/WjbTliK734g

Category	Component	Course Code	Course Title	Contact Hours/ Semester	Credits
PART III	CORE : XIV	25MAP14	THEORY OF NUMBERS	72	4

Contact Hours per Week: 6

Year	Semester	Internal Marks	External Marks	Total Marks
II	III	25	75	100

PREAMBLE :

To enable the students to learn and gain knowledge about Number theory.

COURSE OUTCOME:

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

COs	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Bring back all the concepts in theory of numbers	K_1
CO2	Demonstrate Congruences, Quadratic reciprocity and Arithmetic functions.	K_2
CO3	Apply conceptual knowledge and formulae in number theory to solve the problems.	K_3
CO4	Critique the proof and context of theorems in Divisibility, Primes, Congruences, Quadratic reciprocity and Arithmetic functions.	K_4
CO5	Evaluate the solutions of congruences , Jacobi symbol problems and Arithmetic functions.	K_5
CO6	Manipulate simple research problems on Divisibility, Primes, Congruences, Quadratic reciprocity and Arithmetic functions	K_6

K_1 - Remember; K_2 – Understand; K_3 - Apply; K_4 - Analyze; K_5 – Evaluate; K_6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	9	9	9	9	9	9	9
CO2	9	9	9	9	3	9	9
CO3	9	9	9	9	3	9	9
CO4	9	9	9	9	1	3	1
CO5	9	9	9	9	1	3	1
CO6	9	9	9	9	1	1	1
Total Contribution of COs to POs	54	54	54	54	18	34	30
Weighted Percentage of COs contribution to POs	4.12	4.14	4.26	4.42	2.60	4.89	6.05

Level of Correlation: 0-No Correlation; 1-Low Correlation; 3-Medium Correlation; 9-High Correlation between CO's and PO's.

COURSE CONTENT:

UNIT- I: INTRODUCTION TO THE CONCEPT OF NUMBERS (15 Hours)
Introduction- Divisibility-Primes.

UNIT –II: CONGRUENCES (15 Hours)
Congruences-Solutions of congruences- Congruences of Degree 1- The functions $\phi(n)$ -Congruences of higher degree-Prime power moduli-Prime modulus.

UNIT- III: CONGRUENCES (15 Hours)
Primitive roots and power residues-Congruences degree 2- Prime modulus-Power Residues-Number theory from an algebraic view point - Multiplicative groups-Rings and fields.

UNIT –IV: QUADRATIC RECIPROCITY (15 Hours)
Quadratic residues- Quadratic reciprocity – The Jacobi Symbol.

UNIT –V: ARITHMETIC FUNCTIONS (12 Hours)

Greatest integer function - Arithmetic functions – The Moebius Inversion formula – The multiplication of arithmetic functions .

TEXT BOOK:

Ivan Niven, Herberts Zucherman and Hugh L. Montomery (2013) – "An Introduction to Theory of Numbers", Fifth edition, Wiley Indian Pvt Ltd., New Delhi-110002.

UNIT	CHAPTER	SECTIONS
I	I	1.1-1.3
II	II	2.1-2.3, 2.6 & 2.7
III	II	2.8-2.11
IV	III	3.1 - 3.3
V	IV	4.1-4.3

REFERENCE BOOKS:

1. Apostol.T.M.(1995)– "Introduction to Analytic Number Theory",IeditionSpringer Verlag.
2. Gareth Jones .A. & Mary Jones J.(1998) – " Elementary Number Theory" - Springer publications.

WEB REFERENCES:

1.https://youtu.be/19SW3P_PRHQ

2.https://www.youtube.com/watch?v=xQfsIBj5ZZg

3.https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwjVjJi2hpfzAhU_gtgFHbj5AeIQFnoECCUQAQ&url=https%3A%2F%2Fhome.sandiego.edu%2F~aboocher%2Fwritings%2FNumberTheoryNotes.pdf&usg=AOvVaw34q6dy78kdn49fprv3iIJq

Category	Component	Course Code	Course Title	Contact Hours/ Semester	Credits
PART III	CORE : XV	25MAP15	CLASSICAL MECHANICS	72	4

Contact Hours per Week: 6

Year	Semester	Internal Marks	External Marks	Total Marks
II	III	25	75	100

PREAMBLE:

To enable the students to learn and gain knowledge about mechanical systems, canonical transformations, Lagrange and Poisson brackets and principles of Hamilton, Jacobi, Euler and Lagrange

COURSE OUTCOME:

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

COs	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Recall the notions of configuration space, generalized co-ordinates, degrees of freedom, natural system, ignorable co-ordinates, stationary value, canonical transformation, Lagrange and Poisson brackets.	K_1
CO2	Classify Hamilton's principle, Euler-Lagrange equations, Hamilton-Jacobi theory and different types of constraints, work, energy and momentum.	K_2
CO3	Use Jacobi integral, Routhian procedure, Hamiltonian procedure, generating functions to find the differential equations of motion.	K_3
CO4	Critique all the theoretical techniques.	K_4
CO5	Evaluate the equations of Lagrange, Hamilton, Hamilton-Jacobi, linear, rotational and rolling motions and canonical tranformations	K_5
CO6	Construct brachistochrone problem, geodesic problem , generating function and bilinear covaraint under the canonical transformation.	K_6

K_1 - Remember; K_2 – Understand; K_3 - Apply; K_4 - Analyze; K_5 – Evaluate; K_6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	9	9	9	9	9	7	7
CO2	9	9	9	9	3	1	1
CO3	9	9	9	9	3	1	1
CO4	9	9	9	9	3	1	1
CO5	9	9	9	9	0	0	0
CO6	9	9	3	3	0	0	0
Total Contribution of COs to POs	54	54	48	48	18	10	10
Weighted Percentage of COs contribution to POs	4.12	4.14	3.78	3.92	2.60	1.44	2.02

Level of Correlation: 0-No Correlation; 1-Low Correlation; 3-Medium Correlation; 9-High Correlation between CO's and PO's.

COURSE CONTENT:

UNIT- I: INDRODUCTORY CONCEPTS (15 Hours)

Mechanical system – Generalized coordinates –Constraints – Virtual work – Energy and momentum.

UNIT –II: LAGRANGE'S EQUATIONS (15 Hours)

Derivations of Lagrange's Equations– Examples-Integrals of motion.

UNIT –III: HAMILTON'S EQUATIONS (15 Hours)

Hamilton's Principle – Hamilton's equations.

UNIT- IV: HAMILTON – JACOBI THEORY (12 Hours)

Hamilton's principle function – Hamilton – Jacobi equation.

UNIT- V: CANONICAL TRANSFORMATIONS (15 Hours)

Differential forms and generating functions –Lagrange and Poisson brackets.

TEXT BOOK:

Greenwood.D.T. (1997) – "Classical Dynamics", Dover Publication, New York.

UNIT	CHAPTER	SECTION
I	1	1.1 - 1.5
II	2	2.1 – 2.3
III	4	4.1 – 4.2
IV	5	5.1 – 5.2
V	6	6.1,6.3

REFERENCE BOOKS:

1. Gupta.S.C,Kumar.V.Sharma.H.V.(2015)-"Classical Mechanics" K.K Mittal for PragattiPrakashan,Meerut.
2. Gupta.A.S.(2009)-"Calculus of Variation" PHI Learning pvt.ltd.Newdelhi.

WEB REFERENCES:

1. https://bsc.hcverma.in/course/cm1
2. http://www-f1.ijs.si/~ramsak/KlasMeh/KlasMehA.pdf
3. https://www.youtube.com/watch?v=XEPC8nQsiH8

Category	Component	Course Code	Course Title	Contact Hours/ Semester	Credits
PART III	**CORE : XVI**	**25MAP16**	**RESEARCH TOOLS & TECHNIQUES**	**36**	**2**

Contact Hours per Week: 3

Year	Semester	Internal Marks	External Marks	Total Marks
I	**III**	**25**	**75**	**100**

PREAMBLE:

To enable the students to learn and gain knowledge about the research design and problem.

COURSE OUTCOME:

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

COs	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Recall the basic concepts of Research Methods, Design, Data collection, Interpretation and report writing in Research.	**K_1**
CO2	Explain the concepts of Research Process, Selecting the Research Problem and design, collection of data, Techniques of Interpretation and writing the Report.	**K_2**
CO3	Apply the concepts of Research Process, Selecting the Research Problem and design, collection of data, Techniques of Interpretation and writing the Report.	**K_3**
CO4	Analyze the concepts of Research methodology, Research Problem, Research design, collection of data, Techniques of Interpretation and writing the Report.	**K_4**
CO5	Evaluate the Research Process, Selecting the Research Problem and design, collection of Primary and Secondary data, Techniques of Interpretation and writing the Report.	**K_5**
CO6	Construct the Research Process, Selecting the Research Problem and design, data collection and case study , Interpretation of Research and writing the Report in Research.	**K_6**

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	9	9	9	9	9	9	9
CO2	9	9	9	9	9	9	9
CO3	9	9	9	9	9	9	9
CO4	9	9	9	9	3	3	3
CO5	9	9	9	9	3	3	3
CO6	9	9	9	9	3	3	3
Total Contribution of COs to POs	54	54	54	54	36	36	36
Weighted Percentage of COs contribution to POs	4.12	4.14	4.26	4.42	5.21	5.18	7.26

Level of Correlation: 0-No Correlation; 1-Low Correlation; 3-Medium Correlation; 9-High Correlation between CO's and PO's.

COURSE CONTENT:

UNIT- I: RESEARCH METHODOLOGY: AN INTRODUCTION: (8 Hours)

Meaning of Research – Objectives of Research - Types of Research – Research Approaches – Significance of Research – Research Methods versus Methodology – Research and Scientific Method – Research Process – Criteria of Good Research – Problems Encountered by Researches in India.

UNIT – II: DEFINING THE RESEARCH PROBLEM: (8 Hours)

What is a Research Problem? – Selecting the Problem – Necessity of Defining the Problem – Techniques Involved in Defining a Problem.

RESEARCH DESIGN:

Meaning of Research Design – Need for Research Design – Features of a Good Design – Important Concepts Relating to Research Design.

UNIT –III: RESEARCH DESIGN: (Continue…) (6 Hours)

Different Research Designs – Basic Principles of Experimental Designs – Important Experimental Designs – Conclusion.

UNIT- IV: DATA COLLECTION (6 Hours)

Introduction – Experiments and Survey – Collection of Primary Data – Collection of Secondary Data – Selection of Appropriate Method for Data Collection – Case Study Method.

UNIT- V: INTERPRETATION AND REPORT WRITING: (8 Hours)

Meaning of Interpretation – Technique of Interpretation – Precautions in Interpretation – Significance of Report Writing – Different Steps in Writing Report – Layout of the Research Report – Types of Reports – Oral Presentation – Mechanics of Writing a Research Report - Precautions for a Research Report – Conclusion.

TEXT BOOK :

"Research Methodology: Methods & Techniques" – C.R. Kothari and Gaurav Garg, Fifth Multi Colour Edition(2024), New Age International Publishers, New Delhi.

UNIT	CHAPTER	SECTION
I	I	1.1 – 1.10
II	II, III	2.1 – 2.4 3.1 – 3.4
III	IV	3.5 – 3.8
IV	VI	6.1 – 6.6
V	XIX	19.1 – 19.11

REFERENCE BOOKS:

1. William G.Zikmund, Business Research Methods, 7th Edition, Tata Mc Graw Hill, 2009.
2. Oliver Paul, "The Student's guide to research ethics", McGraw-Hill Education (UK), Second edition 2010 SATHYABAMA INSTITUTE OF SCIENCE AND TECHNOLOGY Centre for Research.

WEB REFERENCES:

1. https://euacademic.org/bookupload/9.pdf
2. https://gevpgkrb.ac.in/Content/207_447_23_Dr.%20Dinesh%20Sriwas_RESEARCH%20_%20PUBLICATION%20ETHICS.pdf
3. https://www.sultanchandandsons.com/Images/BookImages/Chapters/643_TC%201287%20%E2%80%93%20Research%20and%20Publication%20Ethics.pdf

Category	Component	Course Code	Course Title	Contact Hours/ Semester	Credits
PART III	CORE : XVIII ELECTIVE : III	25MAP17A	GRAPH THEORY	72	3

Contact Hours per Week: 6

Year	Semester	Internal Marks	External Marks	Total Marks
II	III	25	75	100

PREAMBLE :

To enable the students to learn and gain knowledge about Graphs, Euler tours, Hamiltonian cycles, matching and Colourings of edges as well as vertices.

COURSE OUTCOME:

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

COs	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Recall the basic concepts of graph theory.	K_1
CO2	Illustrate various types of graph, matchings, coverings and colourings.	K_2
CO3	Apply the preliminaries of graph theory in well –named theorems and Conjectures.	K_3
CO4	Analyze the proof of theorems on graphs, matchings, coverings and colourings.	K_4
CO5	Determine the path , cycle, Chromatic Number,.	K_5
CO6	Construct graphs with Euler tours, Hamiltonian cycles, and four and five Colour concepts.	K_6

K_1 - Remember; K_2 – Understand; K_3 - Apply; K_4 - Analyze; K_5 – Evaluate; K_6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	9	9	9	9	9	9	3
CO2	9	9	9	9	3	9	3
CO3	9	9	9	9	3	3	3
CO4	9	9	9	3	3	3	1
CO5	9	9	9	3	3	3	1
CO6	9	9	9	3	1	1	0
Total Contribution of COs to POs	54	54	54	36	22	28	11
Weighted Percentage of COs contribution to POs	4.12	4.14	4.26	2.94	3.18	4.03	2.22

Level of Correlation: 0-No Correlation; 1-Low Correlation; 3-Medium Correlation; 9-High Correlation between CO's and PO's.

COURSE CONTENT:

UNIT- I: FUNDAMENTAL CONCEPTS OF GRAPHS AND TREES (15 Hours)

Graphs - Simple Graphs – Graph Isomorphism – The Incidence and Adjacency matrices – Subgraphs – Vertex Degrees – Paths and Connection – Cycles and trails. Trees – Cut edges and Bonds – Cut vertices – Cayley's formula.

UNIT- II: CONNECTIVITY AND PATHS (15 Hours)

Connectivity – Blocks. Euler tours and Hamilton Cycles: Euler tours – Hamilton Cycles.

UNIT- III: MATCHINGS (15 Hours)

Matchings and coverings in Bipartite Graphs – Perfect Matchings. Edge colourings: Edge Chromatic number – Vizing's theorem.

UNIT- IV: INDEPENDENT SETS AND VERTEX COLOURINGS (15 Hours)

Independent sets – Chromatic Number – Brook's Theorem – Hajo's Conjecture.

UNIT-V: PLANAR GRAPHS (12 Hours)

Plane and planar Graphs – Dual Graphs – Euler's formula – Bridges – Kuratowski's theorem (Proof omitted) – Five Colour Theorem and Four colour Conjecture.

TEXT BOOK:

J.A.Bondy and U.S.R.Murty(1976), "Graph Theory with Applications", American Elsevier Publishing company., Inc., New York.

UNIT	CHAPTER	SECTION
I	1 2	1.1-1.7 2.1-2.4
II	3 4	3.1-3.2 4.1-4.2
III	5 6	5.1-5.3 6.1-6.2
IV	7 8	7.1 8.1-8.3
V	9	9.1-9.6

REFERENCE BOOKS:

1. Narsinghdeo (1987) "Graph Theory", Prentice Hall of India Private Limited, New Delhi.
2. Frank Harary, "Graph Theory", Narosa Publishing House, New Delhi.
3. R.Balakrishnan and K.Ranganathan, Springer (2008), "A Text Book of Graph Theory", New Delhi.
4. V.K. Balakrishnan, Tata Mcgrawhill (2004), " Graph Theory", Schaum's outlines, New Delhi.

WEB REFERENCES:

1.https://www.youtube.com/watch?v=sWsXBY19o8I
2.https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwjkzq-5jJfzAhW6yjgGHZX7CbsQFnoECAwQAQ&url=https%3A%2F%2Fwww.slideshare.net%2Fehamzei%2Fgraph-theory-70229068&usg=AOvVaw1B86S7CGufOtRuwX4_T7Mq
3.https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwjkzq-5jJfzAhW6yjgGHZX7CbsQFnoECCQQAQ&url=https%3A%2F%2Fwww.slideshare.net%2FManashKumarMondal%2Fgraph-theory-108809072&usg=AOvVaw204o8DeJSq9IMoD7UZ3lSv

Category	Component	Course Code	Course Title	Contact Hours/ Semester	Credits
PART III	**CORE : XVIII ELECTIVE : III**	**25MAP17B**	**INTEGRAL TRANSFORMS**	**72**	**3**

Contact Hours per Week: 6

Year	Semester	Internal Marks	External Marks	Total Marks
II	**III**	**25**	**75**	**100**

PREAMBLE :

To enable the students to learn and gain knowledge about Fourier Cosine and Sine Transforms and Hankel transforms.

COURSE OUTCOME:

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

COs	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Recall the concepts based on Fourier Sine and Cosine transforms, Hankel transforms.	**K_1**
CO2	Explain the concepts of Fourier Transforms, Hankel transforms and diffusion equations.	**K_2**
CO3	Apply the Fourier Transforms, Hankel transforms in Laplace Equation and PDE.	**K_3**
CO4	Analyze the properties on Fourier and Hankel Transforms.	**K_4**
CO5	Evaluate the problems based on Fourier Cosine and sine Transforms and Hankel Transforms.	**K_5**
CO6	Construct the solution of Laplace and linear diffusion equations.	**K_6**

K_1 - Remember; K_2 – Understand; K_3 - Apply; K_4 - Analyze; K_5 – Evaluate; K_6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	9	9	9	9	9	9	3
CO2	9	9	9	9	3	9	3
CO3	9	9	9	9	3	3	3
CO4	9	9	9	3	3	3	1
CO5	9	9	9	3	3	3	1
CO6	9	9	9	3	1	1	0
Total Contribution of COs to POs	54	54	54	36	22	28	11
Weighted Percentage of COs contribution to POs	4.12	4.14	4.26	2.94	3.18	4.03	2.22

Level of Correlation: 0-No Correlation; 1-Low Correlation; 3-Medium Correlation; 9-High Correlation between CO's and PO's.

COURSE CONTENT:

UNIT- I: FOURIER TRANSFORMS: (15 Hours)

Fourier sine and cosine transforms –Fourier transforms of derivatives -Fourier transforms of simple functions.

UNIT- II: FOURIER TRANSFORMS (cont..) (15 Hours)

Convolution integral – Parseval's Theorem-Solution of PDE by Fourier transform –Laplace equation in half plane - Laplace equation in infinite strip.

UNIT- III: DIFFUSION EQUATION (15 Hours)

Laplace equation in semi infinite strip. The Linear diffusion equation on a semi infinite line – The two dimensional diffusion equation. Solution of the diffusion equation $\frac{\partial^2 u}{\partial x^2} = \frac{1}{k}\frac{\partial u}{\partial t}$ with the boundary condition $u_x(0,t) = f(t)$, $t \geq 0$ and the initial condition $u(x,0) = 0$ - Solution of diffusion equation on a semi infinite line.

UNIT- IV: HANKEL TRANSFORMS: (15 Hours)

Properties of Hankel Transforms – Hankel inversion theorem – Hankel Transform of derivative of functions - The Parseval's relation for Henkel Transforms –Axisymmetric Dirichlet problem for a half space.

UNIT- V: HANKEL TRANSFORMS (cont..) (12 Hours)

Axisymmetric Dirichlet problem for a thick plate. Relation between Fourier and Hankel Transforms – Problems.

TEXT BOOKS:

Sneddon.I.N.(1974) – "The Use of Integral Transforms", Tata McGraw Hill, New Delhi.

UNIT	CHAPTER	SECTION
I	2	2.4 – 2.7
II	2	2.9 – 2.10
III	2	2.16- 1(a),(b),(c), 2.16 – 2 (a), (b)
IV	5	5.2 – 5.4, 5.6 & 5-10-1
V	5	5-10-2, 5.7

WEB REFERENCES:

1. https://www.maths.ed.ac.uk/~jmf/Teaching/MT3/IntegralTransforms.pdf
2. https://www.britannica.com/science/integral-transform
3. http://www.hep.caltech.edu/~fcp/math/integralEquations/integralEquations.pdf

Category	Component	Course Code	Course Title	Contact Hours/ Semester	Credits
PART V	**PROFICIENCY ENHANCEMENT (SELF STUDY)**	**25PEMAP01**	**MATHEMATICS FOR COMPETITIVE EXAMINATIONS (SELF STUDY)**		**2**

Contact Hours per Week: -

Year	Semester	Internal Marks	External Marks	Total Marks
II	**III**	**-**	**100**	**100**

PREAMBLE:

To enable the students to learn and gain knowledge about Algebra, Real Analysisand Complex Analysis.

COURSE OUTCOME:

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

COs	CO -STATEMENT	KNOWLEDGE LEVEL
CO1	Recall the fundamental concepts in sequence and series, Group Theory, Complex numbers, Analytic function.	**K_1**
CO2	Illustrate the contexts in sequence and series, Group Theory, Complex numbers, Analytic function	**K_2**
CO3	Apply the basic lemmas and theorems to solve the problems on sequence and series, Group Theory, Complex numbers, Analytic function	**K3**
CO4	Analyze the various problems on sequence and series, Group Theory, Complex numbers, Analytic function	**K_4**
CO5	Evaluate the various methods and problems on sequence and series, Group Theory, Complex numbers, Analytic function	**K_5**
CO6	Construct simple analytical and numerical examples in sequence and series, Group Theory, Complex numbers, Analytic function	**K_6**

K_1 - Remember; K_2 – Understand; K_3 - Apply; K_4 - Analyze; K_5 – Evaluate; K_6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	9	9	9	9	9	9	9
CO2	9	9	9	9	3	9	9
CO3	9	9	9	9	3	3	3
CO4	9	9	9	9	1	3	3
CO5	9	9	9	9	1	1	1
CO6	9	9	9	9	1	0	0
Total Contribution of COs to POs	54	54	54	54	18	25	25
Weighted Percentage of COs contribution to POs	4.12	4.14	4.26	4.42	2.60	3.60	5.04

Level of Correlation: 0-No Correlation; 1-Low Correlation; 3-Medium Correlation; 9-High Correlation between CO's and PO's.

COURSE CONTENT:

UNIT-I: SEQUENCES AND SERIES

Sequence and Series – Convergence - Lim sup.

UNIT-II: SEQUENCES AND SERIES

Lim inf - Bolzano weierstrass theorem - Heine Borel theorem.

UNIT-III: GROUP THEORY

Groups – Subgroups - Normal subgroups - Quotient groups – Homomorphism - Cyclic groups -Permutation groups.

UNIT-IV: GROUP THEORY

Homomorphism - Cyclic groups -Permutation groups.

UNIT-V: COMPLEX NUMBERS, ANALYTIC FUNCTION

Power series - Analytic functions – Cauchy Riemann equations.

TEXT BOOK:

UGC CSIR NET/SET -Mathematical Analysis- 'Pawansharma, Neha Sharma and Suraj singh'- Arihant publications(India) Ltd.

UNIT	CHAPTER	PAGE NUMBER
I,II	II	37-58
III,IV	XV	522-541
V	XI	391-404

REFERENCE BOOK:

UGC CSIR NET/SET-Mathematical Analysis, Akilesh Mmani Thirupathi and Sunil Kushwaha, Kanika publishing company.

SEMESTER – IV

Category	Component	Course Code	Course Title	Contact Hours/ Semester	Credits
PART III	CORE : XIX	25MAP18	FUNCTIONAL ANALYSIS	72	5

Contact Hours per Week: 6

Year	Semester	Internal Marks	External Marks	Total Marks
II	IV	25	75	100

PREAMBLE:

To enable the students to learn and gain knowledge about Banach space and normed linear space.

COURSE OUTCOME:

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

COs	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Recall the basic concept of Banach spaces, quotient space, Continuous linear functional, Hahn banach theorem and Bounded linear operator.	K_1
CO2	Explain the concepts of linear space, normed linear space and banach space.	K_2
CO3	Apply the knowledge of functional analysis in linear space, normed linear space and in banach space.	K_3
CO4	Analyze the properties of Banach spaces, quotient space, Continuous linear functional, Hahn banach theorem and Bounded linear operator.	K_4
CO5	Evaluate the properties of Banach spaces, quotient space, Continuous linear functional, Hahn banach theorem and Bounded linear operator.	K_5
CO6	Construct the vector space in Banach spaces, quotient space, Continuous linear functional, Hahn banach theorem and in Bounded linear operators.	K_6

K_1 - Remember; K_2 – Understand; K_3 - Apply; K_4 - Analyze; K_5 – Evaluate; K_6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	9	9	9	9	9	9	3
CO2	9	9	9	9	9	9	3
CO3	9	9	9	9	9	9	3
CO4	9	9	9	9	9	9	3
CO5	9	9	9	9	9	9	1
CO6	9	9	9	9	9	9	1
Total Contribution of COs to POs	54	54	54	54	54	54	14
Weighted Percentage of COs contribution to POs	4.12	4.14	4.26	4.42	7.81	7.77	2.82

Level of Correlation: 0-No Correlation; 1-Low Correlation; 3-Medium Correlation; 9-High Correlation between CO's and PO's.

COURSE CONTENT:

UNIT- I: BANACH SPACES (15 Hours)

Introduction- Basic inequalities –Metric Space and its properties –Vector space – Normed linear spaces, Definitions and properties-Examples of Banach spaces.

UNIT- II: QUOTIENT SPACES (15 Hours)

Quotient spaces-Direct sum of subspace-Continuous linear transformations.

UNIT- III: CONTINUOUS LINEAR FUNCTIONALS: (15 Hours)

Introduction- continuous linear functional-Representation theorems for functional.

UNIT- IV: HAHN BANACH THEOREM (15 Hours)

The Hahn Banach Theorem-Some consequences of the Hahn Banach Theorems.

UNIT- V: BOUNDED LINEAR OPERATORS (12 Hours)

Introduction-The open mapping theorem-The closed graph theorem-The banach Steinhaus theorem-The Weak and Weak* Convergence-The conjugate of an operator.

TEXT BOOK:

D.Somasundaram(2013) - "A I Course in Functional Analysis ",Third Re-Print , Narosa Publishing House,New Delhi.

Unit	Chapter	Sections
I	I	1.1 – 1.6
II	I	1.7 – 1.9
III	II	2.1 –2.3
IV	II	2.4, 2.5
V	III	3.1 – 3.7

REFERENCE BOOKS:

1 .C. Goffman and G. Pedrick(1987) - "A I Course in Functional Analysis", Prentice Hall of India, New Delhi.
2. G.F. Simmons(1963) - "Introduction to Topology and Modern Analysis", McGraw –Hill Book Company, London.

WEB REFERENCES:

1. https://www.maths.usyd.edu.au/u/athomas/FunctionalAnalysis/daners-functional-analysis-2017.pdf

2. https://docs.ufpr.br/~eidam/2019/2/CM075/Kreyszig.pdf

3. https://people.math.ethz.ch/~salamon/PREPRINTS/funcana.pdf

4. http://www.ddegjust.ac.in/2019/4/mal%20641_19042019.pdf

Category	Component	Course Code	Course Title	Contact Hours/ Semester	Credits
PART III	**CORE : XX**	**25MAP19**	**MATHEMATICAL METHODS**	**72**	**4**

Contact Hours per Week: 6

Year	Semester	Internal Marks	External Marks	Total Marks
II	**IV**	**25**	**75**	**100**

PREAMBLE:

To enable the students to learn and gain knowledge about Integral Equations and Calculus of Variations.

COURSE OUTCOME:

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

COs	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Recall the concepts based on Various types of integral equations and Calculus of Variations.	**K_1**
CO2	Explain various types of integral equations, extremals, Euler equations, Euler – Poisson equation, and Ostrogradsky equation.	**K_2**
CO3	Apply various methods for finding the solutions of Fredhlom Integral Equation, Volterra Integral equation and Calculus of Variation.	**K_3**
CO4	Analyze the concepts of Fredhlom Integral Equation and Volterra Integral equation, Calculus of Variation.	**K_4**
CO5	Evaluate the problems based on Fredhlom Integral Equation, Volterra Integral equation and Calculus of Variation.	**K_5**
CO6	Construct initial, boundary value problems, minimum surface of revolution problem, Brachistochrome problem, problem on geodesics.	**K_6**

K_1 - Remember; K_2 – Understand; K_3 - Apply; K_4 - Analyze; K_5 – Evaluate; K_6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	9	9	9	9	3	1	1
CO2	9	9	9	9	1	3	1
CO3	9	9	9	9	3	3	1
CO4	9	9	9	9	3	1	1
CO5	9	9	9	9	3	3	1
CO6	9	9	9	9	3	3	1
Total Contribution of COs to POs	54	54	54	54	16	14	6
Weighted Percentage of COs contribution to POs	4.12	4.14	4.26	4.42	2.32	2.01	1.21

Level of Correlation: 0-No Correlation; 1-Low Correlation; 3-Medium Correlation; 9-High Correlation between CO's and PO's.

COURSE CONTENT:

UNIT –I: INTEGRAL EQUATIONS (15 Hours)

Types of Integral equations –Integral Fredholm Alternative–Equation with separable Kernel.

UNIT- II: METHOD OF SUCCESSIVE APPROXIMATIONS (15 Hours)

Method of successive Approximations – Iterative Scheme - Volterra integral equations – examples.

UNIT- III: SINGULAR & ABEL INTEGRAL EQUATIONS (15 Hours)

Application of Integral equation to ordinary differential equation –Initial value problems –Boundary value problems –Singular integral equations –Abel Integral equation.

UNIT- IV: CALCULUS OF VARIATIONS (15 Hours)

Variation and its properties – Fundamental lemma of calculus of variations - Euler's equation – Functionals of the integral forms -Functional dependent on higher order derivatives – Euler poisson equations.

UNIT –V: CALCULUS OF VARIATIONS (Con…) (12 Hours)

Functionals dependent on the functions of several independent variables – Ostrogradsky equation - Variational problems in parametric form –Applications.

TEXT BOOKS:

For Units I, II and III:

Kanwal.R.P. (1971) – "Linear Integral Equations Theory and Technique", Academic press, New York.

For Unit IV and V:

Elsgolts.L. (1970) – "Differential Equations and Calculus of Variations", Mir publishers, Moscow.

UNIT	CHAPTER	SECTION
I	I II	1.1 – 1.6 2.3 – 2.5
II	III	3.1 – 3.4
III	V VIII	5.1 – 5.2 8.1 – 8.2
IV	VI	6.1 – 6.4
V	VI	6.5 – 6.7

WEB REFERENCES:

1. https://home.iitk.ac.in/~dasgupta/MathBook/lmastertrans.pdf
2. https://onlinelibrary.wiley.com
3. https://nptel.ac.in/courses/111/107/111107098/

Category	Component	Course Code	Course Title	Contact Hours/ Semester	Credits
PART III	CORE : XXI	25MAP20	FLUID DYNAMICS	72	4

Contact Hours per Week: 6

Year	Semester	Internal Marks	External Marks	Total Marks
II	IV	25	75	100

PREAMBLE:

To enable the students to learn and gain knowledge about the concept of stream lines, path lines, energy equation, two dimensional motion, Navier stokes equations and boundary layer in compressible and incompressible flow.

COURSE OUTCOME:

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

COs	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Recall the concepts based on stream lines, path lines, energy equation, two dimensional motion, Navier stokes equations and boundary layer equations.	K_1
CO2	Illustrate stream lines, path lines, energy equation, two dimensional motion, Navier stokes equations and boundary layer equations.	K_2
CO3	Apply the concepts of fluid dynamics in equations of continuity , momentum theorem, Blasius theorem, Navier Strokes equations and boundary layer equations.	K_3
CO4	Analyze the solutions of energy equations Navier Strokes equations and boundary layer equations.	K_4
CO5	Evaluate the problems based on stream lines, path lines and two – dimensional motion.	K_5
CO6	Construct the energy equations, Navier Strokes equations and boundary layer equations.	K_6

K_1 - Remember; K_2 – Understand; K_3 - Apply; K_4 - Analyze; K_5 – Evaluate; K_6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	9	9	9	9	3	9	9
CO2	9	9	9	9	3	9	9
CO3	9	9	9	9	3	9	9
CO4	9	9	9	9	1	3	3
CO5	3	3	3	3	0	1	1
CO6	3	3	3	3	0	0	0
Total Contribution of COs to POs	42	42	42	42	10	31	31
Weighted Percentage of COs contribution to POs	3.20	3.22	3.31	3.43	1.45	4.46	6.25

Level of Correlation: 0-No Correlation; 1-Low Correlation; 3-Medium Correlation; 9-High Correlation between CO's and PO's.

COURSE CONTENT:

UNIT- I: STREAM LINES AND PATH LINES (15 Hours)

Introductory Motions – Velocity – Stream Lines and Path Lines – Stream Tubes and Filaments – Fluid Body – Density – Pressure. Differentiation following the Fluid – Equation ofcontinuity – Boundary conditions – Kinematical and physical – Rate of change of linear momentum – Equation of motion of an inviscid fluid.

UNIT –II: ENERGY EQUATION FOR INVISCID FLUID: (15 Hours)

Euler's momentum Theorem – Conservative forces – Bernoulli's theorem in steady motion – Energy equation for inviscid fluid – circulation – Kelvin's theorem – Vortex motion –
Helmholtz equation.

UNIT- III: TWO DIMENSIONAL MOTION: (15 Hours)

Two Dimensional Motion – Two Dimensional Functions – Complex Potential – Basic singularities – Source – Sink – Vortex – Doublet – Circle theorem. Flow past a circular cylinder
with circulation – Blasius Theorem – Lift force. (Magnus effect)

UNIT- IV: NAVIER-STOKES EQUATIONS: (15 Hours)

Viscous flows – Navier-Stokes equations – Vorticity and circulation in a viscous fluid –Steady flow through an arbitrary cylinder under pressure – StaedyCouettc flow between cylinders in relative motion .

UNIT –V: BOUNDARY LAYER EQUATIONS (12 Hours)

Laminar Boundary Layer in incompressible flow: Boundary Layer concept – BoundaryLayer equations – Displacement thickness, Momentum thickness – Kinetic energy thickness –Integral equation of boundary layer – Flow parallel to semi infinite flat plate – Blasius equationand its solution in series.

TEXT BOOKS:

For Units I and II:

Milne Thomson.L.M. (1968) –"Theoretical Hydro Dynamics", 5th Edition, McMillanCompany.

For Units III, IV and V:

Curle.Nand Davies.H.J (1968) – "Modern Fluid Dynamics" – (Volume I) DVan Nostrand Company Limited, London.

UNIT	CHAPTER	SECTION
I	I	1.0 – 1.3., 3.10-3.41 (omit 3.32)
II	III	3.42 – 3.53 (omit 3.44)
III	III	3.1 – 3.7.5 (omit 3.3.4, 3.4, 3.5.3,3.6)
IV	V	5.1 – 5.3.2
V	VI	6.1 – 6.3.1(omit 6.2.2., 6.2.5)

WEB REFERENCES:

1. https://youtu.be/0VEDeLU2JJs

2. https://www.slideshare.net/muhsenbd/twodimensional-ideal-flow-chapter-6

3. https://www.slideshare.net/Haroonmechno/fm2-35616441

Category	Component	Course Code	Course Title	Contact Hours/ Semester	Credits
PART III	CORE : XXII	25MAP21	PROJECT WORK AND VIVA VOCE	72	4

Contact Hours per Week: 6

Year	Semester	Internal Marks	External Marks	Total Marks
II	IV	20	80	100

PREAMBLE:

To enable the students to learn and gain knowledge about their principal areas of study.

COURSE OUTCOME:

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

COs	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Recall the fundamental disciplinary concepts and methods appropriate to their principal areas of study.	K_1
CO2	Illustrate the depth knowledge about their principal areas of study	K_2
CO3	Apply the knowledge of principles, theories, and concepts to project situations.	K_3
CO4	Analyze the problems creatively through sustained critical investigation	K_4
CO5	Evaluate the consequences of project and their implications for project objectives.	K_5
CO6	Construct the solutions of contemporary issues in their chosen field of research.	K_6

K_1 - Remember; K_2 – Understand; K_3 - Apply; K_4 - Analyze; K_5 – Evaluate; K_6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	9	9	9	9	9	9	9
CO2	9	9	9	9	9	9	9
CO3	9	9	9	9	9	9	9
CO4	9	9	9	9	3	3	3
CO5	9	9	9	9	3	3	3
CO6	9	9	9	9	3	3	3
Total Contribution of COs to POs	54	54	54	54	36	36	36
Weighted Percentage of COs contribution to POs	4.12	4.14	4.26	4.42	5.21	5.18	7.26

Level of Correlation: 0-No Correlation; 1-Low Correlation; 3-Medium Correlation; 9-High Correlation between CO's and PO's.

Category	Component	Course Code	Course Title	Contact Hours/ Semester	Credits
PART III	CORE : XXIII ELECTIVE : IV	25MAP22A	FUZZY LOGIC AND FUZZY SETS	72	3

Contact Hours per Week: 6

Year	Semester	Internal Marks	External Marks	Total Marks
II	IV	25	75	100

PREAMBLE:

To enable the students to learn and gain knowledge about fuzzy sets, fuzzy relations, fuzzy measures, uncertainty and information and also their applications.

COURSE OUTCOME:

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

COs	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Recall the basic concepts of fuzzy sets theory, types of fuzzy sets, standard operations of fuzzy sets, fuzzy relations, fuzzy graphs and real life applications	K_1
CO2	Express the basic concepts of fuzzy set theory with fuzzy logic, fuzzy relations, fuzzy measures, measures of fuzziness, fuzzy graphs and real life applications	K_2
CO3	Apply the concepts of fuzzy sets, operations of fuzzy sets, fuzzy relations, fuzzy measures in real life applications	K_3
CO4	Analyze the standard fuzzy operations, types of fuzzy relations, different fuzzy measures, types of fuzzy controller.	K_4
CO5	Evaluate fuzzy set, fuzzy relations, fuzzy measures, measures of fuzziness in real life	K_5
CO6	Design fuzzy models in real life situations.	K_6

K_1 - Remember; K_2 – Understand; K_3 - Apply; K_4 - Analyze; K_5 – Evaluate; K_6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	9	9	9	9	3	3	3
CO2	9	9	9	9	3	3	3
CO3	9	9	9	9	3	3	3
CO4	9	9	9	9	3	3	3
CO5	9	9	9	9	3	3	3
CO6	9	9	9	9	3	3	3
Total Contribution of COs to POs	54	54	54	54	18	18	18
Weighted Percentage of COs contribution to POs	4.12	4.14	4.26	4.42	2.60	2.59	3.63

Level of Correlation: 0-No Correlation; 1-Low Correlation; 3-Medium Correlation; 9-High Correlation between CO's and PO's.

COURSE CONTENT:

UNIT – I: FUZZY SETS AND EXTENSIONS (12 Hours)

Basic definitions- Set-theoretic Operations for fuzzy sets- Types of Fuzzy sets- Algebraic operations- Criteria for selection appropriate aggregation operators.

UNIT – II: FUZZY MEASURES AND EXTENSION PRINCIPLE (15 Hours)

Fuzzy measures- Measures of fuzziness- The extension principle- Operations of type 2 fuzzy sets – Special extended operations- LR-representation of fuzzy sets

UNIT – III: FUZZY RELATIONS AND FUZZY GRAPHS (15 Hours)

Fuzzy relations on sets and fuzzy sets – Composition of fuzzy relations- Properties of the max-min composition- Fuzzy graphs- Special fuzzy relations.

UNIT –IV: FUZZY CONTROL (15 Hours)

Origin and objectives- Automatic control- The fuzzy controller- Types of fuzzy controller- Mamdani controller- Defuzzification- Sugeno controller- Applications

UNIT – V: APPLICATIONS (15 Hours)

General discussion – Natural, life and social sciences – Management and decision making – Computer Science.

TEXT BOOK:

1. H.J.Zimmermann (2006) -"Fuzzy set theory and its applications" (Fourth edition), Springer International Edition
2. GeoregeJ.Klir and Tina A. Folger, (1995) - "Fuzzy Sets, Uncertainity and Information", Prentice-Hall of India Private Limited.

UNIT	BOOK	CHAPTER	SECTION	PAGE NUMBER
I	1	2 3	2.1-2.2 3.1-3.2.3	11-20 23-44
II	1	4 5	4.1-4.2 5.1-5.3.2	47-52 55-68
III	1	6	6.1-6.3	71-89
IV	1	11	11.1-11.4.3 11.7-11.7.4	223-240 244-254
V	2	6	6.1 – 6.6	231-264

REFERENCE BOOK:

George J.Klir and Boyuan, "Fuzzy Sets and Fuzzy Logic – Theory and Applications", Prentice-Hall of India Private Limited.

WEB REFERENCES:

1. https://en.wikipedia.org/wiki/Fuzzy_set
2. https://www.tutorialspoint.com/fuzzy_logic/fuzzy_logic_set_theory.htm
3. https://youtu.be/LUz-FbwPh3Q

Category	Component	Course Code	Course Title	Contact Hours/ Semester	Credits
PART III	CORE : XXIII ELECTIVE : IV	25MAP22B	CONTROL THEORY	72	3

Contact Hours per Week: 6

Year	Semester	Internal Marks	External Marks	Total Marks
II	IV	25	75	100

PREAMBLE:

To enable the students to gain the knowledge about modeling the control systems using difference equations.

COURSE OUTCOME:

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

COs	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Recall the concept of observability, controllability, Stability in Control theory.	K_2
CO2	Explain about linear and non-linear equations in control theory.	K_2
CO3	Applying the knowledge of differential equations in linear and non-linear systems.	K_3
CO4	Analyze the properties of linear and non- linear equations in observability, Controllability and stability.	K_4
CO5	Evaluate obsevability, Controllability, stability in different equations.	K_5
CO6	Construct a knowledge in observability, Controllability abd stability of linear and non- linear equations.	K_6

K_1 - Remember; K_2 – Understand; K_3 - Apply; K_4 - Analyze; K_5 – Evaluate; K_6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	9	9	9	9	3	3	3
CO2	9	9	9	9	3	3	3
CO3	9	9	9	9	3	3	3
CO4	9	9	9	9	3	3	3
CO5	9	9	9	9	3	3	3
CO6	9	9	9	9	3	3	3
Total Contribution of Cos to POs	54	54	54	54	18	18	18
Weighted Percentage of Cos contribution to POs	4.12	4.14	4.26	4.42	2.60	2.59	3.63

Level of Correlation: 0-No Correlation; 1-Low Correlation; 3-Medium Correlation; 9-High Correlation between CO's and PO's.

COURSE CONTENT:

UNIT- I: OBSERVABILITY: (15 Hours)

Linear Systems –Observability Grammian –Constant coefficient systems – Reconstruction kernel –Nonlinear Systems.

UNIT- II: CONTROLLABILITY: (14 Hours)

Linear systems –Controllability Grammian – Adjoint systems –Constant coefficient systems –steering function –Nonlinear systems.

UNIT- III: STABILITY: (15 Hours)

Stability –Uniform Stability –Asymptotic Stability of Linear Systems.

Unit- IV: STABILITY (Continuation) (14 Hours)

Perturbed linear systems –Nonlinear systems – OPTIMAL CONTROL: Linear time varying systems.

UNIT- V : STABILIZABILITY: (14 Hours)

Stabilization via linear feedback control –Bass method –Controllable subspace – Stabilization with restricted feedback.

TEXT BOOK :

Balachandran.K and Dauer.J.P.(2012)– "Elements of Control Theory", 2nd edition, Narosa, New Delhi.

UNIT	CHAPTER	PAGE NO.
I	2	21 - 38
II	3	40 – 56
III	4	75 - 81
IV	4, 6	82 – 91, 119 – 128, 130 -131,
V	5	100 - 117

REFERENCE BOOKS:

1. Conti .R (1976) – "Linear Differential Equations and Control", Academic Press, London.
2. Curtain.R.F. and Pritchard.A.J.(1977) – " Functional Analysis and Modern Applied Mathematics", Academic Press, New York.
3. Klamka.J (1991) – "Controllability of Dynamical Systems", Kluwer Academic Publisher, Dordrecht.
4. Russell.D.L. (1979) – "Mathematics of Finite Dimensional Control Systems" , Marcel Dekker, New York.

SYLLABUS FOR VALUE ADDED COURSES

S.NO	COURSE CODE	CLASS	NAME OF THE COURSE
1	25VAP1	I M.SC MATHEMATICS	ABSTRACT REASONING AND INTERPERSONAL COMMUNICATION
2	25VAP2	II M.SC MATHEMATICS	QUANTITATIVE LITERACY

Category	Course Code	Course Title	Contact Hours/ Semester	Class
VALUE ADDED COURSE	**25VAP1**	**ABSTRACT REASONING AND INTERPERSONAL COMMUNICATION**	**75**	**I – M.SC MATHEMATICS**

COURSE CONTENT

UNIT I: Simplification and Calendar **(15 Hours)**

BODMAS Rule- Ascending Problems- Descending Problems- Formulas- Problems Based on Formulas- Square Root Problems- Cube Root Problems- Finding the Value of X- Calendar Introduction- Problems Based on Calendar

Unit II: Profit & Loss, Interest Calculation and Data Arrangements **(15 Hours)**

Profit & Loss Basics- Profit & Loss Word Problems- Mixtures & Alligations- Simple Interest- Compound Interest- Problems Based on Difference between SI & CI- Linear Arrangements- Circular Arrangements.

Unit III: Verbal Ability **(15 Hours)**

Parts of Speech- Tenses- Verbs- Articles- Prepositions- Voices and Speech- Sentence Correction

Unit IV: Professional Etiquette **(15 Hours)**

Body Language- Professionalism- Time Management- Letter Writing- Debate- Presentation Skills 1-Team Building

Unit V: General Communication **(15 Hours)**

Communication (Based on General Topics)- Resume Writing- Self Introduction Practice

RULES AND REGULATION:

The value-added course follows a non-semester pattern, with assessment conducted at the end of the year by the Training and Placement cell, totaling 100 marks. A minimum attendance of 70% is required to be eligible for the examination. The evaluation criteria for the course are as follows:

Split up for 100 Marks

Aptitude	25
Resume Writing	25
Self Introduction & Presentation Skill 1	25
Verbal	25

Category	Course Code	Course Title	Contact Hours/ Semester	Class
VALUE ADDED COURSE	**25VAP2**	**QUANTITATIVE LITERACY**	**75**	**II – M.SC MATHEMATICS**

COURSE CONTENT

UNIT I: Reasoning 1 **(15 Hours)**
Syllogisms- Boats and Streams Problems- Races and Games- Data Sufficiency- Statements & Conclusions- Imaginary Number Questions- Data Interpretation

Unit II: Reasoning 2, Mensuration and Trigonometry **(15 Hours)**
Coding & Decoding- Quadratic Equations- Image Interpretation- Mensuration- Trigonometry

Unit III: Writing and Presentation Skills **(15 Hours)**
Email Writing- Report Writing- Role play- Presentation Skills 2

Unit IV: Training Interview 1 **(15 Hours)**
Communication (Based on Current Affairs and Technology)- Group Discussion Basics- Group Discussion Mock

Unit V: Training Interview 2 **(15 Hours)**
HR Interview Questions- Stress Interview Questions- Personal Interview Mock

RULES AND REGULATION:
The value-added course follows a non-semester pattern, with assessment conducted at the end of the year by the Training and Placement cell, totaling 100 marks. A minimum attendance of 70% is required to be eligible for the examination. The evaluation criteria for the course are as follows:

Split up for 100 Marks

Aptitude	25
Writing & Presentation Skill 2	25
Self Introduction & Group Discussion	25
Personal Interview	25

SYLLABUS FOR CORE (OPEN ELECTIVE) COURSE OFFERED BY DEPARTMENT OF MATHEMATICS

Category	Component	Course Code	Course Title	Contact Hours/ Semester	Credits
PART III	**CORE : XVII OPEN ELECTIVE**	**25MAPOE1**	**MATHEMATICAL APTITUDE FOR COMPETITIVE EXAMINATIONS**	**36**	**2**

Contact Hours per Week: 3

Year	Semester	Internal Marks	External Marks	Total Marks
II	**III**	**25**	**75**	**100**

PREAMBLE:

To enable the students to learn and gain knowledge about the basic concepts of Number System, Time, Speed, Distance, Boats and Streams, Reasoning, Profit and loss, etc.

COURSE OUTCOME:

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

COs	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Recall the basic concepts of Number system, Time, Boats and Streams, Reasoning, Profit and loss.	**K_1**
CO2	Express different types of Number, Distance, Percentage, Coding and Decoding, Boats and Streams.	**K_2**
CO3	Apply the strategies and methods for solving problems.	**K_3**
CO4	Analyze percentage, profit, loss, speed ,time and distance.	**K_4**
CO5	Evaluate the problems based on number system, percentage, profit, loss, speed, time and distance.	**K_5**
CO6	Construct examples based on number system.	**K_6**

K_1 - Remember; K_2 – Understand; K_3 - Apply; K_4 - Analyze; K_5 – Evaluate; K_6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	9	9	9	9	3	3	3
CO2	9	9	9	9	3	3	3
CO3	9	3	9	3	3	3	3
CO4	9	9	3	3	1	0	0
CO5	3	3	9	1	0	0	0
CO6	0	0	0	0	0	0	0
Total Contribution of Cos to POs	39	33	39	25	10	9	9
Weighted Percentage of Cos contribution to POs	2.97	2.53	3.07	2.04	1.45	1.29	1.81

Level of Correlation: 0-No Correlation; 1-Low; 3-Medium; 9-High between CO's and PO's.

COURSE CONTENT:

UNIT -I TEST OF DIVISIBILITY (7 HOURS)

Number System-Classification of Numbers-Test of Divisibility-Units Place-Remainders-LCM and HCF - HCF of Fractions-LCM of Fractions-Factorial.

UNIT- II TIME, SPEED AND DISTANCE (8 HOURS)

Time, Speed and Distance –Relative Speed-Simple Problems on Speed-Average Speed-Different Distance-Same Distance-Solved Examples.

UNIT -III TRAINS, BOATS AND STREAMS (8 HOURS)

Problems on Trains – Same Distance-Opposite Direction- Boats and Streams – Upstream-Downstream Related Problems- Related Examples and Solved Problems.

UNIT- IV PERCENTAGE, PROFIT AND LOSS (7 HOURS)

Percentage – important facts and formulae-Problems on Percentage-Profit and loss-Basic concepts- Formulas-Tricks and Related Examples.

UNIT -V REASONING (6 HOURS)

Reasoning- Arrangement: Linear and Circular-Directions-Blood Relations-Coding and Decoding-Solved Examples.

TEXT BOOK:

1. Aggarwal R.S. (2012 Edition), Quantitative Aptitude for Competitive Examinations, S.Chand & Company Ltd, New Delhi.

REFERENCE BOOK:

1. Sijwali B. S.(2007), Quantitative Aptitude, Arihand Publications (India) PVT LTD.
2. Abhijit Guha(2006), Quantitative Aptitude for Competitive Examinations, McGraw Hill Companies.

BOOKS FOR REFERENCE:

1. https://www.tutorialspoint.com/quantitative_aptitude/aptitude_number_system.htm
2. https://testbook.com/learn/maths-speed-time-and-distance/
3. https://www.handakafunda.com/tricks-to-solve-blood-relations-problems-in-logical-reasoning

SYLLABUS FOR CORE ALLIED COURSES

P.K.R. ARTS COLLEGE FOR WOMEN
(Re-Accredited with 'A' Grade by NAAC)
Autonomous Institution-Affiliated to Bharathiar University
M.C.A. DEGREE PROGRAMME
I SEMESTER

Category	Component	Course Code	Course Title	Contact Hours/ Semester	Credits
PART III	CORE ALLIED	25CAP04	OPERATIONS RESEARCH	48	3

Contact Hours per Week: 4

Year	Semester	Internal Marks	External Marks	Total Marks
II	IV	25	75	100

PREAMBLE:

To enable the students to gain the knowledge about Linear Programming Problem and Methods to solve an L.P.P.

COURSE OUTCOME:

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

COs	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Outline the meaning, purpose and tools of LPP, assignment, replacement, sequencing and pert model	K_1
CO2	Express the procedures and steps for LPP, assignment, replacement, sequencing and pert model	K_2
CO3	Illustrate the methodologies to get the optimal solution and the period of replacement	K_3
CO4	Analyze the concepts of LPP, assignment, replacement, sequencing and pert model	K_4
CO5	Evaluate different situations after the solution of LPP, assignment, replacement, sequencing and pert problems	K_5
CO6	Construct LP and Replacement models for various type of problems	K_6

K_1 - Remember; K_2 – Understand; K_3 - Apply; K_4 - Analyze; K_5 – Evaluate; K_6 – Create.

CO-PO MAPPING (COURSE ARTICULATION MATRIX)

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
CO1	9	9	9	9	3	9	9
CO2	9	9	9	9	3	9	9
CO3	9	9	9	9	3	3	1
CO4	9	9	9	9	1	3	1
CO5	9	9	9	9	1	3	1
CO6	9	9	9	9	0	3	0
Total Contribution of Cos to POs	54	54	54	54	11	30	21
Weighted Percentage of Cos contribution to POs	4.22	4.50	4.56	4.71	1.73	3.00	3.60

Level of Correlation: 0-No Correlation; 1-Low; 3-Medium; 9-High between CO's and PO's.

COURSE CONTENT:

UNIT I : LINEAR PROGRAMMING (10 Hours)

Formulation of LPP - Simplex Method - Big M method - Two Phase Simplex Method

UNIT II : THE ASSIGNMENT PROBLEM (10 Hours)

Introduction – Mathematical formulation - Hungarian Assignment Method – Maximization in Assignment Problem – Unbalanced Assignment Problem.

UNIT III : REPLACEMENT MODEL (10 Hours)

Introduction – Replacement of items that deteriorates gradually : value of money does not change with time – Value of money changes with time – Replacement of items that fails suddenly - Individual Replacement –Group Replacement.

UNIT IV : SEQUENCING PROBLEMS (10 Hours)

Introduction-Problem of sequencing - Basic terms used in sequencing- Processing n-jobs through 2 machines - Processing n –jobs through k machines - Processing 2 jobs through k machines(Problems only).

UNIT V : PERT (8 Hours)

Introduction – Construction of Network - PERT Calculations.

NOTE : No Derivations and Proof, Simple Problems Only.

TEXT BOOK

KantiSwarup, P.K.Gupta, ManMohan(2012), "Operations Research", 16th Edition, Publishing Sultan chand& Sons, New Delhi.

UNIT	CHAPTER	SECTION
I	2 4	2.3 – 2.4, 4.3 – 4.4
II	11	11.1 – 11.4
III	18	18.1 –18.3
IV	12	12.1 – 12.6
V	25	25.1 –25.5, 25.7

REFERENCE BOOKS:

1. Frederick S. Hillier, Gerald J. Lieberman - "Introduction to Operations Research", Tata McGraw Hill Pub Company Ltd., Seventh Edition.
2. Gupta.P.K., Hira.D.S. - "Problems in Operations Research", S.Chand& Company Ltd.
3. Sharma.J.K. - "Operations Research Theory and Applications", Macmillan India Ltd., Second Edition.

WEB REFERENCES:

1. https://youtu.be/vKVkOpNDZ2s

2. https://youtu.be/WrAf6zdteXI

3. https://www.slideserve.com/sara-kent/the-simplex-method

COURSES FOR ADVANCED LEARNERS

S.NO	COURSE CODE	NAME OF THE COURSE
1	**25MAALP1**	**ANALYTIC NUMBER THEORY**
2	**25MAALP2**	**QUANTITATIVE TECHNIQUES**
3	**25MAALP3**	**COMMUTATIVE ALGEBRA**
4	**25MAALP4**	**PROBABILITY AND STATISTICS**

Category	Course Code	Title Of The Course	Credit
EXTRA CREDIT	**25MAALP1**	**ANALYTIC NUMBER THEORY**	**4**

PREAMBLE :

To enable the students to learn and gain knowledge about analytic Number theory.

COURSE OUTCOMES

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

COs	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Bring back the concepts of analytic Number theory.	**K_1**
CO2	Demonstrate Dirichlet multiplication and averages of Arithmetic functions and distribution of primes.	**K_2**
CO3	Apply conceptual knowledge and formulae in analytic number theory to solve the problems.	**K_3**
CO4	Analyze the proof and context of theorems in distribution of Primes, Arithmetic functions.	**K_4**
CO5	Evaluate the solutions of Arithmetic functions.	**K_5**
CO6	Manipulate simple research problems on Arithmetic functions	**K_6**

K_1 - Remember; K_2 – Understand; K_3 - Apply; K_4 - Analyze; K_5 – Evaluate; **K_6 – Create**.

COURSE CONTENT:

UNIT- I ARITHMETICAL FUNCTIONS

Introduction-The Mobious function μ-The euler totient function ϕ-Arelation connecting ϕ and μ- the product formula for ϕ(n).

UNIT –II DIRICHLET MULTIPLICATION

Dirichlet product of arithmetical functions - Dirichlet and Mobious inversion formula –The mangold function- Multiplicative functions and dirichlet multiplication – the inverse of completely multiplicative function-Liovilli's function –the divisors function

UNIT- III AVERAGES OF ARITHMETICAL FUNCTIONS

Introduction – The big oh notion-Euler summation formula-some elementary asymptotic formula-the average of order d(n),the average order of the divisor functions .

UNIT- IV AVERAGES OF ARITHMETICAL FUNCTIONS

Average of order φ (n) - average of order μ(n) and of Λ(n)- The partial sums of a Dirchlet product-Application to μ(n) and Λ(n)-Another identity for the partial sums of a Dirchlet product.

UNIT- V ELEMENTARY THEOREMS ON THE DISTRIBUTION OF PRIMES

Introduction-Chebyshev's function ψ (x) and ϕ(x)-Relation connecting ϕ(x) and π(x)-Some equivalent forms of the prime number theorem.

TEXT BOOK:

Apostol.T.M.(1995)– "Introduction to Analytic Number Theory", I edition Springer Verlag.

UNIT	CHAPTER	SECTIONS
I	**II**	**2.1-2.5**
II	**II**	**2.6 - 2.13**
III	**III**	**3.1 - 3.6**
IV	**III**	**3.7 ,3.9-3.12**
V	**IV**	**4.1-4.4**

REFERENCE BOOKS:

1. Ivan Nivan and HerbertsZucherman (2013) – "An Introduction to Theory of Numbers",Fifth edition,Wiley Indian PvtLtd.,New Delhi-110002.
2. Gareth Jones .A. & Mary Jones J.(1998) – " Elementary Number Theory" - Springer publications.

Category	Course Code	Title Of The Course	Credits
EXTRA CREDIT	**25MAALP2**	**QUANTITATIVE TECHNIQUES**	**4**

PREAMBLE:

To enable the students to learn decision making problems based on deterministic and probabilistic models.

COURSE OUTCOME:

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

COs	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Recall the meaning, purpose and tools of Transportation, Sequencing, Replacement, Non Linear programming and Queuing models.	**K_1**
CO2	Explain the procedures and steps for Transportation, Sequencing, Replacement, Non Linear programming and Queuing Theory.	**K_2**
CO3	Illustrate the methodologies to get the optimal solution and the period of replacement, NLP and Queuing Theory.	**K_3**
CO4	Measure the mathematical background of minimum Transportation cost, Sequencing, the mechanism behind the sudden failure of systems,	**K_4**
CO5	Evaluate the problems based on Transportation, Sequencing, Replacement, Non Linear programming and Queuing models.	**K_5**
CO6	Construct the sequencing tables and Replacement tables for various type of problems	**K_6**

K_1 - Remember; K_2 – Understand; K_3 - Apply; K_4 - Analyze; K_5 – Evaluate; **K_6 – Create**.

COURSE CONTENT:

UNIT- I: TRANSPORTATION PROBLEM

General Structure; Various methods for finding initial solution: Maximization and Minimisation problems North West Corner Method, Least Cost Method, Vogel‟s Approximation Method; Finding Optimal Solution: Modified Distribution method; Variations: Unbalanced Transportation Problem.

UNIT-II: SEQUENCING PROBLEMS

Introduction-Problem of sequencing - Basic terms used in sequencing- Processing n-jobs through 2 machines - Processing n –jobs through k machines - Processing 2 jobs through k machines (Problems only).

UNIT –III: REPLACEMENT

Introduction - Replacement of equipment / assets that deteriorates gradually - Replacement of equipment that fails suddenly and problems.

UNIT- IV: NON LINEAR PROGRAMMING

Quadratic programming – WOLFE’S modified simplex method- BEALE’S method.

UNIT- V: QUEUING THEORY

Queuing Theory -Definition of waiting line model -Queue discipline -Traffic intensity -Poisson arrival –Birth death process -Problem from single server: finite and infinite population model.

TEXT BOOK:

Kantiswarup, P. K. Gupta, Man Mohan (2017) –" Operations Research", 18th Revised edition, S. Chand & Sons Education Publications, New Delhi.

UNIT	CHAPTER	PAGE
I	10	247-258
II	12	327-341
III	18	477-495
IV	28	853-861
IV	21	589-621

REFERENCE BOOKS:

1. DharaniVenkata Krishnan .S – " Operations Research Principles and Problems" Keerthi publishing house PVT Ltd.
2. Prem Kumar Gupta D. S. Hira – "Operations Research " , S. Chand & Company Ltd, Ram Nagar, New Delhi.

Category	Course Code	Title Of The Course	Credits
EXTRA CREDIT	**25MAALP3**	**COMMUTATIVE ALGEBRA**	**4**

PREAMBLE:

To enable the students to learn and gain knowledge about Modules and Rings.

COURSE OUTCOME:

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

COs	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Recall the definitions of Localization , Modules and rings.	**K_1**
CO2	Explain the Localization concepts of Modules and rings.	**K_2**
CO3	Apply the theoretical ideas of group theory in Modules and rings.	**K_3**
CO4	Analyze the properties and proposition on Modules, Noetherian rings and Artinian rings.	**K_4**
CO5	Evaluate the simple problems on Modules and rings.	**K_5**
CO6	Construct simple examples for Modules and rings.	**K_6**

K_1 - Remember; K_2 – Understand; K_3 - Apply; K_4 - Analyze; K_5 – Evaluate; **K_6 – Create**.

COURSE CONTENT:

UNIT - I: MODULES

Introduction – modules – free modules.

UNIT - II: PROJECTIVE MODULES

Introduction - Projective Modules – Shanuel's lemma

UNIT - III: LOCALIZATION

Introduction – ideals – Prime avoidance theorem – Chinese remainder theorem.

UNIT – IV: NOETHERIAN RINGS

Introduction - Hilbert's basis theorem.

UNIT –V: ARTINIAN MODULES

Introduction - Artinian modules – structure of Artinian rings.

TEXT BOOK

N.S. Gopala Krishnan - **Commutative Algebra,** 2nd Edition, University Press (India) Private Limited.

UNIT	CHAPTER	SECTION
I	**1**	**1.1 - 1.1.29**
II	**1**	**1.2 – 1.2.20**
III	**2**	**2.1 – 2.1.32**
IV	**3**	**3.1 – 3.1.13**
V	**3**	**3.3 – 3.3.14**

REFERENCE BOOK:

Sharp. R. Y. , "Step in Commutative Algebra", Cambridge University Press, Cambridge, 2000.

Category	Course Code	Title Of The Course	Credit
EXTRA CREDIT	**25MAALP4**	**PROBABILITY AND STATISTICS**	**4**

PREAMBLE:

To enable the students to gain the knowledge about probability and statistics.

COURSE OUTCOME:

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

COs	CO STATEMENT	KNOWLEDGE LEVEL
CO1	Recall the basic terms and concepts of probability, random variables, sampling, time series, test of hypothesis and significance.	**K_1**
CO2	Classify the distribution functions of discrete and continuous random variables, sampling attributes and probability.	**K_2**
CO3	Apply various theorems and tests to solve statistical problems.	**K_3**
CO4	Analyze time series, probability, distribution functions and test of hypothesis.	**K_4**
CO5	Evaluate the problems on distribution functions, probability and time series.	**K_5**
CO6	Predict the values in time series.	**K_6**

K_1 - Remember; K_2 – Understand; K_3 - Apply; K_4 - Analyze; K_5 – Evaluate; **K_6 – Create**.

COURSE CONTENT:

UNIT –I: THEORY OF PROBABILTY

Introduction to probability – History of probability – Basic Terminologies – Mathematical probability – Limitations – Statistical probability – Limitations – Simple examples.

UNIT- II: THEROMS ON PROBABILITY

Some theorems on probability – Addition Theorem on probability – Boole's inequality – Conditional probability – Multiplication theorem on probability – independent events – Multiplication theorem for independent events

UNIT –III: RANDOM VARIABLE

Introduction to random variable – Distribution function – Discrete random variable – Continuous random variable – Continuous distribution function

UNIT –IV: SAMPLING THEORY

Introduction to Sampling – Types of sampling – Parameter and statistics – Test of significance – Procedure of test of hypothesis – Test of significance of sampling theory – Large sampling – Sampling of Attributes

UNIT –V: TIME SERIES

Definition of Time Series - Components of Time Series-Methods of estimating trend – Graphic, Semi-average, Moving average and Method of Least squares –Advantages and Disadvantages .

TEXT BOOK:

1. Guptha, S.C & Kapoor, V.K.,(2007) - "Fundamentals of Mathematical statistics", Sultan chand & Sons.

UNIT	CHAPTER	SECTION	PAGE NUMBER
I	**3**	**3.1-3.5**	**3.1-3.18**
II	**3**	**3.9 – 3.13**	**3.30 – 3.45**
III	**5**	**5.1 – 5.4**	**5.1 – 5.30**
IV	**14**	**14.1 – 14.7**	**14.1 – 14.23**

2. Navnitham. PA.(2012) - **"**Business Mathematics and Statistics**"**, Jai publishers, Trichy.

UNIT	CHAPTER	PAGE NUMBER
V	**14**	**579-601**

REFERENCE BOOKS:

1. Gupta. S.P. (2016) - "Statistical Methods", Sultan Chand & Sons, New Delhi.
2. Vittal. P.R. (2013) - "Mathematical Statistics", Margham Publishers, Chennai.

DISTRIBUTION OF MARKS

DISTRIBUTION OF MARKS AND QUESTION PAPER PATTERN

FOR SCHOLASTIC COURSES UNDER PART III, IV AND V

OF ALL PG PROGRAMMES – 2025-2026 and onwards

For Scholastic Courses:

S. No.	CATEGORY	TOTAL MARKS	Distribution Of Marks		Passing Minimum For (ESE)		Overall Passing Minimum For (CIA & ESE)
			CIA *	ESE **	CIA *	ESE **	
1.	**Theory** **(Both CIA and ESE)** Core / Allied / Open Elective	100	25	75	-	38	50
2.	**Practical** **(Both CIA and ESE)**	100	40	60	--	30	50
3.	**100% INTERNAL (ONLY CIA / NO ESE)** Ability Enhancement	100	100	--	50	--	50
4.	**100% EXTERNAL (ONLY ESE)** Proficiency Enhancement	100	--	100	--	50	50
5.	**Project Work and Viva-voce**	100	20	80	--	40	50

***Bloom's Taxonomy based assessment pattern.**

**** ONLY CIA indicates 100% CIA course, ONLY ESE indicates 100% ESE appearance, BOTH indicate CIA and ESE components.**

a. For Courses - Theory/Practical/Project - (Both CIA and ESE)

1.1 For THEORY Courses (BOTH CIA AND ESE) - Core / Allied / Open Elective

1.1.1 Distribution of Marks:

<table>
<tr><th>SPLIT – UP</th><th>COMPONENTS</th><th>K LEVEL</th><th colspan="2">MARKS</th><th>TOTAL MARKS</th></tr>
<tr><td rowspan="6">CIA</td><td rowspan="3">Assignments: A student is expected to submit three assignments (includes one e-assignment) on any topic relevant to her course as directed by her course instructor based on the assignment schedule provided at the beginning of the semester for every course. Marks will be awarded based on concept clarification and justification on the task. Average marks of the three assignments are considered in this case. A student can score a maximum of 10 marks from assignments. (All assignments – online submission of e-assignment)</td><td>K4</td><td>5</td><td rowspan="3">Average of 3 assignments

15/3 = 5</td><td rowspan="6">25</td></tr>
<tr><td>K5</td><td>5</td></tr>
<tr><td>K6</td><td>5</td></tr>
<tr><td>Seminar: A student shall handle a seminar on any topic relevant to her course as directed by her course instructor for which marks shall be awarded based on concept clarification and justification on the task. A student can score a maximum of 5 marks for her seminar.</td><td>K3</td><td colspan="2">5</td></tr>
<tr><td>Others: A student will be evaluated during the semester on her participation in class, case studies presentation, field work, field survey, group discussion, term paper, participation in workshop/conference, presentation of papers in conferences, surprise / informed quizzes from the respective courses that maybe conducted online / offline with simple multiple choice questions, report / content writing, etc. Average marks in these activities will fetch her maximum of 5 marks.</td><td>K1 – K6</td><td colspan="2">5</td></tr>
<tr><td>CIA I and CIA II tests: A student will be evaluated during the semester in Two CIA tests that would be conducted as per the schedule approved by the academic head. Average of the two tests will be considered in this category.</td><td rowspan="2">K1 – K6</td><td colspan="2">5</td></tr>
<tr><td>Model Exam: A student has to appear for the MODEL EXAM that would be conducted as per the schedule approved by the academic head.</td><td colspan="2">5</td></tr>
</table>

1.1.2 CIA, Model Exam and ESE Question paper pattern with K-levels:

i. For CIA Tests – 2 Hour test:

SECTION	MARKS	OBE QP Pattern	No. of questions in Knowledge Levels
A	6*1=6 **(MCQ with 4 options)**	K1- 3 questions K2- 3 questions	K1- 3 K2- 3 K3- 2 K4- 2 K5- 2 K6- 1
B	4*5=20 (Either/Or)	K3- 2 questions K4- 2 question	
C	3*8=24 (Either/Or)	K5- 2 question K6- 1 question	
Total	**50**	**13 questions**	

ii. For Model Exam and ESE – 3 Hours exam:

SECTION	MARKS	OBE QP Pattern	No. of questions in Knowledge Levels
A	10*1=10 **(MCQ with 4 options)**	Q. No. 1,3,5,7,9 -K1 Q. No. 2,4,6,8,10 -K2	K1- 5 K2- 5 K3- 3 K4- 2 K5- 3 K6- 2
B	5*5=25 (Either/Or)	K3- 3 questions K4- 2 questions	
C	5*8=40 (Either/Or)	K5- 3 question K6-2 question	
Total	**75**	**20 questions**	

1.2 <u>For Practical Courses (BOTH CIA and ESE):</u>
<u>Distribution of the Marks</u>

SPLIT – UP	COMPONENTS	K Level	MARKS	TOTAL MARKS
CIA	**Conduct of Experiments** / Observations *(Minimum 10 experiments)*	K2	10	40
	Periodical Lab Tests (Average of TWO) : 10 Marks	K3	25	
	Model Test : 15 Marks	K5		
	Record Work	K1	5	
ESE	**Experiment / Activity: 1** Algorithm / Steps / Procedure / Logic Input / Execution / Observations / Output / Result	 K4 K6	 10 15	60
	Experiment / Activity: 2 Algorithm / Steps / Procedure / Logic Input / Execution / Observations / Output / Result	 K4 K6	 10 15	
	Record Work	K1	10	

Record work is MANDATED for appearance in the ESE. Failing to submit will disqualify the candidate from appearing for the ESE.

- There shall be change in the components measured depending on the nature of the course and is left to the discretion of the department.

2. For THEORY COURSES that are 100% INTERNAL (ONLY CIA / NO ESE - 100 Marks):

2.1. CIA Mark Split-up and CIA Question Paper pattern with K-levels:

Tests	Marks	Knowledge Level	Total
FINAL EXAM (3 HOURS)	5 Questions **5 X 20 = 100** One question from each unit *(*Either / or type*)* *Both options from the same unit / same level*	K1, K2, K3, K4, K5, K6 Any level can be used	**100**

Note: 100% CIA ONLY, NO ESE.

3. For THEORY COURSES that are 100% EXTERNAL (NO CIA / ONLY ESE - 100 Marks):

SPLIT – UP	COMPONENTS	K LEVEL	TOTAL MARKS
ESE (3 HOURS)	5 Questions **5 X 20 = 100** One question from each unit *(*Either / or type*)* *Both options from the same unit / same level*	K1, K2, K3, K4, K5, K6 Any level can be used	100

Note: NO CIA, 100% ESE ONLY.

4. For evaluation of Project (ESE) under Part III:

Departments encouraging project work may adopt the following structure for evaluation of reports else, they shall define their own rubrics as per need. **The project reports** are evaluated at the end of semester jointly by the **Internal & External Examiners** as appointed by COE. Following components shall be used for evaluation:

SPLIT - UP	COMPONENTS (K1 – K6 LEVELS)		TOTAL MARKS
CIA	Regularity	10	20
	Review / Presentation	10	
ESE*	Knowledge about the organisation / theme of study	20	80
	Nature of Work / Logic behind the study	20	
	Learning Outcome	20	
	Viva – Voce	20	

* **ESE Viva-Voce for projects will be jointly conducted by internal and external examiners.**

- There shall be change in the components measured depending on the nature of the course and is left to the discretion of the department.

GUIDELINES FOR SCHOLASTIC COURSES

S. No.	Particulars
1	**Credit transferability for courses**
2	**For Courses under Part- III**
	2.1. Open Elective
	2.2. Institutional training / Industrial training / Mini Project
3	**For Courses under Part- IV**
	3.1. Skill Enhancement
	3.2. Ability Enhancement
4	**For Courses under Part- V**
	4.1. Proficiency Enhancement
	4.2. Competency Enhancement

- **Credit transferability for courses:**

In lieu with the direction of the University Grants Commission (UGC) for universities and colleges to use the Massive Open Online Courses (MOOC) available on the HRD Ministry's 'Swayam' platform for credit transfer, students who complete a course in their curriculum (the courses approved by Swayam board, are ready to be offered in the July semester 2020 AND ONWARDS) are permitted to transfer their credit and can be exempted from appearing the particular course in their curriculum. The score obtained will be accounted for CGPA calculation. The credits earned can be transferred under PART-III/PART-IV/PART-V of ANY SEMESTER with due recommendation of the Chairperson of the Board and approval from the COE.

- **For courses under PART III :**

Score obtained in these courses WILL BE ACCOUNTED FOR CGPA CALCULATION.

2.1 Open Elective :

Open elective courses are core courses offered DURING SEMESTER III under Part: III for students of other PG programmes, where a student can choose any course offered under this category from other than her parent department. Notification is handled on advice of the academic head and enrollment for the course is done on first come first serve basis depending upon the available strength. The course is taught and is administered by the norms pertaining to the department which offers the course. Adherence to the scheme, syllabus, distribution of marks and question paper pattern as found in the curriculum of the parent department is MANDATORY. Score obtained in this course will be accounted for CGPA calculation. Following is the list of courses available for the students of the PG programme.

List of open elective courses offered for the students admitted in PG programmes from the academic year 2025-26 and onwards

Course Code	Department	Course	Evaluation	Credit
25TAPOE1	Department of Tamil	Nju;T Nehf;fpy; jkpo; ,yf;fpa tuyhW	Both CIA and ESE	2
25ENPOE1	Department of English	English for Career Development		
25MAPOE1	Department of Mathematics	Mathematical Aptitude for Competitive Examinations		
25PHPOE1	Department of Physics	Environmental Physics		
25CAPOE1	Department of Computer Science	Green Computing		
25CGPOE1	Department of Commerce	Applied E-Commerce		
25BAPOE1	Department of Management	AGRI- PRENEURSHIP		

2.2.1 Institutional Training / Industrial Training / Mini Project:

Institutional Training / Industrial Training reports are evaluated (K1 to K6 levels) at the end of semester- III by the **Internal Examiners** only with prior permission and appointment by COE. Following weight ages shall be used to evaluate the Institutional training / Industrial Training report:

COMPONENTS*	K LEVEL	MARKS	TOTAL MARKS
Understanding and articulation of concepts	K1, K2, K3, K4, K5.K6 Any level can be used	30	**100**
Clarity and comprehensiveness of presentation in the report		30	
Structure and neatness of the report		40	

- 100% CIA, NO ESE.
- Different metrics may be evaluated depending on the nature of the work carried out during the training period and is left to the discretion of the department.

2.2.2. Mini-Project:

Departments encouraging project work may adopt the following structure for evaluation of report; else, they shall define their own rubrics as per need. Following components shall be used for evaluation:

The **project reports** are evaluated during the semester by the **Internal Examiners**.

SPLIT - UP	COMPONENTS	K LEVEL	MARKS	TOTAL MARKS
CIA	Regularity	K1, K2, K3, K4, K5,K6 Any level can be used	15	100
	Review / Presentation		15	
	Knowledge about the organisation / theme of study		20	
	Nature of Work / Logic behind the study		10	
	Learning Outcome		20	
	Viva – Voce		20	

- ***Viva-Voce for projects will be conducted by internal examiners only.**

3. For courses under PART IV :

Score obtained in these courses WILL NOT BE ACCOUNTED FOR CGPA CALCULATION.

3.1 Skill Enhancement (ONLY MBA) :

Course Code	Semester	Course	Evaluation	Credits
		Course offered by the department	To be conducted and evaluated by the Internal Examiner 100% CIA NO ESE	

NOTE: Weekly three hours theory and / or blended practical activities conducted as individual/group tasks or assignments (online and offline) in direct supervision of faculty member during semesters (I, III) and the assessment is to be done by the INTERNAL EXAMINER ONLY. NO ESE.

3.2 Ability Enhancement (COMMON FOR ALL PG):

Course Code	Semester	Course	Evaluation	Credits
25AEP01	II	Cyber Security	100% CIA NO ESE	2

On successful completion of these courses, students will be able to demonstrate skills necessary for tackling challenges in today's digitalized world. They are also taught relating to the main stream of study and hence, ensure job readiness after completion of the PG programme.

4. For courses under PART V :

Score obtained in these courses WILL NOT BE ACCOUNTED FOR CGPA CALCULATION.

Course Code	Semester	Course	Evaluation	Credits
	III	Course offered by the Department (Self Study)	NO CIA 100% ESE	2

4.1 Proficiency Enhancement:

These courses are provided to enhance the academic proficiency of a student. No lecture hours are provided and therefore, these are SELF STUDY courses and the students are expected to prepare the courses on the prescribed syllabi by their own. Students have to appear for the ESE that would be conducted as per the curriculum specification of each department and scoring a passing minimum is mandatory for completion of the PG programme.

4.2 Competency Enhancement:

Competency enhancement activities are conducted by the college / department between semesters I and IV. Evaluation is done under Part: V for 4 credits and credits are awarded based on submission of proofs for completion of the components mentioned therein. Obtaining a grade is MANDATORY for completion of the PG programme.

<table>
<tr><th>Semester</th><th>Course</th><th>Course Completion</th><th>Credit</th></tr>
<tr><td rowspan="5">I - IV</td><td>Online course /
Learning Object Repository*</td><td rowspan="2">Self-paced, Upon personal choice and as guided by faculty mentor</td><td>2</td></tr>
<tr><td>Certificate Course*</td><td>Can be completed during any semester from I – IV
NO CIA, NO ESE</td><td>2</td></tr>
<tr><td colspan="3">*Common to all PG programmes</td></tr>
<tr><td colspan="3">(Students of MBA alone can choose between the previous option and the next one)</td></tr>
<tr><td>Student Start-up Venture /
Internship / Capstone Project & Viva-voce
(PROVIDED AS ADDITIONAL OPTION ONLY FOR MBA)</td><td>SEMESTER I - IV</td><td>4*
(ALTERNATIVE CREDITS)</td></tr>
</table>

Students are awarded with credits on submission of proofs for completion of the components mentioned therein during semester I – IV and these courses are not evaluated for marks.

4.2.1 Online Course / Learning Object Repository: (COMMON TO ALL PG)

Semester	Course	Course Completion	Credit
I - IV	Online Course / Learning Object Repository	As guided by faculty mentor	2

Every student is expected to complete an online certificate course (obtaining a certificate is mandatory) or prepare a learning object repository (based on any of her courses in the curriculum) in consultation with her faculty mentor and shall refer to web sites on open Elective courses, MIT open classroom, Khan Academy, NPTEL, Swayam, UGC SWAYAM MOOCS, Podcast, CANVAS network, Alison, big data university and similar ones as to their choice. Completing this category during any of the FOUR semesters (I / II / III / IV) will fetch her 2 credits.

4.2.2. Certificate Course:

Semester	Course	Course Completion	Credit
I - IV	Certificate Course	As guided by faculty mentor	2

Every student is expected to complete a certificate course (obtaining a certificate is mandatory) in consultation with her faculty mentor. Completing this category during any of the FOUR semesters (I / II / III / IV) will fetch her 2 credits.

4.2.3. Student start-up ventures/Internship/Capstone project & Viva-voce(ONLY MBA)

Semester	Course	Evaluation	Credit
I - IV	Student start-up ventures / Internship / Capstone project & Viva-voce	By the Review Committee	4

Students who propose new business ideas, register their idea as a student start-up and are able to run their unit successfully for a year, or, willing to showcase the integrative experience of their educational programme are allowed to take up Internship / consultancy projects with project guidance from faculty. Alternate credits in PART-V are given for the students of MBA programme who complete this component.

In case of student start-up ventures, a faculty mentor will be supporting the venture from the design thinking process till the venture is pitched in. A review committee set-up by the department will monitor the progress and review the performance for commercialization of the unit to recommend the award of the credits.

In case of Internship, students are guided to take up real-time training of their curricula in an industry with / without stipend with time to time review.

In case of consultancy projects, faculty mentor(s) will be supporting the project from conceptualization of the idea. A review committee set-up by the department will monitor the progress and review the performance of the student on the project undertaken to recommend the award of the credits.

CIA QUESTION PAPER PATTERN:PART – III – CORE COURSES: 50 MARKS

P.K.R. ARTS COLLEGE FOR WOMEN, GOBI
(Re-Accredited with 'A' Grade by NAAC)
Autonomous Institution- Affiliated to Bharathiar University
DEPARTMENT OF_____
Academic Year: _____
Continuous Internal Assessment I / II: Month / Year

Class	Course Code	Course Title

Time: 2 Hours **Maximum Marks: 50**

Answer ALL the Sections
SECTION – A (6 × 1 = 6 Marks)
(Bloom's Taxonomy K1 / K2 Level)
(Multiple Choice Questions)

Answer the following

S. No.	Question	KNOWLEDGE LEVEL
1.	a) b) c) d)	K1- 3 Questions K2- 3 Questions
2.	a) b) c) d)	
3.	a) b) c) d)	
4.	a) b) c) d)	
5.	a) b) c) d)	
6.	a) b) c) d)	

SECTION – B (4 × 5 = 20Marks)
(Bloom's Taxonomy K2 / K3 / K4 Level)
(Options (a) and (b) should be from same unit and same knowledge level)
Answer ALL Questions

S. No.		Question		KNOWLEDGE LEVEL
7.	(a)		(OR)	K3- 2 Questions K4- 2 Questions
	(b)			
8.	(a)		(OR)	
	(b)			
9.	(a)		(OR)	
	(b)			

10.	(a)		**(OR)**	
	(b)			

SECTION – C (3 × 8 = 24 Marks)
(Bloom's Taxonomy K5 / K6 Level)
(Options (a) and (b) should be from the same unit and same knowledge level)
Answer ALL Questions

S. No.	Question			KNOWLEDGE LEVEL
11.	(a)	Unit I	**(OR)**	**K5- 2 Question** **K6- 1 Questions**
	(b)	Unit I		
12.	(a)	Unit II	**(OR)**	
	(b)	Unit II		
13.	(a)	Unit III	**(OR)**	
	(b)	Unit III		

PART – III – CORE COURSES: 75 MARKS

Course Code: …….. **Reg. No.** | | | | | | | | | | |

P.K.R ARTS COLLEGE FOR WOMEN (Autonomous), GOBICHETTIPALAYAM

…PG…. DEGREE ESE EXAMINATION, …… – 2025-26

Branch – …….

Semester …..

(For the candidates admitted from 2025-26 and onwards)

< Title of the Subject >

Time: 3 Hours **Maximum Marks: 75**

Answer ALL the Sections
SECTION – A (10 × 1 = 10 Marks)
(Bloom's Taxonomy K1 / K2 Level)
(Multiple Choice Questions)

Answer the following

S. No.	Question	KNOWLEDGE LEVEL
1.	Unit I a) b) c) d)	**K1**
2.	Unit I a) b) c) d)	**K2**
3.	Unit II a) b) c) d)	**K1**
4.	Unit II a) b) c) d)	**K2**
5.	Unit III a) b) c) d)	**K1**
6.	Unit III a) b) c) d)	**K2**
7.	Unit IV a) b) c) d)	**K1**
8.	Unit IV a) b) c) d)	**K2**
9.	Unit V a) b) c) d)	**K1**
10.	Unit V a) b) c) d)	**K2**

SECTION – B (5 × 5 = 25 Marks)
(Bloom's Taxonomy: K3 – 3 questions, K4 – 2 questions)
(Options (a) and (b) should be from same unit and same knowledge level)
Answer ALL Questions

S. No.	Question			KNOWLEDGE LEVEL
11.	(a)	Unit I	**(OR)**	
	(b)	Unit I		
12.	(a)	Unit II	**(OR)**	
	(b)	Unit II		
13.	(a)	Unit III	**(OR)**	
	(b)	Unit III		
14.	(a)	Unit IV	**(OR)**	
	(b)	Unit IV		
15.	(a)	Unit V	**(OR)**	
	(b)	Unit V		

SECTION – C (5 × 8 = 40 Marks)
(Bloom's Taxonomy: K5 – 3 questions, K6 – 2 questions)
(Options (a) and (b) are from the same unit and same knowledge level)
Answer ALL Questions

S. No.	Question			UNIT	KNOWLEDGE LEVEL
16	(a)		**(OR)**		
	(b)				
17.	(a)		**(OR)**		
	(b)				
18.	(a)		**(OR)**		
	(b)				
19.	(a)		**(OR)**		
	(b)				
20.	(a)		**(OR)**		
	(b)				

****

K –LEVEL	Q.NO.	No. of Questions
K1	1,3,5,7,9	5
K2	2,4,6,8,10,	5
K3	3 QUESTIONS IN SECTION B	3
K4	2 QUESTIONS IN SECTION B	2
K5	3 QUESTIONS IN SECTION C	3
K6	2 QUESTION IN SECTION C	2
	TOTAL	**20 QUESTIONS**

PG:

Course Code : …….. **Reg. No. :** | | | | | | | | | | |

P.K.R ARTS COLLEGE FOR WOMEN (Autonomous), GOBICHETTIPALAYAM

MBA DEGREE EXAMINATION, …… – 2025-26

Branch – …….

Semester …..

(For the candidates admitted from 2025-26 and onwards)

< Title of the Subject > (OPEN-SOURCE EXAMINATION, 100% CIA)

Time: 3 Hours Maximum Marks: 50

Answer ANY TWO Questions (2 × 25 = 50 Marks)
(Bloom's Taxonomy K3 / K4 / K5 / K6 Level)
(Options (a) and (b) should be from same unit and same knowledge level)

S. No.	Question			KNOWLEDGE LEVEL
1.	(a)	Unit I	**(OR)**	
	(b)	Unit I		
2.	(a)	Unit II	**(OR)**	
	(b)	Unit II		
3.	(a)	Unit III	**(OR)**	
	(b)	Unit III		
4.	(a)	Unit IV	**(OR)**	
	(b)	Unit IV		
5.	(a)	Unit V	**(OR)**	
	(b)	Unit V		

Note: Preparation of Question Papers for the Examination:

Well-structured and well-presented arguments and solutions are the expectations out of an open source examination and the question paper will be prepared by the internal examiner by considering the following elements:

- Testing the ability to prepare well structured written reports,
- Testing the ability to analyze problems and suggest appropriate solutions after evaluating alternative courses of action and make recommendations,

- Ability to integrate knowledge of different subject areas.

All questions to be framed with tags pertaining to Apply, Analyze, Evaluate and Create levels of Bloom's taxonomy principles.

PART– IV , PART-V – COURSES: 100 MARKS

Course Code : …….. **Reg. No. :**

P.K.R ARTS COLLEGE FOR WOMEN (Autonomous),
GOBICHETTIPALAYAM
…PG…. DEGREE ESE EXAMINATION, …… – 2025-26
Branch – …….
Semester …..
(For the candidates admitted from 2025-26 and onwards)
< Title of the Subject >

Time : 3 Hours **Maximum Marks : 100**

Answer ALL the Questions
SECTION – A (5 × 20 = 100 Marks)
(Bloom's Taxonomy K1/K2 / K3 / K4 / K5 / K6 Levels)

(Options (a) and (b) should be from same unit and same knowledge level)
Answer ALL Questions

S. No.	Question			KNOWLEDGE LEVEL
1.	(a)	Unit I	**(OR)**	
	(b)	Unit I		
2.	(a)	Unit II	**(OR)**	
	(b)	Unit II		
3.	(a)	Unit III	**(OR)**	
	(b)	Unit III		
4.	(a)	Unit IV	**(OR)**	
	(b)	Unit IV		
5.	(a)	Unit V	**(OR)**	
	(b)	Unit V		

****

CO-SCHOLASTIC COURSES OFFERED FOR THE STUDENTS ADMITTED IN THE PG PROGRAMMES IN 2025-26 AND ONWARDS

CO - SCHOLASTIC COURSES FOR PG PROGRAMMES:

The co-scholastic courses are offered with an intention to provide learner centric, skill oriented technical training that help an individual to showcase their competency, learn commitment for the profession, add value and build expertise in their area of study and helps with job advancement / career building opportune for students of all PG programmes. Evaluation in this category is done by INTERNAL EXAMINERS / COMPETENT CERTIFYING PROFESSIONAL BODIES / PROFESSIONAL INSTITUTIONS as is required, at the end of the semester/ an academic year. Score obtained in this category WILL NOT BE ACCOUNTED FOR CGPA CALCULATION.

Value Added Course is taught 40 Hours in a year and assessment is made at the end of the academic year (even semester ESE ONLY). Students who score the passing minimum will be given certificates with grades, based on the marks scored during the final Examination.

Following are the co-scholastic courses offered for the students admitted in PG programmes during the academic year 2025-2026 and onwards:

Categories available for students admitted in PG Programmes:

1. VALUE ADDED COURSES
2. EXTRA CREDIT COURSES

Are the TWO categories of CO-SCHOLASTIC COURSES offered to nurture - choice based skill / ability / proficiency / competency enhancement of an individual in addition to the courses specified under the scheme of examinations for scholastic courses of the PG programmes.

Scheme of examination for Co-Scholastic Courses:

1. VALUE ADDED COURSES:

Pattern	Department	Course Code	Course Title	Contact Hour / week	Exam Duration Hours	Max. Marks @ annual Exam		
						Theory	Practical	Total
Course to be taught after regular hours								
Value Added Course I I YEAR								
Annual	Tamil	25TAVAP1	**jkpo; kpd;Dhy; cs;slf;fk;**	2 (Sem I) 2 (Sem II)	3	100	-	100
	All PG Programmes (Except Tamil)	25VAP1	Abstract Reasoning And Interpersonal Communication			100	-	100
Value Added Course II II YEAR								
Annual	Tamil	25TAVAP2	**tifik Nehf;fpy; jkpo; ,yf;fpa tuyhW**	2 (Sem III) 2 (Sem IV)	3	100	-	100
	All PG Programmes (Except Tamil)	25VAP2	Quantitative Literacy			100	-	100

2. EXTRA CREDIT COURSES (Self-study courses)

There are five categories, namely,

2.1 Courses offered (Not Chosen electives by the candidate) by parent department for ALL STUDENTS OF THE PROGRAMME

2.2 List of courses offered for ADVANCED LEARNERS ONLY

2.3 Courses offered in a department under PART-III for STUDENTS OF OTHER PROGRAMMES – Inter-disciplinary courses

2.4 Credit transferability for Disciplinary /Inter-disciplinary /Trans-disciplinary /General courses offered in UGC SWAYAM MOOCS

2.5 Comprehension Courses

2.1 Courses offered (Not Chosen elective by the candidate) by parent department for ALL STUDENTS OF THE PROGRAMME: Refer to the scheme of examinations of the programme for the list of courses.

2.2 List of courses offered for ADVANCED LEARNERS ONLY:

Department	Course Code	Courses offered for ADVANCED LEARNERS ONLY
Department of Tamil	25TAALP1	திருக்குறள் நவீன மேலாண்மை
	25TAALP2	மறைக்கப்பட்ட இந்தியா
	25TAALP3	கொங்கு நாட்டுநாட்டுப்புறத்தெய்வவழிபாடு
	25TAALP4	தமிழ்க் கணினி இணையப்பயன்பாடுகள்
Department of English	25ENALP1	South-Asian literature
	25ENALP2	Popular fiction
	25ENALP3	Canadian literature
	25ENALP4	Gender Studies
Department of Mathematics	25MAALP1	Analytic Number theory
	25MAALP2	Quantitative techniques
	25MAALP3	Commutative algebra
	25MAALP4	Probability and statistics
Department of Physics	25PHALP1	Advanced Quantum Mechanics
	25PHALP2	Statistical Mechanics
	25PHALP3	Advanced Instrumentation

	25PHALP4	Plasma physics
Department of Computer Science	25CSALP1	Agile principles, Patterns and practices in C#
	25CSALP2	Building block chain App
	25CSALP3	Fundamentals of Digital Marketing
	25CSALP4	Deep learning
Department of Commerce	25CGALP1	Business ethics and corporate social responsibility
	25CGALP2	Securities and commodities exchange market
	25CGALP3	Customer relationship management
	25CGALP4	Supply chain and Logistics management
Department of Management	25BAALP1	ICT Agricultural management
	25BAALP2	Industry 4.0
	25BAALP3	Rural banking & micro financing
	25BAALP4	Entrepreneurship capstone course

2.3 Courses offered in a department under PART-III for STUDENTS OF OTHER PROGRAMMES – Inter-disciplinary courses - Refer to the scheme of examinations of the PG programme for the list of courses.

2.4 Credit transferability for Disciplinary / Inter-disciplinary / Trans-disciplinary / General courses offered in UGC SWAYAM MOOCS: Refer to the UGC SWAYAM eligibility, guidelines for courses available in the official website.

2.5. Comprehension Courses :

Department	Course Code	Comprehension Courses
Department of Tamil	25TAP1	Comprehension in Tamil - I
	25TAP2	Comprehension in Tamil - II
	25TAP3	Comprehension in Tamil - III
	25TAP4	Comprehension in Tamil - IV
Department of English	25ENP1	Comprehension in English - I
	25ENP2	Comprehension in English - II
	25ENP3	Comprehension in English - III
	25ENP4	Comprehension in English - IV
Department of Mathematics	25MAP1	Comprehension in Mathematics - I
	25MAP2	Comprehension in Mathematics - II
	25MAP3	Comprehension in Mathematics - III
	25MAP4	Comprehension in Mathematics - IV
Department of Physics	25PHP1	Comprehension in Physics - I
	25PHP2	Comprehension in Physics - II
	25PHP3	Comprehension in Physics - III
	25PHP4	Comprehension in Physics - IV
Department of Computer Science	25CAP1	Comprehension in Computer Applications - I
	25CAP2	Comprehension in Computer Applications - II
	25CAP3	Comprehension in Computer Applications - III
	25CAP4	Comprehension in Computer Applications - IV
Department of Commerce	25CGP1	Comprehension in Commerce - I
	25CGP2	Comprehension in Commerce - II
	25CGP3	Comprehension in Commerce - III
	25CGP4	Comprehension in Commerce - IV

Department of Management	25BAP1	Comprehension in Management - I
	25BAP2	Comprehension in Management - II
	25BAP3	Comprehension in Management - III
	25BAP4	Comprehension in Management - IV

In the comprehension component, students are tested on their grasping ability of the courses of study. Comprehension in ……. - I, II, III, IV are SELF-STUDY courses that have only MCQ from Part III Courses. ONLINE EXAMINATION (END-SEMESTER) consisting of 50 Multiple Choice Questions (on Core and Core Elective courses studied in the respective semesters) will be conducted at the end of each semester I, II, III, IV,V AND VI, for a maximum of 100 marks.

Self Study: Online Exams will be conducted at the end of each semester with one credit each.

Distribution of Marks and QP Pattern for Value Added Course:

Department	Category	QP Pattern	Total Marks	Passing Minimum @ Annual Exam	Grade
Tamil	Theory	5*20=100 (Any 5 out of 8 Questions)	100	50	Marks 90 - 100 - A++ Outstanding Marks 80 – 89 - A+ Excellent Marks 70 – 79 - A Very Good Marks 60 - 69 - B+ Good Marks 50 – 59 - B Average Marks 40 – 49 - C Satisfactory Marks 0 - 39 - U Re-appear
All PG Programmes (Except Tamil)	(Online Exam) MCQ	Aptitude Test = 25 Marks	50		
		Soft Skill Test = 25 Marks			
	Self Introduction		10		
	Group Discussion		15		
	Personnel Interview		15		
	Resume		10		
	TOTAL		100		

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