St. PETER'S INSTITUTE OF HIGHER EDUCATION AND RESEARCH
(Deemed to be University U/S 3 of the UGC Act,1956)
AICTE Approved and ISO 9001:2015 Certified
Accredited with A+ Grade by NAAC in the Second Cycle
AVADI, Chennai - 600054
www.spiher.ac.in

FACULTY OF ARTS, SCIENCE, COMMERCE, MANAGEMENT AND HUMANITIES

POST GRADUATE DEGREE PROGRAMMES

REGULATION- 2024

CHOICE BASED CREDIT SYSTEM (CBCS)

Effective from the Academic Year 2024-2025

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St. PETER'S INSTITUTE OF HIGHER EDUCATION AND RESEARCH

POSTGRADUATE REGULATIONS UNDER CHOICE-BASED CREDIT SYSTEM

(Effective from the Academic Year 2024-25 and onwards)

REGULATION (2024)

The following regulations are effective from the academic year 2024-2025 and are applicable to candidates admitted to Post Graduate (PG) degree programmes in the Faculty of Arts, Science, Commerce, Management and Humanities, St. Peter's Institute of Higher Education and Research (SPIHER).

1. PROGRAMMES OFFERED

1.1 The various PG programmes offered in the Faulty of Arts, Science, Commerce and Humanities, SPIHER are listed in the table below.

S. No.	Programme	Discipline
1.	MA	Economics
2.	MA	English
3.	MA	Political Science
4.	MA	Tamil
5.	MBA	Management
6.	MCA	Computer Applications
7.	M.Com.	Commerce
8.	M.Sc.	Biochemistry
9.	M.Sc.	Biotechnology
10.	M.Sc.	Chemistry
11.	M.Sc.	Computer Science
12.	M.Sc.	Information Security and Digital Forensics
13.	M.Sc.	Mathematics
14.	M.Sc.	Microbiology
15.	M.Sc.	Physics
16.	M.Sc.	Visual Communication

1.3 Duration of the Programme

1.3.1 The minimum and maximum period for the completion of the Post graduate degree are given below.

Programme	Minimum number of semesters	Maximum number of semesters
MA. / MBA / MCA / M.Com. / M.Sc.	**4**	**8**

Each semester normally consists of 90 working days or 450 hours instructional hours of study. Examination shall be conducted at the end of every semester for the respective courses.

2. MODE OF STUDY

All programmes are offered under Full-time regular mode. Candidates admitted under Full-time should be present in the SPIHER during the complete working hours for curricular, co-curricular and extra-curricular activities assigned to them.

3. ELIGIBILITY FOR ADMISSION

A candidate for admission to the first semester PG degree programme shall be required to have passed an appropriate UG degree examination of the St. Peter's Institute of Higher Education and Research or any other university accepted by the SPIHER as equivalent thereto. Institution accepts the scores obtained in the Common

University Entrance Test (CUET) conducted by the Ministry of Education, Government of India. Admission shall be offered only to the candidates who possess the qualification prescribed **(Annexure – 1).**

4. CHOICE BASED CREDIT SYSTEM

All the programmes are offered under Choice Based Credit System (CBCS) with a total credit of 80 for PG programmes.

4.1 Credit

Credit means the weightage given to each course by the experts of the Board of Studies concerned.

5. STRUCTURE OF PROGRAMME

Every programme will have a curriculum and syllabus consisting of core, elective courses, open electives, Value added courses, Internship and project work

5.1 CORE COURSES

The core course consists of theory and practical of department domains for which examinations shall be conducted at the end of each semester.

5.2 ELECTIVE COURSES

Elective courses are to be chosen with the approval of the Head of the Department concerned from the list of electives courses prescribed in the curriculum.

5.3 INTERNSHIP

The student shall undergo 15 days internship in the end of the second semester. Internship report will be evaluated and marks will be awarded in the third semester. Students have to earn two credits for the internship. Hundred marks is awarded for internship through CIA.

5.4 OPEN ELECTIVE

Student may select one of the open elective courses from the list given below offered by other departments in the third semester. Students must earn two credits for this course. (The students cannot select the course offered by the parent department).

5.5 PROJECT WORK

The candidates shall undertake the research project or dissertation in the fourth semester either in the department concerned or in industries/research institute or any other organization (National / International) and the project report has to be submitted at the end of the final semester.

In case, the student undertakes the project work outside the department the faculty concerned within the department shall be the Supervisor and the teacher/ scientist under whom the work is carried out will be the Co-Supervisor. The candidate shall bring the attendance certificate from the place where the project work carried out.

Permission for project work in general will be given to innovative and industry related work. Such projects will be evaluated periodically. If the Project evaluation committee is satisfied with the progress of the project work, continuation for the project work will be given until the final assessment is made in the fourth semester. In case, there is no tangible progress in a session, such project work will be terminated and the students have to do their project in their respective departments.

HOD shall assign a project supervisor who shall monitor the student project works. A project assessing committee (PAC) shall be constituted with the HOD and two senior faculty members of the department. The PAC shall announce the dates for the reviews and demonstration. The student shall make a presentation on the progress and demonstration of their project before the PAC in the presence of their supervisor on the scheduled dates.

The candidate has to submit in consultation with his / her supervisor the title, objective and action plan to the PAC on the first review for approval of the project. The student can initiate the project work only after obtaining the approval of PAC.

For project work, assessment is done on a continuous basis by 3 reviews for 40 marks and final *viva voce* carries 100 Marks in each phase at the end of the semester.

There shall be three project reviews (conducted during the pre-final semester and final semester) to be conducted by a review committee. The student shall make presentation on the progress made, before the committee. The head of the department shall constitute the review committee for each branch in consultation with Dean. The members of the review committee will evaluate the progress of the project and award marks as given below.

Project reviews (CIA) Marks			**Final Project Report (ESE) and *Viva Voce* Examination (Marks)**	**Total Marks**
Review 1	**Review 2**	**Review 3**		
5	15	20	60	100

The total marks obtained in the three reviews, rounded to the nearest integer are the continuous internal assessment marks out of 40. There shall be a final *viva-voce* examination at the end of semester conducted by one internal examiner, one external examiner and the supervisor concerned.

A student is expected to attend all the project reviews conducted by the institution on the scheduled dates. It is mandatory for every student to attend the reviews, even if they are working on a project in an industry based outside Chennai city. It is their duty to inform the organization about the project reviews and its importance, and get permission to attend the same. If a student does not attend any of the project reviews, he / she shall not be allowed for the successive reviews and thereby not allowed to appear for the final *viva voce* Examination.

The candidate is expected to submit the project report as per the guidelines of the institution on or before the last day of submission. If he/she fails to submit the project report, even beyond the extended time, then he/she is deemed to have failed in the project work and shall register for the same in the subsequent semester and re-do the project after obtaining permission from the HoD and Dean.

5.6 ONLINE COURSES

The department shall approve the list of online courses offered by approved external agencies such as SWAYAM / NPTEL / MOOC. While listing the courses, the department shall consider the following points:

a. The course evaluation is carried out by the same external agency

b. Equivalent grading mechanism to be arrived at by the department

A student can register up to a maximum of 18 credits (total) as online courses during the entire programme of study. These shall be treated as Elective courses (programme elective or open elective). Students may be allowed to register for one course per semester. The student shall produce a Pass Certificate from the respective agencies. The credits(s) earned by the students will be transferred to the concerned course in the Grade Sheet.

6. MEDIUM OF INSTRUCTION

The medium of instruction, examinations and project report will be in English Language throughout the programme except MA Tamil.

7. MAXIMUM MARKS

All the theory, practical and project courses shall carry a maximum of 100 marks, out of which 40 marks are awarded for Continuous Internal Assessment (CIA) and 60 marks for End Semester Examination (ESE).

8. REQUIREMENTS FOR COMPLETION OF A SEMESTER

A candidate who has fulfilled the following conditions shall be deemed to have satisfied the requirement for completion of a semester.

He / She secures not less than 75% of overall attendance in that semester.

Candidates who do not have the requisite attendance for the semester will not be permitted to write the semester Examinations.

9. VARIOUS POSITIONS IN A DEPARTMENT

9.1 DEAN

All Arts, Science, Commerce, Management and Humanities Departments are headed by a Dean. The dean is responsible for all activities taking place in coordination with all department heads and all faculty members belonging to them. The Dean makes a review of all the academic activities of faculty members, students and research on a regular time interval and takes steps to improve the morale of all Faculty and Students.

9.2 HEAD OF THE DEPARTMENT

Each department offering various UG and PG programmes is headed by a Head of the Department (HoD). The HoD is responsible for allotting courses to each faculty member uniformly in consultation with other HoD's and Deans. The HoD is responsible for streamlined teaching of courses to students, improvement and assessment of teaching quality within the department on a continuous basis, assessment of faculty members, transparent conduct of continuous internal assessment tests, interacting with parents, ensuring that all academic and non-academic activities of Faculty and students are monitored and steps taken for their improvement.

9.3 FACULTY ADVISOR

To help the students in planning their courses of study and to render general advice regarding either the academic programme or any other activity, the Head of the Department concerned, will assign every year, a certain number of students from the first year to a faculty member who will be called as Faculty Advisor. The set of students thus assigned will continue to be under the guidance of this Faculty Advisor till they complete the programme or replaced by the HoD. The Faculty Advisor gets information about the syllabus coverage by the faculty members, requirements of the students academically and otherwise, attendance and progress of the students from the respective class counselors. The Faculty Advisor also informs the students about the academic schedule including the dates of assessments and syllabus coverage for each assessment, weightage for each assessment, their continuous internal assessment marks and attendance percentage details before the commencement of end semester examinations.

9.4 FACULTY MENTOR

To help students in planning their courses of study and for general advice on the academic programme and personal counselling, the HoD shall allot 20 students to a faculty who will function as a faculty mentor throughout their period of study. Faculty mentor shall advise the students and monitor their behaviour and academic performance. Problems if any shall be counselled by them periodically. The faculty mentor is also responsible to inform the parents of their mentee's progress. The faculty mentor shall display the cumulative

attendance particulars of his/her mentees periodically (once in four weeks) on the notice board to know their attendance status and satisfies the requirements to appear for the End Semester Examination.

9.5 COURSE COORDINATOR FOR COMMON COURSE

Each common theory course offered to more than one class or branch or group of branches, shall have a "course coordinator". The course coordinator will be nominated by the dean in consultation with respective head of the department. The course coordinator will be normally a senior faculty member who is one among the teachers teaching the course.

The "Course Coordinator" shall meet the teachers handling the course, as often as possible and ensure

- A common teaching methodology is followed for the course.
- The study materials are prepared by the staff members and communicated to the students periodically.
- The involvement of students in course based projects and assignments.
- To prepare common question paper for continuous internal assessment tests.
- For uniform evaluation of continuous internal assessments answer sheets by arriving at a common scheme of evaluation.

The course coordinator is responsible for evaluating the performance of the students in the continuous internal assessments and end semester examinations and analyse them to find suitable methodologies for improvement in the performance. The analysis should be submitted to the HoD and Dean for suitable action.

10. CLASS COMMITTEE

a) Constitution of the Class Committee

For every class, a class committee shall be constituted by the Heads of Department, as given below:

Chairman	A faculty member not teaching that particular class
Members	• Faculty of all the courses of study • Four student members from the class to be nominated by the HoD

b) Functions of the Class Committee

(i) The class committee shall meet thrice during the semester. The first meeting will be held within two weeks from the date of commencement of the semester in which the nature of the broad assessment procedure for the different courses will be discussed. The second and third meetings will be held six weeks and ten weeks respectively from the commencement of a semester to meaningfully interact and express opinions and suggestions to improve the effectiveness of teaching - learning process and analyze the performance of the students in the assessments. The chairperson of the class committee should send the minutes of the class committee meetings to the Dean through the Head of the Department, immediately after the meetings is over.

(ii) During the first meeting of the class committee, all the faculty members shall give their course plan to the class committee chairperson/chairman for approval and uploading into the ERP.

(iii) Any innovation in any course plan not agreed by the class committee or the HoD will be referred to the Chairman/Chairperson for approval.

11. COURSE PLAN AND DELIVERY

a) The course plan will have details of the overview of the course, course objectives, course outcome, course teaching and learning activities and course assessment methods and policy on compensation assessment.

b) Each course will have tailor-made assessment models viz. group tasks, assignments, report on field visit, quizzes, open book tests, laboratory exercises, mini-project and end of session summative assessment etc. The course plan will also have details of information on study materials.

c) The number of assessments for a course shall range from 3 to 5.

d) Every course should have a final assessment (End Semester) on the entire syllabus with 60% weightage.

e) The course plan shall be approved by the Class Committee (CC) chairperson/chairman and the HoD of the Department offering the course.

f) The Course plans for all courses offered by the Institute will be available in the website for reference.

g) ATTENDANCE

All courses should have a common attendance policy:

a) At least 75% attendance in each course is mandatory.

b) A maximum of 10% shall be allowed under On Duty (OD) category.

c) Students with less than 65% of attendance shall be prevented from writing the End Semester Examination..

12. ASSESSMENT PROCEDURE

Each **COURSE** shall have assessments done according to the Course Plan drawn by the faculty who handles the course. The assessments of a course will depend on the needed course learning outcomes.

There will be a Continuous Internal Assessment Tests and End Semester Examination for both theory and practical courses of all programmes.

(i) Theory / practical / projects courses

Continuous Internal Assessment (CIA) : 40 % Marks

End Semester Examination (ESE) : 60 % Marks

12.1 CONTINUOUS INTERNAL ASSESSMENT (CIA)

(a) Theory Courses

- There will be a minimum of Three continuous internal assessment tests (Assessment Test 1,2 and a Model test, for each theory course.

Distribution of Continuous Internal Assessment (CIA) marks for a theory course			
Evaluation Component	**Syllabus coverage**	**Duration of the Exam**	**Maximum marks**
CIA-1	First 1.5 Units of the syllabus	2 Hours	**7.5**
CIA-2	Second 1.5 Units of the syllabus	2 Hours	**7.5**
Model Test	All Units	3 Hours	**10**
Assignment / Seminar / Mini Project (or) Group Presentation	Two written assignments for each course / Written quiz (or) Presentation of a written Report (or) Case study / Multiple Choice Objective Type Test Or Technical Project involving not more than 3 students (or) any other Group Presentation related to the course.		**10**
Attendance	75% and above		**5**
Total			**40**

- The continuous assessment marks obtained by the candidate in the first appearance shall be retained, considered and valid for all subsequent attempts, till the candidate secures a pass.

(b) Practical Courses

S. No.	**Category**	**Maximum Marks**
01	Attendance (75% and above)	**05**
02	Observation work	**20**
03	Model Test	**15**
Total		**40**

- For practical courses, the student will be evaluated on a continuous basis for 20 Marks (which will include performing all experiments, submitting observation and record note book in scheduled format and time), 15 marks for model test at the end of the semester and 5 marks for attendance in the course.

- For practical courses, if a student has been absent for some practical classes or has performed poorly, then the student will have to get permission from the lab in-charge and year coordinator to do the experiments, so that he/she meets all the requirements for the course and thereby allowed to appear for model and end semester practical exams.

- If a student has not done all the experiments assigned for that lab, before the scheduled date will not be allowed to appear for the model and end semester practical exam. Such students will have to register the course again by doing all the experiments in the next semester when the course is offered.

Pattern of Question Paper (Theory) for CIA 1 and 2

Particulars	Remarks
Maximum Marks	50 Marks
Duration	2 Hours
Part – A (Q.No. 1 to 10)	MCQ (10 x 1 =10)
Part – B (Q.No. 11 to 15)	Short Answers (5 x 4 = 20)
Part – C (Q.No. 16 to 17)	Long Answers (2 x 10 = 20)

12.2 END SEMESTER EXAMINATION (ESE)

- The end semester examinations shall be conducted at the end of the odd and even semester of the Academic year.

- End-semester examinations will be conducted for a maximum of 100 marks. The marks secured in end-semester exams will be converted to 60 marks.

- The training evaluation will be made by a three-member committee constituted by the Head of the Department in consultation with the Faculty Advisor and respective Training Coordinator. A presentation should be made by the student before the Committee, based on the Industrial Training or Professional Enrichment undergone.

Pattern of Question Paper (Theory) for Model and ESE

Particulars	Remarks
Maximum Marks	100 Marks
Duration	3 Hours
Part – A (Q.No. 1 to 10)	MCQ (10x1=10)
Part – B (Q.No. 11 to 15)	Short Answers (Either or Type) (5x5=25)
Part – C (Q.No. 15 to 20)	Long Answers (Either or type) (5x10=50)
Part – D (Q.No. 21)	Essay Answers - Compulsory (1x15=15)

13. PURSUING COURSES IN OTHER INDIAN INSTITUTIONS AND ABROAD

- A student can be selected, to get Professional Exposure in his/her area of Expertise in any Reputed Research Organization or Educational Institution of repute or any University in India and abroad.
- This is possible only with the List of Research Organizations and educational Institutions in India and abroad approved by the Academic Council.
- The student can have the option of spending not more than three to Six months in the Final year or Pre-final year of his/her Degree. During this period, the student can do his/her Project work or register for

courses which will be approved by the Class Committee and Dean, under the guidance of a Project Supervisor who is employed in the Organization and Co-guided by a staff member from our Institution.

- Credit Transfer can be done by the CoE on submission of the certificate through the HoD and Dean within 15 days of completion of the training.
- The students who undergo training outside the Institution (either in India or Abroad) is expected to abide by all Rules and Regulations to be followed as per Indian and the respective Country Laws, and also should take care of Financial, Travel and Accommodation expenses.

14. PASSING REQUIREMENTS

- A candidate should secure not less than 50% of total marks (Minimum 50% of the grand total of CIAE arks and ESE marks put together) prescribed for the courses, subject to securing a minimum of 50% marks out of maximum mark in End Semester Exams (ESE). Then he/she shall be declared to have passed in the examination.
- If a candidate fails to secure a pass in a particular course, it is mandatory that he/she shall register and reappear for the examination in that course during the next semester when examination is conducted in that course. It is mandatory that he/she should continue to register and reappear for the examination till he/she secures a pass.

15. REVALUATION OF ANSWER SCRIPTS

A candidate can apply for revaluation of his/her End semester examination answer Scripts in a theory course, immediately after the declaration of results, on payment of a prescribed fee along with application to the Controller of Examinations through the Head of the Department. The Controller of Examination will arrange for the revaluation and the result will be intimated to the candidate concerned through the Head of the Department. Revaluation is not permitted for practical courses and for project work.

16. WITHDRAWAL FROM EXAMINATIONS

- A candidate may, for valid reasons, (medically unfit / unexpected family situations) be granted permission to withdraw from appearing for the examination in any course or courses in any one of the semester examination during the entire duration of the degree programme.
- Withdrawal application shall be valid only if the candidate is otherwise normally eligible (if he/she satisfies Attendance requirements and should not be involved in Disciplinary issues or Malpractice in Exams) to write the examination and if it is made within FIVE days before the commencement of the examination in that course or courses and also recommended by the Dean through HoD.
- Notwithstanding the requirement of mandatory FIVE days notice, applications for withdrawal for special cases under extraordinary conditions will be considered based on the merit of the case.
- Withdrawal shall not be considered as an appearance for deciding the eligibility of a candidate for the purpose of Classification of Degree.
- Withdrawal is NOT permitted for arrears examinations of the previous semesters.

17. AUTHORIZED BREAK OF STUDY

- This shall be granted by the Institution, only once during the full duration of study, for valid reasons for a maximum of one year during the entire period of study of the degree programme.
- A candidate is normally not permitted to temporarily break the period of study. However, if a candidate would like to discontinue the programme temporarily in the middle of duration of study for valid reasons (such as accident or hospitalization due to prolonged ill health), he / she shall apply through the Dean in advance (Not later than the Reopening day of that semester) through the Head of the

Department stating the reasons. He /She should also mention clearly, the Joining date and Semester for Continuation of Studies after completion of break of Study. In such cases, he/she will attend classes along with the Junior Batches. A student who availed break of study has to rejoin only in the same semester from where he/she left.

- The total period for completion of the programme shall not exceed more than 8 consecutive semesters from the time of commencement of the course irrespective of the period of break of study in order that he / she may be eligible for the award of the degree.
- If any student is not allowed to appear for End Semester Examinations for not satisfying Academic requirements and Disciplinary reasons, (Except due to Lack of Attendance), the period spent in that semester shall NOT be considered a permitted 'Break of Study' and is NOT applicable for Authorized Break of Study.
- In extraordinary situations, a candidate may apply for an additional break of study not exceeding another one Semester by paying a prescribed fee for a break of study. Such extended break of study shall be counted for the purpose of classification of First Class Degree.
- If the candidate has not reported back to the department, even after the extended Break of Study, the name of the candidate shall be deleted permanently from the institution enrolment. Such candidates are not entitled to seek readmission under any circumstances.

18. AWARD OF DEGREE

All assessments of a course will be done on absolute marks basis. However, for the purpose of reporting the performance of a candidate, letter grades, each carrying certain number of points, will be awarded as per the range of total marks (out of 100) obtained by the candidate in each course as detailed below:

RANGE OF MARKS FOR GRADES

Range of Marks	Letter Grade	Grade Point
90 -100	**O**	**10**
80 – 89	**A+**	**9**
70 – 79	**A**	**8**
60 – 69	**B+**	**7**
50 – 59	**B**	**6**
00-49 (Reappear)	**F**	**0**
ABSENT	**AAA**	**0**
Withdrawal	**W**	**0**
Authorised Break of Study	**ABS**	**0**

18.1 CUMULATIVE GRADE POINT AVERAGE CALCULATION

The CGPA calculation on a 10 Point scale is used to describe the overall performance of a student in all courses from first semester to the last semester. RA, AAA and W grades will be excluded for calculating GPA and CGPA.

$$GPA = \frac{\sum_{i=1}^{N} Ci\ GPi}{\sum_{i} Ci} \qquad CGPA = \frac{\sum_{i=1}^{n} Ci\ GPi}{\sum_{i} Ci}$$

Where

Ci – Credits for the course

GPi – Grade Point for the course

i – Sum of all courses successfully cleared during all the semesters

n - Number of all courses successfully cleared during the particular semester in the case of GPA and during all the semesters in the case of CGPA

18.2 GRADE SHEET

After revaluation results are declared in each semester, Grade Sheets will be issued to each student. At the end of programme a consolidated grade sheet also will be issued to each student. The grade sheet and consolidated grade sheet will contain the following details:

- The programme and degree in which the candidate has studied
- The list of courses enrolled during the semester and the grade secured
- The Grade Point Average (GPA) for the semester.

18.3 CLASSIFICATION OF DEGREE AWARDED

Final Degree is awarded based on the following

Range of CGPA	**Classification of Degree**
≥ 7.50	First Class with Distinction
≥ 6.00 <7.50	First Class
≥ 5.00 < 6.0	Second Class

Minimum requirements for award of Degree: A student should have obtained a minimum of 5.0 CGPA.

1. A candidate who qualifies for the award of the Degree having passed the examination in all the courses of all the 4 semesters in his/her first appearance within a maximum of 10 consecutive securing a overall CGPA of not less than 7.5 (Calculated from 1st semester) shall be declared to have passed the examination in **First Class with Distinction**. Authorized Break of Study vide Clause 17, will be considered as an Appearance for Examinations, for award of First Class with Distinction. Withdrawal shall not be considered as an appearance for deciding the eligibility of a candidate for First Class with Distinction

2. A candidate who qualifies for the award of the Degree having passed the examination in all the courses of all the 4 semesters within a maximum period of 6 consecutive semesters after his/her commencement of study securing an overall CGPA of not less than 6.0 (Calculated from 1st semester), shall be declared to have passed the examination in **First Class.** Authorized break of study vide Clause 17 (if availed of) or prevention from writing End semester examination due to lack of attendance will not be considered as Appearance in Examinations.
3. All other candidates who qualify for the award of the Degree having passed the examination in all the courses of all the 4 semesters within a maximum period of 6 consecutive after his/her commencement of study securing a overall CGPA of not less than 5.0, (Calculated from 1st semester) shall be declared to have passed the examination in **Second Class**.
4. A candidate who is absent in semester examination in a course/project work after having registered for the same, shall be considered to have appeared in that examination for the purpose of classification.

18.4 ELIGIBILITY FOR THE AWARD OF DEGREE

A student shall be declared to be eligible for the award of Post graduate degree, provided the student has successfully completed all the requirements of the programme, and has passed all the prescribed examinations within the maximum period specified in clause 1.3.

i) Successfully gained the required number of total credits as specified in the curriculum corresponding to his/her programme within the stipulated time.

ii) Successfully completed the programme requirements and has passed all the courses prescribed in all the semesters within a maximum period of 5 years reckoned from the commencement of the first semester to which the candidate was admitted.
iii) Successfully completed any additional courses prescribed by the Institution.
iv) has earned a CGPA of not less than 5
v) has no dues to the Institution, Library, Hostels, etc.,
vi) has no disciplinary action pending against him / her.

19. SUPPLEMENTARY EXAMINATION

Supplementary examination will be conducted only for the final semester students within 10 days from the date of publication of results for students who have failed up to two theory courses. Only such students shall apply with the prescribed fee to the Controller of Examinations within the stipulated time period.

20. RANKING

A candidate who qualifies for the PG degree programme passing all the examinations in the first attempt, within the minimum period prescribed for the programme of study from semester I through semester IV to the programme shall be eligible for ranking. Such ranking will be confirmed to 10 percent of the total number of candidates qualified in that particular programme of study subject to a maximum of 10 ranks.

21. DISCIPLINE

Every student is required to observe disciplined and decorous behaviour both inside and outside the Institution and not to indulge in any activity which will tend to bring down the prestige of the Institution. If a student indulges in malpractice in any of the end semester theory / practical examination, continuous assessment examinations he/she shall will be liable for disciplinary action as prescribed by the SPIHER from time to time.

22. REVISION OF REGULATION AND CURRICULUM

St. Peter's Institute of Higher Education and Research may from time-to-time revise, amend or change the Regulations, Scheme of Examinations and Syllabi if found necessary.

23. ACADEMIC BANK OF CREDITS (ABC)

All the students who admitted in any one of the above programmes are mandatory to register in the Academic Bank of Credits (ABC) portal provided by the Ministry of Education (MoE), Government of India.

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Annexure – 1

Eligibility requirement for admission to PG Programme in Arts, Science, Commerce and Humanities for the Academic year 2024-2025 and onwards

S. No.	Name of the Programme	Eligibility for admission
01	M.A. Economics	Candidates who passed the Under graduation in any stream of study (B.A/ B.B.A. / B.COM / BCA / B.Sc.) or its equivalent in the relevant subjects as recognized by the Institute or any other equivalent Examination thereto are eligible for admission to M.A. in Economics Programme.
02	M.A. English	Candidates who passed the B.A. English Programme or its equivalent in the relevant subjects as recognized by the Institute or any other equivalent Examination thereto wherever prescribed are eligible for admission to M.A English Programme.
03	M.A. Political Science	B. A. Degree with Political Science / For admissions in M.A Political Science, candidates must have completed a Bachelor's Degree in any discipline under 10+2+3 education pattern with at least 50 % marks in aggregate of Social Sciences subjects and at least 55 per cent marks aggregate of Science and Technology subjects.
04	M.A. Tamil	Candidates need to have a Bachelor's degree in any stream with Tamil as one of the subjects of study with minimum 50% aggregate marks
05	MBA	Candidates who passed the under graduation any stream of study (B.B.A. / B.Com. / BCA / B.Sc.) or its equivalent in the relevant subjects as recognised by the institute or any other equivalent examination thereto are eligible for admission to MBA programme.
06	MCA	a) Recognized Bachelor's Degree of Minimum three year duration in B.Sc. Computer Science / B.Sc. (Information Technology)/ BCA with 50 % in qualifying examination with Mathematics as one of the subjects at graduate level / 10+2 level. b) Other equivalent degrees B.Com. / B.B.M. /B.B.A./ B.L.M. / B.A. Corporate Secretaryship / B.A. Economics / any other degree with Business Mathematics and Statistics or Mathematics / Statistics in Main / Allied level or c) B.Sc. Chemistry with Mathematics and Physics and Physics as allied subject. d) B.E./ B.Tech. / M.B.A. **e)** Bachelor's degree in any discipline with Mathematics as one of the subjects at the Higher Secondary level.
07	M.Com	Candidates who passed the B.Com Programme or its equivalent in the relevant subjects as recognized by the Institute or any other equivalent or Any Bachelor degree with Accounts and Commerce as Major course. (B.Com any stream, BBA and BBM).Examination thereto wherever prescribed are eligible for admission to M.Com Programme.
S. No.	**Name of the Programme**	**Eligibility for admission**
08	M.Sc. Biochemistry	A Bachelor's degree with Biochemistry / Molecular Biology / Biotechnology / Botany / Zoology / Chemistry / Microbiology / Nutrition / Animal Science or Medicine / Veterinary Sciences including Indian forms of Medicine (the main subject of this University or from any other University accepted as equivalent, is eligible for admission to M.Sc. (Biochemistry) degree programme.

09	M.Sc. Biotechnology	Candidate must have a Bachelor's degree in Biotechnology / Botany / Plant Biology & Biotechnology / Zoology / Biochemistry / Microbiology / Agriculture Sciences / Life Sciences are eligible for admission to M.Sc. Biotechnology
10	M.Sc. Chemistry	Candidates who have passed with minimum of 50% Marks in their Bachelor degree from a recognized university like B.Sc. (Hons.) in Chemistry / B.Sc.(Pass) / B.Sc.(Life Sciences) with Chemistry as the main subject.
11	M.Sc. Computer Science	**a)** Recognized Bachelor's Degree of Minimum three year duration in Computer Science/ Information Technology/ Mathematics / Physics / Statistics / BCA b) Any other equivalent degree in Information Technology and Computer Science with an 50% of marks (Inclusive of all subjects)
12	M.Sc. Information Security and Digital Forensics	**a)** Recognized Bachelor's Degree of Minimum three year duration in Computer Science/ Information Technology/ Information Science/ Mathematics / Physics / Statistics / BCA / Forensic Sciences / Criminology / Cyber Security / Information Security / Digital Forensics or any other related degrees b) B.Com / B.B.M. /B.B.A./ B.L.M. / B.A. Corporate Secretaryship / B.A. Economics with Computer Science / Computer Applications/Information Technology / Information Science or similar options as one of the subjects c) B.E./B.Tech with an 50% of marks (Inclusive of all subjects). d) Bachelor's degree in any discipline with Mathematics or Computer Science as one of the subjects at the Higher Secondary level.
13	M.Sc. Mathematics	Candidates who have passed with minimum of 40% Marks or equivalent GPA bachelor degree in Mathematics / Applied Mathematics / B.E./ B.Tech from any reputable University or Institution. Honours degree or equivalent in a mathematics, science or engineering degree.
14	M.Sc. Microbiology	B.Sc. Microbiology / Applied Microbiology / Industrial Microbiology / Medical Microbiology / Botany / Zoology / Biology / Biotechnology / Molecular Biology / Genetic Engineering / Biochemistry / Agriculture / Forestry / Medical Lab Technology / Life Sciences with minimum 40% aggregate marks or equivalent GPA.
S. No.	**Name of the Programme**	**Eligibility for admission**
15	M.Sc. Physics	Candidates who passed the B.Sc. (Physics) Programme or its equivalent in the relevant subjects as recognized by the Institute or any other equivalent Examination thereto wherever prescribed are eligible for admission to M.Sc. in Physics Programme. Or B.Sc. Physics with Mathematics as an ancillary subject (or) B.Sc. Triple major with Physics, Chemistry, and Mathematics (or) B.Sc. (Applied Science/Applied Physics) with Mathematics as an ancillary subject and Physics as a major.
16	M.Sc. Visual Communication	Candidates who have passed any UG degree are eligible to join the M.Sc. Visual Communication.

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M. Sc MATHEMATICS

REGULATION 2024

CHOICE BASED CREDIT SYSTEM

VISION & MISSION OF THE INSTITUTION

Vision

To achieve, Academic Excellence in Engineering, Technology,and Science through Teaching, Research, and Extension to Society.

Mission

By generating, preserving, and disseminating knowledge through rigorous academic study, inquisitiveness to understand and explore nature, entrepreneurship with creativity and innovation.

VISION & MISSION OF THE DEPARTMENT

Vision

To assist students in acquiring a conceptual understanding of the nature and structure of Mathematics, its processes and applications.

Mission

To provide high quality Mathematics graduates who are relevant to industry and Commerce, Mathematics Education and Research in Science and Technology.

M.Sc. Mathematics Program Outcomes (POs)

PO 1 Science knowledge Apply mathematics knowledge and mathematics specialties to the solution of challenging scientific issues.
PO 2 Problem Analysis Analyze and understand the theoretical and practical data at various workplaces.
PO 3 Design/ Development of solutions Design a system, component, or process to meet the desired needs within realistic constraints such as economic, environmental, health and safety, and sustainability.
PO 4 Conduct investigations of complex problems Develop the capacity to analyze complicated issues and offer workable answers by applying applied research knowledge.
PO 5 Modern tool usage Identifying, formulating, and resolving scientific issues with contemporary methods and technologies.
PO 6 Mathematics and Society Obtain the wide education required to comprehend how scientific solutions impact the local, national, international, economic, environmental, and societal contexts.
PO 7 Environment and Sustainability Understand the environmental damage and develop environmental friendly and sustainable scientific practices using the solutions in the societal and environmental context.
PO 8 Ethics Develop an ethical-moral value system and cater to the community needs in a voluntary manner by the judicious use of scientific principles
PO 9 Multidisciplinary Approach Develop a multidisciplinary approach and function on multidisciplinary teams.
PO 10 Communication Develop various communication skills such as listening, speaking, writing, etc. which will help in the effective expression of ideas and views.
PO 11 Project Management and Finance Apply scientific knowledge and management skills to manage projects in industries, research and development institutions, public sector units, higher education and in academia.
PO 12 Life-long Learning Demonstrate effective usage of existing resources at workplaces and raise awareness of the importance of life-long learning.

M.Sc. Mathematics Program Specific Outcomes (PSOs)
PSO 1 Understand the mathematical concepts and explore a variety of applications having interdisciplinary dimensions. Build both analytical as well as innovative approach in solving problems of mathematical sciences.
PSO 2 Apply, analyze, and interpret basic and advanced computational laboratory concepts to develop necessary computing skills in scientific community.
PSO 3 Earn research experience within a specific field of mathematical sciences, through a supervised project to enhance the ability of the students in successfully carrying out multidisciplinary projects, in collaboration with other departments.

M.Sc. Mathematics Program Educational Objectives (PEOs)
PEO 1 Develop students with sound mathematical knowledge and technical skills to identify, analyze and solve real-world problems.
PEO 2 Prepare students with strong foundation in all areas of mathematics for successful careers in research and innovation in various fields including academia, industries, etc.
PEO 3 Integrate comprehensive knowledge, teamwork, leadership qualities, teaching and communication skills for lifelong learning.
PEO 4 Provide students with guidance, practical training and hands-on project.

SEMESTER I

Course Code	Course Title	L	T	P	Credit	Marks		
						CIA	ESE	Total
24MAP101	Algebra-I	4	1	0	4	40	60	100
24MAP102	Statistical Inference – I	4	1	0	4	40	60	100
24MAP111	Statistical Inference - I (Practical)	0	0	2	2	40	60	100
24MAP103	Statistical Package for Social Sciences	4	1	0	3	40	60	100
24CPP103	Design and Analysis of Algorithm	3	1	0	3	40	60	100
24MAP104	**Program Elective –I**	3	1	0	4	40	60	100
Total		**18**	**5**	**2**	**20**	**240**	**360**	**600**

SEMESTER II

Course Code	Course Title	L	T	P	Credit	Marks		
						CIA	ESE	Total
24MAP201	Algebra-II	4	1	0	4	40	60	100
24MAP202	Statistical Inference – II	4	1	0	4	40	60	100
24MAP211	Statistical Inference - II (Practical)	0	0	2	2	40	60	100
24MAP203	Applications of Mathematics in Environmental Studies	4	1	0	3	40	60	100
24CPP203	Network Security	3	1	0	3	40	60	100
24MAP204	**Program Elective –II**	3	1	0	4	40	60	100
Total		**18**	**5**	**2**	**20**	**240**	**360**	**600**

SEMESTER III

Course Code	Course Title	L	T	P	Credit	Marks		
						CIA	ESE	Total
24MAP301	Complex Analysis	4	1	0	4	40	60	100
24MAP302	Topology	4	1	0	4	40	60	100
24MAP303	Numerical Analysis	4	1	0	4	40	60	100
24MAP304	Program Elective –III	4	1	0	4	40	60	100
24……	Institute Elective	2	1	0	2	40	60	100
24MAP321	Internship	0	0	2	2	40	60	100
Total		**18**	**5**	**2**	**20**	**240**	**360**	**600**

SEMESTER IV

Course Code	Course Title	L	T	P	Credit	Marks		
						CIA	ESE	Total
24MAP401	Research Methodology	4	1	0	4	40	60	100
24MAP491	Research Project/Dissertation	0	0	20	16	40	60	100
	Total	**4**	**1**	**20**	**20**	**80**	**120**	**200**

Program Elective –I (Semester I)

Course Code	Course Title	L	T	P	Credit	Marks		
						CIA	**ESE**	**Total**
24MAP104-A	Discrete Mathematics	4	1	0	4	40	60	100
24MAP104-B	Numerical Methods	4	1	0	4	40	60	100
24MAP104-C	Analysis-I	4	1	0	4	40	60	100
24MAP104-D	Graph Theory	4	1	0	4	40	60	100

Program Elective –II (Semester II)

Course Code	Course Title	L	T	P	Credit	Marks		
						CIA	**ESE**	**Total**
24MAP204-A	Operations Research	4	1	0	4	40	60	100
24MAP204-B	Probability Theory	4	1	0	4	40	60	100
24MAP204-C	Number Theory Cryptography	4	1	0	4	40	60	100
24MAP204-D	Mathematical Statistics	4	1	0	4	40	60	100

Program Elective –III (Semester III)

Course Code	Course Title	L	T	P	Credit	Marks		
						CIA	**ESE**	**Total**
24MAP304-A	Differential Geometry	4	1	0	4	40	60	100
24MAP304-B	Functional Analysis	4	1	0	4	40	60	100
24MAP304-C	Partial Differential Equations	4	1	0	4	40	60	100
24MAP304-D	Mechanics	4	1	0	4	40	60	100

(i) **Institute Elective/Open Electives (OE)** comprising of Professional elective courses fromrespective Departments and provides the opportunity to a students to choose any course of any stream. A student should choose atleast1 course during the programme.

OPEN ELECTIVES				
Sl.No.	**Branch**	**Course Code**	**Course Name**	**Credits**

1	CSE		Soft Computing and its applications	3
2	CSE		Artificial Intelligence for Real World Applications	3
3	CSE		Machine Learning for Real World Applications	3
4	CSE		Applied Cloud Computing	3
5	IT		Cyber Security Fundamentals	3
6	IT		Practical Approach to Data Mining and Analytics	3
7	IT		Big Data Analytics Tools and Applications	3
8	IT		Foundations of Block Chain Technologies	3
9	ECE		Electromagnetic Interference and Compatibility	3
10	ECE		PCB Design	3
11	ECE		Digital Design using EDA tools	3
12	CSE, IT		Internet of Things – Overview & its Application	3
13	EEE		Industrial Automation	3
14	EEE		Electric Vehicle Drive System	3
15	EEE		Robotic Systems	3
16	Mech		Waste Management	3
17	Mech		Computer Workstation Ergonomics	3
18	Mech		Structure and Properties of Materials	3
19	Mech		Total Quality Management	3
20	Mech		Supply chain Management	3
21	Mech		Industrial Automation	3
22	Civil		Disaster Management	3
23	Civil		Safety Engineering	3
24	Civil		Climate Change	3
25	Civil		Environmental Impact Assessment	3
26	BME		Trouble shooting of Medical Instruments	3
27	BME		Biomedical Nanotechnology	3
28	BME		Biology for Engineers	3
29	BME		Bioinformatics	3
30	HUM		Gender, Culture and Development studies	3
31	HUM		State, Nation Building and Politics	3
32	HUM		Work Ethics, Corporate Social responsibility andGovernance	3
33	HUM		Indian Constitution, Essence of Indian KnowledgeTradition	3

34	HUM		Cognitive Science	3
35	MBA		Stock Trading Fundamentals	3
36	MBA		Industrial Economics	3
37	MBA		Finance for Non-Finance Professionals	3
38	Maths		Numerical Methods	3
39	Maths		Statistics and Numerical Methods	3
40	Maths		Probability and Random Processes	3
41	Maths		Probability and Statistics	3
42	Maths		Probability and Queuing Theory	3

(ii) **ONLINE Courses**: The department Board of Studies (BoS) shall approve the list of onlinecourses offered by approved external agencies. While listing the courses, the BoS shall considerthe following points:

a. The course evaluation is carried out by the same external agency.

b. Equivalent grading mechanism to be arrived at by the department. A student can register up to a maximum of 6 credits (total) as online courses during the entire programme of study. These shall be treated as Elective courses (program elective or open elective). Students may be allowed to register for one course per semester starting from 2ndsemester onwards.

(iii) **Internship Training** during the course of study.

(iv) **Project Work**

Each semester curriculum shall normally have a blend of lecture courses and practical courses

DEPARTMENT OF MATHEMATICS

PROGRAMME: CORE PAPERS

24MAP101	ALGEBRA -I	L	T	P	C	TOTAL MARKS
		3	1	0	4	100

PREREQUISITES: Undergraduate Algebra

COURSE OBJECTIVES:

The main objectives of this course are to:

- Introduce groups and its types
- Establish the concepts and to develop working knowledge on class equation, solvability of groups.
- Develop the finite abelian groups, linear transformations, real quadratic forms.
- Learn about Ring theory.
- Learn about fields.

UNIT 1:	**GROUPS**	**12**

Introduction to groups: Dihedral groups - Symmetric groups - Matrix groups - Homomorphisms and Isomorphisms - Group actions. Subgroups: Definition and Examples .

UNIT 2:	**CYCLIC GROUPS**	**12**

Cyclic groups and Cyclic subgroups of a group. Quotient Groups and Homomorphisms: Definitions and Examples - More on cosets and Lagrange's Theorem - The isomorphism theorems .

UNIT 3:	**ABELIAN GROUPS**	**12**

Direct and semi-direct products and abelian groups: Direct Products - The fundamental theorem of finitely generated abelian groups.

UNIT 4:	**RING THEORY**	**12**

Definitions and examples – Some simple results – Ideals, Homomorphism's and Quotient Rings - -Maximum ideals – Polynomial rings.

UNIT 5:	**FIELDS**	**12**

Examples of fields – A Brief Excursion into vector spaces – Field extension – Constructability – Roots of polynomial.

60 PERIODS

COURSE OUTCOMES

At the end of this course, the students will be able to:

CO1:	Learn about groups, abelian groups and Modules
CO2:	Get the knowledge of Cyclic groups and Lagrange's Theorem.
CO3:	Learn about abelian groups.
CO4:	Classify and Solve ring theory.
CO5:	Create, select and apply appropriate algebraic structures of Fields to explore the existing results.

TOTAL:60 PERIODS

TEXT BOOKS&REFERENCES

1.	Abstract Algebra" by David S.Dummitand Richard M. Foote, Third Edition, Wiley(2018).
2.	I.N. Herstein. Topics in Algebra (II Edition) Wiley, 2006.
3.	M.Artin, Algebra, Prentice Hall of India, 2011.

4.	P.B.Bhattacharya, S.K.Jain, and S.R.Nagpaul, Basic Abstract Algebra (II Edition) Cambridge University Press, 2012. (Indian Edition)
5.	I.S.Luther and I.B.S.Passi, Algebra, Vol. I - Groups(2011); Vol. II Rings(2000), Narosa Publishing House , New Delhi.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1:	2	2	1	2	-	1	-	2	1	1
CO2:	1	2	2	2	1	2	2	-	-	2
CO3:	-	2	-	2	1	2	-	2	-	2
CO4:	2	2	2	2	-	2	-	-	2	2
CO5:	1	2	2	-	2	2	-	1	1	2

1 - low, 2 - medium, 3 - high

24MAP102	STATISTICAL INFERENCE - I	L	T	P	C	TOTAL MARKS
		3	1	0	4	100

PREREQUISITES: NIL

COURSE OBJECTIVES:

The main objectives of this course are to:

1	To introduce the basic concepts of probability and random variables.
2	To acquaint the knowledge of distributions.
3	Develop the knowledge to understand the concept of two dimensional random variables and their distributions.
4	Discuss about estimations and confidence interval.
5	To impart extended knowledge about time series analysis.

UNIT 1:	**PROBABILITY AND RANDOM VARIABLES**	**12**

Probability — Axioms of probability — Conditional probability — Baye's theorem — Discrete and continuous random variables — Moments — Moment generating functions.

UNIT 2:	**DISTRIBUTIONS**	**12**

Binomial, Poisson, Geometric, Uniform, Exponential ,Gamma and Normal distributions.

UNIT 3:	**TWO DIMENSIONAL RANDOM VARIABLES**	**12**

Joint distributions — Marginal and conditional distributions — Covariance — Correlation and linear regression.

UNIT 4:	**ESTIMATION**	**12**

Preliminary notion – Consistency estimation – Unbiased estimates – Sufficiency – Efficiency – Asymptotically most efficient estimates – methods of finding estimates – confidence Interval.

UNIT 5:	**TIME SERIES ANALYSIS**	**12**

Time Series Analysis – Meaning, Need and Components of Time Series – Different Methods – Simple Average Method – Free hand, Semi Average, Moving Average and Least Square Method – Seasonal Indices.

60 PERIODS

COURSE OUTCOMES

At the end of this course, the students will be able to:

CO1:	Analysis and apply the concepts of probability, momentum generating and characteristics to solve the problems.
CO2:	Analysis the concept of standard distributions , which can describe the real life phenomenon.
CO3:	Analysis the concept of correlation and regression, solve the real life problem.
CO4:	Explain about the estimations and the confidence interval.
CO5:	Understand the concept of time series analysis.

TOTAL:60 PERIODS

TEXT BOOKS&REFERENCES

1.	Rohatgi V.K. and A.K. Md. Ehsanes Saleh," An introduction to Probability and Statistics",John Wiley & Sons, Inc., Second Edition, 2001.
2.	An Introduction to Probability Theory and Its Applications: By William Feller.
3.	M. Fisz , Probability Theory and Mathematical Statistics, John Wiley and sons, New York, 1963.
4.	E.J.Dudewicz and S.N.Mishra , Modern Mathematical Statistics, John Wiley and Sons, New York, 1988.
5.	G.G.Roussas, A First Course in Mathematical Statistics, Addison Wesley Publishing Company, 1973

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1:	1	2	1	2	1	1	1	1	1	1	1
CO2:	1	1	2	2	2	1	1	1	2	1	2
CO3:	1	2	1	1	1	1	2	1	2	1	2
CO4:	1	1	1	2	1	2	1	2	1	2	1
CO5:	2	1	1	1	2	1	2	1	1	1	1

1 - low, 2 - medium, 3 - high

24MAP111	STATISTICAL INFERENCE I (PRACTICAL)	L	T	P	C	Total Marks
		2	0	1	2	100

UniT 1: PROBABILITY AND RANDOM VARIABLES
Probability — Axioms of probability — Conditional probability — Baye's theorem — Discrete and continuous random variables — Moments — Moment generating functions.
UniT 2: DISTRIBUTIONS
Binomial, Poisson, Geometric, Uniform, Exponential ,Gamma and Normal distributions.
UniT 3: TWO DIMENSIONAL RANDOM VARIABLES
Joint distributions — Marginal and conditional distributions — Covariance — Correlation and linear regression.
UniT 4: ESTIMATION
Preliminary notion – Consistency estimation – Unbiased estimates – Sufficiency – Efficiency – Asymptotically most efficient estimates – methods of finding estimates – confidence Interval.
UniT 5: TIME SERIES ANALYSIS
Time Series Analysis – Meaning, Need and Components of Time Series – Different Methods – Simple Average Method – Free hand, Semi Average, Moving Average and Least Square Method – Seasonal Indices.

COURSE OUTCOMES	
At the end of this course, the students will be able to:	
CO1:	Analysis and apply the concepts of probability, momentum generating and characteristics to solve the problems.
CO2:	Analysis the concept of standard distributions , which can describe the real life phenomenon.
CO3:	Analysis the concept of correlation and regression, solve the real life problem.
CO4:	Explain about the estimations and the confidence interval.
CO5:	Apply the concept of time series analysis.
	TOTAL: 30 PERIODS

TEXT BOOKS&REFERENCES	
1.	S.P.Gupta – Statistical Methods, Published by Atlantic Publishers & Distributors (P) Ltd. (2012).
2.	D.N.Gupta – Business Statistics,Published by Tata McGraw Hill, Third Edition-2014.
3.	R.S.N.Pillai & B.Bhagavathi – Statistics, Published by S.Chand,2019.

The Maximum Mark for this Statistical Inference I - Practical shall be 100 with 25 Marks for Internal Assessment, which comprises Tests and Record Work with manual procedures, and 75 Marks for External Practical Examination. The candidate should attend 3 questions, and each question has 25 marks both the manual and system results. The contents for this Statistical Inference I - Practical are the problems related to the topics relating to the areas listed below covered in the current semester. The contents for Statistical Inference I - Practical shall be restricted to the following topics, which are found in the "Excel".

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1:	2	1	-	-	2	2	2	-	1	1
CO2:	2	1	1	-	2	2	1	2	-	2
CO3:	2	1	-	-	2	1	2	1	-	2
CO4:	-	2	2	-	1	-	2	-	-	-
CO5:	-	2	1	-	1	-	2	-	-	1

Strong – 3; Medium – 2; Low – 1

24MAP103	STATISTICAL PACKAGE FOR SOCIAL SCIENCES	L	T	P	C	TOTAL MARKS
		3	1	0	4	100

The Maximum Mark for this paper shall be 100 with 25 Marks for Internal Assessment, which comprises Tests and Record work, and 75 Marks for External Examination. The candidate should attend 3 questions 25 Marks each with internal choice. The contents for this paper are the problems related to the papers covered in all the semesters. Problem relating to the areas listed below covered under Semester I to II. The contents for Statistical Software Practical shall be restricted to the following topics, which are found in the software "SPSS".

- Correlation & Regression – Partial and Multiple Correlations, Linear and Multiple Regression
- Curve Fitting, Time Series and Forecasting Models.
- Inferential Statistics for Single through Multiple Samples (Chi square, t and f test).
- Statistical Quality Control Charts – Determination of Parameters for Constructing Basic Control Charts – X, R, S, p, np, c, u Charts.

COURSE OUTCOMES

At the end of this course, the students will be able to:

CO1:	Install SPSS and demonstrate various tool boxes available in SPSS.
CO2:	Execute Correlation and Regression.
CO3:	Promote the practice of the Inferential Statistics.
CO4:	**A**nalyze the concepts of Statistical Quality Control Charts using SPSS.

TOTAL:45 PERIODS

TEXT BOOKS&REFERENCES

1.	Discovering Statistics Using SPSS Andy Field.
2.	SPSS Survival Manual: A Step by Step Guide to Data Analysis Using SPSS for Windows (Version 15), 3rd Edition Julie Pallant.
3.	Discovering Statistics Using IBM SPSS Statistics [with SPSS v24.0 Software] Andy Field.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1:	2	1	-	-	2	2	2	-	1	1
CO2:	2	1	1	-	2	2	1	2	-	2
CO3:	2	1	-	-	2	1	2	1	-	2
CO4:	-	2	2	-	1	-	2	-	-	-
CO5:	-	2	1	-	1	-	2	-	-	1

Strong – 3; Medium – 2; Low – 1

24MAP201	ALGEBRA-II	L	T	P	C	TOTAL MARKS
		3	1	0	4	100

PREREQUISITES: Groups, quotient groups.

COURSE OBJECTIVES:

The main objectives of this course are to:

- This course is aimed to provide an introduction to the theories, concepts
- Develop the working knowledge of vector space
- Learn about Galois theory and Applications of Galois theory.

UNIT 1:	IDEALS AND HOMOMORPHISMS	12

Ideals and Homomorphisms: Ideals – Homomorphisms – Sum and Direct sum of Ideals- Maximal and Prime Ideals – Nilpotent and nil ideals .

UNIT 2:	EUCLIDEAN DOMAIN	12

Unique Factorization Domain and Euclidean Domain: Unique factorization domain – Principal ideal .

UNIT 3:	MODULES AND VECTOR SPACES	12

Modules and Vector Spaces: Definitions and examples – Submodules and direct sums – R-Homomorphisms and quotient modules – Free modules – Representation of linear mappings – Rank of a linear mapping.

UNIT 4:	GALOIS THEORY	12

Galois Theory: Automorphism groups and fixed fields – Fundamental theorem of Galois theory – Fundamental theorem of algebra

UNIT 5:	APPLICATIONS OF GALOIS THEORY	12

Applications of Galois theory to classical problems: Roots of unity and cyclotomic polynomials – Cyclic extensions – Polynomials solvable by radicals – Symmetric functions – Ruler and compass constructions

60 PERIODS

COURSE OUTCOMES

At the end of this course, the students will be able to:

CO1:	Understand the definition of Ideals and Homomorphism
CO2:	Apply the concepts of Unique Factorization Domain
CO3:	Understand about Modules and vector spaces
CO4:	Using the concept of Galois theory
CO5:	Get the knowledge of Applications of Galois theory

TOTAL:60 PERIODS

TEXT BOOKS&REFERENCES

1.	P.B.Bhattacharya, S.K.Jain, and S.R.Nagpaul, Basic Abstract Algebra (II Edition Cambridge University Press, 2012. (Indian Edition)
2.	"Abstract Algebra" by **David S. Dummit**and **Richard M. Foote**, Third Edition, Wiley , (2018)
3.	I.N. Herstein. Topics in Algebra (II Edition) Wiley, 2006.
4.	M.Artin, Algebra, Prentice Hall of India, 2011.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1:	2	2	1	2	-	2	-	2	1	2
CO2:	1	2	2	2	1	1	2	-	-	2
CO3:	-	2	-	2	1	-	-	2	-	2
CO4:	2	-	2	2	-	2	-	-	2	2
CO5:	1	2	2	-	2	2	-	1	1	2

1 - low, 2 - medium, 3 - high

24MAP202	STATISTICAL INFERENCE - II	L	T	P	C	TOTAL MARKS
		3	1	0	4	100

PREREQUISITES: NIL

COURSE OBJECTIVES:

The main objectives of this course are:

1	To Categorize various sampling methods and apply the Managerial problems.
2	To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
3	To introduce the basic concepts of classifications of design of experiments which plays very important roles in the field of agriculture .
4	To Classify various sampling methods and apply Inferential Statistical techniques ,to solve the Managerial problems.
5	To introduce the basic concepts of statistical quality control.

UNIT 1:	**SAMPLING DISTRIBUTIONS**	**12**

Introduction to sampling distributions- Estimation of parameters- sampling distribution of mean and proportion-application of central limit theorem- sampling techniques.

UNIT 2:	**TESTING OF HYPOTHESIS**	**12**

Large sample tests based on Normal distribution for single mean and difference of means -Tests based on t, and F distributions – Chi-square Contingency table (test for independent) – Goodness of fit.

UNIT 3:	**DESIGN OF EXPERIMENTS**	**12**

One way and Two way classifications – Completely randomized design – Randomized block design – Latin square design – 2^2 factorial design.

UNIT 4:	**NON-PARAMETRIC TESTS**	**12**

Sign test for paired data. Rank sum test. Kolmogorov Smirnov – test for goodness of fit, comparing two populations. Mann – Whitney U test and Kruskal Wallis test. One sample run test.

UNIT 5:	**STATISTICAL QUALITY CONTROL**	**12**

Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits – Acceptance sampling.

60 PERIODS

COURSE OUTCOMES

At the end of this course, the students will be able to:

CO1:	Have the notion of sampling distributions and statistical techniques used in various fields.
CO2:	Apply the concept of testing of hypothesis for small and large samples in real life problems
CO3:	Apply the basic concepts of classifications of design of experiments in the field of agriculture.
CO4:	Develop the ability to choose the appropriate non-parametric test for different types of data and research questions.
CO5:	Develop the ability to design, interpret, and apply various control charts to monitor and control manufacturing processes, and identifying variations that require corrective actions.

TOTAL:60 PERIODS

TEXT BOOKS&REFERENCES

1.	Richard I. Levin, David S. Rubin, Sanjay Rastogi Masood Husain Siddiqui, Statistics for Management, Pearson Education, 7th Edition, 2016.
2.	Prem.S.Mann, Introductory Statistics, 7th Edition, Wiley India, 2016.
3.	Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, An Introduction to Statistical Learning with Applications in R, Springer, 2016.
4.	Aczel A.D. and Sounderpandian J., “Complete Business Statistics”, 6th edition, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2012.

5.	Anderson D.R., Sweeney D.J. and Williams T.A., Statistics for business and economics, 11th edition, Thomson (South – Western) Asia, Singapore, 2012.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1:	1	2	1	2	1	1	1	1	1	1	1
CO2:	1	1	2	2	2	1	1	1	2	1	2
CO3:	1	2	1	1	1	1	2	1	2	1	2
CO4:	1	1	1	2	1	2	1	2	1	2	1
CO5:	2	1	1	1	2	1	2	1	1	1	1

1 - low, 2 - medium, 3 - high

24MAP211	STATISTICAL INFERENCE – II (Practical)	L	T	P	C	TOTAL MARKS
		2	0	1	2	100

PREREQUISITES: NIL

COURSE OBJECTIVES:

The main objectives of this course are:

1	To Categorize various sampling methods and apply the Managerial problems.
2	To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
3	To introduce the basic concepts of classifications of design of experiments which plays very important roles in the field of agriculture .
4	To Classify various sampling methods and apply Inferential Statistical techniques ,to solve the Managerial problems.
5	To introduce the basic concepts of statistical quality control.

UNIT 1:	SAMPLING DISTRIBUTIONS	6

Introduction to sampling distributions- Estimation of parameters- sampling distribution of mean and proportion-application of central limit theorem- sampling techniques.

UNIT 2:	TESTING OF HYPOTHESIS	6

Large sample tests based on Normal distribution for single mean and difference of means -Tests based on t, and F distributions – Chi-square Contingency table (test for independent) – Goodness of fit.

UNIT 3:	DESIGN OF EXPERIMENTS	6

One way and Two way classifications – Completely randomized design – Randomized block design – Latin square design – 2^2 factorial design.

UNIT 4:	NON-PARAMETRIC TESTS	6

Sign test for paired data. Rank sum test. Kolmogorov Smirnov – test for goodness of fit, comparing two populations. Mann – Whitney U test and Kruskal Wallis test. One sample run test.

UNIT 5:	STATISTICAL QUALITY CONTROL	6

Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits – Acceptance sampling.

30 PERIODS

COURSE OUTCOMES

At the end of this course, the students will be able to:

CO1:	Have the notion of sampling distributions and statistical techniques used in various fields.
CO2:	Apply the concept of testing of hypothesis for small and large samples in real life problems
CO3:	Apply the basic concepts of classifications of design of experiments in the field of agriculture.
CO4:	Develop the ability to choose the appropriate non-parametric test for different types of data and research questions.
CO5:	Develop the ability to design, interpret, and apply various control charts to monitor and control manufacturing processes, and identifying variations that require corrective actions.

TOTAL:30 PERIODS

TEXT BOOKS&REFERENCES

1.	Richard I. Levin, David S. Rubin, Sanjay Rastogi Masood Husain Siddiqui, Statistics for Management, Pearson Education, 7th Edition, 2016.
2.	Prem.S.Mann, Introductory Statistics, 7th Edition, Wiley India, 2016.
3.	Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, An Introduction to Statistical Learning with Applications in R, Springer, 2016.

The Maximum Mark for this Statistical Inference II - Practical shall be 100 with 25 Marks for Internal Assessment, which comprises Tests and Record Work with manual procedures, and 75 Marks for External Practical Examination. The candidate should attend 3 questions, and each question has 25 marks both the manual and system results. The contents for this Statistical Inference II - Practical are the problems related to the topics relating to the areas listed below covered in the current semester. The contents for Statistical Inference II - Practical shall be restricted to the following topics, which are found in the "Excel".

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1:	2	1	-	-	2	2	2	-	1	1	2
CO2:	2	1	1	-	2	2	1	2	-	2	2
CO3:	2	1	-	-	2	1	2	1	-	2	2
CO4:	-	2	2	-	1	-	2	-	-	-	-
CO5:	-	2	1	-	1	-	2	-	-	1	-

1 - low, 2 - medium, 3 - high

24MAP203	APPLICATION OF MATHEMATICS IN ENVIRONMENTAL STUDIES	L	T	P	C	TOTAL MARKS
		2	1	0	3	100

PREREQUISITES: NIL

COURSE OBJECTIVES: BASIC DIFFERENTIATIONS

The main objectives of this course are :

1	To Apply the Mathematical concepts in real life situations and solve the problems through the parameters using matrices .
2	To analyze LPP for the real life situations
3	To learn about mathematical modelling.
4	To develop the concept of dynamical systems.
5	To apply discrete dynamic system in solving problems

UNIT 1: MATRICES **9**

System of linear equations, matrix form, elementary row operations, row equivalence, row reduced, row reduced echelon matrices, elementary matrices and their roles in determining inevitability of square matrices, row rank, relation between row equivalence and row space of matrices, matrix population modelling.

UNIT 2: LINEAR PROGRAMMING PROBLEM **9**

Linear programming problem – introduction, graphical solution method, some exceptional cases; general linear programming problem, duality, simplex method; problems related to ecology and environment.

UNIT 3: MATHEMATICAL MODELLING-INTRODUCTION **9**

Simple situations requiring mathematical modelling, techniques of mathematical modeling, Classifications, Characteristics and limitations of mathematical models, some simple illustrations. Mathematical modelling in population dynamics, Mathematical modelling of epidemics through systems of ordinary differential equations of first order Mathematical Models in Medicine

UNIT 4: MATHEMATICAL MODELLING-APPLICATION **9**

Mathematical modelling in population dynamics, Mathematical modelling of epidemics through systems of ordinary differential equations of first order Mathematical Models in Medicine.

UNIT 5: DISCRETE DYNAMICAL SYSTEMS **9**

Discrete dynamical systems, orbit of a point, types of orbit; fixed point: sink, source and neutral fixed points; classification of fixed points of real-valued function of one real variable, dynamics of logistic population model.

45 PERIODS

COURSE OUTCOMES

At the end of this course, the students will be able to:

CO1:	Form the equation and solve.
CO2:	Solve linear programing problem.
CO3:	Identify the modelling
CO4:	Apply the mathematical modelling.
CO5:	Apply the dynamic system to solve the parameters .

TOTAL:45 PERIODS

TEXT BOOKS&REFERENCES

1.	K. Hoffman and R. Kunze -Linear Algebra, Prentice Hall of India Pvt. Ltd., New Delhi, (2nd edition) 2000.
2.	David F. Parkhurst -Introduction to Applied Mathematics for Environmental Science , Springer (2006).

3.	Operations Research (for Group B) – K. Swarup, P. K. Gupt and Man Mohan, Sultan Chand & Sons, New Delhi, 2000.
4.	J. N. Kapur ,Mathematical Modelling, New Age International, 1988.
5.	Gilbert Strang, Brooks Cole -Linear Algebra and its application , 4th edition (2006).
6.	Rutherford, A. Mathematical Modelling Techniques. Courier Corporation, 2012. 3. Linear Algebra (2nd edition) – Promode Kumar Saikia, Pearson, 2009

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1:	**2**	**2**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**2**	**1**
CO2:	**1**	**2**	**3**	**2**	**2**	**2**	**1**	**1**	**2**	**2**	**1**
CO3:	**1**	**2**	**3**	**2**	**2**	**1**	**2**	**1**	**2**	**1**	**2**
CO4:	**1**	**2**	**1**	**2**	**1**	**3**	**1**	**3**	**2**	**1**	**1**
CO5:	**2**	**1**	**2**	**1**	**2**	**1**	**3**	**2**	**1**	**2**	**2**

1 - low, 2 - medium, 3 - high

24MAP301	COMPLEX ANALYSIS	L	T	P	C	TOTAL MARKS
		3	1	0	4	100

PREREQUISITES: Undergraduate Real and Complex Analysis

COURSE OBJECTIVES:

The main objectives of this course are to:

1. Provide an introduction to the theories for functions of a complex variable.
2. Study and understand the topics like Poisson's formula, power series expansions, mapping and elliptic functions.
3. Learn about elliptic functions.
4. Learn Riemann Mapping
5. Study the concept of elliptic functions

UNIT 1:	FUNDAMENTAL THEOREMS	12

Fundamental theorems: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 – Localproperties of analytical functions: Removable singularities, Taylor's theorem – Zeros and poles.

UNIT 2:	THE CALCULUS OF RESIDUES	12

The residue theorem – The argument principle – Evaluation of definite integrals-Harmonic functions: Definition and basic properties – The mean-value property – Poisson's formula.

UNIT 3:	POWER SERIES EXPANSIONS	12

Weierstrass theorem – The Taylor series – The Laurent series- Partial fractions and factorization: Partial fractions – Infinite products – Canonical products-The Gamma functions-Stirling's formula-Jensen's formula- Hadamard's Theorem.

UNIT 4:	THE RIEMANN MAPPING THEOREM	12

Statement and proof – Boundary behavior – Use of the reflection principle – Analytic arcs – Conformal mapping of polygons: The behavior at an angle – The Schwarz-Christoffel formula.

UNIT 5:	ELLIPTIC FUNCTIONS	12

Simply periodic functions: Representation by Exponentials-The Fourier development-Functions of Finite Order. Doubly Periodic Functions: The Period Module- Unimodular Transformations-The Canonical Basis- General Properties of Elliptic Functions.

60 PERIODS

COURSE OUTCOMES

At the end of this course, the students will be able to:

CO1:	Explain the concepts of C-R Equations, Analytic Functions, and Elementary Functions .
CO2:	Construct the proofs of Cauchy Integral Formula, and solve problems related to Residue.
CO3:	Identify different types of singularities, zeros of analytic function, expand the Taylor series , Laurent series and apply the Hadamard's Theorem to solve the problems
CO4:	Understand Analytic arcs and mappings of regions under Schwarz-Christoffel.
CO5:	Understand the periodic function and elliptic functions.

TEXT BOOKS&REFERENCES

1.	Lars V. Ahlfors, Complex Analysis, (3rd Edition) McGraw Hill Book Company, New York, 2013.
2.	H.A. Priestly,Introduction to Complex Analysis, Clarendon Press,Oxford, 2008.
3.	J.B.Conway, Functions of one complex variable, Springer International Edition, 2003
4.	D.Sarason, Notes on Complex function Theory, Hindustan Book Agency, 2008.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1:	2	1	1	2	2	2	-	2	1	2
CO2:	1	2	-	2	1	2	2	-	-	2
CO3:	2	-	2	2	1	2	-	2	2	2
CO4:	2	2	1	2	2	2	-	-	2	2
CO5:	1	2	2	-	2	2	-	1	2	2

Strong – 3; Medium – 2; Low – 1

24MAP302	TOPOLOGY	L	T	P	C	TOTAL MARKS
		3	1	0	4	100

PREREQUISITES: REAL ANALYSIS

COURSE OBJECTIVES:

The main objectives of this course are to:

1. Provide in depth knowledge of this fundamental core course in mathematics.
2. Show various techniques from analysis , set theory , logic that are used in topological spaces to obtain their properties , to demonstrate application in physics.
3. Learn the concept of connectedness
4. Learn the concept of compactness
5. Learn the theorems like The Urysohn's Lemma, Hausdorff spaces.

UNIT 1:	TOPOLOGICAL SPACES	12

Topological spaces- the definition and examples - Bases for a topology - Open sets and closed sets - Interior closure of a set - Exterior and Boundary - Relative or subspace topology - sub bases - Hausdorff spaces

UNIT 2:	CONTINUOUS FUNCTION	12

Continuous function – open set and closed maps – Pasting lemma - Uniform metric and convergence theorem - Quotient space – Metric topology – examples for non metrizable spaces.

UNIT 3:	CONNECTEDNESS	12

Connectedness – Connected spaces – Connected sets on the real line – Path connectedness.

UNIT 4:	COMPACTNESS	12

Compactness – Compact space – Compact sets on the line – limit point compactness – local compactness.

UNIT 5:	REGULAR SPACES	12

T_0, T_1 and T_2 spaces -Hausdorff spaces- Regular and completely regular spaces- normal and completely normal spaces - Urysohn's lemma.

60 PERIODS

COURSE OUTCOMES

At the end of this course, the students will be able to:

CO1:	Understand basics of Topological Spaces .
CO2:	Study Pasting lemma, Metric topology, Local Compactness, Uniform metric and convergence theorem
CO3:	Understand the concept of Connected spaces.
CO4:	Achieve the zenith in treating Compact space, limit point compactness
CO5:	Understand theorems like The Urysohn's Lemma, Hausdorff spaces.

TOTAL:60 PERIODS

TEXT BOOKS&REFERENCES

1.	George F.Simmons, Introduction to Topology and Modern Analysis, Tata-McGraw Hill. New Delhi, 2004.
2.	J.R. Munkres, Topology (2nd Edition) Pearson Education Pvt. Ltd., Delhi-2002 (Third Indian)
3.	J.L. Kelly, General Topology, Springer

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1:	1	2	1	2	2	2	-	2	1	2
CO2:	1	2	2	2	-	2	2	-	-	2
CO3:	2	2	-	2	1	2	-	2	1	2
CO4:	2	2	2	2	1	2	-	-	2	2
CO5:	1	2	2	2	1	-	-	1	1	2

Strong – 3; Medium – 2; Low – 1

24MAP104	ANALYSIS-I	L	T	P	C	TOTAL MARKS
		3	1	0	4	100

PREREQUISITES: Undergraduate Level Analysis

COURSE OBJECTIVES:

The main objectives of this course are to:

1. Learn the concepts of real analysis objects such as open sets, closed sets, compact sets and the concept of sequence of functions,
2. Learn about Weierstrass approximation Theorem
3. Develop the Measurable sets, Lebesgue integral
4. Develop the concept of Fourier series.

UNIT 1:	SEQUENCE OF REAL NUMBERS	12

Definition of a sequence and subsequence; limit of a sequence; covergent sequences; divergent sequences; bounded sequences; monotone sequences; operations on convergent sequences; operations on divergent sequences; Cauchy sequences.

UNIT 2:	THREE FAMOUS THEOREMS	12

The metric space C[a,b] – The Weierstrass approximation theorem – Picard existence theorem for differential equations .

UNIT 3:	MEASURABLE SETS	12

Length of open sets and closed sets- Inner and outer measure. Measurable sets-Properties of measurable sets-Measurable Functions-Definition and existence of the Lebesgue integral for bounded functions.

UNIT 4:	THE LEBESGUE INTEGRAL	12

Properties of the Lebesgue integral for bounded measurable functions-The Lebesgue integral for unbounded functions-Some fundamental theorems-The metric space $L^2[a,b]$.

UNIT 5:	FOURIER SERIES	12

Definition of Fourier series-Formulation of convergence problems-The (C,1)summability of Fourier series-The L^2 theory of Fourier series-Convergence of Fourier series.

60 PERIODS

COURSE OUTCOMES

At the end of this course, the students will be able to:

CO1:	Attain mastery in sequence and series and Uniform convergence.
CO2:	Study in detail metric space, Weierstrass and Picard Theorem.
CO3:	Acquire the knowledge of Open, closed, Measurable sets and Lebesgue integral.
CO4:	Study the Lebesgue integral, The metric space on unbounded functions.
CO5:	Understand the concept the concept of Fourier series.

TOTAL:60 PERIODS

TEXT BOOKS&REFERENCES

1.	Richard R.Goldberg Methods of Real analysis, oxford and IBH Publishing,New Delhi 2020.
2.	Bartle, R.G. Real Analysis, John Wiley and Sons Inc., 2014.
3.	Tom M.Apostol : Mathematical Analysis, 2nd Edition, Narosa,2002.
4.	Malik,S.C. and Savita Arora. Mathematical Anslysis, Wiley Eastern Limited.New Delhi, 2012.
5.	Sanjay Arora and Bansi Lal, Introduction to Real Analysis, Satya Prakashan, New Delhi, 2012.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1:	-	2	1	2	-	2	-	2	1	2
CO2:	1	2	2	1	1	2	2	-	-	2
CO3:	1	2	2	2	1	2	-	2	-	2
CO4:	-	2	1	2	-	2	-	-	1	2
CO5:	1	2	2	-	2	2	-	1	1	2

1 - low, 2 - medium, 3 - high

24MAP204	ANALYSIS-II	L	T	P	C	TOTAL MARKS
		3	1	0	4	100

PREREQUISITES: Undergraduate Level Analysis

COURSE OBJECTIVES:

The main objectives of this course are to:

1. Learn basic elements of field.
2. Learn Lebesgue integration and differentiation.
3. Identify Pointwise uniform convergence
4. Apply the concepts of Functions of Several Variables in solving
5. Learn about Differential Calculus.

UNIT 1:	**REVIEW OF FIELD**	**12**

Review : The Real Field - Euclidean Spaces - Metric Spaces - Compactness -Connectedness - Differentiability - Mean Value Theorem - Continuity .

UNIT 2:	**INTEGRATION OF VECTOR FIELD FUNCTIONS**	**12**

Riemann - Stieltjes Integral : Definition and properties of the integral – Integration and Differentiation - Integration of Vector Valued functions.

UNIT 3:	**SEQUENCES AND SERIES**	**12**

Sequences and series of functions : Pointwise Convergence - Uniform Convergence -Weierstrass Theorem - Power Series - Fourier Series.

UNIT 4:	**FUNCTIONS OF SEVERAL VARIABLES**	**12**

Functions of Several Variables: Derivatives of a function from Rn to Rm - Chain Rule -Partial Derivatives -Derivatives of Higher order.

UNIT 5:	**BASIC THEOREMS OF DIFFERENTIAL CALCULUS**	**12**

Basic Theorems of Differential Calculus: Inverse function Theorem -Implicit function Theorem - Rank Theorem.

60 PERIODS

COURSE OUTCOMES

At the end of this course, the students will be able to:

CO1:	Illustrate the effect of Field - Euclidean Spaces, Mean Value Theorem.
CO2:	Determine the Riemann-Stieltjes integrability of a bounded function and prove a selection of theorems concerning integration.
CO3:	Recognize the difference between pointwise and uniform convergence of sequences and series of functions and understand the Rearrangement of terms of a series
CO4:	Understand the concept of Power series and Functions of several variables.
CO5:	Prove Inverse function theorem and Implicit function theorem.

TOTAL:60 PERIODS

TEXT BOOKS&REFERENCES

1.	P.B.Bhattacharya, S.K.Jain, and S.R.Nagpaul, Basic Abstract Algebra (II Edition Cambridge University Press, 2012. (Indian Edition)
2.	"Abstract Algebra" by **David S. Dummit**and **Richard M. Foote**, Third Edition, Wiley , (2018)
3.	I.N. Herstein. Topics in Algebra (II Edition) Wiley, 2006.
4.	M.Artin, Algebra, Prentice Hall of India, 2011.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1:	2	2	1	2	-	2	-	2	1	2
CO2:	1	2	2	2	1	1	2	-	-	2
CO3:	-	2	-	2	1	-	-	2	-	2
CO4:	2	-	2	2	-	2	-	-	2	2
CO5:	1	2	2	-	2	2	-	1	1	2

1 - low, 2 - medium, 3 - high

24MAP304-A	DIFFERENTIAL GEOMETRY	L	T	P	C	TOTAL MARKS
		3	1	0	4	100

PREREQUISITES: None

COURSE OBJECTIVES:

The main objectives of this course are to:

1. Identify space curves, curvature and evolutes etc.
2. Analyze the intrinsic properties of a surface
3. Understand the concepts of geodesics.
4. Learn about the non-intrinsic properties of surfaces are explored.
5. Identify the differential geometry of surface.

UNIT 1:	SPACE CURVES	12

Definition of a space curve – Arc length – tangent – normal and binormal – curvature and torsion – contact between curves and surfaces- tangent surface- involutes and evolutes- Intrinsic equations – Fundamental Existence Theorem for space curves- Helices.

UNIT 2:	INTRINSIC PROPERTIES OF A SURFACE	12

Definition of a surface – curves on a surface – Surface of revolution – Helicoids – Metric- Direction coefficients – families of curves- Isometric correspondence- Intrinsic properties

UNIT 3:	GEODESICS	12

Geodesics – Canonical geodesic equations – Normal property of geodesics- Existence Theorems – Geodesic parallels – Geodesics curvature- Gauss- Bonnet Theorem – Gaussian curvature- surface of constant curvature.

UNIT 4:	NONINTRINSIC PROPERTIES OF A SURFACE	12

The second fundamental form- Principal curvature – Lines of curvature – Developable - Developable associated with space curves and with curves on surfaces - Minimal surfaces – Ruled surfaces.

UNIT 5:	DIFFERENTIAL GEOMETRY OF SURFACES	12

Compact surfaces whose points are umblics- Hilbert's lemma – Compact surface of constant curvature – Complete surfaces and their characterization – Hilbert's Theorem – Conjugate points on geodesics.

60 PERIODS

COURSE OUTCOMES

At the end of this course, the students will be able to:

CO1:	Understand the basic concept of definition of a space curve curvature, torsion, involutes and Evolutes.
CO2:	Get the knowledge of intrinsic properties of a surface
CO3:	Get the knowledge of Geodesics and its properties.
CO4:	Understand about the second fundamental form
CO5:	Have knowledge about Differential Geometry of Surfaces and characterization of Complete surfaces

TOTAL:60 PERIODS

TEXT BOOKS&REFERENCES

1.	T.J.Willmore, An Introduction to Differential Geometry, Oxford University Press, (17th Impression) New Delhi 2013. (Indian Print)
2.	Struik, D.T. Lectures on Classical Differential Geometry, Addison – Wesley, Mass. 2012.
3.	Wilhelm Klingenberg: A course in Differential Geometry, Graduate Texts in Mathematics, Springer-Verlag 2013.
4.	J.A. Thorpe Elementary Topics in Differential Geometry, Springer International Edition,2004.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1:	2	1	1	1	2	1	2	1	2	1
CO2:	1	1	1	1	2	2	1	2	1	2
CO3:	2	2	1	1	2	1	2	1	1	2
CO4:	1	2	2	1	1	1	2	1	1	1
CO5:	1	2	1	1	2	1	2	1	1	1

1 - low, 2 - medium, 3 - high

24MAP304-B	FUNCTIONAL ANALYSIS	L	T	P	C	TOTAL MARKS
		3	1	0	4	100

PREREQUISITES: 24MAP104- ANALYSIS-I

COURSE OBJECTIVES:

The main objectives of this course are to:

1. Identify Algebraic System
2. Study the details of Banach spaces
3. Applythe concepts Hilbert Spaces in theorems
4. Learn about Banach algebras.
5. Identify the structure of communicative banach algebras.

UNIT 1:	ALGEBRAIC SYSTEMS	12

Groups-Rings-The structure of rings-Linear space-Dimensions of linear space-Linear Transformation-Algebras.

UNIT 2:	BANACH SPACES	12

Banach Spaces - Definition and examples – Continuous Linear Transformations – The Hahn-Banach Theorem. The natural embedding of N in N** - Open mapping theorem – conjugate of an operator.

UNIT 3:	HILBERT SPACES	12

Geodesics – Canonical geodesic equations – Normal property of geodesics- Existence Theorems – Geodesic parallels – Geodesics curvature- Gauss- Bonnet Theorem – Gaussian curvature- surface of constant curvature.

UNIT 4:	PRELIMINARIES ON BANACH ALGEBRAS	12

Definition and some examples – Regular and singular elements – Topological divisors of zero – spectrum – the formula for the spectral radius – the radical and semi-simplicity.

UNIT 5:	STRUCTURE OF COMMUTATIVE BANACH ALGEBRAS	12

Gelfand mapping –Applications of formula r(x)–Involutions in banach algebras- Gelfand-Neumark Theorem.

60 PERIODS

COURSE OUTCOMES

At the end of this course, the students will be able to:

CO1:	Understand the basic concept of Normed Spaces with example.
CO2:	Learn about open mapping theorem and properties.
CO3:	To learn the concept of Conjugate space , Normal and Unitary Operators
CO4:	An understanding the concept of Preliminaries on Banach Algebras
CO5:	To get the knowledge about Gelfand-Neumark Theorem and its uses.

TOTAL:60 PERIODS

TEXT BOOKS&REFERENCES

1.	F.Simmons , Introduction toTopology and Modern Analysis, McGraw Hill International Book Company, New York, 2017.
2.	W.Rudin FunctionalAnalysis, Tata McGraw-Hill Publishing Company, New Delhi, 2017.
3.	E. Kreyszig Introductory Functional Analysis with Applications, John Wiley & Sons, New York.,2008**.**
4.	M.Thamban Nair, Functional Analysis. A First Course, Prentice Hall of India, New Delhi, 2002

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1:	2	1	1	1	2	1	2	1	2	1
CO2:	2	1	1	1	2	2	1	2	1	2
CO3:	2	2	-	1	2	1	2	1	1	2
CO4:	1	2	2	1	1	1	2	-	1	1
CO5:	1	2	1	1	2	1	2	-	1	1

1 - low, 2 - medium, 3 - high

24MAO304-D	ORDINARY DIFFERENTIAL EQUATIONS	L	T	P	C	TOTAL MARKS
		3	1	0	4	100

PREREQUISITES: 24MAP104- ANALYSIS-I

COURSE OBJECTIVES:

The main objectives of this course are to:

1. Develop strong background on finding solutions to linear differential equations with constant and variable coefficients
2. Identify linear equations with constant coeffitients and find the solution of homogenous equations
3. Understand the concepts with singular points, Wronskian and Linear Independance
4. Learn about existence and uniqueness of the solutions of first order differential equations.

UNIT 1:	LINEAR EQUATION OF FIRST ORDER	12

Introduction- Differential equations-Problems associated with differential equations-Linear equations of first order-General linear equations of first order differential equations.

UNIT 2:	LINEAR EQUATIONS WITH CONSTANT COEFFICIENTS	12

Introduction-Second order homogeneous Equations-Initial Value Problems-Linear dependence and independence- Wronskian and a formula for Wronskian- Homogeneous equation of order n –Initial value problems for nth order Equations-Equations with real constants.

UNIT 3:	LINEAR EQUATIONS WITH VARIABLE COEFFICIENTS	12

Introduction-Initial value problems for homogenous equations-Solutions of homogenous equations- – Wronskian and linear Independence – Reduction of the order of a homogeneous equation – Homogeneous equation with analytic coefficients-The Legendre equation.

UNIT 4:	LINEAR EQUATIONS WITH REGULAR SINGULAR POINTS	12

Introduction – The Euler equation-Second order equations with regular singular points – an example – Second order equations with regular singular points – the general case – A convergence proof – The exceptional cases – The Bessel equation – The Bessel equation(continued) – Regular singular points at infinity

UNIT 5:	EXISTENCE AND UNIQUENESS OF SOLUTIONS TO FIRST ORDER EQUATIONS	12

Introduction – Equations with variables separated – Exact equations – The method of successive approximations – The Lipschitz condition – Convergence of the successive approximation – Non-Local existence of solutions – Approximations to, and uniqueness of solutions – Equations with complex-valued functions.

60 PERIODS

COURSE OUTCOMES

At the end of this course, the students will be able to:

CO1:	Understand the definition of Linear equations with constant coefficients.
CO2:	Study the function of Homogeneous , non-homogeneous functions and calculate the Initial value problems
CO3:	Have knowledge about Initial value problems, Existence and Uniqueness Theorems
CO4:	Learn about the Linear equation with regular singular points
CO5:	Get the knowledge of Lipschitz condition Convergence of the successive approximations and the existence theorem

TOTAL:60 PERIODS

TEXT BOOKS&REFERENCES

1.	E.A.Coddington, An introduction to ordinary differential equations (3rd Printing) Prentice-Hall of India Ltd. New Delhi, 2004.
2.	M.D.Raisinghania, Advanced Differential Equations, S.Chand & Company Ltd. New Delhi 2001.

3.	B.Rai, D.P.Choudhury and H.I. Freedman, A Course in Ordinary Differential Equations, Narosa Publishing House, New Delhi, 2002.
4.	George F Simmons, Differential equations with applications and historical notes, Tata McGraw Hill, New Delhi, 2003.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1:	2	1	1	1	2	1	2	1	2	1
CO2:	2	1	1	1	2	2	1	2	1	2
CO3:	2	2	-	1	2	1	2	1	1	2
CO4:	1	2	2	1	1	1	2	-	1	1
CO5:	1	2	1	1	2	1	2	-	1	1

1 - low, 2 - medium, 3 - high

24MAP104-D	GRAPH THEORY	L	T	P	C	TOTAL MARKS
		3	1	0	4	100

PREREQUISITES: None

COURSE OBJECTIVES:

The main objectives of this course are to:

1. Study and develop the concepts of graphs, sub graphs.
2. Understand the concepts of trees, connectivity, Euler tours, Hamilton cycles.
3. Identify Planar graphs
4. Establish the notion of Coloring.
5. Learn about matching, coloring of graphs, independent sets, cliques, vertex coloring, and planar graphs.

UNIT 1:	Graphs and Subgraphs	12

Elementary Concepts of Graphs and Digraphs , Graphs - Degree sequences - Connected graphs and Distance -Digraphs and Multigraphs - Cut vertices - Bridges - Blocks - Automorphism group of a graph.

UNIT 2:	Trees and Networks	12

Trees and Networks: Trees, cut edges and bonds, cut vertices, Cayley Formula, the maxflow min-cut theorem, connectivity, blocks. The Connector problem, Menger's theorem. Connectivity – Blocks – Euler tours – Hamilton Cycles.

UNIT 3:	Planar Graph	12

Planarity in graphs, Euler's Polyhedron formula. Kuratowski's theorem . Vertex connectivity, Edge connectivity, covering, Independence. Matchings – Matching's and Coverings in Bipartite Graphs – The personnel Assignment problems, The Optimal assignment problems. Colorings: Edge chromatic number, Coloring of Chordal graph, Class-1 graphs, Class-2 graphs, Vizing's theorem, Brook's theorem.

UNIT 4:	Colorings	12

Independent sets and Cliques, Vertex Colorings*:* Independent sets – Ramsey's Theorem – Chromatic Number – Brooks' Theorem – Chromatic Polynomials

UNIT 5:	Connected Dual Graphs	12

Planar graphs- Planarity in graphs, Euler's Polyhedron formula. Kuratowski's theorem . Vertex connectivity, Edge connectivity, covering, Independence. Dual graphs – Euler's Formula – The Five-Colour Theorem and the Four-Color Conjecture

60 PERIODS

COURSE OUTCOMES

At the end of this course, the students will be able to:

CO1:	Understand the various types of Graphs, sub graphs ,Trees and paths
CO2:	Learn about the Connectivity, Blocks and Hamilton Cycles
CO3:	Apply the basics concepts of Matching, Edge Colorings.
CO4:	Understand about Ramsey's Theorem and Brooks' Theorem
CO5:	Knows the fundamental of Planar graphs.

TOTAL:60 PERIODS

TEXT BOOKS&REFERENCES

1.	R.J. Wilson, Introduction to Graph Theory, Pearson Education, 4th Edition, 2004, Indian Print.
2.	J.A.Bondy and U.S.R. Murthy, Graph Theory and Applications, Macmillan, London, 2005.
3.	J.Clark and D.A.Holton , A First look at Graph Theory, Allied Publishers, New Delhi , 2006.
4.	A.Gibbons, *Algorithmic Graph Theory*, Cambridge University Press, Cambridge, 2002.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1:	1	1	1	1	2	1	2	1	2	1
CO2:	2	1	1	1	2	2	1	2	1	2
CO3:	2	2	1	1	2	1	2	1	1	2
CO4:	1	2	2	1	1	1	2	1	1	1
CO5:	1	2	1	1	2	1	2	1	1	1

1 - low, 2 - medium, 3 - high

24MAP104-A	DISCRETE MATHEMATICS	L	T	P	C	TOTAL MARKS
		3	1	0	4	100

PREREQUISITES: None

COURSE OBJECTIVES:

The main objectives of this course are to:

1. Identify relations and functions
2. This course aims to explore the topics like lattices .
3. Identify Identities of Boolean algebra
4. Understand the concepts of applications in switching circuits, finite fields, polynomials
5. Learn about coding theory.

UNIT 1:	RELATIONS AND FUNCTIONS	12

Binary relations, equivalence relations and partitions, partial order relations, inclusion and exclusion principle, Hasse diagram, Pigeon hole principle. Functions, inverse functions, compositions of functions, recursive functions.

UNIT 2:	LATTICES	12

Lattices as Partially Ordered Sets. Their Properties, Lattices as algebraic Systems, Sub lattices, Direct Product and homomorphism. Some Special Lattices - Complete, Complemented and Distributive Lattices, Isomorphic Lattices

UNIT 3:	BOOLEAN ALGEBRA	12

Various Boolean identities, the switching Algebra Example, Sub Algebras, Direct Production and Homomorphism. Boolean Forms and their Equivalence, Midterm Boolean forms, Sum of Products, Canonical Forms. Minimization of Boolean Functions. The Karnuagh Map Method.

UNIT 4:	MATHEMATICAL LOGIC	12

Logic operators, Truth tables, Theory of inference and deduction, mathematical calculus, predicate calculus, predicates and qualifiers.

UNIT 5:	CODING THEORY	12

Coding of binary information and error detection, Group codes, decoding and error correction- Linear Codes and Cyclic Codes.

60 PERIODS

COURSE OUTCOMES

At the end of this course, the students will be able to:

CO1:	Understand the definition of Lattice and Boolean algebra.
CO2:	Using Baye's problems to solve conditional probability problem and applications.
CO3:	Learn about finite field problems
CO4:	Identified the concept of Polynomials over Finite fields
CO5:	Understand the concept of Linear Codes and Cyclic Codes

TOTAL:60 PERIODS

TEXT BOOKS&REFERENCES

1.	Rudolf Lidl and Gunter Pilz, Applied Abstract Algebra, Spinger-Verlag, NewYork,
2.	A.Gill, Applied Algebra for Computer Science, Prentice Hall Inc., New Jersey.
3.	J.L.Gersting, Mathematical Structures for Computer Science (3rd Edn.), Computer Science Press, New York**.**
4.	S.Wiitala, Discrete Mathematics- A Unified Approach, McGraw Hill Book Co.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1:	1	2	1	2	2	1	2	1	2	1
CO2:	2	1	1	1	2	2	1	2	1	2
CO3:	2	2	1	1	2	1	2	1	1	2
CO4:	1	2	2	1	1	1	2	1	1	1
CO5:	1	2	1	1	2	1	2	1	1	1

1 - low, 2 - medium, 3 - high

24MAP304-C	PARTIAL DIFFERENTIAL EQUATIONS	L	T	P	C	TOTAL MARKS
		3	1	0	4	100

PREREQUISITES: None

COURSE OBJECTIVES:

The main objectives of this course are to:

1. Introduce to the students the various types of partial differential equations and how to solve these equations.
2. Identify Partial differential equations of second order
3. Apply the concepts of laplace equation and wave equations
4. Apply the concepts of wave equations
5. Learn about Greens function.

UNIT 1:	NONLINEAR PARTIAL DIFFERENTIAL EQUATIONS OF THE FIRST ORDER	12

Cauchy's method of characteristics-Compatible systems of first order equations – Charpit's method- Special types of first order equations – Jacobi's method.

UNIT 2:	PARTIAL DIFFERENTIAL EQUATIONS OF SECOND ORDER	12

The origin of second-order equations – Linear partial differential equations with constant coefficients – Equations with variable coefficients –Characteristic curves of second–order equations- Characteristics of equations in three variables. The solution of linear hyperbolic equations - Separation of variables – The method of integral transforms – Nonlinear equations of the second order.

UNIT 3:	LAPLACE'S EQUATION	12

The occurrence of Laplace's equation in physics- elementary solution of Laplace's equation – Families of equipotential surfaces - boundary value problems- Separation of variables- Problems with axial symmetry.

UNIT 4:	THE WAVE EQUATION	12

The occurrence of wave equation in physics – Elementary solutions of the one-dimensional wave equation – vibrating membranes: Applications of the calculus of variations – Three dimensional problems.

UNIT 5:	GREEN'S FUNCTION	12

Green's function for laplace Equation – methods of Images – Eigen function Method – Green's function for the wave and Diffusion equations. **Laplace Transform method:** Solution of Diffusion and Wave equation by Laplace Transform. **Fourier Transform Method:** Finite Fourier sine and cosine transforms – solutions of Diffusion, Wave and Laplace equations by Fourier Transform Method.

60 PERIODS

COURSE OUTCOMES

At the end of this course, the students will be able to:

CO1:	Applythe rules of Partial Differential Equations of First Order
CO2:	Learn about Dirichlet's Problem, Solution of Laplace equation in Cylindrical and spherical coordinates
CO3:	An ability to calculate Parabolic Differential Equations
CO4:	Have the idea of D'Alembert's solution, one-dimensional wave equation and Duhamel's Principle with Examples
CO5:	Apply the concepts of Green's Function, Laplace Transform and Fourier Transform.

TOTAL:60 PERIODS

TEXT BOOKS&REFERENCES

1.	"Elements of Partial Differential Equations" by I. N. Sneddon, McGraw-Hill Book Company, Singapore**,** 2008**.**
2.	K, Sankar Rao, Introduction to Partial Differential Equations, 2nd Edition, Prentice

	Hall of India, New Delhi. 2005.
3.	R.C.McOwen, Partial Differential Equations, 2nd Edn. Pearson Eduction, New Delhi, 2005.
4.	M.D.Raisinghania, Advanced Differential Equations, S.Chand & Company Ltd., New Delhi, 2001

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1:	2	1	1	1	2	1	2	1	2	1
CO2:	2	1	1	1	2	2	1	2	1	2
CO3:	2	2	-	1	2	1	2	1	1	2
CO4:	1	2	2	1	1	1	2	-	1	1
CO5:	1	2	1	1	2	1	2	-	1	1

1 - low, 2 - medium, 3 - high

24MAP204-B	PROBABILITY THEORY	L	T	P	C	TOTAL MARKS
		3	1	0	4	100

PREREQUISITES: None

COURSE OBJECTIVES:

The main objectives of this course are to:

1. Study theaxiomatic approach to probability theory
2. Identify the parametric distributions
3. Study some statistical characteristics, discrete and continuous distribution functions and their properties characteristic function .
4. Learn about limit theorems and markov chains of probability.
5. Learn and apply Mrkov chain problems

UNIT 1:	RANDOM EVENTS AND RANDOM VARIABLES	12

Random events – Probability axioms – Combinatorial formulae – conditional probability – Baye's Theorem – Independent events – Random Variables – Distribution Function – Joint Distribution – Marginal Distribution – Conditional Distribution – Independent random variables – Functions of random variables.

UNIT 2:	PARAMETERS OF THE DISTRIBUTION	12

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

Characteristic functions: Properties of characteristic functions – Characteristic functions and moments – semi invariants – 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 3:	SOME PROBABILITY DISTRIBUTIONS	12

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

UNIT 4:	LIMIT THEOREMS	12

Stochastic convergence-Bernaulli law of large numbers-Convergence of sequence of distribution functions -Levy-Cramer Theorems-De-Moivre-Laplace Theorem – Poisson, Chebyshev's, Khintchinep Weak law of large numbers – Lindberg Theorem – Lapunov Theroem-Borel-Cantelli Lemma - Kolmogorov Inequality and Kolmogorov Strong Law of large numbers.

UNIT 5:	MARKOV CHAINS	12

Preliminaries-Homogeneous Markov chains-The Transition matrix-The Ergodic theorem-Random variables forming a homogeneous Markov chain.

60 PERIODS

COURSE OUTCOMES

At the end of this course, the students will be able to:

CO1:	Apply the knowledge of Random Events and Random Variables
CO2:	Get the knowledge of Parameters of the Distribution
CO3:	Describe fundamental properties ,Characteristic functions and Properties
CO4:	Apply the concepts of one point, two point, Binomial, Poisson, Uniform, Normal, Gamma, Beta and its applications.
CO5:	Construct the rigorous methods Stochastic convergence, Levy-Cramer Theorems, De-Moivre-Laplace, Chebyshev's Theorem

TOTAL:60 PERIODS

TEXT BOOKS&REFERENCES

1.	R.B. Ash, Real Analysis and Probability, Academic Press, New York, 2000.
2.	K.L.Chung, A course in Probability, Academic Press, New York, 2001.
3.	R.Durrett, Probability Theory and Examples, (2^{nd} Edition) Duxbury Press, New York, 2005.

4.	V.K.Rohatgi An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern Ltd., New Delhi, 2003.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1:	1	1	1	1	2	1	2	1	2	1
CO2:	2	1	1	1	2	2	1	2	1	2
CO3:	2	2	-	1	2	1	2	1	1	2
CO4:	1	2	2	1	1	1	2	-	1	1
CO5:	1	2	1	1	2	1	2	-	1	1

1 - low, 2 - medium, 3 - high

24MAP204-A	OPERATIONS RESEARCH	L	T	P	C	TOTAL MARKS
		3	1	0	4	100

PREREQUISITES: NIL

COURSE OBJECTIVES:

The main objectives of this course are to:

1. Introduce the concept of decision theory,
2. Learn about Network Models PERT, CPM.
3. Study the features of queueing theory
4. Discuss about deterministic and probabilistic inventory systems, queues, replacement and maintenance problems.
5. Identify the failure mechanism and replace the items

UNIT 1:	DECISION THEORY	12

Steps in Decision theory Approach – Types of Decision-Making Environments – Decision Making Under Uncertainty – Decision Making under Risk – Posterior Probabilities and Bayesian Analysis – Decision Tree Analysis – Decision Making with Utilities

UNIT 2:	Network Models	12

Scope of Network Applications-Network Definition-Minimal spanning true Algorithm-Shortest Route problem – Maximum flow model – Minimum cost capacitated flow problem - Network representation – Linear Programming formulation – Capacitated Network simplex Algorithm.

UNIT 3:	Deterministic Inventory Control Models	12

Meaning of Inventory Control – Functional Classification – Advantage of Carrying Inventory – Features of Inventory System – Inventory Model building - Deterministic Inventory Models with no shortage – Deterministic Inventory with Shortages.

Probabilistic Inventory Control Models: Single Period Probabilistic Models without Setup cost – Single Period Probabilities Model with Setup cost.

UNIT 4:	Queueing Theory	12

Essential Features of Queueing System – Operating Characteristic of Queueing System – Probabilistic Distribution in Queueing Systems – Classification of Queueing Models – Solution of Queueing Models – Probability Distribution of Arrivals and Departures – Erlangian Service Times Distribution with k-Phases.

UNIT 5:	Replacement and Maintenance Models	12

Failure Mechanism of items – Replacement of Items that deteriorate with Time – Replacement of items that fail completely – other Replacement Problems.

60 PERIODS

COURSE OUTCOMES

At the end of this course, the students will be able to:

CO1:	Explain the basics concepts of Decision Theory and solve Bayesian problems .
CO2:	Get the knowledge and reproduce of Network Model and Linear Programming problem.
CO3:	Demonstrate the basic concepts of Deterministic Inventory Control Models problem and their application.
CO4:	Apply the concepts of Queueing theory in day to day life.
CO5:	Get the knowledge of Replacement and Maintenance Models in which time is machine replaced or repaired.

TOTAL:60 PERIODS

TEXT BOOKS&REFERENCES

1.	For Unit 2: H.A. Taha, Operations Research, 6th edition, Prentice Hall of India.
2.	For all other Units: J.K.Sharma, Operations Research , MacMillan India, New Delhi, 2001.
3.	F.S. Hiller and J.Lieberman -,Introduction to Operations Research (7th Edition), Tata McGraw Hill Publishing Company, New Delhui, 2001.

4.	Bazaraa, M.S; J.J.Jarvis, H.D.Sharall,Linear Programming and Network flow,John Wiley and sons, New York 2001.
5.	Gross, D and C.M.Harris, Fundamentals of Queueing Theory,(3rd Edition), Wiley and Sons, New York, 2008.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1:	2	2	1	2	-	2	-	2	1	2
CO2:	1	1	2	2	2	2	2	-	1	2
CO3:	2	2	1	2	1	1	-	2	2	1
CO4:	2	1	2	2	2	2	-	-	2	2
CO5:	1	-	2	-	1	2	-	1	2	2

1 - low, 2 - medium, 3 - high

24MAP304-D	MECHANICS	L	T	P	C	TOTAL MARKS
		3	1	0	4	100

PREREQUISITES: None

COURSE OBJECTIVES:

The main objectives of this course are to:

1. Study mechanical systems under generalized coordinate systems.
2. Differentiate Lagranges Equations
3. Identify the principals of Lagranges Equations and Hamiltons principal functions.
4. Identify the Hamiltons principal functions to apply in Jacobi theory.
5. Identify the differential forms of special funtions.

UNIT 1:	INTRODUCTORY CONCEPTS	12

The mechanical system – Generalized coordinates – Constraints – Virtual work – Energy and momentum.

UNIT 2:	LAGRANGE'S EQUATIONS	12

Derivation of Lagrange's equations- Examples- Integrals of motion.

UNIT 3:	HAMILTON'S EQUATIONS	12

Hamilton's Principle - Hamilton's Equation - Other variational principles

UNIT 4:	HAMILTON-JACOBI THEORY	12

Hamilton Principle function – Hamilton-Jacobi Equation - Separability

UNIT 5:	Canonical Transformation	12

Differential forms and generating functions – Special Transformations– Lagrange and Poisson brackets.

60 PERIODS

COURSE OUTCOMES

At the end of this course, the students will be able to:

CO1:	Understand the basic of Mechanical Systems.
CO2:	Learn about the Lagrange's Equations
CO3:	Understand the Hamilton's Equation and uses..
CO4:	Learn about Hamilton-Jacobi Theory and lemma.
CO5:	Get the knowledge of Canonical Transformation

TOTAL:60 PERIODS

TEXT BOOKS&REFERENCES

1.	Classical Mechanics by H. Goldstein, C. Poole & J. Safko, Pearson Education, Inc., New Delhi, 2002.
2.	"Classical Dynamics" by D.T. Greenwood**,** Prentice Hall of India Pvt. Ltd, New Delhi, 2009.
3.	N.C.Rane and P.S.C.Joag, Classical Mechanics, Tata McGraw Hill, 2001.
4.	J.L.Synge and B.A.Griffth, Principles of Mechanics (3rd Edition) McGraw Hill Book Co,NY

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1:	1	1	1	1	2	1	2	1	2	1
CO2:	2	1	1	1	2	2	1	2	1	2
CO3:	2	2	-	1	2	1	2	1	1	2
CO4:	1	2	2	1	1	1	2	-	1	1
CO5:	1	2	1	1	2	1	2	-	1	1

1 - low, 2 - medium, 3 - high