St. PETER'S INSTITUTE OF HIGHER EDUCATION AND RESEARCH

IGNITE • INSPIRE • INNOVATE

(Deemed to be University U/S 3 of the UGC Act, 1956)

M.Sc. (MATHEMATICS)

(Approved by UGC)

(I to IV SEMESTERS)

REGULATIONS AND SYLLABI
CHOICE BASED CREDIT SYSTEM

REGULATIONS – 2020

(Effective from the Academic Year 2020-'21)

St. Peter's Institute of Higher Education and Research
M.Sc.(MATHEMATICS)
REGULATION 2020
CHOICE BASED CREDIT SYSTEM

St. Peter's Institute of Higher Education and Research
M.Sc.(Mathematics)
REGULATION 2020

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.

PEOs (Program Educational Objectives)

M. Sc. Mathematics Course

PEO-1: To equip students with knowledge, skills and insight in Mathematics and related fields.

PEO-2: To enable students to work as a mathematical professional, or to employ as a scientific

PEO-3: To encourage students to recognize the need for and to develop the ability to engage in Life - long learning.

PROGRAMME OUTCOMES (POS)

PO1.**Critical Thinking**: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

PO2.**Effective Communication**: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

PO3. **Social Interaction**: Elicit views of others, mediate disagreements and help reach conclusions in group settings.

PO4. **Effective Citizenship**: Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO5. **Ethics**: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

PO6. **Environment and Sustainability**: Understand the issues of environmental contexts and sustainable development.

PO7. **Self-directed and Life-long Learning**: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes

PO8. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO1: After completion of the PG course will gain a thorough knowledge in preparing themselves for competitive examinations.

PSO2: Pursue research in challenging areas of Pure/Applied Mathematics.

St. PETER'S INSTITUTE OF HIGHER EDUCATION AND RESEARCH
M.Sc. (MATHEMATICS) PROGRAMME
REGULATIONS AND SYLLABI UNDER CHOICE BASED CREDIT SYSTEM
(Effective from the Academic Year (2020-2021)

M.Sc (MATHEMATICS) REGULATIONS (2020)

Regulations – 2020 is applicable to the students admitted to the Degree of Master of Science (M.Sc.) Mathematics (Four Semesters) programme effective from the academic year 2020-2021.

1. NOMENCLATURE

- **Programme :** Refers to the Master of Science Mathematics Stream that a student has chosen forstudy.
- **Course :** Refers to the course (Subject) that a student would have to undergo during the study in the Institution
- **Batch :** Refers to the Starting and Completion year of a Programme of study. Eg. Batch of 2020–2022 refers to students belonging to a 2 years Degree programme admitted in 2020 and completing in 2022.
- **Department :** Each Programme of the Institution is grouped under a Department. Eg.M.Sc Mathematics is grouped under Departments of Mathematics. This Department offers various Undergraduate and Postgraduate Programmes in Sciences like B.Sc(Mathematics), M.Sc(Mathematics).
- **Dean :** Refers to the Head of Arts and Science & Management Studies Programmes.
- **HOD :** Refers to the Head of a Department (HOD) offering various UG and PG programmes.
  He/She will be the Head of all staff members and Students belonging to the Department.

2. QUALIFICATION FORADMISSION

Qualification for admission will be as per the criterion specified by the appropriate agencies of the Government of India.

- Candidates who passed the B.Sc (Mathematics) 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 two Year M.Sc (Mathematics) Programme.

3. STRUCTURE OFPROGRAMME

Every Programme will have a curriculum with syllabi consisting of theory and practical.

CREDIT DISTRIBUTION

S.No	Category	No. of Courses	Credits
1.	Institute Core Courses	5	9
2.	Institute Elective Courses	1	3
3.	Program Core Courses	12	62
4.	Program Elective Courses	4	16
Total		**22**	**90**

SEMESTER I

Course Code	Course Title	L	T	P	Credit	Marks		
						CA	EA	Total
AMAT1901	Algebra-I	6	1	0	6	40	60	100
AMAT1902	Real Analysis-I	6	1	0	6	40	60	100
ACST19--	Institute Core – I	5	0	0	4	40	60	100
AMAT19--	Program Elective I	5	1	0	4	40	60	100
ACSL19--	Institute Core – I/Practicals	0	0	3	2	40	60	100
	Total	**22**	**3**	**3**	**22**	**200**	**300**	**500**

SEMESTER II

Course Code	Course Title	L	T	P	Credit	Marks		
						CA	EA	Total
AMAT1906	Algebra-II	6	1	0	6	40	60	100
AMAT1907	Real Analysis-II	6	1	0	6	40	60	100
--	Institute Elective I	5	1	0	3	40	60	100
AMAT19--	Program Elective II	5	1	0	4	40	60	100
ASSL1901	Soft Skill –I	0	0	2	1	100	0	100
AMAI1908	Internship-I	0	0	0	1	100	0	100
	Total	**22**	**4**	**2**	**21**	**360**	**240**	**600**

SEMESTER III

Course Code	Course Title	L	T	P	Credit	Marks		
						CA	EA	Total
AMAT2901	Complex Analysis-I	6	1	0	6	40	60	100
AMAT2902	Topology	6	1	0	6	40	60	100
AMAT2903	Differential Geometry	6	1	0	6	40	60	100
AMAT29--	Program Elective III	5	1	0	4	40	60	100
ASSL2902	Soft Skill –II	0	0	2	1	100	-	100
AMAI2904	Internship-II	0	0	0	1	100	-	100
	Total	**23**	**4**	**2**	**24**	**360**	**240**	**600**

SEMESTER IV

Course Code	Course Title	L	T	P	Credit	Marks		
						CA	EA	Total
AMAT2908	Complex Analysis-II	6	1	0	6	40	60	100
AMAT2909	Functional Analysis	6	1	0	6	40	60	100
AMAT29--	Program Elective IV	5	1	0	4	40	60	100
AMAP2910	Project plus viva voce	0	0	7	6	40	60	100
ASSL2903	Soft Skill –III	0	0	2	1	100	-	100
	Total	**17**	**3**	**9**	**23**	**260**	**240**	**500**

TOTAL CREDITS: 90Credits

(i) Institute Core Courses (IC) which includes Mathematics paper.

Institute Core Applicable to Department of Mathematics				
Sl.No	**Course Code**	**Course Title**	**No. of Courses**	**No. of Credits**
1	ACST1941	Programming in C ++ and Numerical Methods	1	4
2	ACSL1941	Programming in C ++ and Numerical Methods / Practical's	1	2
3	ACST1942	Java Programming	1	4
4	ACSL1942	Java Programming / Practical's	1	2
5	ACST1943	Data Structures and Algorithms	1	6
6	ASSL1901	Soft Skill –I	1	1
7	ASSL2901	Soft Skill –II	1	1

8	ASSL2902	Soft Skill –III	1	1

(ii)Programme Core courses (PC) belonging to the Major Programme ofstudy.

Programme Core Courses				
Sl.No	**Course Code**	**Course Title**	**Prerequisites/ Co-requisitesCourses**	**No. of Credits**
1	AMAT1901	Algebra-I	None	6
2	AMAT1902	Real Analysis-I	None	6
3	AMAT1906	Algebra-II	AMAT1901	6
4	AMAT1907	Real Analysis-II	AMAT1902	6
5	AMAI1908	Internship-I	None	1
6	AMAT2901	Complex Analysis-I	None	6
7	AMAT2902	Topology	None	6
8	AMAT2903	Differential Geometry	None	6
9	AMAI2904	Internship-II	None	1
10	AMAT2908	Complex Analysis-II	AMAT2901	6
11	AMAT2909	Functional Analysis	None	6
12	AMAP2910	Project plus viva voce	None	6

(iii)Programme Electives (PE) offered by the Department related to the Major programme ofstudy. A student should choose atleast4 courses during the programme.

Program Elective - I (Semester I)

Course Code	**Course Title**	**L**	**T**	**P**	**Credit**	**Marks**		
						CA	**EA**	**Total**
AMAT1903	Ordinary Differential Equations	5	1	0	4	40	60	100
AMAT1904	Graph Theory	5	1	0	4	40	60	100
AMAT1905	Discrete Mathematics	5	1	0	4	40	60	100

Program Elective - II (Semester II)

Course Code	**Course Title**	**L**	**T**	**P**	**Credit**	**Marks**		
						CA	**EA**	**Total**
AMAT1909	Partial Differential Equations	5	1	0	4	40	60	100
AMAT1910	Probability Theory	5	1	0	4	40	60	100
AMAT1911	Mathematical Programming	5	1	0	4	40	60	100

Program Elective - III (Semester III)

Course Code	Course Title	L	T	P	Credit	Marks		
						CA	EA	Total
AMAT2905	Operation Research	5	1	0	4	40	60	100
AMAT2906	Mechanics	5	1	0	4	40	60	100
AMAT2907	Number Theory and Cryptography	5	1	0	4	40	60	100

Program Elective - IV (Semester IV)

Course Code	Course Title	L	T	P	Credit	Marks		
						CA	EA	Total
AMAT2911	Tensor Analysis and Relativity	5	1	0	4	40	60	100
AMAT2912	Calculus of Variations and Integral Equations	5	1	0	4	40	60	100
AMAT2913	Fluid Dynamics	5	1	0	4	40	60	100

(iv)Institute Elective/Open Electives (OE) comprising of Professional elective courses from respective 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	ACST3112	Soft Computing and its applications	3
2	CSE	ACST3120	Artificial Intelligence For Real World Applications	3
3	CSE	ACST4124	Machine Learning For Real World Applications	3
4	CSE	ACST4139	Applied Cloud Computing	3
5	IT	AITT3111	Cyber Security Fundamentals	3
6	IT	AITT3119	Practical Approach to Data Mining and Analytics	3
7	IT	AITT4129	Big Data Analytics Tools and Applications	3
8	IT	AITT4130	Foundations of Block Chain Technologies	3
9	ECE	AECT3117	Electromagnetic Interference and Compatibility	3
10	ECE	AECT3120	PCB Design	3
11	ECE	AECT3121	Digital Design using EDA tools	3
12	CSE, IT	AITT3120	Internet of Things – Overview & its Application	3
13	EEE	AEET3112	Industrial Automation	3
14	EEE	AEET3119	Electric Vehicle Drive System	3

15	EEE	AEET4140	Robotic Systems	3
16	Mech	AMET4163	Waste Management	3
17	Mech	AMET4164	Computer Workstation Ergonomics	3
18	Mech	AMET4165	Structure and Properties of Materials	3
19	Mech	AMET4166	Total Quality Management	3
20	Mech	AMET4167	Supply chain Management	3
21	Mech	AMET4168	Industrial Automation	3
22	Civil	ACIT4130	Disaster Management	3
23	Civil	ACIT4131	Safety Engineering	3
24	Civil	ACIT4132	Climate Change	3
25	Civil	ACIT4125	Environmental Impact Assessment	3
26	BME	ABMT4128	Trouble shooting of Medical Instruments	3
27	BME	ABMT3117	Biomedical Nanotechnology	3
28	BME	ABMT1101	Biology for Engineers	3
29	BME	ABMT4136	Bioinformatics	3
30	HUM	AHMT4101	Gender, Culture and Development studies	3
31	HUM	AHMT4102	State, Nation Building and Politics	3
32	HUM	AHMT4103	Work Ethics, Corporate Social responsibility and Governance	3
33	HUM	AHMT4104	Indian Constitution, Essence of Indian Knowledge Tradition	3
34	HUM	AMBT3102	Cognitive Science	3
35	MBA	AMBT3103	Stock Trading Fundamentals	3
36	MBA	AMBT3104	Industrial Economics	3
37	MBA	AMBT3105	Finance for Non Finance Professionals	3
38	MATHS	AMAT2105	Numerical Methods	3
39	MATHS	AMAT2106	Statistics and Numerical Methods	3
40	MATHS	AMAT2107	Probability and Random Processes	3
41	MATHS	AMAT2108	Probability and Statistics	3
42	MATHS	AMAT2109	Probability and Queueing Theory	3
43	MATHS	AMAT2110	Fundamentals of Resource Management Techniques	3
44	CSA	ACST3618	PHP with Wordpress	3

(v) ONLINE Courses: The department Board of Studies (BOS) shall approve the list of online courses offered by approved external agencies. While listing the courses, the BOS 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 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 2nd semesteronwards.

(vi) Internship Trainingduring the course of study.

(vii) Project Work
Each semester curriculum shall normally have a blend of lecture courses and practical courses.

3.1 MEDIUM OF INSTRUCTION:

The medium of instruction, examinations and project report will be in English Language throughout the Programme.

3.2 CREDIT ALLOTMENT TO COURSES

Each course is normally assigned certain number of credits asfollows:

- **Lecture Hours (Theory)** 1 credit per lecture hour per week.
- **Laboratory Hours** 1 credit for 2 Practical hours, 2 credits for 3 or 4 hours of practical per week.
- **Project Work** 6 credits for 7 hours of project work per week.
- **Internship Training** 1 credit (In 2nd and 3rd Semesters)

*** All the courses having 4 or 6 credits may have 5 or 7 lecture hours of which one hour will be dedicated for tutorial which will not be accounted as a credit.**

4. DURATION OF THEPROGRAMME

A student is normally expected to complete the M.Sc Programme in 4 semesters but in any case not more than 8 consecutive semesters from the time of commencement of the course.

5. REQUIREMENTS FOR COMPLETION OF ASEMESTER

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

- He/She secure not less than 75% of overall attendance in thatsemester.
- Candidates who do not have the requisite attendance for the semester will not be permitted to

write the semesterExaminations.

6. VARIOUS POSITIONS IN A DEPARTMENT

6.1DEAN

All Arts, Science and Management Studies Departments are headed by a Dean. The dean is responsible for all activities taking place in coordination with all department heads and all staff members belonging to them. The Dean shall act as a bridge between the Management, Vice – Chancellor, Registrar, HOD's, Faculty Members and the Students. The Dean makes a review of all the academic activities of staff, students and research on a regular time interval and takes steps to improve the morale of all Faculty and Students.

6.2 HEAD OF THEDEPARTMENT

Each department offering various UG and PG Programmes is headed by a Head (HOD). The head of the department (HOD) is responsible for allotting courses to each staff 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 assessment examinations, interacting with Parents, ensuring that all academic and non-academic activities of Faculty and students are monitored and steps taken for their improvement.

6.3 FACULTYADVISOR

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 staff 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 assessment marks and attendance % details before the commencement of end semesterexaminations.

6.4 CLASSCOUNSELOR

There shall be a class counselor for each class/section. The class counselor will be one among the teachers of the department. He/She will be appointed by the Head of the respective department. The responsibilities for the class counselor shall be:

- To act as the channel of communication between the HOD, Dean, Year Coordinator, Course Coordinator, Staff and Students of the respectiveclass.
- To collect and maintain various statistical details ofstudents.

- To help the year coordinator in planning and conduct of theclasses.
- To monitor the academic performance of the students including attendance and to inform the yearcoordinator.
- To take care of the students' welfare activities like industrial visits, seminars, awardsetc.

6.5 COURSE COORDINATOR FOR EACHCOURSE

Each 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 senior staffs who are one among the teachers teaching thecourse.

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

- A common teaching methodology is followed for thecourse.
- The study materials are prepared by the staff members and communicated to the students periodically.
- The involvement of students in course based projects andassignments.
- To prepare common question paper forcontinuous assessment exams.
- For uniform evaluation of continuous 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 assessments and end semester examinations and analyze them to find suitable methodologies for improvement in the performance. The analysis should be submitted to the HOD and Dean for suitable action.

6.6 CLASS COMMITTEE

a) Constitution of the ClassCommittee

For every class, a class committee shall be constituted by the Heads of Department, asgiven 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 Head of the Department

b) Functions of the ClassCommittee

(i) The class committee shall meet thrice during the session. The first meeting will be heldwithintwoweeksfromthedateofcommencementofthesession 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 session 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 theDean through the Head of the Department immediatelyaftertheclass committeemeetings.

(ii) Duringthefirstmeetingoftheclasscommittee,allthefacultymembersshall give their course plan to the class committee chairperson for approval and uploading into the course plan website.

(iii) Any innovationin any course plan not agreed by the class committee or the HOD will be referred to the Chairman for approval.

7 COURSE PLAN AND DELIVERY

a) Thecourseplan(**IC,PC,PE&OE**)willhavedetailsoftheoverview of the course, course objectives, course outcome, course teaching and learning activities and course assessment methods and policy on compensationassessment.
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 studymaterials.
c) The number of assessments for a course shall range from 4 to6.
d) Everycourseshouldhaveafinalassessment (End Semester) ontheentiresyllabuswith60% weightage.
e) ThecourseplanshallbeapprovedbytheClassCommittee(CC)chairpersonandthe HODoftheDepartmentofferingthecourse.
f) The Course plans for all courses offered by the Institute will be available in the website for reference by the faculty and students.

8 ATTENDANCE

All courses should have a common attendance policy:

a) At least 75% attendance in each course ismandatory.
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.

9ASSESSMENT PROCEDURE

Each **COURSE** shall have assessments done according to the Course Plan drawnby thefacultywhohandlesthecourse. Theassessmentsofacoursewilldepend on the needed course learningoutcomes.
There will be a continuous assessment examination and end semester examination for both theory

and practical courses of all programmes.

(i) Theorycourses

ContinuousAssessment **(CAE)** : 40Marks
EndSemesterExams **(ESE)** : 60Marks

(ii) Practicalcourses

ContinuousAssessment **(CAE)** : 40Marks
EndSemesterExams **(ESE)** : 60Marks

9.1 CONTINUOUS ASSESSMENTEXAMS (CAE)

(a) TheoryCourses

- There will be a minimum of Three continuous assessment exams (Assessment Test 1, 2 and a Model Exam), for each theory course.

DISTRIBUTION OF CONTINUOUS ASSESSMENT EXAM (CAE) MARKS FOR A THEORY COURSE			
Evaluation Component	**Syllabus coverage**	**Duration of the Exam**	**Max. Weightage**
CAE-1	**First 1.5 Units of the syllabus**	**2 Hours**	**25 Marks (20% weightage for CAE 1 & CAE 2 and 60% for Model Exam)**
CAE-2	**Next 1.5 Units of the syllabus**	**2 Hours**	
Model Exam	**Full syllabus**	**3 Hours**	
Assignment	**2 written assignments for each course / Written quiz (or) Presentation of a written Report (or) Case study / Multiple choice Objective Type Test**		**10 Marks**
Mini Project (or) Group Presentation	**Technical Project involving not more than 3 students (or) any other Group Presentation related to the course.**		**5 Marks**

- 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) PracticalCourses

- For practical courses, the student will be evaluated on a continuous basis for 20 Marks (which willincludeperformingallexperiments,submittingobservationandrecordnote-bookin scheduled format and time), 15 marks for model exam 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 Incharge 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 semesterexams.
- If a student has not done all the experiments assigned for that lab, before the scheduled date nor has attendance percentage less than 75%, the student will not be allowed to appear for the model and end semester practical exam. Such students will have to redo the course again by doing all the experiments in the next semester when the course isoffered.

9.2 END SEMESTEREXAMINATIONS (ESE)

- The end semester examinations shall normally be conducted between October and December during the odd semesters and between March and May during the even semesters for both theory and practical courses of allprogrammes.
- End semester examinations will be conducted for a maximum of 100 marks. The marks secured in end semester exams will be converted to 60marks.

9.3 Internship / Industrial Training

- Every student is required to undergo Industrial Visits during every semester of the Programme. HODs shall take efforts to send the students to industrial visits in everysemester.
- Every student will have to undergo Internship / Industrial training for a Minimum period of 2-3 weeks during the $2^{nd}$and 3^{rd} semester.
- This could be internship in an industry approved by the Dean or Professional Enrichment courses (like attending Summer Schools, Winter Schools, and Workshops) offered on Campus or in Registered off Campus recognized Training Centre's approved by the Dean for a minimum period of three weeks.
- A report on Training undergone by the student, duly attested by the Coordinator concerned from the industry / Organization, in which the student has undergone training and the Head of the Department concerned, shall be submitted after the completion of training. The evaluation of report and viva voce examination can be computed as per norms for the End Semesterexamination.
- The evaluation of training will be made by a three member committee constituted by Head of the Department in consultation with Faculty Advisor and respective Training Coordinator. A presentation should be made by the student before the Committee, based on the Industrial Training or Professional Enrichmentundergone.

9.4 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 Universities in India andabroad.

- This is possible only with the List of Research Organizations, 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 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 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 Accommodationexpenses.

9.5 PROJECTWORK

Project work has to be done by each student in the final year. The project work has to be done during the final semester.

- Permission for project work in the second year of the programme in general will be given to innovative and industry related work. Such projects will be evaluated in every session until the IV semester. If the 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 IV 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 the final semester in their respective departments.
- Project work is an individual project done by the student.
- For project work, assessment is done on a continuous basis by 3 reviews for 40 marks and final viva voce carries 60 Marks.
- 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

	PROJECT REVIEWS			FINAL PROJECT
	1	2	3	VIVA VOCE
Max.Marks	5	15	20	60

- The total marks obtained in the three reviews, rounded to the nearest integer is the continuous assessment marks out of 40. There shall be a final viva-voce examination at the end of final 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
- The final project viva-voce examination shall carry 60 marks. Marks are awarded to each student of the project group based on the individual performance in the viva-voce examination. The external examiner shall be appointed by the controller of examinations. The internal and external examiner will evaluate the project for 20 Marks each. The project report shall carry a maximum of 10 marks.
- 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 a candidate fails to submit the project report on or before the specified deadline, he/she can be granted an extension of time up to a maximum limit of 5 days for the submission of project work, by the head of the department.
- 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.

9.7 REVALUATION OF ANSWER PAPERS:

A candidate can apply for revaluation of his/her End semester examination answer paper 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.

10 PASSINGREQUIREMENTS

- A candidate should secure not less than 50% of total marks (Minimum 50% of the grand total of CAE Marks 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 conductedin that course. It is mandatory that he/she should continue to register and reappear for the examination till he/she secures a pass.

11 WITHDRAWAL FROMEXAMINATIONS

- 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 degreeprogramme.
- 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 throughHOD.
- 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 thecase.
- Withdrawal shall not be considered as an appearance for deciding the eligibility of a candidate for First Class – ……, First Class with Distinction and FirstClass.
- Withdrawal is NOT permitted for arrears examinations of the previoussemesters.

12 AUTHORIZED BREAK OFSTUDY

- 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 10 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 thedegree.
- 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 as permitted 'Break of Study' and is NOT applicable for Authorized Break ofStudy.
- In extraordinary situations, a candidate may apply for additional break of study not exceeding another one Semester by paying prescribed fee for break of study. Such extended break of study shall be counted for the purpose of classification of First ClassDegree.
- 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 anycircumstances.

13 AWARD OFDEGREE

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 Points (GP)
90 -100	**O**	**10**
80 – 89	**A**	**9**
70 – 79	**B**	**8**
60 – 69	**C**	**7**
50 – 59	**D**	**6**
00-49 (Reappear)	**RA**	**0**
ABSENT	**AAA**	**0**
Withdrawal	**W**	**0**
AuthorisedBreak of Study	**ABS**	**0**

13.1 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.

$$GPA = \frac{\sum_{i=1}^{n} i\, C_i GP_i}{\sum iC_i}, \qquad CGPA = \frac{\sum_{i=1}^{n} i\, C_i GP_i}{\sum iC_i}$$

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

14 GRADESHEET

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:

- Name of the candidate with date of birth andphotograph.

- The programme and degree in which the candidate hasstudied
- The list of courses enrolled during the semester and the gradesecured
- The Grade Point Average (GPA) for thesemester.

15 CLASSIFICATION OF DEGREEAWARDED

Final Degree is awarded based on the following:

Range of CGPA	Classification of Degree
≥ 7.5	**First Class with Distinction**
≥ 6.00 <7.5	**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 8 consecutive semesters 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 Studyvide Clause 12, 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 8 consecutive semesters after his/her commencement of study securing a 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 12 (if availed of) or prevention from writing End semester examination due to lack of attendance will not be considered as Appearance in Examinations. For award of First class, the extra number of semesters than can be provided will be equal to the Number of semesters availed for Authorized Break of Study or Lack of Attendance. Withdrawal shall not be considered as an appearance for deciding the eligibility of a candidate for First Class.

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 8 consecutive semesters 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.

16 ELIGIBILITY FOR THE AWARD OFDEGREE

A student shall be declared to be eligible for the award of the M.Sc(MATHS) degree, provided the student has successfully completed all the requirements of the programme, and has passed all the prescribed examinations in all the 4 semesters within the maximum period specified in clause 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 4 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.
vii) No disciplinary action pending against the student.

The award of Degree must have been approved by the Board of Management of the Institution.

17 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 Institution from time to time.

18 POWER TO MODIFY

From time to time, the Institution may revise, amend or change the regulations, scheme of examinations and syllabi if found necessary.

INSTITUTE CORE PAPERS

		L	T	P	C	Total Marks
ACST1941	**PROGRAMMING IN C++ AND NUMERICAL METHODS**	**5**	**0**	**0**	**4**	**100**

Prerequisites : None

COURSE OBJECTIVES:

- Make the students familiar with basic concepts and techniques of object oriented programming in C++.
- Develop an ability to write programs in C++ for problem solving.
- Develop types of inheritance like single, multiple, multilevel hierarchical and hybrid inheritance.
- Develop operator overloading with unary and binary operator overloading.
- Develop program to use of constructor and destructor with its types.
- To provide a basic understanding of the derivation, analysis, and use of numerical methods.

UNIT-I: **12 Hrs**

Tokens, Expressions and Control Structures – Functions in C++

UNIT-II: **12** Hrs

Classes and Objects – Constructors and Destructors – Operator Overloading and Typeconversions.

UNIT-III: **12 Hrs**

Inheritance – Pointers – Virtual Functions and Polymorphism.

UNIT-IV: **12 Hrs**

The solution of Nonlinear Equations f(x)=0
Interpolation and Polynomial Approximation

UNIT-V : **12 Hrs**

Curve Fitting.
Solution of Differential Equations.

TOTAL HOURS :60 Hrs

COURSE OUTCOMES:

After Completing the course students will be able to:

CO 1: Describe the principles of object oriented programming.
CO 2: Apply the concepts of data encapsulation, inheritance in C++.
CO 3: Understand basic program constructs in C++.
CO 4: Apply the concepts of classes, methods and inheritance to write C++ programs.
CO 5: Using appropriate numerical methods, determine the solutions to given non-linear equations
CO 6: Using appropriate numerical methods, determine approximate solutions to systems of polynomial approximation.
CO 7: Using appropriate numerical methods, determine approximate solutions to ordinary differential equations.
CO 8: Demonstrate the use of interpolation methods to find intermediate values in given graphical and/or tabulated data.

REFERENCE BOOKS:

1. E. Balagurusamy, Object Oriented Programming withC++, Tata McGraw Hill, New Delhi, 2009.
2. John H.Mathews, Numerical Methods for Mathematics, Science and Engineering(2^{nd}Edn.), Prentice Hall, New Delhi, 2010
3. D. Ravichandran, Programming withC++, Tata McGraw Hill, New Delhi, 2006.
4. Conte and de Boor, Numerical Analysis, McGraw Hill, New York, 2010.

		L	**T**	**P**	**C**	**Total Marks**

ACSL1941	**PROGRAMMING IN C++ AND NUMERICAL METHODS/PRACTICALS**	**0**	**0**	**3**	**2**	**100**

Prerequisites : None

COURSE OBJECTIVES:

- To develop the Knowledge of programming skills.

LIST OF EXPERIMENTS

Section I : Computer Language Exercises for Programming in C++ :

1. Write a class to represent a vector (a series of float values). Include member functions to perform the following tasks: To create the vector, To modify the value of a given element, To multiply by a scalar value, To display the vector in the form (10, 20, 30,…). Write a program to test yourclass.

2. Create a class **FLOAT** that contains one float data member. Overload all the four arithmetic operators so that they operate on the objects of**FLOAT**.

3. Write a class called employee that contains a name and an employee number. Include a member function to get data from the user for insertion into object, and another function to display the data. Write a main() program to create an array of employee information and accept information from the user and finally print the information.

4. Write a program which shows the days from the start of year to date specified. Hold the number of days for each month in an array. Allow the user to enter the month and the day of the year. Then the program should display the total days till theday.

5. Write a program to use a common friend function to exchange the private values of twoclasses.

6. Write a program to include all possible binary operators overloading using friend function.

7. Write a program to read an array of integer numbers and sort it in descending order. Use readdata, putdata, and arraymax as member functions in aclass.

8. Write a program to read two character strings and use the overloaded '+' operator to append the second string to thefirst.

9. Write a function that takes two Distance values as arguments and returns the larger one. Include a main() program that accept two Distance values from the user, compare them and displays thelarger.

10. Write a program to implement the concept of object as function argument and returningobjects.

11. Develop a program Railway Reservation System using Hybrid Inheritance and Virtual Function.

12. Using overloaded constructor in a class write a program to add two complex numbers.

13. Create a class MAT of size(m,n). Define all possible matrix operations for MAT type objects.

14. Write a program that determines whether a given number is a prime number or not and then prints the result usingpolymorphism.

Sections II : Numerical Methods Exercises for Programming in C++:

1. **Non-Linear Equations**
   - BisectionMethod
   - Regula-falsiMethod
   - Newton-RaphsonMethod
   - SecantMethod
   - Fixed PointIteration

2. **Interpolation**
   - Lagrange's Interpolation Formula
   - Newton Interpolation Formula.

3. **Curve Fitting**
   - Least-Squareline
   - Least-Squarepolynomial
   - Non-linear curvefitting

4. **Numerical Solution to Differential Equations**
   - Euler's Method
   - Taylor's Method of order4
   - Runge-Kutta Method of order four
   - Milne-Simpson Method

TOTAL HOURS :30

COURSE OUTCOMES:

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

CO 1: Able to Understand Concept of C++ language features and able to understanding and applying various Data types, Operators, Conversions in program design.

CO 2: Able to Understand and Apply the concepts of Classes & Objects, friend function, constructors &destructors in program design.

CO 3: To learn about Inheritance – Pointers – Virtual Functions and Polymorphism

CO 4: Able to Analyze and explore various types of the solution of Nonlinear Equations

CO 5: To get the knowledge of Curve Fitting and its applications.

ACST1942	JAVA PROGRAMMING	L	T	P	C	Total Marks
		5	0	0	4	100

Prerequisites : None

COURSE OBJECTIVES

To initiate the study of Java statements, Decision making and Branching, Arrays – Strings – Vectors and Applet Programming.

UNIT-I: **12**
Java Tokens – Java statements – Constants – Variables – Data types.

UNIT-II: **12**
Operators – Expressions – Decision making and Branching.

UNIT-III: **12**
Classes – Objects – Methods – Arrays – Strings – Vectors – Multiple Inheritance.

UNIT-IV: **12**
Multithreaded Programming – Managing errors and Exceptions.

UNIT-V: **12**
Applet Programming.

TOTAL HOURS :60

COURSE OUTCOMES:
After On the successful completion of the course, students will be able to:
CO 1: Able to Understand Concept ofJavatokens and its constants,variables data types.
CO 2: Able to Understand and Apply the concepts of operators and decision making.
CO 3: To learn about Arrays,strings,vectors and mulyiple inheritance
CO 4: Able to Analyze and exploremulyi
threaded and applet programming

REFERENCE BOOKS:

1. E. Balagurusamy, Programming with Java – A primer, Tata McGraw Hill Publishing Company Limited, New Delhi, 2002.
2. Mitchell Waite and Robert Lafore, Data Structures and Algorithms in Java, Techmedia (Indian Edition), New Delhi, 1999.
3. Adam Drozdek, *Data Structures and Algorithms in Java,* (Brown/Cole), Vikas Publishing House, New Delhi, 2001.

ACSL1942	JAVA PRGRAMMING/PRACTICALS	L	T	P	C	Total Marks
		0	0	3	2	100

Prerequisites : None

COURSE OBJECTIVES: To develop the Knowledge of programming skills

LIST OF EXPERIMENTS

Section I : CLASSES, OBJECTS, INHERITANCE, INTERFACE

1. Design a class to represent a bank Account. Include the followingmembers:

DataMembers	Methods
Name oftheDepositor	To Assign initialvalues
AccountNumber	To deposit anamount
Typeof account	To withdraw an amount after checking the balance
Balance	To display thenameandbalance

Write a Java program for handling 10customers.

2. Java lacks a complex datatype. Write a complex class that represents a single Complex number and includes methods for all the usual operations, (ie) addition, subtraction, multiplication,division.

Section II : EXCEPTION HANDLING, MULTITHREADING AND PACKAGES

3. Write a Java program to handle different types of exceptions using try, catchand finallystatements

4. Write a Java program to implement the behavior ofthreads.
- **(a)** To create and runthreads.
- **(b)** To suspend and stop threads.
- **(c)** To move a thread from one state toanother.
- **(d)** By assigning a priority for eachthread.

5. Create three classes Protection, Derived and SamePackage all in same package. Class Protection is a base class for the class Derived and SamePackage is aseparate class. Class Protection has three variables each of type private,protected and public. Write a program that shows the legal protection modes of all the different variables.

Section 3: APPLET PROGRAMMING

6. Write an applet to draw the following shapes :
- **(a)** Cone
- **(b)** Cylinder
- **(c)** Cube
- **(d)** Square inside a circle
- **(e)** Circle inside a square.

7. Creating a Java applet which finds palindromes in sentences. Your applet will have two input controls; One input will be a text field for entering sentences, the other input will be a text field or scroll bar for selecting the minimum length a palindrome to be shown. Your applet will output the first 10 palindromes it finds in thesentence.
8. Write a program which displays a text message coming down the screen bymoving left to right and modify the above program instead of text moving from left to right it moves top tobottom.

Section 4 : AWT FORMS DESIGN USING FRAMES

9. Create a frame that contains 3 text fields and four buttons for basic arithmetic operations. You have to enter two numbers in first two text fields. On clicking the respective button that answer should be displayed in the last textfiled.

10. Create a frame with check box group containing Rectangle, Circle, Triangle, Square. If the particular value is true then the corresponding shape should be displayed.

TOTAL HOURS :30

COURSE OUTCOMES:

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

CO 1: Understand the concept of Java Tokens, Java statements, Constants, Variables and Data types.

CO 2: To learn about Operators, Expressions, Decision making and Branching.

CO 3: To learn the concept of c Objects – Methods – Arrays – Strings – Vectors – Multiple Inheritance.

CO 4: Explore the use of various operating systems commands on different platforms.

CO 5: Students will be able to a better understanding of essential problem solving and programming concepts

	DATA STRUCTURES AND	L	T	P	C	Total Marks

ACST1943	ALGORITHMS	6	1	0	6	100

Prerequisites : None

COURSE OBJECTIVES:

- To impart the basic concepts of data structures and algorithms
- To understand concepts about searching and sorting techniques
- To Understand basic concepts about stacks,queues,lists,trees and graphs
- To understanding about writing algorithms and step by step approach in solving problems with the help of fundamental data structures

UNIT-I : Algorithms and Elementary Data Structures 18

Algorithms – Structures programs – Analysis of algorithms – Stacks and Queues – Trees – Heaps and Heapsort – Sets and disjoint set union – Graphs – Hashing.

UNIT-II : The Divide and Conquer Method 18

The general method – Binary search – Finding the maximum and minimum-Mergesort-Quicksort – Selection sort – Strassen's matrix multiplication.

UNIT-III : The Greedy Method 18

The General method – Optimal storage on tapes – Knapsack problem – Job Scheduling with deadlines – Optimal merge pattern – Minimum spanning trees – Single source shortest paths.

UNIT-IV : Backtracking 18

The general methods – The 8-queens problem - sum of subsets – Graph colouring – Hamiltonian Cycles – Knapsack problem.

UNIT-V : Branch-and-Bound and NP-Hard and NP-Complete problems 18

Branch and Bound Method – 0/1 knapsack problem – Traveling salesperson – Efficiency Considerations- Basic concepts of NP-Hard problems – Cook's theorem - NP-Hard graph problems - NP- Hard SchedulingProblems.

TOTAL HOURS :90

COURSE OUTCOMES:

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

CO 1: Ability to analyze algorithms and aalgorithm correctness.
CO 2: Ability to summarize searching and sorting techniques
CO 3: Ability to describe stack,queue and linked list operation.
CO 4: Ability to have knowledge of treeand graphs concepts.

REFERENCE BOOKS:

1.S.Sahni. Fundamentals of Computer Algorithm, Galgotia Publications New Delhi, 2004.
2.D.E.Knuth, The Art of Computer Programming, Sorting and Searching. Vol.3. Addismtreshermass.2003.
3.A.Nijenhuis and H.S.Wilf, Combinatorial Algorithms, Academic Press. New York 2005.
4. M.Garey and D.Johnson, Computers and Intractability: A Guide to the theory of NP.Completeners. Johnson, Freeman and San Francisco, 2009.
5. A.V.Aho, J.E.Hoperoft, JD Ullman, The Design and Analysis of ComputerAlgorithms. Addison – Wesley, Reading', MASS. 2004.

PROGRAMME: CORE PAPERS

		L	T	P	C	Total Marks
AMAT1901	**ALGEBRA-1**	**6**	**1**	**0**	**6**	**100**

Prerequisites : None

COURSE OBJECTIVES:

- To introduce the concepts and to develop working knowledge on classequation, solvability of groups, finite abelian groups, linear transformations, real quadratic forms.

UNIT-I: **18**

Introduction to groups: Dihedral groups - Symmetric groups - Matrix groups - Homomorphisms and Isomorphisms - Group actions. Subgroups: Definition and Examples - Centralizers and Normalizer, Stabilizers and Kernels.

UNIT-II: **18**

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 - Transpositions and the Alternating group.

UNIT-III: **18**

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

UNIT-IV: **18**

RING THEORY: Definitions and examples – Some simple results – Ideals, Homomorphisms and Quotient Rings - -Maximum ideals – Polynomial rings – Polynomial over the Rational – Field of Quotiests of an integral domain .

UNIT-V: **18**

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

TOTAL HOURS :90

COURSE OUTCOMES:

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

CO 1: Understand the basic concepts of Counting principle, finite groups, applications and Sylow's theorems.

CO 2: Learn about groups, abelian groups and Modules.

CO 3: Get the knowledge of Canonical forms and Triangular form.

CO 4: Apply the knowledge of Jordan form - rational canonical form.

CO 5: Learn about Hermitian, and real quadratic form.

REFERENCE BOOKS:

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.

Mapping with Programme Outcomes

CO's\PO's\PSO's	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

Strong – 3; Medium – 2; Low – 1.

Course Outcomes

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

CONumber	CO Statement	Knowledge Level
CO1	Understand the basic concepts of Counting principle, finite groups, applications and Sylow's theorems.	**K1, K2 ,K3**
CO2	Learn about groups, abelian groups and Modules.	**K1, K2,K3,K5**
CO3	Get the knowledge of Canonical forms and Triangular form.	**K1, K2,K3.K4,K5**
C04	Apply the knowledge of Jordan form - rational canonical form .	**K1,K2,K3**
CO5	Learn about Hermitian, and real quadratic form.	**K1,K2,K3**

AMAT1902	REAL ANALYSIS-1	L	T	P	C	Total Marks
		6	1	0	6	100

Prerequisites : None

COURSE OBJECTIVES:

- To work comfortably with functions of bounded variation, Riemann-Stieltjes Integration, convergence of infinite series, infinite product and uniform convergence and its interplay between various limiting operations.

UNIT-I :SEQUENCE AND SERIES OF FUNCTIONS **18**

Pointwise convergence of sequence of functions – Uniform convergence of sequence of functions – Consequence of uniform convergence – convergence and uniform convergence of series of functions – Abel summability – A continuous, nowhere-differentiable function

UNIT-II: THREE FAMOUS THEOREMS **18**

The metric space C[a,b] – The Weierstrass approximation theorem – Picard existence theorem for differential equations – The Arzela theorem on equicontinuous families

UNIT-III : THE LEBESGUE INTEGRAL **18**

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-IV : THE LEBESGUE INTEGRAL **18**

Properties of the Lebesgue integral for bounded measurable functions-The Lebesgue integral for unbounded functions-Some fundamental theorems-The metric space $L^2[a,b]$-The integral on $(-\infty, \infty)$ and in the plane.

UNIT-V: FOURIER SERIES **18**

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-Orthonormal expansions in $L^2[a,b]$

TOTAL HOURS :90

COURSE OUTCOMES:

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

CO 1: Understand the basics concept of Convergence and uniform convergence

CO 2: Learn about Weierstrass approximation theorem, Picards existence theorem and Arzela theorem.

CO 3: Get the knowledge of Stieltjes integrals, Second Mean Value Theorem and Sufficient. condition for uniform convergence and Mean convergence.

CO 4: Learn about the infinite Series, infinite Products and Power series.

CO 5: Apply the knowledge of Sequences of Functions.

REFERENCE BOOKS:

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.

Mapping with Programme Outcomes

CO's\PO's\PSO's	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

Strong – 3; Medium – 2; Low – 1.

Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Understand the basics concept of monotonicfunctions, continuous functions, properties, Dirichlet's test, Abel's test, and Riemann's theorem.	**K1, K2,K3,K4,K5**
CO2	Learn about Riemann Integral-Euler's summation formula and properties of upper and lower integrals.	**K1, K2,K3,K4**
CO3	Get the knowledge of Stieltjes integrals, Second Mean Value Theorem and Sufficient condition for uniform convergence and Mean convergence.	**K1, K2,K3**
C04	Learn about the infinite Series, infinite Products and Power series.	**K1,K2,K3**
CO5	Apply the knowledge of Sequences of Functions.	**K1,K2,K3,K4, K5**

AMAT1906	ALGEBRA-II	L	T	P	C	Total Marks
		6	1	0	6	100

Prerequisites : AMATI901

COURSE OBJECTIVES:

- To study field extension, roots of polynomials, Galois Theory, finitefields, division rings, solvability by radicals and to develop computational skill in abstract algebra.

UNIT-I: **18**

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

UNIT-II: **18**

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

UNIT-III: **18**

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-IV: **18**

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

UNIT-V: **18**

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.

TOTAL HOURS :90

COURSE OUTCOMES:

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

CO 1: Understand the definition of Ideals and Homomorphism
CO 2: Apply the concepts of Unique Factorization Domain
CO 3: To understand about Modules and vector spaces
CO 4: Using the concept of Galois theory
CO 5: Get the knowledge of Applications of Galois theory

REFERENCE BOOKS:

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.

Mapping with Programme Outcomes

CO's\PO's\PSO's	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

Strong – 3; Medium – 2; Low – 1.

Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Understand the definition of Extension fields	**K1, K2 ,K3, K5**
CO2	Apply the concepts of Roots or Polynomials	**K1, K2,K4,K5**
CO3	To understand about Elements of Galois theory	**K1,K4,K5**
C04	Using the concept of Finite fields - Wedderburn's theorem	**K1,K2,K3**
CO5	Get the knowledge of Galois groups and A theorem of Frobenius	**K1,K2,K3**

AMAT1907	REAL ANALYSIS-II	L	T	P	C	Total Marks
		6	1	0	6	100

Prerequisites : AMAT1902

COURSE OBJECTIVES:

- To introduce measure on the real line, Lebesgue measurability andintegrability, Fourier series and Integrals, in-depth study in multivariable calculus.

UNIT-I : Fourier Series **18**

Introduction - Orthogonal system of functions - The theorem on best approximation - The Fourier series of a function relative to an orthonormal system - Properties of Fourier Coefficients - The Riesz-Fischer Thorem - The convergence and representation problems in for trigonometric series - The Riemann - Lebesgue Lemma - The Dirichlet Integrals - An integral representation for the partial sums of Fourier series - Riemann's localization theorem - Sufficient conditions for convergence of a Fourier series at a particular point - Cesarosummability of Fourier series- Consequences of Fejes's theorem - The Weierstrass approximation theorem – Other forms of Fourier Series.

UNIT – II: Fourier Integral: **18**

Fourier integral theorem – The exponential for the Fourier integral theorem – Integral transforms – Convolutions – The convolution theorem for Fourier transforms – The poisson summation formula.

UNIT-III: Multivariable Differential Calculus **18**

Introduction - The Directional derivative - Directional derivative and continuity - The total derivative - The total derivative expressed in terms of partial derivatives - The matrix of linear function - The Jacobian matrix.

UNIT -IV:(Continuity) The chain rule - Matrix form of chain rule - The mean - value theorem for differentiable functions - A sufficient condition for differentiability - A sufficient condition for equality of mixed partial derivatives - Taylor's theorem for functions of R^n to R^1

UNIT-V: Implicit Functions and Extremum Problems **18**

Introduction - Functions with non-zero Jacobian determinants – The inverse function theorem- The Implicit function theorem-Extrema of real valued functions of severable variables-Extremum problems with side conditions.

TOTAL HOURS :90

COURSE OUTCOMES:

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

CO 1: Analyze the Riesz-Fischer Theorem, Riemann's localization theorem and Fejes's theorem
CO 2: Apply the concept of Fourier Integral theorem
CO 3: Understand the concept of the Directional derivative, The total derivative
CO 4: Apply the concepts of chain rule
CO 5: Have the idea of Implicit Functions and Extremum Problems

REFERENCE BOOKS:

1. Tom M.Apostol : Mathematical Analysis, 2nd Edition, Narosa 2002 (for Units III, IV and V)
2. G. De Barra, Measure Theory and Integration, New Age International, 2003 (for Units I and II).
3. Richard R.Goldberg Methods of Real analysis, oxford and IBH Publishing, New Delhi, 2020.
4. Rudin,W.Principles of Mathematical Analysis, 3rd Edition. McGraw Hill Company, New York, 2013.
5. A.L.Gupta and N.R.Gupta, Principles of Real Analysis, Pearson Education, (Indian print) 2004.

Mapping with Programme Outcomes

CO's\PO's\PSO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	1	2	2	1	2	2	-	2	1	2
CO2	1	2	2	2	1	2	2	-	-	2
CO3	-	2	2	2	1	2	-	2	-	2
CO4	-	2	1	2	2	2	-	-	2	2
CO5	1	2	2	1	2	2	-	1	1	2

Strong – 3; Medium – 2; Low – 1.

Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Understand the definition Measure on the Real line	**K1, K2 ,K3,K4, K5**
CO2	Apply the concept of Riemann and Lebesgue Integrals	**K1, K2,K4,K5**
CO3	Analyze the Riesz-Fischer Theorem,, The Riesz-Fischer Theorem, Riemann's localization theorem and Fejes's theorem	**K1, K2,K4,K5**
C04	Understand the concept of the Directional derivative, The total derivative and Taylor's theorem	**K1,K2,K3**
CO5	Have the idea of Implicit Functions and Extremum Problems	**K1, K2 ,K3,K4, K5**

ASSL1901- Soft skills –I

ASSL1901	Soft skills –I	**L**	**T**	**P**	**C**	**Total Marks**
		0	**0**	**2**	**1**	**100**

II /I	ASSL1901	Soft skills –I	Personality Skills: 1. Self confidence 2. Self-disclosure 3. Dress code 4. Body Language

References:

1. https://www.britishcouncil.org/voices-magazine/five-essential-listening-skills-english-learners
2. https://www.mosaicprojects.com.au/WhitePapers/WP1012_Active_Listening.pdf
3. https://www.skillsyouneed.com/ips/ineffective-listening.html
4. https://www.brighthubpm.com/resource-management/122339-effective-listening-10-barriers-and-how-to-overcome-them/

Video References:

1. https://www.youtube.com/watch?v=m_tbFlbRpK8
2. https://www.youtube.com/watch?v=gwPMHbbueZI
3. https://www.youtube.com/watch?v=o6JGi2voyDM

AMAT2901	COMPLEX ANALYSIS-I	L	T	P	C	Total Marks
		6	1	0	6	100

Prerequisites : None

COURSE OBJECTIVES:

- To Study Cauchy integral formula, local properties of analytic functions,general form of Cauchy's theorem and evaluation of definite integral and harmonic functions.

UNIT-I: Fundamental theorems **18**

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 -Local properties of analytical functions: Removable singularities, Taylor's theorem – Zeros and poles – The local mapping – The maximum principle –The general form of Cauchy's theorem: Chains and cycles.– Simple Connectivity - Exact Differentials in Simply Connected Regions - Multiply Connected Regions

UNIT-II: The calculus of residues **18**

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

UNIT-III:Power series Expansions **18**

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-IV: The Riemann mapping theorem **18**

The Riemann mapping theorem: 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 – Mapping on a rectangle. – The Triangle Functions of Schwarz- A close look at Harmonic functions: Functions with mean-value property, Harnack's Principle

UNIT-V: Elliptic functions **18**

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.

The Weierstrass Theory: The Weierstrass ρ-function, The functions (z) and (z)- The Differential Equation- The Modular Function $\lambda(\tau)$.

TOTAL HOURS :90

COURSE OUTCOMES:

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

CO 1:study the Cauchy's Integral Formula and Local Properties of Analytical Functions

CO 2: Understand the general form of Cauchy's Theorem

CO 3: Learn the basic concept of integrals, Harmonic functions, Poisson formula and basic properties.

CO 4: Define and recognize the harmonic functions and Power Series Expansions

CO 5: Get the knowledge of Partial Fractions and Entire Functions

REFERENCE BOOKS:

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.

Mapping with Programme Outcomes

CO's\PO's\PSO's	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.

CourseOutcomes

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

CO Number	CO Statement	Knowledge Level
CO1	To study the Cauchy's Integral Formula and Local Properties of Analytical Functions	**K1, K2 ,K3, K4 K5**
CO2	Understand the general form of Cauchy's Theorem.	**K1, K2,K4,K5**
CO3	Learn the basic concept of integrals, Harmonic functions, Poisson formula and basic properties.	**K1, K2,K4,K5**
C04	Define and recognize the harmonic functions and Power Series Expansions.	**K1,K2,K3**
CO5	Get the knowledge of Partial Fractions and Entire Functions.	**K1,K2,K3**

AMAT2902	TOPOLOGY	L	T	P	C	Total Marks
		6	1	0	6	100

Prerequisites : None

COURSE OBJECTIVES:

- To study topological spaces, continuous functions, connectedness,compactness, countability and separation axioms.

UNIT-I: **18**

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-II: **18**

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

UNIT-III: **18**

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

UNIT-IV: **18**

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

UNIT-V: **18**

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

TOTAL HOURS :90

COURSE OUTCOMES:

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

CO 1: Learn the basic concept of metric Spaces and Topological Spaces.
CO 2: Get the knowledge of Compact spaces and its uses.
CO 3: Prove basic results about completeness, compactness. Connectedness and convergence within these structures.
CO 4: Understanding of Urysohn's lemma and the Tietze extension theorem
CO 5: There is also application for medical imaging software and technology.

REFERENCE BOOKS:

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.

Mapping with Programme Outcomes

CO's\PO's\PSO's	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.

Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Learn the basic concept of metric Spaces and Topological Spaces.	**K1, K2 ,K3, K5**
CO2	Get the knowledge of Compact spaces and its uses.	**K1, K2,K3,K4,K5**
CO3	Apply the concepts of Tychonoff's theorem and Ascoli's theorem	**K1, K2,K3,K5**
C04	An understanding of Urysohn's lemma and the Tietze extension theorem	**K1,K2,K3**
CO5	Have the knowledge of theWeierstrass approximation Theorem and its uses.	**K1,K2,K3**

AMAT2903	DIFFERENTIAL GEOMETRY	L	T	P	C	Total Marks
		6	1	0	6	100

Prerequisites : None

COURSE OBJECTIVES:

- This course introduces space curves and their intrinsic properties of asurface and geodesics. Further the non-intrinsic properties of surfaces are explored.

UNIT-I: Space curves **18**

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-II: Intrinsic properties of a surface **18**

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

UNIT-III: Geodesics **18**

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

UNIT-IV: Nonintrinsic properties of a surface **18**

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-V: Differential Geometry of Surfaces **18**

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.

TOTAL HOURS :90

COURSE OUTCOMES:

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

CO 1: Understand the basic concept of definition of a space curve curvature, torsion, involutes and evolutes.

CO 2: To get the knowledge of intrinsic properties of a surface

CO 3: To get the knowledge of Geodesics and its properties.

CO 4: To understand about the second fundamental form

CO 5: To have knowledge about Differential Geometry of Surfaces and characterization of Complete surfaces

REFERENCE BOOKS:

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.

Mapping with Programme Outcomes

CO's\PO's\PSO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	1	2	1	2	2	1	-	2	1	1
CO2	1	2	2	2	1	2	2	-	-	2
CO3	2	2	2	2	1	2	-	2	1	2
CO4	2	2	2	2	2	2	-	-	2	2
CO5	1	2	2	2	2	2	-	1	1	2

Strong – 3; Medium – 2; Low – 1.

Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Understand the basic concept of definition of a space curvecurvature, torsion, involutes and evolutes.	**K1, K2 ,K3.S**
CO2	To get the knowledge of intrinsic properties of a surface	**K1, K2,K3,K4**
CO3	To get the knowledge of Geodesics and its properties.	**K1, 2,K3.K4,K5**
C04	To understand about the second fundamental form	**K1,K2,K3**
CO5	To have knowledge about Differential Geometry of Surfaces and characterization of Complete surfaces	**K1,K2,K3**

ASSL2902 Soft skills –II

ASSL1902	Soft skills –II	**L**	**T**	**P**	**C**	**Total Marks**
		0	**0**	**2**	**1**	**100**

III/II	ASSL2902	Soft skills –II	Communication Skills: 1. Listening 2. Speaking 3. Reading 4. Writing and Different Modes of Writing 5. Digital Literacy 6. Effective Use of Social Media 7. Non-Verbal Communication Universal Human Values: 1. Love and Compassion 2. Truth 3. Non-Violence 4. Righteousness 5. Peace 6. Service 7. Renunciation (Sacrifice) Tyag

References:

1. https://www.britishcouncil.org/voices-magazine/five-essential-listening-skills-english-learners
2. https://www.mosaicprojects.com.au/WhitePapers/WP1012_Active_Listening.pdf
3. https://www.skillsyouneed.com/ips/ineffective-listening.html
4. https://www.brighthubpm.com/resource-management/122339-effective-listening-10-barriers-and-how-to-overcome-them/

Video References:

1. https://www.youtube.com/watch?v=m_tbFlbRpK8
2. https://www.youtube.com/watch?v=gwPMHbbueZI
3. https://www.youtube.com/watch?v=o6JGi2voyDM

AMAT2908	COMPLEX ANALYSIS - II	L	T	P	C	Total Marks
		6	1	0	6	100

Prerequisites :AMAT2901

COURSE OBJECTIVES:

- To study Riemann Theta Function and normal families, Riemannmapping theorem, Conformal mapping of polygons, harmonic functions, elliptic functions and Weierstrass Theory of analytic continuation.

UNIT-I: Riemann Zeta Function and Normal Families: 18

Product development – Extension of $\zeta(s)$ to the whole plane – The zeros of zeta function – Equicontinuity – Normality and compactness – Arzela's theorem – Families of analytic functions – The Classical Definition

UNIT-II: Riemann mapping Theorem 18

Statement and Proof – Boundary Behavior – Use of the Reflection Principle. Conformal mappings of polygons: Behavior at an angle Schwarz-Christoffel formula – Mapping of a rectangle.

UNIT-III: Analytic Continuation 18

The Weierstrass Theory – Germs and Sheaves – Sections and Riemann surfaces – Analytic continuation along Arcs – Homotopic curves – The Monodromic Theorem – Branch points.

UNIT-IV: 18

Algebraic Functions – The resultant of two polynomials – Definition and properties of Algebraic functions – Behavior at the critical points - Picard's Theorem – Lacunary points.

UNIT-V: 18

Linear Differential Equations -Ordinary points-regular scalar points-solution at infinity-Hyper Geometric Differential Equations-Riemann's point of view.

TOTAL HOURS :90

COURSE OUTCOMES

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

CO 1: Understand the zeros of zeta function and Arzela's theorem.
CO 2: Learn about the Riemann mapping Theorem.
CO 3: Get the knowledge of Analytic continuations
CO 4: To understand about Picard's Theorem.
CO 5: Get the knowledge of Linear Differential equation

REFERENCE BOOKS:

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. T.W Gamelin, Complex Analysis, Springer International Edition, 2006.
4. D.Sarason, Notes on Complex function Theory, Hindustan Book Agency, 2008.

Mapping with Programme Outcomes

CO's\PO's\PSO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	2	-	1	2	2	2	-	2	1	2
CO2	1	2	2	2	1	2	2	-	2	2
CO3	-	1	-	1	2	2	-	2	2	1
CO4	2	-	2	2	-	2	-	-	2	2
CO5	1	2	2	-	2	2	-	1	-	2

Strong – 3; Medium – 2; Low – 1.

Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Understand the zeros of zeta function and Arzela's theorem.	**K1, K2 ,K3,**
CO2	Learn about the Riemann mapping Theorem.	**K1, K2,K3,K4**
CO3	Get the knowledge of Analytic continuations	**K1, K2,K3**
C04	To understand about Picard's Theorem.	**K1,K2,K3**
CO5	Get the knowledge of Linear Differential equation.	**K1,K2,K3**

AMAT2909	FUNCTIONAL ANALYSIS	L	T	P	C	Total Marks
		6	1	0	6	100

Prerequisites : None

COURSE OBJECTIVES:

- To study the details of Banach and Hilbert Spaces and to introduceBanach algebras.

UNIT-I: Algebraic systems

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

UNIT-II:Banach Spaces **18**

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-III: Hilbert spaces **18**

Definition and properties – Orthogonal complements – Orthonormal sets - Orthogonal complements - Orthonormal sets - Conjugate space H* - Adjoint of an operator – Self-adjoint operator – Normal and Unitary Operators – Projections

UNIT-IV : Preliminaries on Banach Algebras **18**

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-V: Structure of commutative Banach Algebras **18**

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

TOTAL HOURS :90

COURSE OUTCOMES:

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

CO 1: Understand the basic concept of Normed Spaces with example.
CO 2: Learn about open mapping theorem and properties.
CO 3: To learn the concept of Conjugate space , Normal and Unitary Operators
CO 4: An understanding the concept of Preliminaries on Banach Algebras
CO 5: To get the knowledge about Gelfand-Neumark Theorem and its uses.

REFERENCE BOOKS:

1. G.F.Simmons , Introduction toTopology and Modern Analysis, McGraw Hill International Book Company, New York, 2017.
2. W.RudinFunctionalAnalysis, 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

Mapping with Programme Outcomes

CO's\PO's\PSO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	2	2	1	2	-	2	-	2	1	2
CO2	1	2	2	2	2	2	2	-	1	2
CO3	-	2	1	2	1	2	-	2	2	2
CO4	2	2	2	2	2	2	-	-	2	2
CO5	1	1	2	1	1	2	-	1	1	2

Strong – 3; Medium – 2; Low – 1.

Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Understand the basic concept of Normed Spaces with example.	**K1, K2 ,K3,**
CO2	Learn about open mapping theorem and properties.	**K1, K2,K4,K5**
CO3	To learn the concept of Conjugate space , Normal and Unitary Operators	**K1, K2,K3.K4**
C04	An understanding the concept of Preliminaries on Banach Algebras	**K1,K2,K3**
CO5	To get the knowledge about Gelfand-Neumark Theorem and its uses.	**K1,K2,K3**

ASSL2903 Soft skills –III

ASSL1903	Soft skills –III	**L**	**T**	**P**	**C**	**Total Marks**
		0	**0**	**2**	**1**	**100**

IV/II	ASSL2903	Soft skills – III	Professional Skills A. Career Skills 1. Resume Skills 2. Interview Skills 3. Group Discussion Skills 4. Exploring Career Opportunities Skills B. Team Skills 1. Presentation Skills 2. Trust and Collaboration 3. Listening as a Team Skill 4. Brainstorming 5. Social and Cultural Etiquettes 6. Internal Communication Leadership and Management Skills 1. Leadership Skills 2. Managerial Skills 3. Entrepreneurship 4. Innovative Leadership and Design Thinking 5. Ethics and Integrity

References:

1. https://www.britishcouncil.org/voices-magazine/five-essential-listening-skills-english-learners
2. https://www.mosaicprojects.com.au/WhitePapers/WP1012_Active_Listening.pdf
3. https://www.skillsyouneed.com/ips/ineffective-listening.html
4. https://www.brighthubpm.com/resource-management/122339-effective-listening-10-

barriers-and-how-to-overcome-them/

Video References:

1. https://www.youtube.com/watch?v=m_tbFlbRpK8
2. https://www.youtube.com/watch?v=gwPMHbbueZI
3. https://www.youtube.com/watch?v=o6JGi2voyDM

PROGRAM - ELECTIVE PAPERS

ELECTIVE –I(SEMESTER-I)

		L	T	P	C	Total Marks
AMAT1903	ORDINARY DIFFERENTIAL EQUATIONS	5	1	0	4	100

Prerequisites : None

COURSE OBJECTIVES:

- To develop strong background on finding solutions to linear differentialequations with constant and variable coefficients and also with singular points, to study existence and uniqueness of the solutions of first order differential equations.

UNIT-I :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

UNIT-II: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-III: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-IV: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-V:Existence and Uniqueness of Solutions to First OrderEquations **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.

TOTAL HOURS :60

COURSE OUTCOMES:
On the successful completion of the course, students will be able to
CO 1: Understand the definition of Linear equations with constant coefficients.
CO 2: To study the function of Homogeneous , non-homogeneous functions and calculate the Initial value problems
CO 3: To have knowledge about Initial value problems, Existence and Uniqueness Theorems
CO 4: To learn about the Linear equation with regular singular points
CO 5: Get the knowledge of Lipschitz condition Convergence of the successive approximations and the existence theorem

REFERENCE BOOKS:

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.
5. N.N. Lebedev, Special functions and their applications, Prentice Hall of India, New Delhi, 2005.

Mapping with Programme Outcomes

CO's\PO's\PSO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	2	2	1	2	-	1	-	2	1	2
CO2	1	2	2	2	1	2	2	-	-	2
CO3	-	2	-	2	1	2	-	2	-	2
CO4	1	1	2	2	-	2	-	-	2	2
CO5	1	1	2	-	2	2	-	1	1	2

Strong – 3; Medium – 2; Low – 1.

Course Outcomes

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

CONumber	CO Statement	Knowledge Level
CO1	Understand the definition of Linear equations with constant coefficients.	**K1, K2 ,K3,**

CO2	To study the function of Homogeneous , non-homogeneous functions and calculate the Initial value problems	**K1, K2,K4,K5**
CO3	To have knowledge about Initial value problems, Existence and Uniqueness Theorems	**K1, K2,K3.K4**
C04	To learn about the Linear equation with regular singular points	**K1,K2,K3**
CO5	Get the knowledge of Lipschitz condition Convergence of the successive approximations and the existence theorem	**K1,K2,K3**

		L	T	P	C	Total Marks
AMAT1904	**GRAPH THEORY**	**5**	**1**	**0**	**4**	**100**

Prerequisites : None

COURSE OBJECTIVES:

- To study and develop the concepts of graphs, sub graphs, trees,connectivity, Euler tours, Hamilton cycles, matching, coloring of graphs, independent sets, cliques, vertex coloring, and planar graphs

UNIT-I : 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-II : 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-III: 12

Planarity in graphs, Euler's Polyhedron formula. Kuratowski'stheorem . 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-IV: 12

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

UNIT-V: 12

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

TOTAL HOURS :60

COURSE OUTCOMES:

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

CO 1: Understand the various types of Graphs, sub graphs ,Trees and paths

CO 2: To learn about the Connectivity, Blocks and Hamilton Cycles
CO 3 Apply the basics concepts of Matching, Edge Colorings.
CO 4: To understand about Ramsey's Theorem and Brooks' Theorem
CO 5: Knows the fundamental of Planar graphs.

REFERENCE BOOKS:

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.
5. R.J.Wilson and J.J.Watkins, Graphs : An Introductory Approach, John Wiley and Sons, New York, 2001.

Mapping with Programme Outcomes

CO's\PO's\PSO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	-	2	1	2	2	2	-	2	1	1
CO2	2	-	2	2	-	2	2	-	2	2
CO3	2	2	2	1	1	2	-	2	1	1
CO4	2	1	2	2	2	2	-	-	-	2
CO5	2	2	1	1	2	2	-	1	1	2

Strong – 3; Medium – 2; Low – 1.

Course Outcomes

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

CONumber	CO STATEMENTS	Knowledge Level
CO1	Understand the various types of Graphs, sub graphs ,Trees and paths	**K1,K2,K3,K4**
CO2	To learn about the Connectivity, Blocks and Hamilton Cycles.	**K1,K2,K3,K4**
CO3	Apply the basics concepts of Matching, Edge Colorings.	**K1,K2,K3**
CO4	To understand about Ramsey's Theorem and Brooks' Theorem.	**K1,K2,K3,K4**

CO5	Knows the fundamental of Planar graphs.	**K1,K2,K3**

AMAT1905	**DISCRETE MATHEMATICS**	**L**	**T**	**P**	**C**	**Total Marks**
		5	**1**	**0**	**4**	**100**

Prerequisites : None

COURSE OBJECTIVES

- This course aims to explore the topics like lattices and their applicationsin switching circuits, finite fields, polynomials and coding theory.

UNIT-I: 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-II: 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-III: 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-IV: Mathematical Logic **12**

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

UNIT-V: Coding Theory **12**

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

TOTAL HOURS :60

COURSE OUTCOMES:

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

CO 1: Understand the definition of Lattice and Boolean algebra.
CO 2: Using Baye's problems to solve conditional probability problem and applications.
CO 3: To learn about finite fieldproblems
CO 4: Identified the concept of Polynomials over Finite fields
CO 5: Understand the concept of Linear Codes and Cyclic Codes

REFERENCE BOOKS:

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 ComputerScience(3rdEdn.), Computer Science Press, New York.
4. S.Wiitala, Discrete Mathematics- A Unified Approach, McGraw Hill Book Co.

Mapping with Programme Outcomes

CO's\PO's\PSO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	1	1	1	2	2	2	-	2	1	2
CO2	2	2	2	2	1	2	2	-	1	2
CO3	1	2	1	2	1	2	-	2	-	2
CO4	2	2	2	1	1	2	-	-	2	2
CO5	1	1	2	1	2	2	-	1	1	2

Strong – 3; Medium – 2; Low – 1.

Course Outcomes

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

CO Number	CO STATEMENTS	Knowledge Level
CO1	Understand the definition of Lattice and Boolean algebra.	**K1,K2,K3,K4**
CO2	Using Bayes problems to solve conditional probability problem and applications.	**K1,K2**
CO3	To learn about finite fieldproblems	**K1,K2,K3**
CO4	Identified the concept of Polynomials over Finite fields	**K1,K2,K3,K4,K5**
CO5	Understand the concept of Linear Codes and Cyclic Codes	**K1,K2,K3**

ELECTIVE – II (SEMESTER-II)

AMAT1909	PARTIALDIFFERENTIAL EQUATIONS	L	T	P	C	Total Marks
		5	1	0	4	100

Prerequisites : None

COURSE OBJECTIVES:

- The aim of the course is to introduce to the students the various typesof partial differential equations and how to solve these equations.

UNIT-I: Nonlinear partial differential equations of the first order12

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

UNIT-II: 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-III: 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-IV: The wave equation 12

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

The diffusion equation: Elementary solutions of the diffusion equation – Separation variables- The use of integral transforms.

UNIT-V: 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.

TOTAL HOURS :60

COURSE OUTCOMES:

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

CO 1: Understand the rules of Partial Differential Equations of First Order

CO 2: Learn aboutDirichlet's Problem, Solution of Laplace equation in Cylindrical and spherical coordinates

CO 3: An ability to calculate Parabolic Differential Equations

CO 4: Have the idea of D'Alembert's solution, one-dimensional wave equation and Duhamel's Principle with Examples

CO 5: Apply the concepts of Green's Function, Laplace Transform and Fourier Transform.

REFERENCE BOOKS:

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, 2ndEdn. Pearson Eduction, New Delhi, 2005.
4. M.D.Raisinghania, Advanced Differential Equations, S.Chand& Company Ltd., New Delhi, 2001

Mapping with Programme Outcomes

CO's\PO's\PSO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	-	2	1	2	-	2	-	2	1	2
CO2	1	2	2	2	1	2	2	-	2	2
CO3	-	2	-	2	1	2	-	2	2	1
CO4	-	2	1	2	-	2	-	-	2	2
CO5	1	1	2	-	1	2	-	1	2	2

Strong – 3; Medium – 2; Low – 1.

Course Outcomes

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

CO Number	CO Statement	Knowledge Level

CO1	Understand the rules of Partial Differential Equations of First Order	**K1, K2 ,K3, K5**
CO2	Learn about Dirichlet's Problem, Solution of Laplace equation in Cylindrical and spherical coordinates.	**K1, K2,K3,K4**
CO3	An ability to calculateParabolic Differential Equations	**K1, K2,K3.K4**
C04	Have the idea of D'Alembert's solution, one-dimensional wave equation and Duhamel's Principle with Examples	**K1,K2,K3**
CO5	Apply the concepts of Green's Function, Laplace Transform and Fourier Transform	**K1,K2,K3**

		L	T	P	C	Total Marks
AMAT1910	**PROBABILITY THEORY**	**5**	**1**	**0**	**4**	**100**

Prerequisites : None

COURSE OBJECTIVES:

- The aim of the course is to introduce axiomatic approach to probability theory, to study some statistical characteristics, discrete and continuous distribution functions and their properties, characteristic function and basic limit theorems of probability.

UNIT-I: 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-II : 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-III: 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-IV: 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 – LapunovTheroem-Borel-Cantelli Lemma - Kolmogorov Inequality and Kolmogorov Strong Law of large numbers.

UNIT-V:Markov Chains **12**

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

TOTAL HOURS :60

COURSE OUTCOMES:

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

CO 1: Apply the knowledge of Random Events and Random Variables

CO 2: Get the knowledge ofParameters of the Distribution

CO 3: Describe fundamental properties ,Characteristic functions and Properties
CO 4: Apply the concepts of one point, two point, Binomial, Poisson, Uniform, Normal, Gamma, Beta and its applications.
CO 5: Construct the rigorous methods Stochastic convergence, Levy-Cramer Theorems, De-Moivre-Laplace, Chebyshev's Theorem

REFERENCE BOOKS:

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, (2nd Edition) Duxbury Press, New York, 2005.
4. V.K.RohatgiAn Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern Ltd., New Delhi, 2003.
5. B.R.Bhat , Modern Probability Theory (3rd Edition), New Age International (P)Ltd, New Delhi,2009.

Mapping with Programme Outcomes

CO's\PO's\PSO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	2	2	1	2	2	2	-	2	1	2
CO2	1	2	2	1	1	2	2	-	2	1
CO3	2	-	-	2	1	2	-	2	1	2
CO4	2	1	2	2	2	1	-	-	2	2
CO5	2	1	2	2	2	2	-	1	1	2

Strong – 3; Medium – 2; Low – 1.

Course Outcomes

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

CONumber	CO Statement	Knowledge Level
CO1	Apply the knowledge of Random Events and Random Variables	**K1,K2,K3**
CO2	Get the knowledge of Parameters of the Distribution.	**K1,K2,K4,K5**
CO3	Describe fundamental properties ,Characteristic functions and Properties	**K1,K4,K5**

C04	Apply the concepts of One point, two point, Binomial, Poisson, Uniform, normal,gamma,Beta and its applications.	**K1,K2,K4,K5**
CO5	Construct the rigorous methods Stochastic convergence, Levy-Cramer Theorems, de Moivre-Laplace , Chebyshev Theorem	**K1,K2,K4,K5**

		L	T	P	C	Total Marks
AMAT1911	**MATHEMATICAL PROGRAMMING**	**5**	**1**	**0**	**4**	**100**

Prerequisites : None

COURSE OBJECTIVES:

- This course is designed to understand how to formulate integer programming andsolving it also it describe important dynamic technology and develop programming stages.Students will also learn advanced topics in Linear and non-linear Programming

UNIT-I:Integer Linear Programming **12**

Types of Integer Linear Programming Problems – Concept of Cutting Plane – Gomary's all Integer Cutting Plane Method – Gomary's mixed Integer Cutting Plane method – Branch and Bound Method.

UNIT-II:Dynamic Programming **12**

Characteristics of Dynamic Programming Problem – Developing Optimal Decision Policy – Dynamic Programming Under Certainty – DP approach to solve LPP.

UNIT-III:Classical Optimization Methods **12**

Unconstrained Optimization – Constrained Multi-variable Optimization with Equality Constraints - Constrained Multi-variable Optimization with inequality Constraints

Non-linear Programming Methods: Examples of NLPP – General NLPP – Graphical solution – Quadratic Programming – Wolfe's modified Simplex Methods

UNIT-IV:Linear Programming Problem **12**

Simple problems.

Parametric Linear Programming: Variation in the coefficients cj, Variations in the Right hand side, bi .

UNIT-V:Goal Programming **12**

Difference between LP and GP approach – Concept of Goal Programming – Goal Programming Model formulation – Graphical Solution Method of Goal Programming – Modified Simplex method of Goal Programming.

TOTAL HOURS :60

COURSE OUTCOMES:

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

CO 1: Know the formulation of IPP and solving the problems.

CO 2: Understand the concepts of dynamic programming and they can develop programming stages.

CO 3: Identify the constrained multi variable optimization with equality and inequality constraints.

CO 4: Analyze the concepts of Linear Programming problem and also they know how to apply LPP in Parametric Programming.

CO 5: Differentiate between Linear Programming and Goal Programming

REFERENCE BOOKS:

1. J.K.Sharma,Operations Research , Macmillan (India) New Delhi 2001.
2. Hamdy A. Taha, Operations Research, (seventh edition) Prentice - Hall of India Private Limited, New Delhi, 2005.
3. F.S. Hiller &J.Lieberman, Introduction to Operation Research (7^{th} Edition) Tata- McGraw Hill Company, New Delhi, 2001.
4. Beightler. C, D.Phillips, B. Wilde,Foundations of Optimization (3^{nd} Edition) Prentice Hall Pvt Ltd., New York, 2009.
5. S.S. Rao - Optimization Theory and Applications, Wiley Eastern Ltd. New Delhi. 2010.

Mapping with Programme Outcomes

CO's\PO's\PSO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	2	2	1	1	2	1	-	2	1	2
CO2	1	2	2	-	1	2	2	-	2	2
CO3	1	1	2	2	1	2	-	2	2	2
CO4	2	-	-	1	2	-	-	-	2	2
CO5	1	2	2	1	2	2	-	1	1	2

Strong – 3; Medium – 2; Low – 1.

Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Know the formulation of IPP and solving the problems.	**K1, K2 ,K3, K5**
CO2	Understand the concepts of dynamic programming and they can develop programming stages.	**K1, K2,K3,K4,K5**
CO3	Identify the constrained multi variable optimization with equality andunequalityconstraints.	**K1, K2,K3.K4,K5**
C04	Analyze the concepts of Linear Programming problem and also they know how to apply LPP in Parametric Programming.	**K1,K2,K3, K4,K5**

CO5	Differentiate between linear programming and Goal Programming	**K1,K2,K3,K4,K5**

ELECTIVE –III (SEMESTER-(III)

		L	T	P	C	Total Marks
AMAT2905	**OPERATION RESEARCH**	**5**	**1**	**0**	**4**	**100**

Prerequisites : None

COURSE OBJECTIVES:

- This course aims to introduce decision theory, PERT, CPM, deterministicand probabilistic inventory systems, queues, replacement and maintenance problems.

UNIT-I: 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-II: 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-III: 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-IV: 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-V: 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.

TOTAL HOURS :60

COURSE OUTCOMES:

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

CO 1: Explain the basics concepts of Decision Theory and solve Bayesian problems

CO 2: Get the knowledge and reproduce of Network Model and Linear Programming problem.

CO 3: Demonstrate the basic concepts of Deterministic Inventory Control Models problem and their application.

CO 4: Apply the concepts of Queueing theory in day to day life

CO 5: Get the knowledge of Replacement and Maintenance Models in which time is machine replaced or repaired.

REFERENCE BOOKS:

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.

Mapping with Programme Outcomes

CO's\PO's\PSO's	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

Strong – 3; Medium – 2; Low – 1.

Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Explain the basics concepts of Decision Theory and solve Bayesian problems.	**K1,K2,K3,K5**
CO2	Get the knowledge and reproduce of Network Model and Linear Programming problem.	**K1, K2,K3,K5**
CO3	Demonstrate the basic concepts of Deterministic Inventory Control Models problem and their application.	**K1, K2,K3, K5**
C04	Apply the concepts of Queuing theory in day to day life.	**K1, K2,K3, K5**
CO5	Get the knowledge of Replacement and Maintenance Models in which time is machine replaced or repaired.	**K1, K2,K3, K5**

AMAT2906	MECHANICS	L	T	P	C	Total Marks
		5	1	0	4	100

Prerequisites : None

COURSE OBJECTIVES:

- The aim of the course isto study mechanical systems under generalized coordinate systems,virtual work, energy and momentum, to study mechanics developed by Newton, Langrange, Hamilton Jacobi and Theory of Relativity due to Einstein

UNIT-I: Introductory Concepts **12**

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

UNIT-II: Lagrange's Equations **12**

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

UNIT-III: Hamilton's Equations **12**

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

UNIT-IV: Hamilton-Jacobi Theory **12**

Hamilton Principle function – Hamilton-Jacobi Equation - Separability

UNIT-V: Canonical Transformation **12**

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

TOTAL HOURS :60

COURSE OUTCOMES:

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

CO 1: Understand the basic of Mechanical Systems.
CO 2: Learn about theLagrange's Equations
CO 3: To understand the Hamilton's Equation and uses..
CO 4: To learn about Hamilton-Jacobi Theory and lemma.
CO 5: To get the knowledge of Canonical Transformation

REFERENCE BOOKS:

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

Mapping with Programme Outcomes

CO's\PO's\PSO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	1	2	1	2	-	2	-	2	2	2
CO2	1	2	2	2	1	2	2	-	2	2
CO3	-	2	-	2	1	1	-	2	-	1
CO4	2	2	1	2	-	1	-	-	1	2
CO5	1	2	2	-	1	2	-	1	1	2

Strong – 3; Medium – 2; Low – 1.

Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Understand the basic of Mechanical Systems.	**K1, K2 ,K3**
CO2	Learn about the Lagrange's Equations	**K1, K2,K3,K5**
CO3	To understand the Hamilton's Equation and uses.	**K1,K2,K3.K4**
C04	To learn about Hamilton-Jacobi Theory and lemma.	**K1,K2,K3**
CO5	To get the knowledge of Canonical Transformation	**K1,K2,K3**

AMAT2907	NUMBER THEORY AND CRYPTOGRAPHY	L	T	P	C	Total Marks
		5	1	0	4	100

Prerequisites : None

COURSE OBJECTIVES:

- This course aims to give elementary ideas from number theory which will have applications in cryptology.

UNIT-I : **12**

Divisibility and Euclidean algorithm – Congruence, Euler's Theorem, Wilson's Theorem, Chinese Remainder Theorem, Primitive roots - Applications to Factoring.

UNIT-II: **12**

Finite Fields – Quadratic Residues – Quadratic Reciprocity – The Jacobi symbol.

UNIT-III: **12**

Cryptosystems – Enciphering Matrices – Public Key Cryptography – Concepts of Public Key Cryptography – Modular Arithmetic – RSA.

UNIT-IV: **12**

Pseudo primes and Strong Pseudo primes – The rho method – Fermat factorization and factor bases and Algorithm – The Continued fraction method and Algorithm.

UNIT-V: **12**

Primality, Factoring, Elliptic curves – Basic Facts and Elliptic curve crypto systems.

TOTAL HOURS :60

COURSE OUTCOMES:

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

CO 1: Understand the basic concept of Euclidean algorithm and its applications.
CO 2: Introduction to Classical Crypto systems and Enciphering matrices.
CO 3: To get the knowledge of Finite Field.
CO 4: To learn about the Public Key Cryptography.
CO 5: Get the knowledge of Elliptic curve.

REFERENCE BOOKS:

1. Neal Koblitz, A Course in Number Theory and Cryptography, Springer-Verlag, New York,2004.
2. I.Niven and H.S.Zuckermann, An Introduction to Theory of Numbers (Edn. 3), Wiley Eastern Ltd., New Delhi,2006
3. David M.Burton, Elementary Number Theory, Brown Publishers, Iowa,2009
4. K.Ireland and M.Rosen, A Classical Introduction to Modern Number Theory, Springer Verlag, 2002
5. N.Koblitz, Algebraic Aspects of Cryptography,Springer 2008.

Mapping with Programme Outcomes

CO's\PO's\PSO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	2	2	1	2	2	1	-	2	1	1
CO2	2	2	2	2	1	2	2	-	1	-
CO3	1	1	2	2	1	2	-	2	1	2
CO4	2	2	2	2	2	2	-	-	2	-
CO5	-	1	2	1	2	2	-	1	-	2

Strong – 3; Medium – 2; Low – 1.

Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Understand the basic concept of Euclidean algorithm and its applications.	**K1, K2 ,K3**
CO2	Introduction to Classical Crypto systems and Enciphering matrices.	**K1, K2,K3**
CO3	To get the knowledge of Finite Field.	**K1, K2, K3.**
C04	To learn about the Public Key Cryptography.	**K1,K2,K3**
CO5	Get the knowledge of Elliptic curve.	**K1,K2,K3**

ELECTIVE –IV (SEMESTER-(IV)

AMAT2911	TENSOR ANALYSIS AND RELATIVITY	L	T	P	C	Total Marks
		5	1	0	4	100

Prerequisites : None

COURSE OBJECTIVES:

- The course aims to introduce vector algebra and vector calculus andspecial relativity and relativistic kinematics, dynamics and accelerated systems.

UNIT-I : **12**

Invariance - Transformations of coordinates and its properties - Transformation by invariance - Transformation by covariance and contra variance - Covariance and contra variance - Tensor and Tensor character of their laws - Algebras of tensors - Quotient tensors - Symmetric and skew symmetric tensors – Relative tensors.

UNIT-II: **12**

Metric Tensor - The fundamental and associated tensors - Christoffel's symbols -Transformations of Chrisffel's symbols- Covariant Differentiation of Tensors - Formulas for covariant Differentiation- Ricci Theorem - Riemann -Christoffel Tensor and their properties.

UNIT-III: **12**

Einstein Tensor- Riemannian and Euclidean Spaces (Existence Theorem)-The e-systems and the generalized Kronecker deltas - Application of the e-systems.

UNIT-IV: **12**

Special Theory of Relativity: Galilean Transformation - Maxwell's equations - The ether Theory – The Principle of Relativity Relativistic Kinamatics : Lorentz Transformation equations - Events and simultaneity - Example Einstein Train - Time dilation -Longitudinal Contraction -Invariant Interval - Proper time and Proper distance – World line - Example - twin paradox - addition of velocities - Relativistic Doppler effect.

UNIT-V: **12**

Relativistic Dynamics: Momentum – Energy – Momentum – energy four vector – Force - Conservation of Energy – Mass and energy – Example – inelastic collision – Principle of equivalence – Lagrangian and Hamiltonian formulations.

Accelerated Systems: Rocket with constant acceleration – example – Rocket with constant thrust.

TOTAL HOURS :60

COURSE OUTCOMES:

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

CO 1: Understand the basic concept of invariants ,covariant and contra variant vector.

CO 2: To get the knowledge of Riemannian Space, Christoffel Symbols and their properties

CO 3: Calculate the value of Tensor and their properties.

CO 4: To learn about Maxwell's equations and the Principle of Relativity.

CO 5: Get the knowledge of Momentum ,Energy Momentum, Lagrangian and Hamiltonian

REFERENCE BOOKS:

1. S. Sokolnikoff, Tensor Analysis, John Wiley and Sons, New York, 2013.
2. D. Greenwood, Classical Dynamics, Prentice Hall of India, New Delhi, 2012.
3. An introduction to Tensor Analysis and the calculus of moving surfaces,Pavel grinfeld,springer,2013.
4. A.S.Eddington. The Mathematical Theory of Relativity, Cambridge University Press, 2008.
5. P.G.Bergman, An Introduction to Theory of Relativity, Newyork, 2010.

Mapping with Programme Outcomes

CO's\PO's\PSO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	2	-	1	-	2	1	-	2	1	1
CO2	1	2	2	2	1	2	2	-	2	2
CO3	2	2	1	2	2	2	-	2	1	1
CO4	2	2	2	2	1	2	-	-	2	2
CO5	1	1	2	1	2	2	-	1	1	2

Strong – 3; Medium – 2; Low – 1.

Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Understand the basic concept of invariants ,covariant and contra variant vector	**K1, K2 ,K3, K5**
CO2	To get the knowledge of Riemannian Space , Christoffel Symbols and their properties	**K1, K2,K3, K4,K5**
CO3	Calculate the value of Tensor and their properties.	**K1, K2,K3.K4,K5**
C04	To learn about Maxwell's equations and the Principle of Relativity.	**K1,K2,K3**
CO5	Get the knowledge of Momentum ,Energy Momentum , Lagrangian and Hamiltonian	**K1,K2,K3**

AMAT2912	CALCULUS OF VARIATIONS AND INTEGRAL EQUATIONS	L	T	P	C	Total Marks
		5	1	0	4	100

Prerequisites : None

COURSE OBJECTIVES:

- To initiate the study on The Method of Variations in Problems with Fixed Boundaries, Variational Problems with Moving Boundaries and and Integral Equations with Separable.

UNIT-I: **12**

The Method of Variations in Problems with Fixed Boundaries

UNIT-II : **12**

Variational Problems with Moving Boundaries and certain other problems and Sufficient conditions for an Extremum

UNIT-III : **12**

Variational Problems Involving a conditional Extremum

UNIT-IV: **12**

Integral Equations with Separable Kernels and Method of successive approximations.

UNIT-V: **12**

Classical Fredholm Theory, Symmetric Kernels and Singular Integral Equations

TOTAL HOURS :60

COURSE OUTCOMES:

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

CO 1: Understand the concept of The Method of Variations in Problems with Fixed Boundaries.
CO 2: To learn the concept of Variational Problems with Moving Boundaries and certain other problems and Sufficient conditions for an Extremum.
CO 3: An understanding of Variational Problems Involving a conditional Extremum problems .
CO 4: To learn the concept of Integral Equations with Separable Kernels and Method of successive approximations.
CO 5: To get the knowledge of Classical Fredholm Theory , Symmetric Kernels and Singular Integral Equations

REFERENCE BOOKS:

1. For Units I,II and III: L. Elsgolts , Differential Equations and the Calculus ofVariations, Mir Publishers, Moscow, 2003 (2nd Edition)
2. For Units IV and V:Ram P.Kanwal,Linear Integral Equations, Academic Press, NewYork, 2001.
3. I.M.Gelfand and S.V.Fomin, Calculus of Variations, Prentice-Hall Inc. New Jersey, 2003.
4. A.S.Gupta, Calculus of Variations with Applications, Prentice-Hall of India, New Delhi, 2007.
5. M.Krasnov, A.Kiselev and G.Makarenko, Problems and Exercises in Integral Equations,Publishers, Moscow, 2009

Mapping with Programme Outcomes

CO's\PO's\PSO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	2	2	1	2	-	1	-	2	1	2
CO2	1	2	2	1	1	2	2	-	2	2
CO3	1	-	1	1	1	2	-	2	2	1
CO4	2	2	2	2	2	2	-	-	2	2
CO5	2	1	2	2	1	2	-	1	1	2

Strong – 3; Medium – 2; Low – 1.

Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Understand the concept of The Method of Variations in Problems with Fixed Boundaries.	**K1, K2 ,K3**
CO2	To learn the concept of Variational Problems with Moving Boundaries and certain other problems and Sufficient conditions for an Extremum.	**K1, K2,K3, K4,K5**
CO3	An understanding of Variational Problems Involving a conditional Extremum problems .	**K1, K2,K3.K4,K5**
C04	To learn the concept of Integral Equations with Separable Kernels and Method of successive approximations.	**K1,K2,K3,K4**
CO5	To get the knowledge of Classical Fredholm Theory , Symmetric Kernels and Singular Integral Equations	**K1,K2,K3,K4**

AMAT2913	FLUID DYNAMICS	L	T	P	C	Total Marks
		5	1	0	4	100

Prerequisites : None

COURSE OBJECTIVES:

- This course aims to discuss kinematics of fluids in motion, Equations ofmotion of a fluid, three dimensional flows, two dimensional flows and viscous flows.

UNIT-I : **12**

Real Fluids and Ideal Fluids - Velocity of a Fluid at a point – Streamlines and Path lines: Steady and Unsteady Flows – The Velocity potential – The Vorticity vector – Local and Particle Rates of Change – The Equation of continuity – Worked examples – Acceleration of a Fluid – Conditions at a rigid boundary – General analysis of fluid motion – Pressure at a point in a Fluid at Rest – Pressure at a point in Moving Fluid – Conditions at a Boundary of Two Inviscid Immiscible Fluids – Euler's equation of motion – Bernoulli's equation – Workedexamples.

UNIT-II: **12**

Discussions of a case of steady motion under conservative body forces – Some potential theorems – Some Flows Involving Axial Symmetry – Some special two- Dimensional Flows-Impulsive Motion.Some three- dimensional Flows: Introduction – Sources, Sinks and Doublets – Images in a Rigid infinite Plane – Axi-Symmetric Flows; Stokes stream function.

UNIT-III : **12**

Some Two- Dimensional Flows: Meaning of a Two- Dimensional Flow – Use of cylindrical polar co-ordinates – The stream function – The Complex Potential for Two- Dimensional, Irrotational , Incompressible Flow – complex velocity potentials for Standard Two Dimensional Flows – Some worked examples – The Milne- Thomson circle theorem and applications – The theorem of Blasius.

UNIT-IV: **12**

The use of conformal Transformation and Hydrodynamical Aspects – Vortex rows. Viscous flow Stress components in a real fluid - relations between cartesian components of stress - Translational Motion of Fluid element – The Rate of Strain Quadraic and Principle Stresses – Some further properties of the rate of strain quardric - Stress analysis in fluid motion – Relations between stress and rate of strain - The coefficient of viscosity and laminar flow – TheNavier- Stokes equations of motion of a viscous fluid.

UNIT-V: **12**

Some solvable problems in viscous flow – Steady viscous flow in tubes of uniform cross section – Diffusion of vorticity – Energy Dissipation due to viscosity – Steady Flow past a Fixed Sphere – Dimensional Analysis; Reynolds Number – Prandtl's Boundary Layer.

TOTAL HOURS :60

COURSE OUTCOMES:

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

CO 1: Understand the basic concept of Kinematics of Fluids in motion

CO 2: Learn the concept of Pressure at a point in a fluid at rest and Euler's equation of motion.

CO 3: To get the knowledge of axis symmetric flows and Stokes stream function

CO 4: To learn the concept of two dimensional flows

CO 5: Get the knowledge of relations between Cartesian components of stress- Translational motion of fluid elements and Relation between stress and rate of strain

REFERENCE BOOKS:

1. Text Book of Fluid Dynamics by F.Chorlton ,CBS Publishers & Distributors, New Delhi ,2004.
2. R.W.Fox and A.T.McDonald. Introduction to Fluid Mechanics, Wiley, 2015.
3. E.Krause, Fluid Mechanics with Problems and Solutions, Springer, 2005.
4. B.S.Massey, J.W.Smith and A.J.W.Smith, Mechanics of Fluids, Taylor and Francis, New York, 2005
5. T.Petrila, Basics of Fluid Mechanics and Introduction to Computational Fluid Dynamics, Springer, berlin, 2004.

Mapping with Programme Outcomes

CO's\PO's\PSO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	2	2	1	1	2	1	-	2	1	2
CO2	1	2	2	2	1	2	2	-	2	2
CO3	1	2	2	1	1	2	-	2	2	2
CO4	1	2	2	1	2	2	-	-	2	2
CO5	1	2	2	1	2	2	-	1	1	2

Strong – 3; Medium – 2; Low – 1.

Course Outcomes

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

CO Number	CO Statement	Knowledge Level
CO1	Understand the basic concept of Kinematics of Fluids in motion.	**K1, K2 ,K3,**
CO2	Learn the concept of Pressure at a point in a fluid at rest and Euler's equation of motion.	**K1, K2,K3**
CO3	To get the knowledge of axis symmetric flows and Stokes stream function	**K1, K2,K3.K4**
C04	To learn the concept of two dimensional flows	**K1,K2,K3**
CO5	Get the knowledge of relations between Cartesian components of stress- Translational motion of fluid elements and Relation between stress and rate of strain	**K1,K2,K3**

AITT3111	CYBER SECURITY FUNDAMENDALS	L	T	P	C	Total Marks
		5	1	0	3	100

Prerequisites : None

COURSE OBJECTIVES:

The students should be madefamiliar:

- Overview of CyberSecurity
- Understand Cyber SecurityVulnerabilities
- Understand Intrusion Detection andPrevention
- With cyberspace and cyberforensics

Unit 1: Introduction to Cyber Security ***09***

Overview of Cyber Security, Internet Governance– Challenges and Constraints, Cyber Threats:-Cyber Warfare-Cyber Crime-Cyber terrorism-Cyber Espionage, Need for a Comprehensive Cyber Security Policy, Need for a Nodal Authority, Need for an International convention on Cyberspace.

Unit 2: Cyber Security Vulnerabilities and Cyber Security Safeguards ***09***

Cyber Security Vulnerabilities-Overview, vulnerabilities in software, System administration, Complex Network Architectures, Open Access to Organizational Data, Weak Authentication,Unprotected Broadband communications, Poor Cyber Security Awareness. Cyber Security Safeguards-Overview, Access control, Audit, Authentication, Biometrics, Cryptography, Deception, Denial of Service Filters, Ethical Hacking, Firewalls, Intrusion Detection Systems, Response, Scanning, Security policy, Threat Management.

Unit 3: Intrusion Detection andPrevention ***09***

Intrusion, Physical Theft, Abuse of Privileges, Unauthorized Access by Outsider, Malware infection, Intrusion detection and Prevention Techniques, Anti-Malware software, Network based Intrusion detection Systems, Network based Intrusion Prevention Systems, Host based Intrusion prevention Systems, Security Information Management, Network Session Analysis,System Integrity Validation.

Unit 4: Cyberspace and theLaw ***09***

Introduction, Cyber Security Regulations, Roles of International Law, the state and Private Sector in Cyberspace, Cyber Security Standards. The INDIAN Cyberspace, National Cyber Security Policy 2013.

Unit 5: Cyber Forensics ***09***

Introductionto Cyber Forensics, Handling PreliminaryInvestigations, Controlling an Investigation, Conducting disk-based analysis, Investigating Information-hiding, Scrutinizing E-mail, Validating E-mail header information, Tracing Internet access, Tracing memory in real-time.

TOTAL HOURS :45

COURSE OUTCOMES:

Upon completion of the course the students should be able to:

CO1: Challenges and Constraints of Internet Governance

CO2: Understand about Cyber SecuritySafeguards

CO3: Intrusion prevention Systems and Security Information Management

CO4: Investigate Information-hiding, Scrutinize and validateE-mail

REFERENCE BOOKS:

1 Introduction to Cyber Security available athttp://uou.ac.in/foundation-course

2. Fundamentals of Information Securityhttp://uou.ac.in/progdetail?pid=CEGCS-17

3. Cyber Security Techniqueshttp://uou.ac.in/progdetail?pid=CEGCS-17.

4. Cyber Attacks and Counter Measures: User Perspective http://uou.ac.in/progdetail?pid=CEGCS-17 Information Systemhttp://uou.ac.in/progdetail?pid=CEGCS-17.